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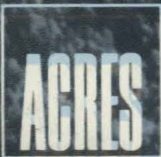
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SUSITNA HYDROELECTRIC PROJECT

1980 - 81 GEOTECHNICAL REPORT

VOLUME 2
APPENDIX A-F
FINAL DRAFT

Prepared by:



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SUSITNA HYDROELECTRIC PROJECT

1980 - 81 GEOTECHNICAL REPORT

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APPENDIX A
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APPENDIX B
WATANA DIAMOND CORE DRILLING LOGS

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-12
 Site Watana (South Bank) Sheet No. 1 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40				60
0	1976											Overburden		
20													TOP OF ROCK 27.0'	
40												Andesite		
47	1947												Fracture zone.	
60														
80													Alteration zone.	
100	1917											Diorite		
120														
140														
147	1888												Dike, mafic.	
160													Alteration zone.	
180													Shear.	
200	1858												Shear.	
220													Shear.	
240													Shear.	
247	1829												Shear zone.	
260														
280														
300	1800													
320														
340														



Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-12
 Site Watana (South Bank) Sheet No. 2 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40				60
-360												Diorite	Alteration zone.	
-380														
-400	1741												Fracture zone.	
-420														
-440														
-447	1711												Fracture/alteration zone.	
-460													Shear/alteration zone.	
-480													Shear/alteration zone.	
-500	1682												Shear.	
-520													Shear/fracture zone	
-540														
-547	1653												Shear.	
-560													Shear.	
-580												Quartz Diorite	Shear/alteration zone.	
-600	1623													
-620														
-640														
-647	1594											Granodiorite		
-660														
-680														
-700												Quartz Diorite	Alteration zone.	
-200	1564													



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-12
 Site Watana (South Bank) Sheet No. 3 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	ROD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
720						Quartz Diorite	Shear. Shear.
740	1535						Shear/alteration zone.
760							Dike, felsic.
780							Shears. Shear.
800	1506						END OF BORING 798.9'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-1
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %	ROD %	NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS
0	1459					Overburden	
20							
40							TOP OF ROCK 43.8'
60	1409					Quartz Diorite	Shear, breccia.
80							
100	1359						Shear, fracture, alteration zone.
120							Dike, andesite.
140	1319						END OF BORING 122.8'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.01
 Project Susitna Hydroelectric Project Hole No. COE DH-3
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %	ROD %	NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS
0	1458					Overburden	
20							
40							
60	1408						TOP OF ROCK 77.6'
80						Quartz Diorite	
100	1358						
120							
140							
160							
180	1278						END OF BORING 174.5'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-4
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5		
0	1461													Overburden	
20															
40															
60	1411														TOP OF ROCK 70.0'
80														Quartz Diorite	
100	1361														Core loss 4.3'
120															
140															END OF BORING 122.9'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-5
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5		
0	1461													Overburden	
20															
40															
60	1411														TOP OF ROCK 59.6'
80														Quartz Diorite/ Grano-diorite	Andesite porphyry(?) Alteration zone.
100	1361														
120															
140															
160	1311														
180															END OF BORING 176.9'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.05
Hole No. COE DH-6
Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS				
0	1716	Negligible Flow	[Bar chart showing core recovery data]	[Bar chart showing RQD data]	[Bar chart showing number of joints per 10 ft. data]	Diorite/ Quartz Diorite	TOP OF ROCK 3.5'				
20											
40											
60	1666									Quartz Diorite	
80											
100	1616										
120											
140											
160	1566										
											Alteration zone.
											Fracture zone.
											Fracture zone.
											END OF BORING 149.6'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana

Job No. P5700.05
Hole No. COE DH-7
Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS				
0	1716	[Bar chart showing permeability data]	[Bar chart showing core recovery data]	[Bar chart showing RQD data]	[Bar chart showing number of joints per 10 ft. data]	Overburden	TOP OF ROCK 8.5'				
20											
40											
60	1673										
80											
100	1630										
120											
140	1596										
											Shear/alteration zone.
											Zone of four closely spaced felsic dikes.
											END OF BORING 122.2'



Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-8
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %		RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
			20 40 60 80	20 40 60 80				
0	1910						Overburden	TOP OF ROCK 16.2'
-20							Quartz Diorite	Breccia healed quartz diorite in andesite matrix.
-40							Diorite	
-60	1860							
-80								
-100	1810							
-120								Series of shear zones, (3) 0.5" each.
-140								
-160	1760							END OF BORING 150.0'



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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-9
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %		RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
			20 40 60 80	20 40 60 80				
0	1913						Quartz Diorite	TOP OF ROCK 5.6'
-20								Breccia, healed with green igneous rock.
-40								
-60	1878							Fracture zone.
-80								
-100	1843							Shear/fracture zone. Andesite dike.
-120								
-140							Felsic Dike	
-160	1808						Diorite	
-180								
-200	1773							
-220								
-240								
-260	1738							Fracture zone.
-280								
-300	1703							END OF BORING 284.2'



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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-10
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	2033					Overburden	TOP OF ROCK 19.6'
20						Andesite Porphyry	Diorite breccia in andesite. Alteration zone.
40	1983						
60						Andesite Porphyry	Diorite breccia in andesite. Alteration zone.
80							
100	1933					Andesite Porphyry	Diorite breccia in andesite. Alteration zone.
120							
140						Andesite Porphyry	Alteration zone. Fracture zone.
160	1883	Negligible Flow					
180						Andesite Porphyry	Fracture zone.
200	1833						
220	1813						END OF BORING 203.5'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-11
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	2033					Overburden	TOP OF ROCK 22.7'
20						Diorite	Fracture zone.
40	1998						
60						Diorite	Fracture zone. Fracture zone.
80							
100	1963					Diorite	Fracture zone. Fracture zone.
120							
140						Diorite	Dike, andesite (?)
160	1928						
180						Diorite	Shear/alteration zone. Shear/alteration zone.
200	1893						
220						Diorite	Fracture zone.
240	1858						
260						Diorite	Fracture zone.
280							
300	1823						END OF BORING 300.0'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-12
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %		RQD %		NUMBER OF JOINTS PER 10 FT	ROCK TYPE	REMARKS
			20 40 60 80	20 40 60 80	5 10 15 20				
0	1951							Overburden	TOP OF ROCK 9.5'
20								Diorite/ Quartz Diorite	
40	1901							Quartz Diorite	
60									Shear/alteration zone.
80									
100	1851								Fracture zone, minor shears.
120									
140									
160	1801								
180									177-184.3 Shear/alteration zone.
200	1751								
220									
240									
260	1701								
280									
300	1651								291.3-295.5 Shear zone, healed.
320									END OF BORING 301.1'



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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-21
 Site Watana Sheet No. 1 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %		RQD %		NUMBER OF JOINTS PER 10 FT	ROCK TYPE	REMARKS
			20 40 60 80	20 40 60 80	5 10 15 20				
0	1478							Overburden	
20									
40									
60	1436								
80									TOP OF ROCK 84.5'
100	1393							Quartz Diorite	
120									
140									
160	1351								Alteration zone.
180									
200	1309								
220									
240									Alteration zone.
260	1267								Alteration zone.
280									Alteration zone.
300	1224								Alteration zone.
320									
340									



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-21
 Site Watana Sheet No. 2 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
360	1182					Quartz Diorite	
380							
400	1140						
420							
440							
460	1098						Alteration zone.
480							
500	1056						
520						Andesite	
540						Quartz Diorite	
560	1014						Alteration and sheared zone.
580							
600	972						
620							END OF BORING 603.7'



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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-23
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1952					Overburden	TOP OF ROCK 7.0'
20						Diorite	
40							
60	1902						Shear/fracture zone.
80							Shear/fracture zone.
100	1852						Shear/fracture zone.
120	1832						END OF BORING 119.2'



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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-24
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %			NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
			20	40	60			
0	2061						Overburden	TOP OF ROCK 6.9'
20							Quartz Diorite	
40	2011	Negligible Flow						
60								
80								
100	1961							
120								Irregular contact with andesite.
140	1921							END OF BORING 139.9'



Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. COE DH-28
 Site Watana Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %			NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
			20	40	60			
0	1971						Overburden	TOP OF ROCK 9.2'
20							Andesite Porphyry	Shear/fracture zone.
40	1921							Shear/fracture zone.
60								Shear/fracture zone.
80								Fracture zone.
100	1871							Fracture zone.
120								Andesite
140	1931							END OF BORING 125.2'



**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-1
SITE: Watana (North Bank) SHEET NO. 1 OF 10

CONTRACTOR: Interstate Exploration Inc. DRILLING DATES: August 10 to August 14, 1981
LOGGED BY: R.R. Henschel DATE: September 1981

DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
ROCK Diamond Core - Triple Tube CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,227,942 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E743,085 GROUND SURFACE 2049.7
AZIMUTH 030° ROCK SURFACE 2032.1
DIP 70° BOTTOM OF HOLE 1767.9
WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ().
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION - COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0	Overburden			
10 (9.4)				
18.7 (17.6) 20 (18.8)		TOP OF ROCK		
	Quartz Diorite	Medium gray to medium green-gray, medium grained crystalline rock, non-foliated with 10-15% mafics (biotite/hornblende), 10-15%	Run 1 18.7- 21.0	100 (87)

APPROVED: *[Signature]*

DATE: February 1, 1982

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Watana (North Bank) SHEET NO. 2 OF 10

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Quartz Diorite	quartz. Fresh to slightly weathered, generally hard to very hard. Joints very close to wide, fresh to slightly weathered with iron oxide staining on surfaces. Carbonate and sulphides common as coating on joints and fractures.	Run 2 21.0 to 26.0	96 (54)
		18.7-41.1 - Slightly weathered with iron oxide staining along joint surfaces. No penetrative weathering. Joints closely spaced.	Run 3 26.0 to 31.0	92 (74)
30 (28.2)		21.2-22.8 - Fracture zones, very close spaced fractures and joints healed with carbonate and iron oxide. Some open fractures very close to close spaced at 0-10°, 20°, and 70°.	Run 4 31.0 to 36.0	94 (88)
		21.5-21.9 - Core broken by drilling, slickensides on some fragments.	Run 5 36.0 to 41.0	92 (56)
40 (37.6)		36.95-40.0 - Shear/fracture zone, joints and fractures very close to closely spaced. numerous healed fractures throughout.	Run 6 41.0 to 46.0	100 (90)
		37.1 - Possible shear, with 0.25 inch layer of clay and rock fragments at 40°.	Run 7 46.0 to 51.0	100 (86)
		37.4-38.3 - Core broken by drilling, fragments 0.25 to 1.0 inch, average less than 0.50 inch. Core loss of 0.6 feet between 37.4 and 40.6.		
		38.8-39.4 - Shear, 10°, rough, plane with slickensides, chlorite coated, tight. Sulphide mineralization in surrounding rock.		
		39.5-39.6 - Shear, 40°, very tight, healed.		
		39.4-40.0 - Some minor hydrothermal alteration with feldspars altering to clay.		
50 (47.0)		41.1-46.5 - Joints close to moderately closely spaced.		
		49.4-63.9 - Joints closely spaced.		

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Watana (North Bank) SHEET NO. 3 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
60 (56.4)	Quartz Diorite	57.9-59.5 - Felsic dike, light gray, no mafics, very hard.	Run 8 51.0 to 56.1	100 (76)
			Run 9 56.1 to 61.0	100 (92)
70 (65.8)	Quartz Diorite	62.2-63.8 - Alteration zone, slightly to moderately hydrothermally altered, core slightly pitted, several healed fractures. Sulphide mineralization on fracture surfaces. 62.45 - Fracture, 70°-90°, friable on surfaces, clayey. 62.75 - Possible shear, 40°-50°, less than 0.12 inches wide, clay filling. 63.9-87.9 - Joints close to moderately closely spaced. 68.9-87.9 - Joints close to moderately closely spaced. 68.0-70.0 - Sulphides along most joints.	Run 10 61.0 to 66.0	100 (80)
			Run 11 66.0 to 71.2	100 (90)
			Run 12 71.2 to 76.2	100 (94)
80 (75.2)	Quartz Diorite	75.9-76.1 - Joints at 50° and 15°, respectively with clay coating, sulphide mineralization. 63.2-77.4 - Core is more highly broken mostly by drilling, very close to closely spaced throughout.	Run 13 76.2 to 81.1	100 (88)
			Run 14 81.1 to 86.2	100 (94)

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Watana (North Bank) SHEET NO. 4 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
90 (84.6)	Quartz Diorite	86.3-96.5 - Healed breccia, quartz diorite fragments in a fine grained quartz diorite matrix with some minor hydrothermal alteration along joints. 86.3-86.9 - Mineralized vein, less than 0.25 inch at 86.65, possible shear. 89.1-93.1 - Joints very close to close spaced.	Run 14	
			Run 15 86.2 to 91.2	100 (88)
100 (94.0)	Quartz Diorite	93.1-96.5 - Fracture/alteration zone, light gray, moderately hydrothermal altered, joints very close to close spaced, moderately hard to hard, friable locally. 91.2-181.0 - Drilling water return generally less than 50%. 94.2-96.2 - Core loss 1.2 feet. 96.5-99.4 - Occasional healed fractures. 99.4-101.2 - Healed breccia, hard. 100.15-101.2 - Core loss 1.05 feet. Some clay at 100.15.	Run 16 91.2 to 96.2	90 (62)
			Run 17 96.2 to 101.2	76 (68)
			Run 18 101.2 to 103.9	100 (44)
110 (103.4)	Quartz Diorite	101.2-117.2 - Healed breccia, irregular fragments of quartz diorite in a medium green-gray, very fine grained quartz diorite matrix, hard to very hard. Some quartz healed fractures. Minor hydrothermal alteration locally, numerous quartz stringers and pods.	Run 19 103.9 to 107.0	100 (97)
			Run 20 107.0 to 111.2	98 (86)
			Run 21 111.2 to 116.3	100 (100)
		115.0-125.0 - Core medium to dark gray, gray-green and light gray due to variation in mafic minerals.		

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Watana (North Bank) SHEET NO. 5 OF 10

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
120 (112.8)	Quartz Diorite	120.4-135.0 - Joints close to moderately close.	Run 22 116.3 to 121.2	100 (100)
		123.5-123.75 - Alteration zone, slightly bleached, slightly hydrothermally altered. Two joints at 30° and 50° with some clay/carbonate coating, slightly friable. 125.0-125.8 - Healed breccia, quartz diorite fragments in fine grained quartz diorite matrix.	Run 23 121.2 to 126.1	100 (96)
130 (122.2)	Quartz Diorite	126.1-127.3 - Alteration zone, slightly bleached, hydrothermally altered and mineralized band, sulphide healed fractures, tight, hard.	Run 24 126.1 to 131.0	100 (100)
		135.8-174.2 - Core becoming more fractured. Joints generally very close to close spaced, some drilling induced. Contains a few healed fractures.	Run 25 131.0 to 136.0	98 (98)
140 (131.6)	Quartz Diorite		Run 26 136.0 to 141.0	100 (80)
			Run 27 141.0 to 145.5	100 (100)
			Run 28 145.5 to 149.7	100 (76)

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Watana (North Bank) SHEET NO. 6 OF 10

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
150 (141.0)	Quartz Diorite	150.7-158.4 - Numerous fractures, joints closely spaced at 10°-20° to core axis, some broken by drilling, planar. Healed with carbonate and chlorite. Core loss 1.2 feet.	Run 29 149.7 to 155.9	81 (53)
		159.7-174.2 - Shear/alteration zone, moderately to completely hydrothermally altered with localized shearing.	Run 30 155.9 to 161.0	76 (55)
160 (150.4)	Quartz Diorite	159.7-165.4 - Alteration zone, severely to completely altered, core friable, pitted, feldspars altered to clay. Very soft and plastic in upper 2.0 feet. Slickensides observed on soft clay coated remnant joint. Core loss 3.3 feet.	Run 31 161.0 to 166.0	58 (0)
		165.4-171.0 - Moderately hard to hard, bleached white, slightly friable along fractures and joints.	Run 32 166.0 to 171.0	100 (66)
170 (150.4)	Quartz Diorite	171.0-174.2 - Completely hydrothermally altered as above, friable, soft and clayey, plastic.	Run 33 171.0 to 176.0	76 (30)
		174.0 - Partially healed shear or breccia zone, 20° to core axis, 0.5 inch wide.	Run 34 176.0 to 181.0	100 (96)
180 (169.1)	Quartz Diorite	174.2-222.0 - Fresh and hard, joints very close to moderately close spaced.		

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY	JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project	SOLE NO. BH-1
SITE Watana (North Bank)	SHEET NO. 7 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
190 (178.5)	Quartz Diorite		Run 35 181.0 to 186.0	100 (100)
			Run 36 186.0 to 191.0	100 (100)
			Run 37 191.0 to 196.0	100 (92)
			Run 38 196.0 to 199.0	93 (73)
			Run 39 199.0-201.0	100 (70)
			Run 40 201.0 to 203.9	100 (93)
			Run 41 203.9	100 (100)
			Run 42 204.8 to 208.4	100 (64)
200 (187.9)		<p>195.6-196.6 - Joint at 0°-10°, partially open with thin coating of carbonate and chlorite, and sand size rock fragments.</p> <p>195.0-205.6 - Several closely spaced low angle joints 0°-15°. Most are tight with irregular surfaces, partially to completely coated with chlorite and carbonate.</p>	Run 43 208.4 to 211.0	92 (92)
			Run 44 211.0-216.1	100 (76)
			Run 42 204.8 to 208.4	100 (64)
			Run 43 208.4 to 211.0	92 (92)
210 (197.3)		<p>207.1-207.3 - Shear, 30°, contains 0.13 inch wide brownish green calcareous clay with some small rock fragments, surrounding core hard.</p> <p>207.6-208.3 - Shear, 10°, 0.06 inch wide, yellow-brown carbonate filling with small rock fragments. Surrounding core is hard.</p>	Run 43 208.4 to 211.0	92 (92)
			Run 44 211.0-216.1	100 (76)

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CLIENT ALASKA POWER AUTHORITY	JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project	SOLE NO. BH-1
SITE Watana (North Bank)	SHEET NO. 8 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
220 (206.7)	Quartz Diorite		Run 44 211.0 to 216.1	100 (76)
			Run 45 216.1 to 221.0	100 (82)
			Run 46 221.0 to 226.0	100 (51)
			Run 47 226.0 to 231.0	100 (78)
			Run 48 231.0 to 236.0	100 (100)
			Run 49 236.0 to 240.9	100 (94)
			Run 50 240.9 to 246.0	100 (90)
			Run 42 204.8 to 208.4	100 (64)
230 (216.1)		<p>211.0-270.2 - Drilling water return less than 50%.</p> <p>222.0-224.8 - Alteration zone, moderately to severely hydrothermally altered, feldspars altered to clay. Texture intact. Very friable.</p> <p>223.5-224.8 - Alteration zone, moderately hydrothermally altered, cut throughout by irregular fractures and joints, primarily at 0°-10° and 40°. Carbonate healed but altered by hydrothermal solution. Penetrative up to 0.06 inches around fractures. Weakened but moderately hard.</p> <p>224.8-243.0 - Joints close to moderately close spaced.</p> <p>226.0-226.5 - Quartz vein, 0.12 inches wide at 20° to core axis, 0.75 inches wide alteration zone above it, moderately hydrothermally altered. Moderately hard.</p> <p>226.3-227.3 - Quartz stringer, 0°-10°, 0.12 inches to 0.25 inches wide.</p> <p>227.7-228.2 - Mafic dike, aphanitic, 20°, 0.5 inches wide, hard. Probably andesite.</p> <p>232.8 - Shear, 25°, less than 0.06 inch wide, hard, tight. Healed with carbonate.</p>	Run 48 231.0 to 236.0	100 (100)
			Run 49 236.0 to 240.9	100 (94)
			Run 50 240.9 to 246.0	100 (90)
			Run 42 204.8 to 208.4	100 (64)
240 (225.5)			Run 49 236.0 to 240.9	100 (94)
			Run 50 240.9 to 246.0	100 (90)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Watana (North Bank) SHEET NO. 9 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RGD)
250 (234.9)	Quartz Diorite	242.5 - Shear, 30°, less than 0.06 inch wide, possibly broken by drilling. Contains thin coating of calcareous clay material. 244.5-245.4 - Felsic dike, quartz rich, less than 2% mafics, very hard. Upper and lower contacts at 40°. 243.0-256.0 - Core is generally very hard. Cut by numerous fractures at 5°-20°, most are healed and tight, some broken by drilling. Contains thin coating of carbonate and chlorite. Fracture spacing close to moderately close spaced. 256.0-299.9 - Core is very hard with close to moderately close spaced joints. 267.4-269.2 - Joint, 5°, healed with carbonate.	Run 50	
			Run 51	
			246.0 to 251.0	100 (100)
			Run 52	
			251.0 to 256.0	100 (96)
			Run 53	
			256.0 to 260.9	100 (94)
			Run 54	
260 (244.3)	Quartz Diorite		260.9 to 265.6	100 (100)
			Run 55	
			265.6 to 270.2	100 (80)
270 (253.7)	Quartz Diorite		Run 56	
			270.2 to 275.4	96 (96)
			Run 57	

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Watana (North Bank) SHEET NO. 10 OF 10

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RGD)
280 (263.1)	Quartz Diorite	282.5-284.7 - Alteration zone, severely hydrothermally altered, very soft and friable, all feldspars altered to clay, texture partially preserved. 282.5-283.4 - Contains a thin aphanitic dike, 0.38 inches wide, 20°, sheared and brecciated but intact. 284.8-287.2 - Aphanitic dike, quartz rich, less than 5% mafics, very hard. Joints close at 10° and 45°, most have carbonate coating. Numerous healed, irregular fractures throughout. 290.2-292.0 - Fracture, 0°-5°, healed with quartz, very tight, hard.	Run 57	
			275.4 to 280.4	100 (100)
			Run 58	
			280.4 to 285.6	100 (25)
			Run 59	
			285.6 to 289.0	100 (82)
			Run 60	
			289.0 to 295.0	83 (58)
			Run 61	
			295.0 to 298.8	100 (82)
			Run 62	
299.9 (281.8)				
300 (281.9)		END OF BORING		

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-1
 Site Watana (North Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	2050					Overburden	TOP OF ROCK 18.7'
20						Quartz Diorite	<input type="checkbox"/> Shear/fracture/ alteration zone. <input type="checkbox"/> Dike, felsic. <input type="checkbox"/> Shear. <input type="checkbox"/> Breccia, healed. <input type="checkbox"/> Fracture zone, altered. <input type="checkbox"/> Dike, felsic. <input type="checkbox"/> Fracture, healed. <input type="checkbox"/> Shear, alteration zone. <input type="checkbox"/> Shear. <input type="checkbox"/> Shear/fracture zone. <input type="checkbox"/> Dike, felsic. <input type="checkbox"/> Fracture zone.
40	2003						
60							
80							
100	1956						
120							
140							
160	1909						
180		No Test Data					
200	1862						
220							
240							
260	1815						
280							
300	1768						
							END OF BORING 299.9'



ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
 PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-2
 SITE: Watana (North Bank) SHEET NO. 1 OF 13
 CONTRACTOR: The Drilling Company DRILLING DATES: July 14 TO July 27, 1980
 LOGGED BY: K.J. White, M.P. Bruen DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
 ROCK Diamond Core - Triple Tube CORE DIAMETER: NQ (1.75") O.D.
 LOCATION: LATITUDE N3,227,725 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
 DEPARTURE E742,040 GROUND SURFACE 1838.8
 AZIMUTH 043° ROCK SURFACE 1830.6
 DIP 55° BOTTOM OF HOLE 1510.3
 WATER TABLE 1768.8 (7-28-80)

NOTES: 1) Depths measured along hole. True depths in ().
 2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (ROD)
0	Overburden			
10 (8.2)	Andesite Porphyry	<p align="center">TOP OF ROCK</p> Greenish gray to medium gray, fine grained groundmass with fine to medium grained white plagioclase phenocrysts. Flow structures. Contains inclusions of a gray-white, medium grained diorite, a green, very fine grained andesite, and possibly some argillite. Inclusions are generally less than 0.75 inches in diameter. Generally hard, fresh to slightly weathered. Joints are iron stained, some carbonate filling. Disseminated sulphides throughout. 10.0-23.4 - Joints closely spaced. 15.8-16.9 - Core badly broken by drilling, angular fragments 0.5 to 1.0 inches, carbonate filling and iron oxide staining.	Run 1 10.0 to 15.0 Run 2 15.0 to 18.7 Run 2A 82 (45) Run 3	 100 (46) 100 (57) 82 (45)
20 (16.4)				

APPROVED: *Sto M* DATE: February 1, 1982

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
 SITE Watana (North Bank) SHEET NO. 2 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
30 (24.6)	Andesite Porphyry	15.8-16.9 - Core badly broken by drilling, angular fragments 0.5 to 1.0 inches, carbonate filling and iron oxide staining. 23.4-26.1 - Joints very close to closely spaced. 25.7 - Joint, 30°, trace of clay. 26.1-30.9 - Joints closely spaced. 29.4 - Fracture, 50°, clay coating. 30.9-48.25 - Joints very close to closely spaced.	Run 3 19.8 to 25.0 Run 4 100 (0) Run 5 25.5 to 30.5 Run 6 30.5 to 35.5 Run 7 35.5 to 40.5 Run 8 40.5 to 45.7 Run 9 45.7 to 50.5 Run 10 50.5-55.7	 100 (58) 100 (58) 98 (24) 100 (92) 96 (53) 100 (77) 100 (81)
40 (32.8)				
50 (41.0)		51.0 - Flow structure. 50°. 51.65-55.9 - Joints very close to moderately close spaced.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Watana (North Bank) SHEET NO. 3 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
60 (49.1)	Andesite Porphyry	53.05 - Joint, 30°, less than 0.1 inch wide, rough, irregular, clay coating. 55.7-60.8 - Core loss 0.7 feet.	Run 10	100
			50.5 to 55.7	(81)
		57.65-70.45 - Joints very close to closely spaced.	Run 11	100
			55.7 to 60.8	(55)
70 (57.3)		64.3 - Joint, 30°, irregular, smooth, slickensides.	Run 12	76
			60.8-63.7	(38)
		69.7-70.5 - Fracture zone, joints very closely spaced, 30° and 60° orientation. Some fractures healed, carbonate filling, some iron staining.	Run 13	88
			63.7 to 66.9	(28)
80 (65.5)		71.2-177.1 - Shear/fracture zone, joints very closely spaced, fracture zones of gouge and breccia. Hole caving, core badly ground in places, grouted. Core loss greater than 20.6 feet.	Run 14	95
			66.9-68.9	(0)
		71.2-79.6 - Fracture zone, joints very closely spaced at 20° to 60°, fresh to slightly weathered. Clay and carbonate filling, rounded to subangular pieces less than 0.2 feet. Core loss 5.9 feet.	Run 15	100
			68.9-71.2	(65)
		80.8-81.1 - Fracture zone, joints very closely spaced at 40° to 70°, iron oxide staining.	Run 16	100 (0)
			Run 17	20
			72.0 to 75.5	(0)
			Run 18	15
	75.5 to 77.5	(0)		
	Run 19	57		
	77.5 to 81.0	(11)		
	Run 20	97		
	81.0 to 84.5	(34)		
	Run 21	100 (0)		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Watana (North Bank) SHEET NO. 4 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
90 (73.7)	Andesite Porphyry	81.9-82.3 Rubble 83.1-85.0 Fracture zone, joints very closely spaced at 30° to 60°, some are healed. Some iron oxide staining and carbonate filling.	Run 22	77
			85.0 to 90.2	(51)
		88.0-109.6 Shear/fracture zone, joints close to very close spaced at 20° to 80°, with iron oxide staining, carbonate coating and clay gouge, slickensides. Core badly broken. Core loss 11.8 feet.	Run 23	67
			90.2-92.0	(0)
			Run 24	77
			92.0 to 95.0	(0)
			Run 25	100
			(0)	
	Run 26	92		
	(0)			
100 (81.9)		109.6-118.2 Shear/alteration zone, bleached chalky white breccia and gouge, slightly to severely altered hydrothermally throughout, soft, friable, slickensides. Thin gray clay layer at 20° to 50°. Core loss 2.2 feet.	Run 27	18
			97.8 to 100.1	(0)
		114.8-118.2 Slightly to moderately altered hydrothermally, bleached. Joints at 20° to 40°, healed fractures and joints throughout. Core loss 0.8 feet.	Run 28	29
			100.1-101.8	(0)
110 (90.1)			Run 29	3
			101.8 to 108.0	(0)
			Run 30	19
			108.0-109.6	(0)
	Run 31	75		
	109.6 to 115.2	(0)		
	Run 32	73		
	115.2-118.2	(0)		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Watana (North Bank) SHEET NO. 9 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Diorite	247.0-248.6 Brecciated and clay gouge, irregular fractures and carbonate filling.	Run 69	
245.8 (201.3)	Andesite (?)	Light to medium green aphanitic to fine ground mass, fine and medium grained white phenocrysts of feldspar, less than 10% mafics, primarily has a porphyritic texture, Contains inclusions of the gray-white diorite and a very fine grained mafic rock. Possible flow structure. Upper contact in brecciated zone assumed to be fairly sharp. Joints very close to closely spaced, most carbonate coated, some iron oxide staining. [Note: Resembles both andesite and diorite in places due to variations in grain size.]	Run 70 247.2 to 252.2	100 (0)
250 (204.8)			Run 71 252.2 to 257.4	100 (49)
			Run 72 257.4 to 262.2	100 (28)
260 (213.0)			Run 73 262.2 to 265.0	100 (41)
			Run 74 265.0 to 269.0	100 (50)
			Run 75 269.0- 271.0	100 (100)
270 (221.2)			Run 76 271.0 to 276.1	100 (84)
			Run 77	
		277.7 Lower contact, oriented at 20°, sharp contact of andesite and diorite, single joint with thin clay seam. Rock is fresh and hard on both sides.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Watana (North Bank) SHEET NO. 10 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)	
277.8 (227.6)	Diorite	Gray-white to gray-green, medium grained rock, 20-30% mafics. Generally very hard and fresh. Joints are closely spaced, some carbonate filling, iron stained, and/or calcite filled.	Run 77 276.1 to 280.6	89 (58)	
280 (229.4)			Run 78 280.6 to 285.8	96 (61)	
			285.8-287.8 Fracture zone, joints very close to closely spaced, oriented at 20° to 60°, carbonate present. Hard and fresh. Core loss 0.1 ft.	Run 79 285.8- 287.8	90 (0)
			288.2-289.3 Healed shear, 15°-30°, healed with dark green fine grained diorite.	Run 80 287.8 to 291.1	100 (88)
290 (237.6)			290.7-293.1 Joints very close to closely spaced, oriented at 15° to 70°. Iron staining and carbonate filling.	Run 81 291.1 to 296.1	96 (48)
				Run 82 296.1 to 301.1	100 (80)
300 (245.7)			300.9-301.2 Fracture zone, joints very closely spaced, oriented at 40° to 70°. Clay filling and chlorite coating.	Run 83 301.1 to 306.1	100 (62)
			301.1-306.1 Core loss 0.4 ft.		
			301.2-328.0 Joints close to moderately close spaced, oriented at 0° to 70° chlorite and carbonate filling. Hard and fresh.	Run 84 306.1- 310.2	100 (90)

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Watana (North Bank) SHEET NO. 11 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)	
310 (253.9)	Diorite		Run 84		
			Run 85 310.2 to 315.4	92 (54)	
			Run 86 315.4 to 320.4	100 (86)	
		320 (292.1)	321.2-321.4 Shear, breccia and gouge, clay with some carbonate filling, iron oxide staining.	Run 87 320.4 to 325.3	100 (52)
			325.1 Joint, 40°, slickensides.	Run 88 325.3- 328.0	100 (63)
			328.0-335.9 Joints, close to very closely spaced generally oriented at 30° to 50°, carbonate filling.	Run 89 328.0 to 332.4	98 (43)
		330 (270.3)	335.9-372.0 Joints close to moderately close spaced, carbonate and chlorite.	Run 90 332.4 to 337.5	100 (75)
340 (278.5)		Run 91 337.5 to 341.0	97 (81)		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Watana (North Bank) SHEET NO. 12 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)	
350 (286.7)	Diorite		Run 92	63 (0)	
			Run 93 341.4 to 346.6	100 (100)	
			Run 94 346.6 to 351.0	98 (77)	
			Run 95 351.0 to 356.0	100 (88)	
			Run 96 356.0 to 361.0	94 (95)	
		360 (294.9)	361.0-366.0 Core loss 0.8 ft. 362.0 Amount of mafics increase from 20-30% to 30-40%. 362.5-363.5 Felsic Dike, light gray, hard, unfractured, tight contact, oriented at 10°, 0.5 in. wide.	Run 97 361.0 to 366.0	90 (90)
			Run 98 366.0 to 370.6	100 (91)	
		370 (303.1)	370.3-381.0 Carbonate in joints.	Run 99	100 (87)

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5700.05
HOLE NO. BH-2
SHEET NO. 13 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
380 (311.3)	Diorite	374.1-375.0 Iron oxide staining.	Run 99 370.6 to 375.8	100 (87)
			Run 100 375.8 to 381.0	96 (67)
			Run 101 381.0 to 386.2	96 (51)
			Run 102 386.2 to 391.2	100 (87)
			Run 103 391.2 to 396.3	96 (59)
			Run 104 393.3- 398.8	96 (38)
390 (319.5)		382.0-392.6 Shear/alteration zone, slightly to moderately altered. Joints are very close to close spaced, filled with carbonate and iron oxide staining, clay gouge, and sulfide mineralization. 382.0 Joint, oriented at 70°, 0.1 in. wide black clay layer in a carbonate vein 0.5 in. wide. 383.5 Shear, oriented at 40°, 0.5 in. wide, breccia, soft and friable. Carbonate filling with iron oxide staining. 386.2-386.8 Shear zone, chalky white clay gouge, iron oxide stained breccia. Soft, friable.		
400 (327.7)		392.6-401.0 Joints very close to close spaced, numerous healed joints throughout, hard.	Run 105	100 (100)
401.0 (328.5)		END OF BORING		

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-2
 Site Watana (North Bank) Sheet No. 1 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5		
0	1839													Andesite Porphyry	TOP OF ROCK 10.0'
20														Andesite Porphyry	
40	1798														
60														Diorite	Fracture zone.
80															Fracture zone.
100	1757													Diorite	Shear/alteration zone.
120															
140														Diorite	Shear/fracture zone
160	1716														Fracture/alteration zone.
180														Diorite	Shear.
200	1675														Shear.
220														Andesite(?)	Shear, slickensides
240															Fracture zone.
260	1634													Diorite	
280															Fracture zone.
300	1593													Diorite	Shear/alteration zone.
320															
340															



Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-2
 Site Watana (North Bank) Sheet No. 2 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5		
360														Diorite	
380														Diorite	Fracture/alteration zone.
400	1511														
															END OF BORING 401.0'



**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT: ALASKA POWER AUTHORITY **JOB NO.:** P5700.05
PROJECT: Susitna Hydroelectric Project **HOLE NO.:** BH-3
SITE: Watana (North Bank) **SHEET NO. 1 OF 31**
CONTRACTOR: Interstate Exploration Inc. **DRILLING DATES:** August 15 to September 9, 1981
LOGGED BY: K.J. White, M.P. Bruen **DATE:** September 1981
DRILLING METHOD: SOIL Casing Advancer **CASING DIAMETER:** NW (3.0") I.D.
ROCK Diamond Core - Triple Tube **CORE DIAMETER:** NQ (1.75") O.D.
LOCATION: **LATITUDE** N3,228,197 **ELEVATIONS:** **DATUM** MSL, A.S.P.C., Zone 4
DEPARTURE E744,103 **GROUND SURFACE** 2150.7
AZIMUTH 338° **ROCK SURFACE** 2124.7
DIP 55° **BOTTOM OF HOLE** 1367.8
WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ().
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (ROD)
0	Overburden	No samples taken.		
10 (8.2)				
20 (16.4)				

APPROVED: *K.J. White*

DATE: February 1, 1982

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT: Alaska Power Authority **JOB NO.** P5701.05
PROJECT: Susitna Hydroelectric Project **HOLE NO.** BH-3
SITE: Watana (North Bank) **SHEET NO. 2 OF 31**

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
30 (24.6)	Overburden	TOP OF ROCK		
31.7 (26.0)	Diorite	Medium gray-green, medium grained, less than 5% quartz. Joints generally close to moderately closely spaced, iron oxide staining near surface, most joints carbonate coated. Fresh, very hard to hard. 31.8-46.4 Joints close to very closely spaced. Iron oxide staining on 30-40% of joints, trace to coating of carbonate. 36.7 Felsic dike, light gray, fine to medium grained, 10-20% quartz, less than 5% mafics, 0.5 in. to 1.5 in. wide. Tight contacts, hard, oriented at 90°.	Run 1 31.7 to 36.7	100 (44)
40 (32.8)			Run 2 36.7 to 40.7	100 (40)
			Run 3 40.7 to 45.8	100 (37)
			Run 4 45.8 to 50.8	100 (36)
50 (41.0)			Run 5 50.8 to 55.8	100 (97)
			Run 6 55.8 to 60.8	100 (98)

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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT Alaska Power Authority

JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-3

SITE Watana (North Bank)

SHEET NO. 3 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)			
60 (49.1)	Diorite	46.0-46.4 Shears, two along joints at 40°, approximately 0.1 foot and 0.05 feet wide, breccia and gouge. 46.4-111.2 Joints close to moderately closely spaced, trace to coating of carbonate and chlorite 46.8-48.4 Joints 20° to 30°, closely spaced, healed with carbonate. 49.4-50.2 Numerous irregular fractures healed with carbonate, very closely spaced. 52.3 Felsic dike, 30°, unfractured, 0.25 inch wide, tight. 52.4-53.1 Fracture zone, irregular, discontinuous, healed with carbonate, very closely spaced joints. 53.3-58.0 Healed diorite breccia, subrounded fragments of diorite to 2 inch, healed with dark green diorite. 57.5-57.9 Fracture zone, fractures less than 0.1 inch wide, very closely spaced, irregular and discontinuous, healed with carbonate. 61.2, 64.3 Inclusion of dark green fine grained diorite, 1.0 inch and 2.0 inches respectively. 65.9-69.9 Fractures, irregular and discontinuous, filled with carbonate, less than 0.1 inch to 0.25 inch wide, 10% of rock. 67.7-75.9 Healed breccia, contains fragments of diorite in the dark green, fine grained diorite. Fragments, 70-80% of rock.	Run 6 50.8 to 55.8	100 (98)			
			Run 7 55.8 to 60.7	100 (92)			
			Run 8 60.7 to 65.7	100 (94)			
			Run 9 65.7 to 70.7	100 (80)			
			Run 10 70.7 to 75.9	98 (79)			
			Run 11 75.9 to 80.9	98 (68)			
			Run 12 80.9 to 85.9	98 (84)			
			70 (57.3)	Diorite			
			80 (65.5)	Diorite			

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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT Alaska Power Authority

JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-3

SITE Watana (North Bank)

SHEET NO. 4 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)			
90 (73.7)	Diorite	69.2 Inclusion of dark green, fine grained diorite. 69.5-72.8 Occasional patches of red stain, irregular and discontinuous. 79.6-79.8 Core broken by drilling, pieces 1.0 inch to 2.0 inches. 80.8-80.9 Red staining on the core. 81.3-82.3 Joints, 20°-30°, possibly open, iron oxide staining and carbonate coating. 81.3-87.0 Diorite breccia, healed, hard. 85.7-93.8 Joints/fractures, closely spaced, up to 2.0 inches wide, healed with carbonate. 94.1-95.1 Pods of felsic rock, light gray, fine to medium grained, some have quartz centers, up to 0.5 inches wide. Less than 5% of rock. 96.6-98.5 Joints, very close to closely spaced, healed with carbonate. 106.4-106.7 Red stain in core, covering 70% of zone. 111.2-190.7 Joints moderately closely spaced, with zones of closely, spaced joints. 111.6-132.0 Diorite breccia, rounded to sub-angular rock fragments to 1.0 inch, 60-70% of rock, in a dark green diorite matrix. Hard.	Run 12				
			Run 13 85.9 to 90.8	100 (98)			
			Run 14 90.8 to 95.8	100 (84)			
			Run 15 95.8 to 100.8	100 (100)			
			Run 16 100.8 to 106.0	100 (100)			
			Run 17 106.0 to 110.7	100 (100)			
			Run 18 110.7 to 115.9	100 (100)			
			Run 19				
			100 (81.9)	Diorite			
			110 (90.1)	Diorite			

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DRILLING REPORT

CLIENT Alaska Power Authority
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 5 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
120 (98.3)	Diorite	116.7-126.7 Joints, close to moderately closely spaced, healed with carbonate up to 0.25 inch wide, irregular and discontinuous.	Run 19 115.9 to 120.7	100 (100)
			Run 20 120.7 to 125.7	100 (100)
130 (106.5)	Diorite	127.0-133.6 Shear/alteration zone, bleached to a light green, slightly altered hydrothermally, hard. 127.7 Shear, 15°, slickensides on carbonate, trace amounts of gouge. 128.9-135.7 Fracture zone, healed with carbonate, closely spaced up to 0.5 inch but generally less than 0.1 inch.	Run 21 125.7 to 130.7	100 (100)
			Run 22 130.7 to 135.7	100 (100)
			Run 23 135.7 to 140.7	98 (50)
			Run 24 140.7 to 145.8	100 (100)
140 (114.7)	Diorite	135.7-138.3 Shear/alteration zone, slightly to moderately altered hydrothermally, oriented along healed shear to 10°. Feldspars breaking down to clay, approximately 1.0 inch wide. Moderately hard to soft. Core badly broken by drilling. 137.9-138.3 Silty-sand coating, possible gouge. 140.2-143.4 Fracture zone, closely spaced, irregular, and discontinuous joints healed with carbonate filling less than 0.1 inch wide. 146.0-149.0 Joints healed with carbonate. 149.0-152.0 Alteration zone, slightly altered hydrothermally, feldspars altering to clay, hard.	Run 25 145.8 to 150.7	100 (100)

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CLIENT Alaska Power Authority
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 6 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (122.9)	Diorite	153.0, 154.0 Felsic dikes, light gray and light red-gray, 10° and 15°, respectively, 0.5 inch wide. Second dike is offset 0.25 inch along a joint at 50°, healed with carbonate, hard. 153.9 Felsic dike, light red-gray, fine grained, at 10°. Truncated by shear at 30°, healed with dark green igneous material and carbonate, with offset greater than 2.0 inches. 156.0 Carbonate vein, possibly a healed shear at 25°, 0.25 inch thick. Carbonate is stained red. 157.0 Alteration zone, moderately altered hydrothermally, approximately 1.0 inch wide at 25°.	Run 25 150.7 to 155.7	100 (100)
			Run 26 150.7 to 155.7	100 (100)
160 (131.1)	Diorite	157.3-174.6 Healed breccia, angular fine grained fragments to 0.25 inch in an igneous groundmass, hard. Majority of fragments in breccia are dark gray to green subangular, fine grained, igneous rock. 165.2 Alteration zone, hydrothermally altered, 0.5 inch wide, feldspars breaking down to clay. No definitive contacts.	Run 27 155.7 to 160.7	100 (100)
			Run 28 160.7 to 165.7	100 (100)
			Run 29 165.7 to 170.7	100 (98)
			Run 30 170.7 to 175.7	100 (94)
170 (139.3)	Diorite	Note: Zones of alteration within the healed breccia up to 6.0 inch wide, generally less than 1.0 foot to 2.0 feet apart, moderately hard. Up to 25% of feldspars altering to clay. 177.0, 177.2 Shear, 20°, 0.25 inch wide, healed with green igneous rock and carbonate.	Run 31 175.7 to 180.7	100 (98)
			Run 32 180.7 to 185.7	100 (98)
180 (147.4)	Diorite		Run 33 185.7 to 190.7	100 (98)

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DRILLING REPORT

CLIENT Alaska Power Authority

JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-3

SITE Watana (North Bank)

SHEET NO. 7 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION - COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC. (ROD)
190 (155.6)	Diorite	178.9 Joint, 20°, possible iron oxide staining. Alteration of feldspars on either side to 0.5 inches.	Run 32	100
		180.7 Joints closely spaced, approximately 50% are carbonate healed, with chlorite coating.	180.7 to 185.4	(87)
		184.4-184.7 Core is badly broken, pieces less than 0.5 inches. Friable, possible fracture zone or shear zone.	Run 33	98
		184.8 Fracture, 0°, carbonate filled, offset approximately 0.5 inches.	185.4 to 190.7	(89)
		186.3 Joints, two, 40° and 90°, with sandy-silt coating.		
		188.0-190.3 Shear/fracture zone along joint at 0° to 10°, joints very closely spaced. Approximately 0.1 to 0.25 inches of gouge, no slickensides. Some are partially healed with carbonate and chlorite.	Run 34	100
		190.3-191.6 Healed breccia, 50-60% rock fragments within a dark green diorite matrix, hard.	190.7 to 195.6	(100)
		190.7-228.6 Joints moderately close to widely spaced, averaging 2-3 feet, most healed with carbonate.		
		190.7-195.0 Irregular patches of red stain.	Run 35	100
			195.6 to 200.7	(94)
200 (163.8)	Diorite	203.0-203.5 Diorite breccia, healed with carbonate.	Run 36	100
			200.7 to 205.7	(100)
		206.1-206.2 Healed breccia, 70°, hard.	Run 37	100
210 (172.0)	Diorite		205.7 to 210.7	(100)
			Run 38	100
			210.7 to	(100)

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BUFFALO, NEW YORK
DRILLING REPORT

CLIENT Alaska Power Authority

JOB NO. P5701.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-3

SITE Watana (North Bank)

SHEET NO. 8 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION - COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC. (ROD)
220 (180.2)	Diorite	214.5-215.1 Numerous fractures, irregular and discontinuous, healed with carbonate up to 0.25 inches wide.	Run 38	100
			210.7 to 215.7	(100)
		218.3-219.4 Healed breccia, approximately 50-60% rock fragments to 2 inches in a fine grained diorite matrix.	Run 39	100
			215.7 to 220.7	(100)
			Run 40	100
			220.7 to 225.8	(100)
			Run 41	100
			225.8 to 230.8	(100)
			Run 42	100
			230.8 to 235.9	(100)
230 (188.4)	Diorite	224.1-225.5 Fracture zone, fractures/joints very closely spaced at 0° to 20° and 50° to 70°. Healed with carbonate, tight.	Run 43	100
		228.6-228.8 Core broken by drilling (?), angular pieces, 0.25 to 0.5 inches, carbonate coating.	235.9 to 240.9	(96)
		228.6-315.7 Joints moderately closely spaced (average 1.0 to 2.0 feet). Approximately 50% healed with carbonate.		
240 (196.6)	Diorite	230.5 Felsic dike, fractured but tight, at 20°, 0.5 inches wide.	Run 44	100
		233.3 Healed shear, 10°, 1.0 inch wide breccia zone, fragments of breccia are predominately carbonate, matrix is dark green igneous material. Re-shearing along this zone, silt and clay coating.	240.9 to 245.9	(100)
		236.4 Healed shear, 20°, 0.25 inches wide, hard.		
		239.6 Joint, 20°, trace to 0.25 inches wide, tight.		
		241.3 Shear, 10°, 0.5 inches wide, healed with carbonate, tight.		

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT Alaska Power Authority
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 9 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
250 (204.8)	Diorite	241.8-242.2 Discoloration of feldspars, yellow stain. 243.0-243.6 Carbonate vein, 0.3 inches wide, tight. 245.4-246.4 Numerous fractures, up to 0.25 inches, healed with carbonate. Joint, 10°, 0.5 inches of carbonate filling. 247.5-250.4 Joints closely spaced. 248.0-248.6 Fracture zone, joints very closely spaced, healed with carbonate, some broken by drilling. 248.8-248.9 Core broken by drilling, pieces 0.5 to 1.0 inches. 254.6-255.1 Fracture zone, very closely spaced, joints irregular, discontinuous, healed with carbonate.	Run 44	
			Run 45 245.9	100 (100)
			to 250.9	
			Run 46 250.9	100 (100)
			to 255.9	
			Run 47 255.9	100 (100)
			to 260.9	
			Run 48 260.9	98 (92)
			to 265.6	
			Run 49 265.6	100 (100)
260 (213.0)	Diorite		Run 50 270.7	100 (92)
			to 275.7	
			Run 51 275.7	100 (94)
			to 270.7	
270 (221.2)	Diorite		Run 50 270.7	100 (92)
			to 275.7	

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT Alaska Power Authority
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 10 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
280 (229.4)	Diorite	280.8-281.2 Inclusion of dark green, fine grained diorite. 284.7-302.8 Alternation zone, slightly altered hydrothermally. Within the alteration zone are healed breccia zones up to 2.0 inches wide, healed with dark green igneous rock and carbonate, moderately closely spaced. Feldspars stained yellow-green, moderately hard.	Run 51	100 (94)
			275.7	
			to 280.7	
			Run 52	100 (100)
			280.7	
			to 285.7	
			Run 53	100 (100)
			285.7	
			to 290.7	
			Run 54	100 (100)
290 (237.6)	Diorite		290.7	
			to 295.7	
			Run 55	100 (100)
			295.7	
300 (245.7)	Diorite		to 300.7	
			Run 56	100 (100)
			300.7	
			to 305.7	
	Diorite	306.4-307.0 Healed diorite breccia, hard. 307.0-307.7 Numerous joints, 20°, healed by carbonate, very closely spaced, tight.	Run 57	100 (100)
			305.7	
			to 310.7	

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT				
CLIENT		Alaska Power Authority	JOB NO. P5701.05	
PROJECT		Susitna Hydroelectric Project	HOLE NO. BH-3	
SITE		Watana (North Bank)	SHEET NO. 13 OF 31	
DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
380 (311.3)	Diorite	365.8-366.6 Fracture zone, joints and fractures healed with carbonate very closely spaced, joints at 20°. Fractures are irregular and discontinuous, tight. 366.8-367.1 Healed breccia, 60-70% diorite fragments, in a dark green igneous matrix, hard. 371.2-371.8 Red staining on core. 372.2 Joint, 10°, 0.1 inch coating of carbonate, chlorite, clay. 374.3-388.7 Joints close to moderately closely spaced, averaging 0.5 to 1.5 feet. 374.6 Joint, 0° to 10°, coated with carbonate chlorite, and silt/clay, approximately 0.1 inches wide. 379.4-388.2 Alteration zone, slightly altered hydrothermally, 30-40% of feldspars show staining and beginning to alter to clay. Close to very closely spaced joints, tight, healed with carbonate, moderately hard. 379.5 Joint, 60°, filling of silt/clay, approximately 0.25 inches thick. 379.9 Joint, 80°, coated with silt/clay. 384.5 Joint, 35°, with faint slickensides, chlorite staining. 384.8-385.2 Shear, 70°, predominantly a breccia with layers of gouge to 0.5 inches. Breccia/gouge partially healed with carbonate, soft. 386.2-386.4 Core broken by drilling, average 1.0 inch, pieces coated with carbonate and chlorite. 386.4 Shear, 50° with 0.1 inch of breccia. 386.5-387.0 Shear, 0° to 10°, 0.1 inch of gouge. Slickensides on chlorite, slightly to moderately altered hydrothermally, friable. 392.3-416.7 Joints, very close to closely spaced, numerous zones of core broken by drilling, averaging 0.5 to 1.0 feet. 394.7-396.3 Joints, healed with carbonate, some broken by drilling.	Run 70 370.7 to 375.7	100 (72)
			Run 71 375.7 to 380.7	100 (80)
			Run 72 380.7 to 385.9	100 (69)
			Run 73 385.9 to 390.7	96 (54)
			Run 74 390.7 to 394.3	100 (58)
			Run 75 394.3 to 399.3	100 (46)
			Run 76 399.3 to 400.8	100 (0)
			Run 77 400.8 to 405.8	100 (74)

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT				
CLIENT		Alaska Power Authority	JOB NO. P5701.05	
PROJECT		Susitna Hydroelectric Project	HOLE NO. BH-3	
SITE		Watana (North Bank)	SHEET NO. 14 OF 31	
DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
410 (335.9)	Diorite	406.3-408.7 Shear and fracture zone, joints very closely spaced. 406.3 Joint, 80°, slickensides on chlorite. 407.3-407.7 Core broken by drilling, pieces 0.5 to 1.0 inches, minor slickensides. 409.1-409.5 Alteration zone, core bleached to yellow-gray, slightly to moderately altered hydrothermally. Feldspars are stained and altering to clay. Trend is parallel to healed shear at 40°, crosscuts this zone. 414.4-424.4 Shear/alteration zone, core is bleached to light yellow-green, slightly altered hydrothermally, feldspars, stained, hard to moderately hard. 415.0 Shear, 20°, slickensides on chlorite and carbonate filling. Crosscuts 1.0 inch wide zone of very closely spaced joints healed with carbonate. 416.6 Possible shear, 30°, healed by carbonate. 416.7-450.5 Joints close to moderately closely spaced, average 1.0 to 2.0 feet. Chlorite coating of carbonate. 419.7 Healed shear, 20°, up to 0.25 inch thick, healed with dark green igneous material and carbonate. 424.2 Two joints very closely spaced, 20°, slickensides on chlorite and carbonate. Rusty-orange stain on carbonate. 426.7 Joint, healed, 20°, rusty-orange, less than 0.1 inches of carbonate. Alteration of feldspars to 0.25 inches on either side. 428.2 Healed joint, 30°, rusty-orange stain, slickensides on carbonate and chlorite.	Run 77	
			Run 78 405.8 to	100 (88)
			Run 79 410.8 to 415.8	100 (90)
			Run 80 415.8 to 420.9	100 (94)
			Run 81 420.9 to 425.8	100
			Run 82 425.8 to 430.7	100 (100)
			Run 83 430.7- 432.4	100 (100)
			Run 84 432.4	100 (88)
			Run 85 432.8 to 438.0	100 (98)

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CLIENT Alaska Power Authority JOB NO. P5701.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
SITE Watana (North Bank) SHEET NO. 15 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
440 (360.4)	Diorite	439.9 Joint, 15°, healed with carbonate, trace of silty-sand, broken by drilling.	Run 85	
			Run 86 438.0 to 440.7	100 (100)
			Run 87 440.7 to 445.6	100 (100)
450 (368.6)	Diorite	443.2 Joint, 20°, slickensides on chlorite. 447.0-447.2 Shears (2), 20° and 40°, approximately 0.3 inches of chlorite breccia, slickensides. 449.0-454.5 Healed diorite breccia, 80 to 90% diorite fragments, in dark green, fine grained diorite, hard. 450.5-458.3 Joints and fractures very closely spaced, tight, less than 50% healed by carbonate. 457.2 Joint, 20°, slickensides on carbonate and chlorite. 457.8 Joint, 0°, healed with carbonate, slickensides. 450.5-475.9 Joints, very close to closely spaced, average 0.5 to 1.0 feet. 459.7-460.7 Core broken by drilling, pieces 0.5 to 1.0 inch. Most surfaces have chlorite and carbonate stain, potential fracture zone.	Run 88 445.6 to 450.6	100 (100)
			Run 89 450.6 to 455.6	100 (100)
			Run 90 455.6 to 460.7	100 (78)
			Run 91 460.7 to 463.7	100 (100)
460 (376.8)	Diorite	463.5-464.1 Fracture zone, joints and fractures very closely spaced, fragments have gray-green coating, broken by drilling. 467.4-475.9 Shear/fracture zone, joints very closely spaced. Approximately 25% of the core is badly broken by drilling.	Run 92 463.7 to 468.3	100 (76)
			Run 93	

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CLIENT Alaska Power Authority JOB NO. P5701.05
PROJECT Susitna Hydroelectric HOLE NO. BH-3
SITE Watana (North Bank) SHEET NO. 16 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
470 (385.0)	Diorite	469.5 Fragment with faint slickensides. 470.3 Joint, 0°, faint slickensides. 471.0 Shear, 10°, approximately 0.5 inches of gouge and breccia. Core is badly broken.	Run 93	100
			468.3 to 473.7	(81)
			Run 94 473.7 to 478.7	96 (8)
480 (393.2)	Diorite	474.1-530.0 Shear/alteration zone, core is bleached to light yellow-green to light yellow-gray, moderate hydrothermal alteration. Approximately 50% of feldspars have altered to clay. Numerous carbonate healed joints, close to very closely spaced. Moderately hard to soft, locally friable. 483.7-486.9 Shear zone, partially healed. Breccia healed with carbonate.	Run 95 478.7 to 483.7	100 (0)
			Run 96 483.7 to 488.7	100 (0)
			Run 97 488.7 to 491.5	100 (0)
			Run 98 491.5 to 496.5	100 (0)
490 (401.4)	Diorite	494.6-503.5 Shear zone, partially healed, contact at 20°. Breccia and gouge healed with carbonate.	Run 99 496.5 to 500.7	86 (0)
			Run 100	

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SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 17 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REG (ROD)
510 (417.8)	Diorite	509.7-513.8 Shear zone, partially healed. Breccia and gouge healed with carbonate. Fragments of red-gray igneous material, possibly a dike.	Run 100 500.7 to 503.5	71 (0)
			Run 101 503.5 to 507.0	94 (0)
			Run 102 507.0 to 510.8	100 (0)
			Run 103 510.8 to 515.8	100 (0)
			Run 104 515.8 to 520.8	100 (0)
			Run 105 520.8 to 525.9	100 (0)
			Run 106 525.9 to 530.7	100 (14)
520 (426.0)				
530 (434.2)	Diorite	530.0-550.7 Joints close to moderate closely spaced, chlorite coating, trace to coating of carbonate.	Run 107 530.7 to 530.7	100 (100)

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SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 18 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REG (ROD)			
540 (442.3)	Diorite	538.3 Joint, 30°, healed with carbonate, slight to moderate alteration to 1.5 inches on either side. 545.0-551.0 Shear/alteration zone, core is bleached to a medium yellow-green, generally slightly altered hydrothermally. Feldspars are stained, less than 10% are altered to clay. Moderately hard, coincident with a healed breccia zone.	Run 107 530.7 to 535.7	100 (100)			
			Run 108 535.7 to 540.7	100 (88)			
			Run 109 540.7 to 541.5	100 (100)			
			Run 110 541.5 to 546.4	100 (100)			
			Run 111 546.4 to 550.7	100 (100)			
			Run 112 550.7 to 555.7	96 (24)			
			Run 113 555.7 to 560.7	100 (100)			
			Run 114 560.7 to 565.7	100 (78)			
			550 (450.5)				
			560 (458.7)	Diorite	559.9-622.4 Alteration zone, bleached to a light-medium yellow-green, slightly altered hydrothermally. Feldspars are stained, but generally have not altered to clay. Seems to be a mixture of diorite, an aphanitic/fine grained dark green igneous rock, and abundant carbonate fillings in approximately 10% of rock. Hard to moderately hard, carbonate stained red in places. 559.9-600.5 Healed shear zone, coincides with altered zone.		

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SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 19 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
570 (466.9)	Diorite	560.9-561.0 Two shears, very closely spaced, 30°. Upper shear, 0.5 inches wide breccia zone; lower shear, coating of carbonate. 563.6-565.7 Shear/fracture zone, joints very closely spaced, some joints have a silt/clay coating, gouge(?). 597.2-600.5 Felsic dike (?), light gray, fine to medium grained. Brittle, slightly altered hydrothermally, highly fractured, numerous drilling breaks. 565.7-600.5 Joints moderately close to wide, chlorite coating, with trace to coating of carbonate.	Run 114	
			Run 115	100
			565.7	(100)
			to	
			570.7	
			Run 116	100
			570.7	(100)
			to	
			575.1	
			Run 117	100
575.1	(100)			
to				
580.1				
580 (475.1)	Diorite	600.4-605.3 Slightly to moderately altered hydrothermally, most joints are carbonate healed. Feldspars are discolored and and beginning to alter to clay, moderately hard.	Run 118	100
			580.1	(100)
			to	
			585.2	
590 (483.3)	Diorite		Run 119	100
			585.2	(100)
			to	
590.3				
	Diorite		Run 120	100
			590.3	(100)
			to	
595.4				
	Diorite		Run 121	100
				(96)

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SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 20 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
600 (491.5)	Diorite	600.5-622.4 Joints close to very closely spaced, numerous joints are healed with carbonate. Tight and competent, some broken during drilling, carbonate filling averages 0.1 to 0.25 inches. Moderately spaced healed shears, tight.	Run 121	100
			595.4	(96)
			to	
			600.5	
			Run 122	100
			600.5	(96)
			to	
			605.7	
			Run 123	100
			605.7	(98)
to				
610.8				
610 (499.7)	Diorite		Run 124	100
			610.8	(100)
			to	
615.8				
620 (507.9)	Diorite	622.4-633.0 Alteration zones, closely spaced, approximately 0.5 feet wide. Feldspars stained, hard. 622.4-754.0 Joints close to moderately closely spaced, trace of carbonate, chlorite common. Average 0.5 to 1.5 feet.	Run 125	100
			615.8	(100)
			to	
620.8				
	Diorite	626.8 Carbonate vein, offset by joints at 60°, offset approximately 0.25 inches.	Run 126	100
			620.8	(100)
			to	
625.9				
	Diorite		Run 127	100
			625.9	(100)
630.7				

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JOB NO. P5701.05
 HOLE NO. BH-3
 SHEET NO. 21 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
630 (516.1)	Diorite		Run 127	
			Run 128 630.7 to 635.7	100 (100)
			Run 129 635.7 to 640.7	100 (86)
			Run 130 640.7 to 645.7	100 (100)
			Run 131 645.7 to 650.7	100 (100)
			Run 132 650.7 to 655.6	100 (100)
			Run 133 655.6 to 660.7	100 (100)
640 (524.3)				
650 (532.4)				
660 (540.6)				
		657.0 Shear, 20°, up to 0.25 inches wide, healed primarily with carbonate, but also some dark green diorite. 657.0-657.8 Joints, 10°-20°, very closely spaced, 20°. Healed with carbonate, tight.		

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 SITE Watana (North Bank)

JOB NO. P5701.05
 HOLE NO. BH-3
 SHEET NO. 22 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
670 (548.8)	Diorite		Run 134 660.7 to 665.7	100 (100)
			Run 135 665.7 to 670.7	100 (98)
			Run 136 670.7 to 673.8	100 (97)
			Run 137 673.8 to 678.8	100 (92)
			Run 138 678.8 to 680.8	100 (45)
			Run 139 680.8 to 685.7	100 (80)
			Run 140 685.7 to 690.7	100 (80)
			Run 141 690.7 to 695.7	100 (88)
			Run 142 695.7 to 700.7	100 (88)
			Run 143 700.7 to 705.7	100 (88)
680 (557.0)				
690 (565.2)				
		677.0-681.1 Joints very close to closely spaced.		
		683.1 Irregular shaped inclusion of felsic material.		
		688.8-689.4 Fracture zone, core broken by drilling, joints very closely spaced.		

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SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 23 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
700 (573.4)	Diorite	695.4-696.1 Fracture zone, joints very closely spaced at 60°.	Run 141	100
			690.7	(88)
			to	
			695.7	
			Run 142	100
			695.7	(98)
			to	
			700.7	
			Run 143	100
			700.7	(78)
710 (581.6)	Diorite	702.0-707.7 Shear/alteration zone, bleached to a medium yellow-green, generally slightly altered hydrothermally. Hard to very hard. 702.7-703.5 Felsic dike, light green-gray, fine grained, fractured but tight. At 703.0 dike has been offset along a joint at 60°, approximately 1.0 inch. 704.2-705.7 Alteration is slight to moderate, with feldspars altering to clay. Rock is soft to moderately hard, friable along shear. Shear is at 705.0 and 705.5, approximately 0.25 inches of breccia and gouge. Minor sulfide mineralization. 704.5-705.7 Core loss 0.2 feet.	Run 144	100
			705.7	(100)
			to	
			710.7	
			Run 145	100
			710.7	(88)
			to	
			715.6	
			Run 146	100
			715.6	(100)
720 (589.8)	Diorite	717.2 Felsic dike, 20°, gray green, fine grained to aphanitic, slightly fractured, chill margins, 2.0 inches wide. 718.3 Joint, 10°, trace of sandy-silt. 719.0 Joint, 10°, slickensides on chlorite, coating of carbonate and chlorite gouge.	Run 147	100
			719.7	(96)
			to	
			724.8	

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SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 24 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
730 (598.0)	Diorite	729.2 Joint, 10°, trace of sandy-silt.	Run 148	100
			724.8	(100)
			to	
			730.0	
			Run 149	100
			730.0	(100)
			to	
			735.0	
			Run 150	100
			735.0	(100)
740 (606.2)	Diorite	737.6 Healed breccia, 70-80% diorite fragments in a dark green diorite matrix. Hard, numerous irregular, discontinuous fractures filled with carbonate, up to 0.3 inches, comprise 10% of rock.	Run 151	100
			740.2	(100)
			to	
			745.2	
			Run 152	100
			745.2	(98)
			to	
			750.3	
			Run 153	100
			750.3	(100)
750 (614.4)	Diorite	745.7 Joint, 45°, slickensides on chlorite. 749.5 Joint, 80°, slickensides on chlorite.	Run 154	100
			750.3	(100)
			to	
			755.4	
	Diorite	753.6 Shear, 10°, healed. 754.0-773.9 Shear/fracture zone, joints very closely spaced, most are tight, some carbonate healed joints. Pieces of intact core approximately 1.0 foot long, brittle.	Run 154	100
				(96)

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CLIENT Alaska Power Authority
 PROJECT Susitna Hydroelectric Project
 SITE Watana (North Bank)

JOB NO. P5710.05
 HOLE NO. BH-3
 SHEET NO. 25 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
760 (622.6)	Diorite	757.0 Joint, 30°, slickensides on chlorite. 757.2 Joint, 60°, slickensides on chlorite. 757.7 Joint, 30°, slickensides on chlorite and carbonate. 758.6 Joint, 30°, slickensides on chlorite and carbonate. 759.3 Joint, 30°, slickensides, trace of gouge. 764.3-769.3 Most joints becoming healed with carbonate, less than 0.1 inch thick. 768.0 Shear, 30°, 1.0 inches of breccia, slickensides on chlorite, talc (?).	Run 154	100
			755.4 to 760.5	(96)
			Run 155	100
			760.5 to 765.5	(98)
			Run 156	100
			765.5 to 770.5	(96)
770 (630.7)	Diorite	773.9 Joint, 35°, slickensides on chlorite. 773.9-801.1 Fracture zone, joints are close to very closely spaced, some healed with carbonate, tight, pieces average generally to 1.0 foot, but are brittle.	Run 157	98
			770.5 to 775.5	(70)
			Run 158	100
780 (638.9)	Diorite		775.5 to 780.6	(98)
			Run 159	100
			780.6 to 785.7	(100)
			Run 160	100
			785.7 to 790.8	(100)

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CLIENT Alaska Power Authority
 PROJECT Susitna Hydroelectric Project
 SITE Watana (North Bank)

JOB NO. P5710.05
 HOLE NO. BH-3
 SHEET NO. 26 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
790 (647.1)	Diorite		Run 160	100
			790.8 to 793.5	(100)
			Run 161	100
			793.5 to 798.5	(76)
800 (655.3)	Diorite	800.5-800.7 Alteration zone, slightly altered hydrothermally, slightly bleached. Between a set of joints very closely spaced, at 20°, carbonate healed. Approximately 10% of feldspars are altered to clay. 801.1-840.8 Joints are closely spaced, average 0.5 to 1.0 feet. Chlorite filling, trace of carbonate. 801.3 Felsic dike, light gray, fine grained, 0.5 inches wide, offset by a healed shear. 805.7-807.0 Joints, very closely spaced, tight, healed with carbonate. 806.7 Joint, 20°, slickensides on chlorite.	Run 162	100
			798.5 to 800.7	(100)
			Run 163	100
			800.7 to 805.7	(100)
810 (663.5)	Diorite		Run 164	100
			805.7 to 810.7	(100)
			Run 165	100
			810.7 to 815.7	(100)
820 (671.7)	Diorite	812.5 Felsic dike or healed breccia, light gray, fine grained to aphanitic ground mass with diorite fragments. Tight contacts, 0.5 inches wide, 10°, hard. 817.5 Felsic dike, 15°, light gray, fine grained to aphanitic, 1.0 inch wide, margins are fine grained quartz and feldspar, with 0.5 inch zone of quartz.	Run 166	100
			815.7 to 820.7	(100)
			Run 167	100
			820.7 to	(100)

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CLIENT Alaska Power Authority JOB NO. P5701.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
SITE Watana (North Bank) SHEET NO. 27 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Diorite	821.4 Joint, 50°, coating of sandy-silt/clay, gouge (?).	Run 168 820.7 to 825.5	98 (96)
		828.9-844.8 Diorite becomes light to medium green, possibly due to changing composition of feldspars, may be an increase in quartz content.	Run 169 825.5 to 830.5	100 (90)
830 (679.9)		831.3 Felsic dike, 90°, light gray, medium grained, 1.0 inch wide. 831.3-833.6 Gradational change in texture from medium grained to fine grained. Sharp contact with the underlying medium grained diorite, unfractured.	Run 170 830.5 to 835.2	100 (100)
		840.8-882.3 Joints close to moderately closely spaced (average 1.0 feet), chlorite, trace to occasional filling of carbonate.	Run 171 835.2 to 840.2	100 (100)
840 (688.1)		847.8, 848.0 Inclusions of dark green, fine grained diorite, 1.0 inch in diameter.	Run 172 840.2 to 845.2	100 (100)
			Run 173 845.2 to 850.2	100 (100)
850 (696.3)			Run 174 850.2- 855.0	100 (100)

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CLIENT Alaska Power Authority JOB NO. P5701.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
SITE Watana (North Bank) SHEET NO. 28 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Diorite		Run 174	100 (100)
			Run 175 855.0 to 858.7	100 (100)
860 (704.5)		861.3-862.0 Several inclusions of dark green, fine grained diorite, up to 0.75 inches in diameter.	Run 176 858.7- 860.7	100 (100)
			Run 177 860.7 to 865.7	100 (100)
870 (712.7)			Run 178 865.7 to 870.8	100 (100)
		871.7, 872.0 Inclusions of dark green, fine grained diorite, 1.0 and 2.0 inches, respectively. 873.1-955.7 Diorite changes to a light gray-green. Increase in quartz, possibly up to 10%.	Run 179 870.8 to 875.7	100 (98)
		878.6 Felsic dike (?), 60°, light gray, fine grained, 2.0 inches wide, irregular contacts, hard. 879.3-882.5 Healed breccia zone.	Run 180 875.7 to 880.7	100 (100)
880 (720.9)		880.3 Shear along joint, at 15°, approximately 0.1 inch of clay/silt, carbonate; gouge (?). 881.6 Shear along joint, at 20°, 0.5 inches wide breccia gouge zone. Partially healed with carbonate.	Run 181 880.7 to 885.8	100 (94)

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 PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
 SITE Watana (North Bank) SHEET NO. 29 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION - COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)		
890 (729.0)	Diorite	882.3-888.1 Core broken by drilling, pieces generally less than 3.0 inches. Possible fracture zone (?).	Run 181			
			Run 182	100 (94)		
		888.1-908.0 Joints closely spaced, with local zones of very closely spaced joints. Trace to occasional filling of carbonate.	885.8			
			to 890.7			
		894.5-897.4 Shear/fracture zone (?), joints and fractures close to very closely spaced.	Run 183	100 (100)		
			Run 184	100 (74)		
		894.5-895.7 Core badly broken by drilling, pieces 1.0 to 2.0 inches. Two joints at 10° have slickensides, pieces are angular, fresh to slight chlorite staining.	892.0			
			to 896.6			
		898.8-899.1 Core broken by drilling, pieces are 1.0 to 2.0 inches, fresh, angular.	Run 185	100 (90)		
			896.6			
900 (737.2)	Diorite	903.0 Joint, 10°, healed, carbonate filling to 0.5 inches.	to 900.7			
			Run 186	100 (80)		
		903.8-904.2 Core broken by drilling, pieces 0.5 to 1.0 inch.	900.7			
			to 905.7			
		905.1-906.0 Core broken by drilling or possible fracture zone. Pieces average 1.0 inch.	Run 187	100 (92)		
			905.7			
		908.0-929.5 Joints are moderately close to close, averaging 1.0 to 1.5 feet.	to 910.7			
			Run 188	100 (100)		
		910 (745.4)	Diorite	912.6-913.1 Fracture zone, joints very closely spaced at 10°.	910.7	
					to 915.7	
Run 189	100 (98)					

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 BUFFALO, NEW YORK
DRILLING REPORT

CLIENT Alaska Power Authority JOB NO. P5710.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
 SITE Watana (North Bank) SHEET NO. 30 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION - COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
920 (753.6)	Diorite	923.5-925.1 Fracture zone, joints very closely spaced. Most are tight but have been broken by drilling.	Run 189	100 (98)
			915.7	
			to 920.7	
			Run 190	100 (100)
		926.6-928.2 Shear/alteration zone, core bleached to light yellow-green, slightly altered hydrothermally, hard to moderately hard. Upper contact is gradational, lower is sharp along a 60° carbonate healed joint.	920.7	
			to 925.8	
			Run 191	100 (92)
			925.8	
930 (761.8)	Diorite	927.2 Shear on joint at 35°, approximately 0.5 inches of breccia gouge, slickensides. 928.3-928.7 Irregular fractures healed with carbonate, up to 0.3 inches, less than 5% of rock.	to 930.8	
			Run 192	100 (100)
940 (770.0)	Diorite	929.5-955.7 Fracture zone, joints very closely spaced, most are tight, approximately 25% healed with carbonate. Minor sulfide mineralization, unbroken pieces range from 0.5 to 3.0 feet.	930.8	
			to 935.9	
		933.2-946.5 Shear/alteration zone, bleached to light yellow-green, slightly altered hydrothermally. Feldspars are stained, hard to moderately hard.	Run 193	100 (100)
			935.9	
		934.9 Shear, 40°, coating of clay gouge, coincident with a healed shear. 943.6 Shear, 30°, up to 0.5 inches of breccia gouge.	to 940.7	
			Run 194	100 (100)
		946.1 Shear, 25°, up to 0.5 inches of breccia gouge.	940.7	
			to 945.8	
940 (770.0)	Diorite	946.1 Shear, 25°, up to 0.5 inches of breccia gouge.	Run 195	100 (100)
			945.8	
			to 950.7	

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CLIENT Alaska Power Authority
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5701.05
HOLE NO. BH-3
SHEET NO. 31 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
950 (778.2)	Diorite	948.0-948.9 Alteration zone, slightly altered hydrothermally, approximately 10-25% of feldspars are altering to clay. Hard to moderately hard.	Run 195	100 (100)
			Run 196 950.7 to 955.7	100 (100)
955.7 (782.9)		END OF BORING		

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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-3
 Site Watana (North Bank) Sheet No. 1 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5		
0	2151													Overburden	
20															TOP OF ROCK 31.7'
40	2111													Diorite	Shear. Fracture zone, healed. Fracture zone.
60															Breccia, healed.
80															Breccia, healed. Shear, alteration zone.
100	2069														Alteration zone.
120															Alteration zone.
140	2028														Shear.
160															
180															
200	1987														Shears, healed.
220															
240	1987														Alteration zone.
260															
280															
300	1905														Alteration zone.
320															
340															Alteration zone.



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-3
 Site Watana (North Bank) Sheet No. 2 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5		
360															Joint, slickensides.
380															Shear/alteration zone.
400	1823														Shear/alteration zone.
420															Shear/fracture zone.
440	1784														Shear/alteration zone.
460															
480															No Test Data
500	1741														Shear/alteration zone.
520															
540	1700														Shear/alteration zone. Shear/fracture zone.
560															
580															
600	1659														
620															
640	1619														
660															
680															
700	1578														



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-3
 Site Watana (North Bank) Sheet No. 3 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %				ROD %				NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80				5
-720																Shear/alteration zone.
-740	1536															Zone of joints with slickensides.
-760																Shear/fracture zone.
-780																
-800	1496															
-820																
-840	1455															
-860																
-880																Fracture zone.
-900	1414															Shear.
-920																
-940	1373															Shear/fracture/alteration zone.
-960																END OF BORING 955.7'
-980																



**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
 PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-4
 SITE: Watana (North Bank) SHEET NO. 1 OF 31
 CONTRACTOR: Interstate Exploration Inc. DRILLING DATES: Sept. 11 to Sept. 23, 1981
 LOGGED BY: K.J. White, M.P. Bruen DATE: September 1981

DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
 ROCK Diamond Core - Triple Tube CORE DIAMETER: NW (1.75") O.D.
 LOCATION: LATITUDE N3,228,421 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
 DEPARTURE E743,471 GROUND SURFACE 2187.8
 AZIMUTH 060° ROCK SURFACE 2177.3
 DIP 58° BOTTOM OF HOLE 1382.5
 WATER TABLE

NOTES: 1) Depths measured along hole. True depths in ().
 2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	Overburden and cobbles.		
		6.5-12.4 - Very weathered fractured bedrock.		
10 (8.5)		TOP OF ROCK		
12.4 (10.5)	Andesite Porphyry	Medium gray to medium green-gray, aphanitic groundmass with white, fine to medium grained plagioclase phenocrysts (20-30%), up to 0.25 inches. Flow structures visible in some sections. Fresh to slightly weathered, hard to very hard. Occasional pods and stringers of carbonate, less than 0.5 inches, joints moderately closely spaced, generally iron stained and carbonate coated.	Run 1 12.4 to 16.1	100 (92)
			Run 2 16.1 to 21.0	100 (96)
20 (17.0)				

APPROVED: *[Signature]* DATE: February 1, 1982

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
 SITE Watana (North Bank) SHEET NO. 2 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Andesite Porphyry	12.4-21.0 - Joints closely to moderately closely spaced, trace of iron oxide staining, most joints have a trace of carbonate filling.	Run 3 21.0 to 25.2	100 (33)
		15.8 - Joint, 60°, 0.1 inches of silt/clay, possible shear.		
		21.0-70.6 - Joints closely to very closely spaced, iron oxide staining.	Run 4 25.2-27.1	100 (78)
		21.8-22.5 - Shear/fracture zone, joints very closely spaced, slightly weathered.		
		22.3 - Breccia/gouge, 0.25 inches thick on joint at 50°.	Run 5 27.1 to 30.8	100 (49)
		24.1-24.3 - Fracture zone, broken core, yellow calcareous silt coating.		
		30.2-34.5 - Color changes to a light gray-green. Contains fragments of argillite to 0.5 inches, comprising approximately 5-10%.	Run 6 30.8 to 35.7	100 (35)
		32.5-41.0 - Fracture zone, joints very closely spaced, pieces are 1.0 to 2.0 inches.		
		34.0 - Joint, 80° with a silty-sand coating.	Run 7 37.1 to 40.7	100 (0)
		37.4 - Joint, 40° with a silty-clay coating.	Run 8 37.1 to 40.7	89 (0)
		38.5-39.6 - "Granitic" rock, medium grained, 20-30% quartz, mafics less than 1.0%. Light yellow-gray rock, slightly to moderately altered/weathered, badly broken. Joint coated with calcareous clay. Contacts are fractured, not exposed.	Run 9 40.7 to 45.8	100 (33)
	39.6-41.0 - Slightly to moderately weathered.			
	43.4-44.6 - Fracture zone, very closely spaced joints, silty/sand coating.			
	48.9-49.6 - Probable fracture zone, pieces average 1.0 inch.	Run 10 45.8 to 50.8	100 (70)	
	50.1 - Joint, 40°, sulfide mineralization.			
		Run 11		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
 SITE Watana (North Bank) SHEET NO. 3 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
60 (50.9)	Andesite Porphyry	53.8-57.9 - Fracture zone, very closely spaced joints, heavy iron oxide staining, carbonate.	Run 11 50.8 to 55.6	98 (60)
			Run 12 55.6-57.5	100 (0)
			Run 13 57.5-59.2	100 (24)
			Run 14 59.2 to 64.3	100 (40)
70 (59.4)	Andesite Porphyry	62.5-70.6 - Fracture zone, very closely spaced joints, at 10° and 60°, heavy iron oxide staining, some carbonate coating.	Run 15 64.3 to 69.3	98 (8)
			Run 16 69.3 to 74.3	100 (72)
			Run 17 74.3 to 79.5	100 (60)
80 (67.8)	Andesite Porphyry	78.1-78.5 - Fracture zone, joints very closely spaced, at 30°. Slightly to moderately weathered, friable in places, silty/sand coating on most joint surfaces.	Run 18 79.5 to 84.5	100 (64)
			80.5-81.3 - Fracture zone, very closely spaced joints, iron oxide staining, carbonate.	
			80.9 - Joint, 8°, possible slickensides. 84.2-112.0 - Joints closely spaced, iron oxide staining and carbonate coating.	
			Run 19	

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
 SITE Watana (North Bank) SHEET NO. 4 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
90 (76.3)	Andesite Porphyry	84.5-112.0 - Rock changes to light green-gray with lithic fragments. Some flow structure at 70°, fragments of argillite, diorite, and andesite up to 1.0 inch but generally less than 0.5 inches. 88.7-90.1 - Shear/fracture zone, joints very closely spaced, at 10° and 60°. 88.9-89.1 - Breccia/gouge fragments. 92.0-102.6 - Joints close to moderately closely spaced, open at 10° to 20°, irregular and rough. Heavy iron oxide staining and organics (?).	Run 19 84.5 to 89.6	96 (53)
			Run 20 89.6 to 94.7	100 (53)
			Run 21 94.7 to 99.6	100 (67)
			Run 22 99.6 to 104.5	86 (41)
			Run 23 104.5 to 109.5	100 (58)
			Run 24 109.5 to 112.0	92 (0)
			Run 25 112.0 to 115.1	95 (23)
110 (93.3)	Diorite	108.2-109.8 - Slightly to moderately weathered, joints very closely spaced. 109.8-112.5 - Fracture zone, joints very closely spaced, silt and clay coating.		
			Run 26 115.1 to 118.0	85 (49)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 5 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
120 (101.8)	Diorite	112.0 - Sharp contact with very thin stringers of andesite penetrating the diorite. Joint at contact, 70°, with a trace of silt coating. Penetrative iron staining for 0.5 feet, slightly weathered.	Run 26 115.1 to 119.8	85 (49)
		112.0-126.1 - Joints close to very closely spaced, with iron oxide staining. 113.8-115.1 - Fracture zone, joints very closely spaced at 30° and 50°. 116.0 - Fracture, 10°, tight, healed with calcite, 0.25 inches wide, discontinuous, contains small fragments of diorite. 118.2-126.1 - Shear/fracture zone, joints very closely spaced, slightly to moderately weathered. Core loss 1.3 feet. 122.9-124.8 - Shear, gouge and breccia, friable.	Run 27 119.8 to 124.8	84 (0)
130 (110.2)	Diorite	126.1-160.1 - Joints close to moderately closely spaced, generally 1.0 to 2.0 feet. Iron oxide staining, carbonate and chlorite present. 134.0 - Inclusion of dark green, fine grained diorite, 1.0 inch. 137.9 - Joint, 40°, carbonate/calcite.	Run 28 124.8 to 130.1	96 (51)
		139.0 - Joint, 10° with calcareous clay coating, some moderate hydrothermal alteration 1.0 inch on either side. Feldspars altering to clay. 143.8 - Joint, 30°, moderately altered hydrothermally, 0.25 inches on either side of joint.	Run 29 130.1 to 135.3	100 (86)
140 (118.7)	Diorite		Run 30 135.3 to 140.5	100 (89)
			Run 31 140.5 to 145.5	100 (94)
			Run 32 145.5 to 150.6	100 (98)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 6 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
150 (127.2)	Diorite		Run 32	100 (98)
		153.2-153.6 - Healed shear, 20°, joints very closely spaced, healed with dark green fine grained diorite. 154.7-160.1 - Shear/fracture zone, joints very closely spaced at 20°-60°. Slightly altered hydrothermally, iron oxide staining and carbonate coating. 157.7 - Gouge, 0.1 inches wide.	Run 33 150.6 to 155.8	100 (79)
160 (135.7)	Diorite	160.1-165.2 - No iron oxide staining. 163.3 - Joint, 30°, with clay coating. 165.2-205.8 - Joints close to very closely spaced, iron oxide staining, carbonate and chlorite coating. 165.2-175.4 - Fracture/alteration zone, slightly to moderately weathered/alter hydrothermally, joints very closely spaced. Hard to moderately hard, iron oxide staining below 171.5. 165.2-165.7 - Clay on most joints. 169.0-169.5 - Shear/alteration zone, severely to completely altered hydrothermally, soft and friable.	Run 34 155.8 to 160.1	77 (0)
			Run 35 160.1 to 165.2	100 (92)
170 (144.2)	Diorite		Run 36 165.2 to 170.0	88 (21)
			Run 37 170.0 to 175.0	100 (36)
180 (152.6)	Diorite		Run 38 175.0 to 180.0	94 (32)
			Run 39	

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CLIENT ALASKA POWER AUTHORITY	JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project	HOLE NO. BH-4
SITE Watana (North Bank)	SHEET NO. 7 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
190 (161.1)	Diorite	181.8-184.2 - Fracture zone, joints are very closely spaced, at 10° and 40°-60°. 187.2 - Joint, 70°, with slickensides at 80°. 188.5 - Joint, 50°, with slickensides at 0°. 189.3 - End of iron oxide staining, trace amounts below this depth, carbonate coating on joints. 195.5 - Joint, 15°, with clay filling 0.1 inches wide. 199.7-200.1 - Core is broken, sandy clay coating. 204.4-205.4 - Shear along three joints, at 10°. Slickensides on chlorite and carbonate, 0.1 inches wide. 205.8-375.6 - Joints are moderately close to widely spaced, with a few zones of closely spaced. Trace of carbonate. 209.3-210.7 - Joints closely spaced. 229.8-231.8 - Joints closely spaced.	Run 39 180.0 to 185.0	100 (22)
			Run 40 185.0 to 190.1	100 (90)
			Run 41 190.1 to 195.0	100 (88)
			Run 42 195.0 to 200.0	100 (48)
			Run 43 200.0 to 204.0	100 (65)
			Run 44 204.0- 205.8	88 (88)
			Run 45 205.8 to 210.7	100 (88)
			Run 46 210.7	100 (100)
			200 (169.6)	
210 (178.1)				

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CLIENT ALASKA POWER AUTHORITY	JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project	HOLE NO. BH-4
SITE Watana (North Bank)	SHEET NO. 8 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)			
220 (186.6)	Diorite	234.8-236.4 - Shear/fracture zone, joints very closely spaced, at 20°. Chlorite and carbonate coating, less than 0.1 inches thick, slickensides.	Run 46 210.7 to 215.7	100 (100)			
			Run 47 215.7 to 220.8	100 (100)			
			Run 48 220.8 to 225.8	100 (100)			
			Run 49 225.8 to 230.8	100 (94)			
			Run 50 230.8 to 235.8	100 (100)			
			Run 51 235.8 to 240.8	100 (90)			
			Run 52 240.8 to 245.8	100 (100)			
			230 (195.0)				
			240 (203.5)				

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4
SITE Watana (North Bank) **SHEET NO.** 9 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
250 (212.0)	Diorite	247.1 - Felsic vein, 90°, light gray, less than 0.25 inches wide, tight, hard.	Run 52	
			Run 53 245.8 to 251.0	100 (100)
			Run 54 251.0 to 255.7	100 (100)
			Run 55 255.7 to 260.8	100 (100)
			Run 56 260.8 to 265.8	100 (100)
			Run 57 265.8 to 270.8	100 (100)
			Run 58 270.8 to 275.8	100 (100)
			Run 59	
260 (220.5)				
270 (229.0)				

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4-
SITE Watana (North Bank) **SHEET NO.** 10 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
280 (237.4)	Diorite	279.8 - Carbonate vein, 30°-40°, 0.1 inches wide.	Run 59 275.8 to 280.8	100 (100)
			Run 60 280.8 to 285.8	100 (100)
			Run 61 285.8 to 290.7	100 (100)
			Run 62 290.7 to 295.8	100 (100)
			Run 63 295.8 to 298.9	100 (84)
			Run 64 298.9- 300.8	100 (95)
			Run 65 300.8 to 305.8	100 (100)
			Run 66 305.8 to 310.8	100 (100)
			Run 67 306.0-307.9 314.2-314.6 } Red intergranular stain on the diorite.	
			Run 68	
290 (245.9)				
300 (254.4)				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
 SITE Watana (North Bank) SHEET NO. 11 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
310 (262.9)	Diorite		Run 66	
			Run 67 310.8 to 315.8	100 (100)
320 (271.4)	Diorite	316.2 - Healed breccia, 20°, 0.1 feet wide, healed with dark green, fine grained igneous material, hard.	Run 68 315.8 to 320.8	100 (96)
			Run 69 320.8 to 325.8	100 (100)
			Run 70 325.8 to 330.8	100 (100)
330 (279.8)	Diorite	320.3-320.6 - Core broken by drilling, fresh, angular pieces, 1.0 to 2.0 inches. 322.0-322.3 - Inclusion of fine grained, dark green diorite. 324.4-325.0 - Fractures healed with carbonate, irregular shape, discontinuous, up to 0.5 inches wide. 326.7-330.4 - Joint, 0°-10°, chlorite and carbonate coated, faint slickensides.	Run 71 330.8 to 335.8	100 (100)
			Run 72 335.8 to 340.8	100 (100)
340 (288.3)	Diorite	331.2-332.2 - Fracture zone, joints very closely spaced at 0°-30°, some surfaces altered hydrothermally.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
 SITE Watana (North Bank) SHEET NO. 12 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
350 (296.8)	Diorite	343.7-343.8 - Fracture zone, up to 0.1 inches wide, irregular, discontinuous, healed by calcite/carbonate, tight, hard. 344.0 - Healed shear, 30°, healed by dark green, fine grained igneous material, tight, hard.	Run 73 340.8 to 345.7	100 (100)
			Run 74 345.7 to 350.7	100 (100)
360 (305.3)	Diorite	355.8 - Fracture, filled with carbonate, discontinuous, 0.25 inches wide. 356.5-357.7 - Fractures, 0°-10°, healed with carbonate less than 0.1 inches thick.	Run 75 350.7 to 355.6	100 (100)
			Run 76 355.6 to 360.2	100 (100)
370 (313.8)	Diorite	361.0 } 366.0 } Healed shears, 15°, less than or equal to 0.25 inches wide. Healed with dark green, fine grained diorite, hard.	Run 77 360.2 to 365.4	100 (100)
			Run 78 365.4 to 370.5	100 (100)
			Run 79 370.5-375.6	100 (100)
		370.0-370.5 - Core broken by drilling.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 13 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
380 (322.2)	Diorite	373.0-373.2 - Felsic dike, white-yellow to gray, 10-20% quartz, 1.0 to 2.0 inches wide. Contacts are hard, tight, and irregular. 375.6-423.9 - Joints are moderately closely spaced, average 2.0 feet, generally trace of carbonate and/or chlorite. 378.5 - Joint, 20°, trace of silt/clay.	Run 79 370.5 to 375.6	100 (100)
			Run 80 375.6 to 380.6	100 (100)
			Run 81 380.6 to 385.6	100 (100)
			Run 82 385.6 to 390.7	100 (100)
			Run 83 390.7 to 395.5	100 (94)
			Run 84 395.5 to 400.6	100 (100)
			Run 85 400.6 to 405.5	100 (98)
			390 (330.7)	
400 (339.2)				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 14 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)			
410 (347.7)	Diorite	405.2 - Healed breccia along a joint at 10°-20°, approximately 1.0 inches wide. Healed with dark green, fine grained diorite.	Run 86 405.5 to 410.4	100 (100)			
			Run 87 410.4 to 415.7	98 (98)			
			Run 88 415.7 to 420.7	100 (100)			
			Run 89 420.7 to 425.7	100 (100)			
			Run 90 425.7 to 430.9	100 (100)			
			Run 91 430.9 to 435.8	100 (100)			
			Run 92				
			420 (356.2)		416.5-416.8 - Healed breccia, 50°, diorite inclusions up to 2.0 inches in dark green, fine grained diorite. 417.7-418.6 - Healed breccia, diorite fragments up to 2.0 inches and comprise 70-80% of the rock. Healed with a dark green, fine grained diorite, hard, tight. 419.3-419.8 - Fracture zone, joints very closely spaced at 60°, carbonate filling, tight healed joints. 420.8 - Felsic vein, 15°, less than 0.25 inches wide, tight. 423.9-510.4 - Joints close to moderately closely spaced, average 1.0 foot. Trace to coating of carbonate and chlorite.		
			430 (364.6)		426.0 - Joint, 10° with faint slickensides on chlorite. Felsic vein, 15°, light gray, fine grained, chilled contact, tight, hard. 429.2 - Joint, 60° with faint slickensides. 429.5 - Joint, 10°, with slickensides on chlorite. 429.8 - Joint, 55°, with slickensides on chlorite at 40°.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 17 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION - COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)		
510 (432.5)	Diorite	502.6-503.0 - Felsic dike, light gray, fine grained, probably granodiorite. Upper contact fractured, lower contact tight at 70°. Hard, unfractured.	Run 106 500.8 to 505.8	100 (100)		
			Run 107 505.8 to 510.7	100 (100)		
		510.4-627.8 - Joints moderately close to widely spaced, trace of chlorite and carbonate coating.	Run 108 510.7 to 515.8	100 (100)		
			Run 109 515.8 to 520.5	100 (100)		
			Run 110 520.5 to 525.6	100 (96)		
		523.5-525.1 - Zones of joints very closely spaced, at 20°-30°, healed with carbonate. 524.3 - Healed shear, 30°, 1.0 inch wide, healed with dark green, fine grained diorite.	Run 111 525.6 to 530.7	100 (100)		
			Run 112 530.7-535.8	100 (100)		
		520 (441.0)	Diorite	526.5-527.6 - Textural and mineralogical changes. Medium to fine grained, less than 15% mafics. Hard, sharp, tight contacts.	Run 111 525.6 to 530.7	100 (100)
					Run 112 530.7-535.8	100 (100)
		530 (449.4)	Diorite	526.5-527.6 - Textural and mineralogical changes. Medium to fine grained, less than 15% mafics. Hard, sharp, tight contacts.	Run 111 525.6 to 530.7	100 (100)
Run 112 530.7-535.8	100 (100)					

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 18 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION - COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)		
540 (457.4)	Diorite	537.1 - Shear along joint, 20°, 0.5 inches of breccia and gouge, slickensides on chlorite. 537.7 - Joint, 30°, slickensides on chlorite.	Run 112 530.7 to 535.8	100 (100)		
			Run 113 535.8 to 540.7	100 (100)		
		538.3-538.9 - Numerous healed fractures, irregular, discontinuous. Healed with calcite/carbonate, up to 0.25 inches wide.	Run 114 540.7 to 545.9	100 (65)		
			Run 115 545.9 to 550.8	100 (43)		
			Run 116 550.8 to 555.8	100 (100)		
		550 (466.4)	Diorite	553.0-553.5 - Felsic dikes, three, 80°-90°, closely spaced, less than 0.5 inches, hard, tight.	Run 116 550.8 to 555.8	100 (100)
					Run 117 555.8 to 560.8	100 (100)
		560 (474.9)	Diorite	559.7 - Healed shear, 30°, 1.5 inches wide. Healed with dark green, fine grained diorite, hard. 560.5-561.2 - Red staining on core.	Run 117 555.8 to 560.8	100 (100)
					Run 118 560.8 to 565.8	100 (100)

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 19 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
570 (483.4)	Diorite	567.7 - Felsic dike, 90°, light gray, medium to coarse grained, unfractured, 0.1 feet wide, tight contacts, hard. 569.3 - Joint, 0°-20°, carbonate healed, slight hydrothermal alteration up to 1.0 inch. 571.7-574.9 - Alteration zone, bleached to yellow-white, moderately to severely altered hydrothermally. Feldspars altered to clay, no mafics, moderately hard to soft, locally friable. RQD = 0%.	Run 118	
			Run 119	
			565.8 to 570.9	100 (100)
			Run 120	
			570.9 to 575.9	100 (50)
			Run 121	
			575.9 to 580.8	100 (100)
			Run 122	
			580.8 to 585.8	100 (100)
			Run 123	
580 (491.8)	Diorite	578.0-578.8 - Healed shears, closely spaced, healed by dark green, fine grained igneous material, hard. 578.5 - Possible offset of felsic dike, 1.0 inch wide. Offset up to 0.5 inches.	585.8 to 590.8	100 (100)
			Run 124	
			590.8 to 595.8	100 (100)
590 (500.3)	Diorite	588.5 - Healed shear, 30°, healed with carbonate less than 0.1 inches wide. Healed with dark green diorite, tight. 588.8-588.9 - Fracture zone, fractures very closely spaced, healed with carbonate, discontinuous, irregular, hard. 591.0 - Healed shear, 30°, 0.25 inches wide, healed with dark green diorite and carbonate, tight.	Run 125	

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 20 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
600 (508.8)	Diorite	597.0 - Felsic dike, 80°, light orange, 0.5 inches wide. Truncated by healed shear at 40°. 597.9 - Inclusion of dark green, fine grained diorite, diameter of 1.0 inch.	Run 125	
			595.8 to 600.7	100 (100)
			Run 126	
			600.7 to 605.7	100 (100)
			Run 127	
			605.7 to 610.7	100 (100)
			Run 128	
			610.7 to 615.7	100 (15)
			Run 129	
			615.7 to 620.8	100 (59)
610 (517.3)	Diorite	610.9-618.3 - Shear/alteration zone, bleached to a light yellow-gray, slightly to moderately altered hydrothermally with zones of severe alteration. Feldspars altered to clay, moderately hard to soft, biotite crystals close to altered zone. 612.1-618.3 - Shear, 0°, 0.5 inches wide, partially healed with carbonate and chlorite. Alteration is more intense on one side than the other.	Run 130	
			620.8 to 625.9	100 (80)
620 (525.8)	Diorite	620.1-622.2 - Shear, 10°, partially healed by carbonate, up to 0.5 inches wide. 627.8-710.2 - Joints close to moderately closely spaced, chlorite coated with trace to coating of carbonate.	Run 131	
			625.9 to 630.9	100 (88)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4
SITE Watana (North Bank) **SHEET NO.** 21 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
630 (534.2)	Diorite	629.3 - Shear, 10°, 0.25 to 0.5 inches wide, partially healed by carbonate.	Run 131	100 (88)
		632.5 - Joint, 10°, partially healed by carbonate. Slickensides on chlorite.	Run 132 630.9 to 635.9	100 (30)
		635.9-637.5 - Fracture zone, joints and fractures very closely spaced, up to 0.1 inches wide. Healed with carbonate, discontinuous, irregular.	Run 133 635.9 to 640.8	100 (70)
640 (542.7)	Diorite	642.4 - Joint, 10°, slickensides on chlorite.	Run 134 640.8 to 645.8	100 (45)
		644.1-644.8 - Fracture zone, joints very closely spaced, at 60°.	Run 135 645.8 to 650.8	100 (70)
		648.0-648.7 - Healed breccia, fragments of diorite comprise 70-80%, healed by dark green diorite. Hard, joint at 20° at upper contact, healed with carbonate, approximately 0.25 inches wide.	Run 136 650.8 to 655.8	100 (85)
650 (551.2)	Diorite	649.4-649.8 - Joints, 50°-70°, very closely spaced, tight.	Run 137 655.8 to 660.7	100 (100)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4
SITE Watana (North Bank) **SHEET NO.** 22 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
670 (568.2)	Diorite	666.8 - Diorite breccia, 0.5 inches wide, healed with carbonate, irregular, tight.	Run 138 660.7 to 665.7	100 (66)
		669.7-670.7 - Joints, 10°, 0.5 inches wide, healed with carbonate. Irregular fractures, discontinuous, healed with carbonate.	Run 139 665.7 to 670.7	100 (96)
		671.4-672.3 - Red stain on core.	Run 140 670.7 to 675.7	100 (98)
		672.8 - Joint, 30°, 0.25 inches wide, healed with carbonate.	Run 141 675.7 to 680.8	100 (67)
680 (576.6)	Diorite	673.6-678.6 - Shear, 0°-10°, partially healed by carbonate and chlorite. Slickensides, thin coating of gouge less than 0.1 inches.	Run 142 680.8 to 685.7	100 (100)
			Run 143 685.7 to 690.8	100 (100)
			Run 144 690.8 to 695.8	100 (100)
690 (585.1)	Diorite	691.7-691.9 - Felsic dike, 30°, light green-gray, medium grained. Up to 10% quartz, 5-10% mafics. Tight, welded contacts, fractured and healed with carbonate, hard.		

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4
SITE Watana (North Bank) **SHEET NO.** 23 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)	
700 (593.6)	Diorite	692.8-693.3 - Pods of felsic material similar to above dike. Irregular shapes up to 1.0 inch, hard. 693.9 - Inclusion of dark green, fine grained diorite, 2.0 inches long.	Run 144 690.8 to 695.8	100 (100)	
			Run 145 695.8 to 700.8	100 (100)	
		701.4-703.1 - Numerous healed fractures, closely to very closely spaced, up to 0.25 inches thick. Healed with carbonate, irregular, discontinuous.	Run 146 700.8 to 705.7	100 (100)	
			Run 147 705.7 to 710.8	100 (90)	
		710 (602.1)	710.2-710.8 - Fracture zone, joints and fractures very closely spaced, angular pieces 0.5 to 1.0 inch, most surfaces stained. 710.2-755.9 - Joints closely spaced with zones of very closely spaced. Generally a coating of chlorite and a trace to coating of carbonate. 712.0-713.5 - Fracture zone, joints very closely spaced, at 20° and 60°. Joints at 20° are healed with carbonate.	Run 148 710.8 to 715.8	100 (90)
				Run 149 715.8 to 720.8	100 (36)
		720 (610.6)	720.1-721.1 - Fracture zone, joints very closely spaced, at 40°-70°. 723.3 - Joint, 20°, trace of silty sand.	Run 150 720.8 to 725.8	98 (56)

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PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4
SITE Watana (North Bank) **SHEET NO.** 24 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)	
730 (619.0)	Diorite	726.1-730.9 - Shear/fracture zone, joints very close to closely spaced, oriented at 30° and 10°. Numerous irregular fractures, some carbonate healed. Slickensides.	Run 150 726.1 to 730.9	98 (56)	
			Run 151 725.8 to 730.8	100 (15)	
		732.5 - Joint, 10°, with slickensides on chlorite. 734.6-738.0 - Shear/fracture zone, numerous joints very closely spaced, at 30°. Some healed with carbonate, up to 0.25 inches thick, tight.	Run 152 730.8 to 735.8	100 (30)	
			Run 153 735.8 to 740.8	100 (30)	
		740 (627.5)	736.4 - Joint, 20°, slickensides on chlorite. 738.3-739.5 - Joints, 70°, closely spaced.	Run 154 740.8 to 745.8	100 (35)
				Run 155 745.8 to 750.8	100 (60)
		750 (636.0)	742.3-743.2 - Fracture zone, joints very closely spaced at 70°. 749.4-755.0 - Fracture zone, joints and fractures very closely spaced, mostly tight, randomly oriented. Joints at 0°-10°, and 60°, less than half are healed with carbonate. 752.8-755.0 - Core broken along the 60° joint set. 755.9-768.8 - Joints are close to moderately closely spaced.	Run 156 750.8 to 755.9	100 (16)
				Run 157	

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5700.05
HOLE NO. BH-4
SHEET NO. 25 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
760 (644.5)	Diorite	758.5-759.8 - Healed shear, 10°, healed with dark green diorite and carbonate, tight.	Run 157	100 (94)
			755.9 to 760.9	
			Run 158	
770 (623.0)	Diorite	768.8-771.2 - Fracture zone, joints very closely spaced, at 0°-10°, some are healed by carbonate. 768.8-786.2 - Joints close to very closely spaced.	760.9 to 765.8	100 (80)
			Run 159	100 (65)
			765.8 to 770.9	
			Run 160	100 (16)
780 (661.4)	Diorite	780.0 - Joint, 15°, slickensides on chlorite, trace of yellow sandy silt. 783.7 - Joint, 15°, trace of silt or clay. 786.2-850.5 - Joints close to moderately closely spaced, average 0.5 to 1.0 foot. Chlorite coating, trace to coating of carbonate.	770.9 to 775.9	100 (58)
			Run 161	100 (50)
			775.9 to 780.9	
	Diorite		Run 162	100 (50)
			780.9 to 785.9	
	Diorite		Run 163	100 (90)
	Diorite		785.9 to 790.9	100 (90)

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5700.05
HOLE NO. BH-4
SHEET NO. 26 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
790 (669.9)	Diorite		Run 163	100 (90)
800 (679.1)			Run 164	100 (59)
	790.9 to 795.8			
	Run 165	100 (75)		
	795.8 to 800.7			
	Run 166	100 (69)		
810 (686.9)	Diorite	797.1 - Inclusion of fine grained diorite, diameter 1.0 inch. 797.8-798.1 - Fracture zone, joints very closely spaced at 70°. Carbonate, chlorite coating, possibly some talc. 803.0 - Healed shear, 10°, healed with fine grained felsic material, tight. Offset of 0.5 inches along inclusion of fine grained diorite. 804.1-805.3 - Fracture zone, joints/fractures very closely spaced, at 0°-10°, and 40°, most healed with carbonate, broken by drilling. 805.2-806.2 - Healed shear, 10°, 1.0 inch wide, fragments of diorite, healed by dark green diorite, tight, hard. 811.9-820.5 - Textural changes in diorite, light gray-green, medium to coarse grained, less than 10% mafics. 812.0-815.8 - Shear/fracture zone, joints very closely spaced at 10° and 60°. Broken by drilling, pieces 0.5 to 2.0 inches, coated with silt or clay. Most joints are tight, minor sulfide mineralization. 813.5 - Breccia, 1.0 inch wide, partially healed with carbonate.	800.7 to 805.6	100 (88)
			Run 167	100 (88)
			805.6 to 810.7	
			Run 168	100 (41)
820 (695.4)	Diorite		810.7 to 815.8	100 (41)
			Run 169	100 (32)
	Diorite		815.8 to 820.8	100 (32)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 27 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)			
830 (703.8)	Diorite	825.3-825.9 - Core is broken by drilling, minor sulfide mineralization on broken surfaces. 828.8 - Joint, 80°, faint slickensides on chlorite. 834.5-835.8 - Fracture zone, joints/fractures very closely spaced, at 0°-10° and 40°-60°, irregular, healed to partially healed by carbonate. Joint/shear, 0°, offset 0.1 inches. 837.8 - Joint, 50°, possible slickensides.	Run 170 820.8 to 825.8	100 (80)			
			Run 171 825.8 to 830.8	100 (60)			
			Run 172 830.8 to 835.8	100 (40)			
			Run 173 835.8 to 840.8	100 (94)			
			Run 174 840.8 to 845.7	100 (100)			
			Run 175 845.7 to 850.5	100 (85)			
			Run 176 850.5 to 855.6	100 (100)			
			840 (712.3)	Diorite	850.5-896.0 - Joints moderately closely spaced, chlorite coating, trace to coating of carbonate.	Run 176 850.5 to 855.6	100 (100)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 28 OF 31

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)			
860 (729.3)	Diorite	858.1-869.9 - Diorite changes to light green-gray, 10-20% mafics. 859.6-866.6 - Fracture zone, joints and fractures very closely spaced, oriented at 30° and 70°. Mostly tight, less than 25% healed with carbonate.	Run 176 850.5 to 855.6	100 (100)			
			Run 177 855.6 to 860.5	100 (100)			
			Run 178 860.5 to 865.5	100 (100)			
			Run 179 865.5 to 870.6	100 (100)			
			Run 180 870.6 to 875.6	100 (80)			
			Run 181 875.6 to 880.6	100 (100)			
			Run 182 880.6 to 885.6	100 (92)			
			870 (737.8)	Diorite	870.3-871.0 - Fracture zone, joints very closely spaced at 60°.	Run 182 880.6 to 885.6	100 (92)
880 (746.2)	Diorite	873.0-875.2 - Shear/alteration zone, core bleached to a light yellow-green, slightly to moderately altered hydrothermally. Hard to medium hard, joints/fractures very closely spaced, tight, generally healed with carbonate. 875.0 - Shear, 60°, healed with carbonate, breccia, 0.1 feet. 877.5 - Inclusion of dark green, fine grained diorite, 1.5 inches in diameter. 878.8 - Joint, 30°, trace of clay.	Run 183 885.6 to 890.6	100 (100)			

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 29 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
890 (754.7)	Diorite	883.5-884.5 - Numerous healed fractures/joints, healed with carbonate, 10% of rock. Joints, 20°-30°, fractures are irregular and discontinuous.	Run 182	
			Run 183	
			885.6 to 890.6	100 (100)
		890.6-895.7 - Shear/alteration zone, core is bleached to a light yellow-green, generally slightly altered hydrothermally. Generally hard except for the following zones:	Run 184	
		891.7 - Healed shear, 50°, crosscut by a joint with clay fillings less than 0.1 inches wide.	890.6 to 895.6	100 (45)
		893.0-895.1 - Moderately altered hydrothermally, moderately hard to soft, locally friable.	Run 185	
		893.1 - Shear, 15°, 1.0 to 2.0 inches of breccia, partially healed by carbonate.	895.6 to 900.6	100 (100)
		893.3-893.4 - Broken fragments of breccia.	Run 186	100 (98)
		893.8-894.1 - Fragments of altered diorite and breccia, pieces less than 1.0 inch.		
		895.1 - Shear, 30°, 1.0 inch wide, breccia and gouge healed with carbonate.	Run 187	
900 (763.2)	Diorite	896.0-949.6 - Joints moderately close to wide, chlorite coating, trace to coating of carbonate.	900.6 to 905.6	
		898.9-899.8 - Joints, 30° and 70°, very closely spaced, healed with carbonate to 0.1 inches.	905.6 to 910.6	100 (100)
		902.4 - Inclusion of dark green, fine grained diorite.	Run 188	100 (100)
		903.0-903.2 - Inclusion or dike of dark green diorite, sharp contact at 45°.		
		904.5 - Joint, 80°, clay and carbonate coating.	Run 189	
909.1 - Felsic dike, 50°, light gray, medium grained, 0.5 inches wide, unfractured, tight contact.	910.6 to 915.6	100 (100)		
910 (771.7)	Diorite	909.5-910.5 - Healed shear, 0°-10°, healed with dark green, fine grained diorite.	Run 189	100 (100)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Watana (North Bank) SHEET NO. 30 OF 31

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
920 (780.2)	Diorite	913.5-939.0 - Healed shear zone, numerous shears very closely spaced, healed by dark green diorite, hard, competent. Felsic dikes within shear are light gray, fine grained, up to 1.0 inch wide, offset along healed shear planes up to 1.0 inch. Approximately 50-75% of zone is healed shears, approximately 5% of the shear zone is felsic dikes.	Run 189	
			915.6 to 920.6	100 (100)
			Run 190	
			920.6 to 925.7	100 (100)
			Run 191	
			925.7 to 930.3	100 (100)
			Run 192	
			930.3 to 935.4	100 (100)
			Run 193	
			935.4 to 939.3	100 (100)
930 (788.6)	Diorite	939.3-939.4 - Fragments, two, of andesite porphyry, probably fell in hole during bit change.	Run 194	
			939.3 to 944.4	100 (98)
			Run 195	
940 (797.1)	Diorite		944.4 to 949.6	96 (96)

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Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana (North Bank)

Job No. P5700.05
Hole No. BH-4
Sheet No. 1 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.				CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²		20	40	60	80	20	40				60
0	2188													Overburden	TOP OF ROCK 12.4'
20														Andesite Porphyry	Shear/fracture.
40															Fracture zone.
60	2146														Fracture zone.
80															Fracture zone.
100	2103													Diorite	Shear/fracture.
120															Fracture zone.
140															Shear/fracture zone.
160	2061														Shear/fracture zone.
180															Fracture/alteration zone.
200	2018														Shear/fracture.
220															
240															Shear/fracture.
260	1976	No Test													
280															
300	1934														Joint, slickensides on chlorite.
320															
340															

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Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Watana (North Bank)

Job No. P5700.05
Hole No. BH-4
Sheet No. 2 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.				CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²		20	40	60	80	20	40				60
360														Diorite	
380															
400	1849														
420															
440															Shear.
460	1806														Fracture zone.
480															Dike, mafic.
500	1764														Shear.
520															
540															Shear.
560	1722														Alteration zone.
580															Alteration zone.
600	1679														
620															Shear/alteration zone.
640															Shear.
660	1637														
680															
700	1594														

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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-4
 Site Watana (North Bank) Sheet No. 3 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10-6 10-4 10-2	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
						Diorite	
720							Shear/fracture zone
740	1552						Fracture zone.
760							
780							
800	1509						Shear/fracture zone
820							
840	1467						Fracture zone.
860							
880							
900	1425						Shear/alteration zone.
920							
940							
960	1382						END OF BORING 949.6'



**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-6
SITE: Watana (North Bank) SHEET NO. 1 OF 24

CONTRACTOR: The Drilling Company DRILLING DATES: June 26 to July 9, 1981
LOGGED BY: K.J. White, M.P. Bruen DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
ROCK Diamond Core - Triple Tube CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,226,922 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E744,256 GROUND SURFACE 1608.8
AZIMUTH 225° ROCK SURFACE 1601.9
DIP 60° BOTTOM OF HOLE 967.6
WATER TABLE 1461.8 (12-06-80)

NOTES: 1) Depths measured along hole. True depths in ().
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (ROD)
0.0	Overburden	Sandy gravel with cobbles and boulders.		
8.0 (6.9)	TOP OF ROCK			
10 (8.7)	Diorite	Gray-green, fine to medium grained crystalline rock, 30-40% mafics (biotite and hornblende), up to 10% quartz. Slightly weathered, hard, fresh. Joints moderately closely spaced with iron oxide staining. 8.0-10.7 - Core loss 0.7 feet. Red staining in core parallel to some joints, penetrative to 0.5 inches.	Run 1 8.0- to 10.7	74 (52)
			Run 2 10.7 to 15.0	88 (60)
			Run 3 15.0 to 19.6	100 (35)
17.5 (15.2)	Quartz Diorite	Green-gray to light gray, fine to medium grained rock. Mafics 20-30% (biotite and hornblende), 10-15% quartz, generally hard to very hard, fresh. Gradational contact.		
20 (17.3)			Run 4	83 (0)

APPROVED: *[Signature]* DATE: February 1, 1982

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 2 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
30 (26.0)	Quartz Diorite	Joints are very close to moderately close, with iron oxide staining. 17.1-26.8 - Fracture zone, joints and fractures very closely spaced, moderately to severely weathered with penetrative iron oxide staining. Core loss 0.7 feet. 26.0-64.3 - Fresh to slightly weathered, with more intense weathering on joints, iron oxide staining. Joints closely to moderately closely spaced. 26.8-30.0 - Core loss 0.5 feet. 29.7-30.3 - Fracture zone, joints and fractures very closely spaced, joints at 0°-10° and 30°-40°, slightly weathered.	Run 4 19.6 to 23.8	83 (0)
			Run 5 23.8 to 26.8	97 (0)
			Run 6 26.8 to 30.3	100 (63)
			Run 7 30.3 to 32.8	100 (60)
			Run 8 32.8 to 36.8	100 (78)
			Run 9 36.8 to 40.5	100 (59)
			Run 10 40.5 to 44.7	100 (90)
			Run 11 44.7 to 49.1	91 (57)
			Run 12 49.1 to 50.0	100 (0)
			Run 13 50.0 to 50.0	100 (0)
			Run 14 50.0 to 50.0	100 (0)
			Run 15 50.0 to 50.0	100 (0)
			Run 16 50.0 to 50.0	100 (0)
			Run 17 50.0 to 50.0	100 (0)
40 (34.6)		40.5-45.0 - Core loss 0.2 feet.		
		45.6-46.5 - Core broken by drilling.		
		48.4-48.9 - Fracture zone, joints very closely spaced 0°-10°, 30°, and 50°-60°.		
50 (43.3)				

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CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-6

SITE Watana (North Bank)

SHEET NO. 3 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
60 (52.0)	Quartz Diorite		Run 14 51.4- 55.5	100 (82)
			Run 15 55.5 to 59.3	100 (26)
			Run 16 59.3 to 63.2	100 (77)
			Run 17 63.2 to 66.5	97 (33)
			Run 18	
			Run 19	
			Run 20 67.7 to 70.4	100 (59)
			Run 21 70.4 to 75.3	96 (41)
			Run 22 75.3 to 80.3	100 (77)
			Run 23 80.3 to 84.2	100 (77)
70 (60.6)		64.3-105.8 - Joints are moderately close to closely spaced, at 10° to 60°, iron stained, some carbonate filled. 66.5-67.3 - Core loss 0.8 feet. Core broken by drilling.		
80 (69.3)		71.3-73.1 - Shear/fracture zone, joints very closely spaced, at 30°-60°. Slightly to moderately weathered, very thin clay gouge, iron oxide staining.		
			Run 24	100(89)

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CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-6

SITE Watana (North Bank)

SHEET NO. 4 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
90 (77.9)	Quartz Diorite	89.3-94.6 - Core loss 0.3 feet.	Run 24 84.2 to 89.3	100 (89)
			Run 25 89.3 to 94.6	94 (70)
			Run 26 94.6 to 98.5	97 (79)
			Run 27 98.5- 100.3	83 (78)
			Run 28	100(75)
			Run 29	71(54)
			Run 30	100(0)
			Run 31 103.1 to 108.2	94 (61)
			Run 32 108.2 to 111.7	100 (94)
			Run 33	100(90)
100 (86.6)		101.9-102.3 - Core loss 0.4 feet. 102.7-106.3 - Penetrative iron oxide staining on joints up to 0.5 inches.	Run 34 112.2 to 116.2	100 (94)
			Run 35	100(84)
110 (95.3)		105.45 - Joint, 45°, clay coating 0.1 inch. 105.8-106.3 - Fracture zone, joints very closely spaced at 10° and 70°, iron oxide staining, clay coating on surfaces for 0.2 feet. 106.3-136.8 - Joints moderately closely spaced, generally fresh, minor iron oxide staining. 112.7-122.1 - Core loss 0.4 feet.	Run 24	100(89)
			Run 25	100(26)
			Run 26	100(77)
			Run 27	97(33)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 5 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
120 (103.9)	Quartz Diorite	122.5-123.6 - Penetrative iron oxide staining on joints to 0.5 inches.	Run 35 116.2 to 121.1	100 (84)
			Run 36 121.1 to 126.2	100 (82)
			Run 37	100 (89)
			Run 38 127.6 to 131.1	100 (91)
130 (112.6)	Quartz Diorite	129.6-130.6 - Felsic dike, light gray, fine grained quartz phenocrysts, less than 5% mafics. Fresh, unfractured, tight contacts, at 20°. Iron oxide stained joints, penetrative to 0.5 inches. 131.0-131.1 - Felsic dike as above, 20°, unfractured, tight. 131.8-132.5 - Joints, 40°, with iron oxide staining.	Run 39 131.1 to 136.2	100 (83)
			Run 40 136.2 to 140.6	100 (66)
			Run 41 140.6 to 145.6	76 (100)
140 (121.2)	Quartz Diorite	136.8-155.1 - Alteration along joints penetrating slightly, average 0.06 inches up to 0.1 feet. Joints are closely spaced, at 20° to 50°, with iron oxide staining and carbonate filling.	Run 42 145.6 to 150.6	100 (82)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 6 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
150 (129.9)	Quartz Diorite	154.2-155.1 - Fracture zone, joints very closely spaced, at 20° to 50°, iron and carbonate staining. 155.1-168.2 - Joints very closely to closely spaced, carbonate coated, iron oxide staining.	Run 42	100 (82)
			Run 43 150.6 to 155.6	100 (46)
			Run 44 155.6 to 160.6	100 (72)
			Run 45 160.6 to 165.7	100 (71)
160 (138.6)	Quartz Diorite	162.4-163.3 - Fracture/alteration zone, altered hydrothermally, numerous healed fractures. Joints and fractures are very closely spaced, 10° to 60°, some iron oxide staining and carbonate filling. 165.6-175.2 - Core loss 0.3 feet.	Run 46 165.7 to 170.0	100 (47)
			Run 47 170.0 to 175.2	94 (19)
			Run 48 175.2 to 179.8	91 (10)
170 (147.2)	Quartz Diorite	176.3-177.2 - Shear zone, joints at 20°-60°, soft and friable. 178.2-179.8 - Shear zone, joints at 20°-60°, 0.4 feet of clay, soft and friable.	Run 49	100(59)
			Run 49	100(59)
180 (155.9)	Quartz Diorite		Run 49	100(59)

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5700.05
HOLE NO. BH-6
SHEET NO. 7 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
190 (164.5)	Quartz Diorite	186.8-221.1 - Joints closely spaced, most carbonate coated.	Run 49 179.8 to 184.9	100 (59)
			Run 50 184.9 to 190.0	100 (82)
			Run 51 190.0 to 195.1	98 (86)
			Run 52 195.1 to 200.2	100 (82)
			Run 53 200.2 to 205.1	100 (45)
			Run 54 205.1 to 210.0	98 (95)
200 (173.2)		Below 208.0, texture fine to medium grained.		
210 (181.9)		210.0-215.0 - Core loss 0.3 feet. 210.0-245.0 - Inclusions of fine grained mafic rock, joints very close to widely spaced, up to 2.0 inches.	Run 55	

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Watana (North Bank)

JOB NO. P5700.05
HOLE NO. BH-6
SHEET NO. 8 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
220 (190.5)	Quartz Diorite	215.4-215.7 - Highly fractured and moderately weathered. 221.1 - Joints moderately close to widely spaced, most carbonate coated, occasional trace of iron oxide staining.	Run 55 210.0-215.0	97 (86)
			Run 56 215.0 to 220.0	96 (72)
			Run 57 220.0 to 225.2	100 (96)
			Run 58 225.2 to 230.4	100 (85)
			Run 59 230.4 to 235.4	100 (84)
			Run 60 235.4 to 240.3	100 (100)
			Run 61 240.3 to 245.5	96 (90)
230 (199.2)				
240 (207.8)				

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-6
SITE Watana (North Bank) **SHEET NO.** 9 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
250 (216.5)	Quartz Diorite		Run 62 245.5 to 249.7	100 (93)
			Run 63 249.7 to 255.0	100 (79)
260 (225.2)	Quartz Diorite	255.2-256.8 - Shear/alteration zone, slightly to moderately altered hydrothermally along joints, small light gray breccia and gouge zone. Numerous rehealed joints, chalky-white diorite, feldspars beginning to decompose. 256.0-256.6 - Shear, 30°, joints very closely spaced, clay, carbonate, and breccia filling.	Run 64 255.0 to 260.1	100 (86)
			Run 65 260.1 to 265.1	100 (100)
270 (233.8)	Quartz Diorite	266.5-280.6 - Irregular discontinuous patches of red staining.	Run 66 265.1 to 270.2	100 (82)
			Run 67 270.2 to 275.4	100 (56)
		272.6-273.8 - Shear/alteration zone, slightly altered hydrothermally, friable, with a breccia-gouge 0.1 feet thick, closely spaced joints.	Run 68 275.4 to 280.6	100 (92)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-6
SITE Watana (North Bank) **SHEET NO.** 10 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
280 (242.5)	Quartz Diorite	273.4-273.5 - Breccia and clay gouge, 60°, soft and friable, carbonate filling. 273.8-315.0 - Joints moderately closely spaced with minor carbonate coating.	Run 68 275.4 to 280.3	100 (92)
			Run 69 280.3 to 284.6	100 (100)
290 (251.1)	Quartz Diorite	284.6-290.6 - Core loss 0.2 feet.	Run 70 281.6 to 284.6	100 (100)
			Run 71 284.6-286.6	100 (100)
300 (259.8)	Quartz Diorite		Run 72 286.6 to 290.5	100 (100)
			Run 73 290.5 to 295.7	100 (92)
			Run 74 295.7 to 300.7	100 (86)
			Run 75 300.7 to 305.0	100 (100)
			Run 76 305.0 to 310.2	99 (98)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 11 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
310 (268.5)	Quartz Diorite		Run 76	99 (98)
			Run 77 310.2 to 315.4	99 (83)
320 (277.1)	Quartz Diorite	318.8-319.7 - Shear/alteration zone, bleached light gray, slightly to moderately altered hydrothermally. Friable, feldspars altering to clay, iron oxide staining on joints and fractures. 319.2 - Shear, 30°, 0.13 inch breccia and gouge, carbonate filling. 320.6-325.6 - Core loss 0.2 feet. 321.2-321.9 - Fracture zone, 0°-20°, joints very closely spaced, iron oxide staining and carbonate filling. 322.5-325.6 - Fracture/alteration zone, slightly to moderately altered hydrothermally, healed joints very close to closely spaced. Carbonate and clay filling in joints from altered feldspars, moderately hard.	Run 78 315.4 to 320.6	99 (88)
			Run 79 320.6 to 325.6	100 (100)
330 (285.8)	Quartz Diorite	322.5-325.6 - Fracture/alteration zone, slightly to moderately altered hydrothermally, healed joints very close to closely spaced. Carbonate and clay filling in joints from altered feldspars, moderately hard. 323.8 - Joint, 30°, slickensides, clay and carbonate filling, minor iron oxide staining. 324.4 - Carbonate vein, 40°, 0.5 inches wide, offset 0.5 inches along healed shear at 10°, tight. 328.2-332.7 - Fracture zone, joints very closely spaced, soft and friable. Core loss 3.3 feet.	Run 80 325.6 to 330.2	72 (48)
			Run 81 330.2 to 332.7	20 (0)
340 (294.4)	Quartz Diorite		Run 82 332.7 to 337.9	96 (65)
			Run 83 337.9 to 342.9	100 (100)

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BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 12 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
350 (303.1)	Quartz Diorite	339.0-345.0 - Alteration zone, bleached light gray, slightly altered hydrothermally, feldspars beginning to alter to clay. Joints very close to closely spaced at 30°, generally healed and tight with carbonate filling and iron oxide staining, hard to moderately hard. 343.0 - Core loss 0.2 feet. 345.0 - Joints close to moderately closely spaced.	Run 83	100 (100)
			Run 84 342.9 to 348.8	98 (92)
360 (311.8)	Quartz Diorite	357.9-358.6 - Fracture zone, joints very closely spaced at 10°-20°, 30°, and 50°. 360.1 - Joint, 50°, highly altered hydrothermally, carbonate filling. 360.1-361.4 - Fracture/alteration zone, slightly altered hydrothermally, joints very closely spaced (scalloped). Moderately hard to soft, friable.	Run 85 348.8 to 353.8	100 (100)
			Run 86 353.8 to 358.9	100 (70)
370 (320.4)	Quartz Diorite	368.2-373.2 - Core loss 0.2 feet.	Run 87 358.9 to 363.1	100 (40)
			Run 88 363.1 to 368.2	100 (75)
380 (330.0)	Quartz Diorite		Run 89	100 (98)
			Run 90 368.2 to 373.2	100 (98)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-6
SITE Watana (North Bank) **SHEET NO.** 13 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
380 (329.1)	Quartz Diorite	374.1-374.7 - Fracture zone, 20-30°, joints very closely spaced, carbonate filling and some iron oxide staining.	Run 90 373.2 to 378.4	96 (77)
		377.2 - Joint, 40°, surface severely altered hydrothermally to 0.13 inches.		
		380.2-382.2 - Shear/alteration zone, slightly to moderately altered hydrothermally, joints close to very closely spaced. Numerous re-healed fractures, feldspars decomposing to clay, soft and friable.	Run 91 378.4 to 383.7	100 (72)
		381.5-382.2 - Shear zone, 40-50°, joints very closely spaced, clay gouge, breccia.		
		383.3-388.3 - Core loss 0.1 feet.	Run 92 383.7 to 388.6	100 (98)
		382.2-477.5 - Joints closely to moderately closely spaced.		
			Run 93 388.6 to 393.3	100 (100)
			Run 94 393.3 to 398.3	100 (86)
			Run 95 398.3- 400.6	100 (76)
			Run 96 400.6 to 403.4	100 (95)
390 (337.7)	Quartz Diorite		Run 97 403.4 to 407.4	100 (98)
400 (346.4)	Quartz Diorite	402.0 - Felsic dike, granodiorite composition, 0.1 feet thick.	Run 96 400.6 to 403.4	100 (95)
			Run 97 403.4 to 407.4	100 (98)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-6
SITE Watana (North Bank) **SHEET NO.** 14 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
410 (355.1)	Quartz Diorite		Run 97 407.4 to 410.9	100 (98)
			Run 98 406.2 to 410.9	100 (98)
		412.0 - Inclusions of fine grained diorite, 0.2 feet in diameter, sharp contacts, irregular shape.	Run 99 410.9 to 416.0	100 (100)
			Run 100 416.0 to 420.8	100 (100)
		421.8 - Inclusion of fine grained diorite, 0.2 feet in diameter.		
			Run 101 420.8 to 426.0	99 (94)
			Run 102 426.0 to 430.5	100 (97)
			Run 103 430.5 to 435.6	100 (100)
			Run 104 435.6 to 440.0	100 (98)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 15 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
440 (381.1)	Quartz Diorite	454.6-455.1 - Fracture zone, joints very closely spaced, at 20°-30° and 40°-70°, carbonate coating.	Run 104	100 (98)
			435.6 to 440.4	
			Run 105	100 (94)
			440.4 to 445.6	
			Run 106	100 (90)
			445.6 to 450.6	
			Run 107	96 (79)
450.6 to 455.8				
450 (389.7)	Quartz Diorite	454.6-455.1 - Fracture zone, joints very closely spaced, at 20°-30° and 40°-70°, carbonate coating.	Run 108	88 (88)
			455.8-458.2	
			Run 109	100 (78)
458.2 to 463.2				
460 (398.4)	Quartz Diorite	454.6-455.1 - Fracture zone, joints very closely spaced, at 20°-30° and 40°-70°, carbonate coating.	Run 110	43(0)
			Run 111	100 (88)
			463.9 to 468.4	
			Run 112	95(83)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 16 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
470 (407.0)	Quartz Diorite	472.7-473.3 - Core badly broken by drilling.	Run 112	95 (83)
			468.4 to 473.3	
			Run 113	100 (92)
			473.3 to 477.8	
			Run 114	92 (72)
			477.8 to 480.3	
			Run 115	94 (65)
480.3 to 485.3				
480 (415.7)	Quartz Diorite	477.5-477.9 - Fracture zone, joints very closely spaced, at 60°-80°, chlorite coating.	Run 116	61 (0)
			485.3 to 490.5	
			Run 117	99 (95)
490.5 to 495.5				
490 (424.4)	Quartz Diorite	481.9-482.6 - Fracture zone, joints very closely spaced at 40°-60°.	Run 118	98 (77)
			495.5 to 500.5	
			Run 119	95(91)
			500.5 to 505.5	
490 (424.4)			Run 112	95(83)
490 (424.4)	Quartz Diorite	485.3-490.5 - Core barrel mismatched during drilling. Core loss 2.0 feet.	Run 116	61 (0)
			485.3 to 490.5	
			Run 117	99 (95)
490.5 to 495.5				
500 (433.0)	Quartz Diorite	481.9-482.6 - Fracture zone, joints very closely spaced at 40°-60°.	Run 118	98 (77)
			495.5 to 500.5	
			Run 119	95(91)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-6
SITE Watana (North Bank) **SHEET NO.** 17 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
510 (441.7)	Quartz Diorite	505.7 - Healed shear, 40°, 0.5 inches wide, healed with dark green, fine grained diorite, tight, hard.	Run 119 500.5 to 505.6	95 (91)
			Run 120 505.6 to 510.6	100 (100)
			Run 121 510.6 to 515.6	99 (92)
			Run 122 515.6 to 520.7	98 (66)
			Run 123 520.7 to 525.6	100 (67)
			Run 124 525.6 to 530.4	100 (74)
			Run 125 530.4 to 535.3	93 (0)
			Run 126 535.3 to 540.2	100 (0)
			Run 127 540.2 to 545.1	100 (52)
520 (450.3)	Quartz Diorite	516.2-516.8 - Core badly broken by drilling. 517.7 - Carbonate vein, 0.25 inches wide, irregular and discontinuous. 519.3 - Two joints very closely spaced, at 40°, healed with carbonate.		
530 (459.0)	Quartz Diorite	529.5-529.9 - Fracture zone, joints very closely spaced at 40°, 0.5 inches spacing, carbonate filling and chlorite staining.		

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-6
SITE Watana (North Bank) **SHEET NO.** 18 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
540 (467.7)	Quartz Diorite	530.5-533.0 - Shear/alteration zone, moderately to severely altered hydrothermally, moderately hard. Feldspars altered to clay. 530.5-531.8 - Fracture, joints very closely spaced, carbonate filling. 531.8-532.8 - Approximately 1.0 foot of light gray clay gouge and breccia. 533.5-547.5 - Core loss 1.2 feet.	532.0-534.5	100 (52)
			Run 128 534.5 to 539.5	100 (90)
			Run 129 539.5 to 544.6	100 (73)
			Run 130 544.6 to 547.5	79 (55)
			Run 131 547.5 to 550.4	100 (76)
			Run 132 550.4 to 555.4	94 (79)
			Run 133 555.4 to 560.7	100 (83)
			Run 134 560.7 to 565.7	100 (100)
			Run 135 565.7 to 570.7	100 (100)
			Run 136 570.7 to 575.7	100 (100)
550 (476.3)	Quartz Diorite	541.3-541.7 - Fracture zones, joints very closely spaced, at 50° and 40°, carbonate filling and iron oxide staining.		
560 (485.0)	Quartz Diorite	559.6-561.1 - Numerous healed joints, 60°, carbonate filled. 560.8-561.5 - Shear, breccia healed with carbonate, chlorite, and quartz.		

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CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-6

SITE Watana (North Bank)

SHEET NO. 19 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REG (RQD)	
570 (493.6)	Quartz Diorite	564.6-576.7 - Shear/alteration zone, light gray, slightly to moderately altered hydrothermally. Joints close to very closely spaced, generally 20°-80°, numerous healed fractures. Feldspars decomposing to clay, carbonate filling and iron oxide staining. Soft, friable in places. Core loss 0.8 feet. 569.0 - Shear, 60°, very thin clay gouge. 571.9-572.7 - Breccia and clay gouge, white to light gray, 20° and 50°, soft, friable.	Run 134	100(100)	
			565.7 to 570.7	90 (7)	
			Run 136	570.7 to 575.9	94 (83)
580 (502.3)	Quartz Diorite	579.5-580.7 - Fracture/alteration zone, slightly altered hydrothermally, joints very closely spaced, numerous healed fractures. 581.1-604.3 - Joints closely spaced, some carbonate filling and iron oxide staining. 583.4-583.7 - Core broken by drilling.	Run 137	575.9 to 580.7	98 (61)
			Run 138	580.7 to 585.8	100 (64)
			Run 139	585.8 to 590.8	100 (51)
590 (511.0)	Quartz Diorite	590.8-592.8 - Core barrel mismatched during drilling. Core loss 0.6 feet.	Run 140	590.8-592.8	70 (0)
			Run 141	592.8 to 597.8	99 (82)

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CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-6

SITE Watana (North Bank)

SHEET NO. 20 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REG (RQD)	
600 (519.6)	Quartz Diorite	602.1-602.6 - Core broken by drilling.	Run 141	99(82)	
			Run 142	597.8 to 602.6	100 (42)
			Run 143	602.6 to 608.3	100 (61)
610 (528.3)	Quartz Diorite	607.7-607.9 - Core broken by drilling.	Run 144	608.3 to 611.8	100 (89)
			Run 145	611.8 to 615.4	78 (64)
			Run 146	615.4 to 620.3	100 (96)
620 (536.9)	Quartz Diorite	611.3-612.4 - Felsic dike, light gray, fine grained, fresh, 6.0 inches thick. Lower and upper contacts at 10°, tight.	Run 147	620.3 to 625.2	100 (94)
			Run 148	625.2 to 630.2	92 (79)
			Run 148	626.1-627.2 - Felsic dike as above, light gray, fine grained, 20-30% quartz, 5-10% mafics, interfingering or containing clasts of the quartz diorite. Unfractured, contacts tight and melted, upper at 70°, lower at 40°.	

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 21 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION : COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)	
630 (545.6)	Quartz Diorite	Core loss 0.4 feet.	Run 148	92 (79)	
			Run 149	88 (72)	
			Run 150	631.8 to 636.7	100 (80)
			Run 151	636.7 to 640.5	100 (100)
640 (554.3)	Quartz Diorite		Run 152	640.5 to 645.6	98 (85)
			Run 153	645.6 to 650.5	99 (88)
649.7 (562.7)	Quartz Diorite	648.7-649.7 - High concentration of biotite.	Run 154	650.5 to 655.8	98 (88)
650 (562.9)	Granodiorite	Light gray-white, generally fine to medium grained crystalline rock, 60-80% feldspars, 10-20% mafics (biotite), 10-20% quartz. Generally hard and fresh, some feldspars stained brown. Upper contact is gradational over 0.1 feet, feldspars slightly altered, tight. 656.0-670.0 - Numerous healed joints, calcite filling.	Run 155	655.8 to 660.6	96 (50)
			Run 156		
660 (571.6)	Granodiorite				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-6
SITE Watana (North Bank) SHEET NO. 22 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION : COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)	
670 (580.2)	Granodiorite	674.4-674.7 - Core broken by drilling.	Run 156	660.6 to 665.7	100 (74)
			Run 157	665.7 to 670.8	97 (90)
			Run 158	670.8 to 676.0	100 (58)
			Run 159	676.0 to 680.6	97 (93)
			Run 160	680.6 to 685.4	98 (90)
			Run 161	685.4-687.9	76 (72)
			Run 162	687.9 to 692.5	100 (91)
680 (588.9)	Granodiorite				
690 (597.6)	Granodiorite				
			Run 163		

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-6
SITE Watana (North Bank) **SHEET NO.** 23 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (REQ)
700 (606.2)	Granodiorite	703.5-706.0 - Fracture/alteration zone, slightly altered hydrothermally, joints close to very closely spaced, at 40°-60°, feldspars altering to clay, carbonate filling present.	Run 163 692.5 to 697.5	100 (80)
			Run 164 697.5 to 702.7	100 (83)
			Run 165 702.7 to 707.2	100 (44)
			Run 166 707.2 to 712.2	100 (78)
			Run 167 712.2 to 717.1	100 (88)
			Run 168 717.1 to 722.2	100 (92)
710 (614.9)	Granodiorite	722.0-727.1 - Core loss 0.1 feet.	Run 169 722.2 to 727.3	99 (69)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-6
SITE Watana (North Bank) **SHEET NO.** 24 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (REQ)
730 (632.2)	Granodiorite	725.7-726.3 - Numerous healed joints very closely spaced, 20°-40°, faint slickensides, calcite filling.	Run 169	99 (69)
			Run 170 727.3 to 730.5	100 (84)
			Run 171 730.5 to 735.3	100 (92)
			Run 172 735.3 to 740.4	93 (73)
(640.9) 740		END OF BORING		
740.4 (641.2)				
750 (649.5)				

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-6
 Site Watana (North Bank) Sheet No. 1 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5		
0	1609													Overburden	TOP OF ROCK 8.0'
20														Diorite	
40														Quartz Diorite	Fracture zone.
60	1566														
80															Shear/fracture zone
100	1522														Fracture.
120															
140															Alteration zone.
160	1479														
180															Shear/alteration zone.
200	1436														
220															
240															
260	1392														Shear.
280															Shear.
300	1349														
320															Shear.
340															Fracture zone.
															Alteration zone.



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-6
 Site Watana (North Bank) Sheet No. 2 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5		
360														Quartz Diorite	
380															Shear.
400	1263														
420															
440															
460	1219														
480															
500	1176														Shear, healed.
520															
540															Shear/alteration zone.
560	1133														
580															Shear/alteration zone.
600	1089														
620															Dike, felsic.
640															Dike, felsic.
660	1046													Granodiorite	
680															
700	1003														



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-6
 Site Watana (North Bank) Sheet No. 3 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.				ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40	60	80	5	10		
720																
740	968															END OF BORING 740.4'



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 BUFFALO, NEW YORK
 DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
 PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-8
 SITE: Watana (South Bank) SHEET NO. 1 OF 24
 CONTRACTOR: The Drilling Company DRILLING DATES: July 29 To August 9, 1980
 LOGGED BY: K.J. White, M.P. Bruen DATE: July 1980
 DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
 ROCK Diamond Core - Triple Tube CORE DIAMETER: NO (1.75") O.D.
 LOCATION: LATITUDE N3,225,586 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
 DEPARTURE E744,482 GROUND SURFACE 1979.7
 AZIMUTH 060° ROCK SURFACE 1972.8
 DIP 60° BOTTOM OF HOLE 1328.1
 WATER TABLE 1963.7
 NOTES: 1) Depths measured along hole. True depths in ().
 2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden			
8.0 (6.9)	Andesite Porphyry	Light gray to greenish gray, aphanitic ground-mass with white, feldspar phenocrysts to 0.1 inch and 5-10% angular inclusions of argillite to 0.5 inch. Slightly weathered and hard. Flow structures visible. Joints very close to close spaced with planar to irregular, rough surfaces. Penetrative iron oxide staining up to 0.5 inch, minor carbonate filling. 8.0-13.8 - No core taken. 13.8-18.3 - Moderately weathered. Joints very close spaced with traces of sand and silt. Core loss 1.5 feet.	No Core	
10 (8.7)			Run 1 13.8 to 18.0	64 (0)
20 (17.3)			Run 2 18.0 to 23.8	90 (20)
APPROVED: <i>[Signature]</i>		DATE: February 1, 1982		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
 SITE Watana (South Bank) SHEET NO. 2 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
30 (26.0)	Andesite Porphyry	18.3-34.1 - Slightly to moderately weathered. Joints very close to close spaced. Core loss 1.2 feet. 33.8-38.8 - Core loss 1.1 feet. 34.1-49.6 Fresh to slightly weathered. Joints very close to close spaced with nonpenetrative iron oxide staining.	Run 2 18.0 to 23.8	90 (20)
			Run 3 23.8 to 28.8	92 (58)
			Run 4 28.8 to 33.8	100 (35)
			Run 5 33.8 to 38.8	79 (56)
			Run 6 38.8 to 43.9	98 (77)
40 (34.6)	Andesite Porphyry	44.3-49.6 - Fracture zone, joints very close spaced. 46.0-47.1 - Subrounded to subangular inclusions of argillite, quartz, diorite, and volcanics up to 2 inches, andesite matrix. 47.1-49.6 - Moderately to severely weathered. Silty to sandy clay with 20-30% subangular to subrounded, coarse sand. Core loss 1.1 feet. Drilling water return 50%.	Run 7 43.9-45.6	100 (0)
			Run 8 45.6 to 49.6	73 (26)
			Run 9 49.6-52.5	72 (0)
49.6 (43.0)	Diorite to Quartz Diorite	Light gray to greenish gray, fine to medium grained, nonfoliated crystalline rock. 50-80% feldspar, 20-40% mafics (biotite and hornblende), 0-15% quartz and trace carbonate.		
50 (43.3)				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
SITE Watana (South Bank) SHEET NO. 3 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
60 (52.0)	Diorite to Quartz Diorite	Fresh and very hard to hard. Joints close spaced, planar to rough. Carbonate coating on most surfaces.	Run 10 52.5 to 56.5	91 (11)
		49.6-53.4 - Fracture/alteration zone, hydrothermally altered, joints very closely spaced.	Run 11 56.5 to 59.5	100 (52)
		50.1-52.9 - Two alteration zones, severely hydrothermally altered. 1 inch wide, 30°, soft and friable.	Run 12 59.5 to 63.6	85 (67)
		53.4-61.4 - Joints closely spaced, iron oxide stained.	Run 13 63.6 to 68.0	100 (69)
		60.3-61.4 - Healed shear, diorite breccia in dark gray, fine grained diorite matrix. Hard and tight. Carbonate stringers.	Run 14 68.0 to 73.0	100 (87)
		61.4 - Contact resheared, 30°, 0.1 inch clay gouge.	Run 15 73.0 to 77.7	100 (48)
		61.4-64.5 - Alteration zone, moderately hydrothermally altered. Joints very close to close spaced.	Run 16 77.7 to 80.7	100 (25)
		62.2, 62.9, 64.4 - Severely hydrothermally altered zones, 1.0-2.0 inches wide, at 50-70°. soft and friable.	Run 17 80.7 to 84.0	97 (55)
		64.5-75.0 - Joints very close to close, surfaces fresh.	Run 18	
		65.0-66.0 - Three healed shears up to 1 inch wide, at 50°. Healed with dark green, fine grained diorite. Hard and tight.		
70 (60.6)		75.0-78.8 - Fracture zone, joints very close to close spaced, open at 10-30°, 90°, and 0°. Some treated with carbonate, minor iron oxide staining and chlorite.		
		78.8-91.6 - Joints close spaced. Iron oxide staining, some carbonate filling. Slickensides on some surfaces.		
80 (69.3)		82.0-85.4 - Fracture zone, joints very close spaced at 80-90°, 50-60°, and 20-30°. Minor iron oxide staining, carbonate and chlorite.		
		83.5 - Slickensides on carbonate staining.		

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
SITE Watana (South Bank) SHEET NO. 4 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
90 (77.9)	Diorite to Quartz Diorite	88.4-91.6 - Fracture zone, joints very closely spaced at 0-30°. Iron oxide staining, some carbonate filling.	Run 18 84.0 to 89.3	98 (63)
		91.6-96.6 - Core loss 0.6 feet.	Run 19 89.3- 91.6	100 (0)
			Run 20 91.6 to 96.6	88 (57)
			Run 21 96.6 to 101.0	100 (91)
			Run 22 101.0 to 106.2	100 (83)
			Run 23 106.2 to 111.0	100 (94)
			Run 24 111.0 to 116.1	100 (92)
100 (86.6)		100.0-141.0 - Joints closely spaced, planar, rough. Iron oxide staining and carbonate coating.		
		105.2-111.4 - Healed shears, 1-2 feet spacing up to 0.1 feet wide. Healed with dark green, fine grained diorite. Tight, hard.		
110 (95.3)				
		116.1-121.1 - Core loss 0.3 feet.		
			Run 25	

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SITE Watana (South Bank)

JOB NO. P5700.05
HOLE NO. BH-8
SHEET NO. 5 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
120 (103.9)	Diorite to Quartz Diorite		Run 25 116.1 to 121.1	95 (80)
			Run 26 121.1 to 126.1	100 (76)
			Run 27 126.1 to 131.1	100 (98)
130 (112.6)			Run 28 131.1 to 135.6	100 (88)
			Run 29 135.6 to 140.8	100 (82)
			Run 30 140.8- 143.9	79 (26)
140 (121.2)		140.8-142.9 - Core loss 0.5 feet. 141.0-190.0 - Joints closely spaced, planar, rough. Carbonate or chlorite filling. 145.0-147.1 - Shear/fracture zone, joints very close, 40-90°. Chlorite filling. 146.0-146.3 - Slickensides on chlorite surface. Joints tight. Fresh and hard.	Run 31 142.9 to 148.0	100 (70)
			Run 32	

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SITE Watana (South Bank)

JOB NO. P5700.05
HOLE NO. BH-8
SHEET NO. 6 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
150 (129.9)	Diorite to Quartz Diorite	148.9-149.3 - Diorite dike, dark green, fine grained. Tight irregular contacts at 30°, hard. 152.6-167.5 - Core loss 0.7 feet.	Run 32 148.0 to 152.6	100 (96)
			Run 33 152.6 to 157.7	100 (89)
			Run 34 157.7 to 162.7	96 (85)
160 (138.6)			Run 35 162.7 to 167.5	90 (79)
			Run 36 167.5 to 171.9	99 (86)
			Run 37 171.9 to 176.5	85 (39)
170 (147.2)		171.5-173.0 - Shear/alteration zone, hydrothermally altered, bleached white, medium hard to soft and friable, joints very close, some tight and healed with chlorite. Clay gouge less than 3 inches. Angular fragments 0.5-1.0 inches. Resheared healed shear, core loss 0.7 feet. 176.5-182.7 - Red staining intergranular. Irregular, discontinuous.	Run 38 176.5 to 181.0	90 (80)
			Run 39	
			Run 40	
180 (155.9)		180.7-181.0 - Possible fracture zone, core broken into fragments less than 1 inch, some fragments of healed breccia core loss 0.5 feet.	Run 41	
			Run 42	

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SITE Watana (South Bank) SHEET NO. 7 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
190 (164.5)	Diorite to Quartz Diorite	189.2-189.4 - Possible fracture zone, slightly to moderately hydrothermally altered, fragments less than 1 inch, some healed breccia. Core loss 0.4 feet. 190.0-230.0 - Joints moderately close spaced, plane, rough, carbonate coated.	Run 39	
			181.0 to 185.9	100 (97)
			Run 40	
			185.9-189.2	88 (73)
			Run 41	
			189.2 to 194.2	100 (98)
			Run 42	
			194.2 to 199.2	100 (98)
			Run 43	
			199.2-201.0	100 (94)
200 (173.2)		199.0-201.8 - Red staining, discontinuous. 200.5 - Healed shear, 40°, 1 inch wide, healed with dark green diorite. Tight, hard, competent.	Run 44	
			201.0 to 206.4	100 (100)
			Run 45	
210 (181.9)		206.8-207.9 - Fracture/alteration zone, hydrothermally altered, joints very close at 30°, healed with carbonate, iron oxide staining, patches of rock bleached white, tight, hard. 210.9 - Healed shear, 0.5 inch wide, carbonate filling at contact, tight, hard, healed with dark green diorite. 211.0-215.1 - Core loss 0.6 feet.	206.4 to 211.0	87 (76)
			Run 46	
			Run 46	

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SITE Watana (South Bank) SHEET NO. 8 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
220 (190.5)	Diorite to Quartz Diorite	221.2-222.2 - Fracture/alteration zone, hydrothermally altered, bleached white, joints very close at 30-40°. Iron oxide staining, slightly altered, hard. 224.1-228.1 - Red staining, irregular, discontinuous. 225.4-230.6 - Core loss 0.2 feet.	Run 46	
			211.0-215.1	100 (68)
			Run 47	
			215.1 to 219.3	100 (88)
			Run 48	
			219.3-221.2	100 (100)
			Run 49	
			221.2 to 225.4	100 (88)
			Run 50	
			225.4 to 230.6	96 (71)
230 (199.2)		230.0-290.0 - Joints moderately close, plane, rough, carbonate coated. 230.6-231.8 - Joint, tight, red staining penetrating 0.5 inches on each side.	Run 51	
			230.6 to 235.6	96 (94)
			Run 52	
240 (207.8)		238.7, 239.2, 246.2 - Healed shears, 20-70°, less than 1 inch wide, healed with dark green, fine grained diorite, tight, hard.	235.6 to 240.9	98 (89)
			Run 53	
			240.9 to 245.6	100 (91)

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SITE Watana (South Bank) SHEET NO. 9 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
250 (216.5)	Diorite to Quartz Diorite	246.8-247.2 - Alteration zone, slightly to moderately altered hydrothermally, feldspars altering to clay, mafics completely altered, bleached white. Joints at 50° with iron oxide and carbonate, hard to moderately hard. 250.0-251.8 - Possible shear/alteration zone, bleached light gray, slightly to moderately hydrothermally altered, hard to moderately hard. Joints very close at 50°, most tight but some opened by drilling, carbonate filling and iron oxide staining. Some clay on joints from altered feldspars. 251.8-324.5 - Joints close to moderately close except where noted. 254.8-258.8 - Red staining, irregular, discontinuous.	Run 54	
			245.6 to 251.0	98 (81)
			Run 55	
			251.0 to 255.2	100 (57)
260 (225.2)		261.6-262.2 - Healed shear, 10-20°, healed with dark green diorite, tight.	Run 56	
			255.2 to 260.1	100 (76)
			Run 57	
270 (233.8) 271.5 (235.1)			260.1 to 265.1	98 (70)
			Run 58	
			265.1 to 270.1	100 (62)
	Run 59		270.1 to 275.3	100 (77)

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SITE Watana (South Bank) SHEET NO. 10 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
280 (242.5)	Quartz Diorite to Granodiorite	Joints moderately close to close, planar, smooth to rough, mostly carbonate coated. 280.7-281.0 - Dike/possible inclusion of granodiorite, fine grained groundmass of orthoclase feldspar and quartz, medium grained plagioclase feldspar phenocrysts, tight contacts, hard. 287.8-291.0 - Core barrel mismatch during drilling. Core loss 1.0 feet. 290.0-330.0 - Joints moderately close, planar, rough, few with carbonate coating. 294.6-295.9 - Core badly broken during drilling. 300.8-302.5 - Healed shear zone, 50-70°, very close shears healed with dark green quartz diorite, tight, hard, competent.	Run 60	
			275.3 to 280.3	100 (100)
			Run 61	
			280.3 to 284.4	98 (98)
290 (251.1)			Run 62	
			284.4 to 287.8	94 (85)
			Run 63	
300 (259.8)			287.8-291.0	70 (25)
			Run 64	
			291.0 to 296.1	100 (75)
			Run 65	
300.8-303.7			296.1 to 300.8	100 (89)
			Run 66	
303.7 to 308.8			300.8-303.7	97 (95)
			Run 67	
			303.7 to 308.8	100 (76)

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SITE Watana (South Bank)

JOB NO. P5700.05
HOLE NO. BH-8
SHEET NO. 11 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
310 (268.5)	Quartz Diorite to Granodiorite		Run 68 308.8 to 313.2	100 (93)
			Run 69 313.2 to 318.2	100 (98)
320 (277.1)		324.6-333.1 - Felsic, possible aplite dikes, light pinkish gray, 3 and 2 inches wide at 30° and 20°, respectively. Unfractured, hard.	Run 70 318.3 to 321.5	94 (84)
			Run 71 321.5 to 326.9	100 (94)
330 (285.8)		330.0-346.3 - Joints close to very close, planar, smooth to rough. Carbonate coated with zones of iron oxide staining.	Run 72 326.9 to 330.8	97 (97)
			Run 73 330.8 to 335.8	100 (96)
339.3 (293.8)			Run 74 335.8 to 340.1	100 (90)
340 (294.4)	Diorite/Diorite Porphyry	Dark greenish gray, fine grained crystalline rock with medium grained plagioclase		

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SITE Watana (South Bank)

JOB NO. P5700.05
HOLE NO. BH-8
SHEET NO. 12 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
	Diorite/Diorite Porphyry	phenocrysts, fresh, hard. Joints coated with chlorite and carbonate.	Run 75 340.1-343.2	97 (76)
			Run 76 343.2 to 348.4	100 (100)
347.2 (300.7)		346.3-351.9 - Joints close to moderately close, carbonate coating and filling.		
350 (303.1)	Quartz Diorite	Rock description, as above. 351.9-437.5 - Joints close to very close, planar, smooth to rough, carbonate coated, zones of iron oxide staining.	Run 77 348.4 to 351.8	100 (68)
			Run 78 351.8 to 356.8	100 (100)
360 (311.8)		360.9-361.1 - Diorite porphyry inclusion.	Run 79 356.8 to 360.9	100 (90)
			Run 80 360.9 to 364.2	100 (62)
366.3 (317.2)	Diorite Porphyry	Dark greenish gray, fine grained crystalline matrix with medium to coarse grained plagioclase phenocrysts, 40-50% mafics, fresh, hard. 369.5 - Felsic dike, light gray, 1.5 inches wide, 30°, fractured along trend, tight contacts.	Run 81 364.2 to 366.3	85 (69)
			Run 82 365.5 to 370.5	100 (82)
370 (320.4)			Run 83 370.5 to 375.8	100 (91)

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PROJECT Susitna Hydroelectric Project		HOLE NO. BH-8		
SITE Watana (South Bank)		SHEET NO. 13 OF 24		
DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Diorite Porphyry		Run 83 370.5 to 375.8	100 (91)
377.0 (326.5)	Quartz Diorite	Rock description, as above.	Run 84	
		378.3 - Felsic dike, possibly aplite, light gray, unfractured, 0.5 inches wide, 40°, tight.	375.8 to 380.7	100 (86)
380 (329.1)			Run 85	
			380.7 to 384.3	89 (56)
		385.1-387.0 - Shear/alteration zone slightly to moderately altered hydrothermally, soft and friable. Iron oxide staining and carbonate filling on joints. Silty sand gouge. Core loss 0.4 feet.	Run 86	
		385.1-400.5 - Iron oxide staining on most joints.	384.3 to 389.3	98 (36)
390 (337.7)			Run 87	
			389.3 to 393.7	98 (67)
			Run 88	
			393.7 to 398.0	100 (100)
400 (346.4)			Run 89	
			398.0 to 403.5	100 (93)
		403.5-413.1 - Core loss 0.8 feet.	Run 90	

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PROJECT Susitna Hydroelectric Project		HOLE NO. BH-8		
SITE Watana (South Bank)		SHEET NO. 14 OF 24		
DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Quartz Diorite	405.3-410.9 - Fracture/alteration zone, yellowish gray, slightly hydrothermally altered, generally moderately hard but occasionally soft. Carbonate and iron oxide staining.	Run 90 403.5 to 409.0	91 (26)
410 (355.1)		407.1 - Moderately to severely altered, possible shear, 2.0 inches wide. Broken rock fragments less than 0.5 inch.	Run 91 409.0 to 413.1	93 (49)
			Run 92 413.1 to 418.3	100 (73)
		418.3-418.5 - Healed shear, quartz diorite breccia in fine grained quartz diorite groundmass, tight.	Run 93 418.3 to 422.5	100 (79)
420 (363.7)		420.0-429.0 - Iron oxide staining on most joints.	Run 94 422.5 to 427.6	100 (100)
			Run 95 427.6 to 432.2	100 (57)
430 (372.4)		433.7-437.5 - Shear/fracture zone, joints very close, 20°-50°, some healed with carbonate.	Run 96 432.2- 434.8	69 (38)
		433.7-434.8 } 436.1-437.5 } Soft and friable rock, slickensides, chlorite, clay gouge to 2.0 inches. Core loss 1.1 feet.	Run 97 434.8- 437.5	89 (24)

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PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-8
SITE Watana (South Bank) **SHEET NO.** 15 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC	LENGTH OF RUN (FT)	REC (RQD)
440 (381.1)	Quartz Diorite	437.5-453.3 - Joints very close to close spaced, healed with carbonate, iron oxide stained.	Run 98 437.5 to 442.2	98 (66)
			Run 99 442.2 to 447.2	94 (54)
450 (389.7)		443.1-446.2 - Shear/alteration zone, rock bleached white, 40-90°, moderately weathered. Joints and fractures close, rough, planar. 0.8 feet clay gouge.	Run 100 447.2 to 452.2	88 (88)
			453.3-610.0 - Joints moderately close to close, planar, smooth to rough, some carbonate coated.	Run 101 452.2 to 457.4
460 (398.4)				Run 102 457.4 to 462.2
			Run 103 462.2 to 466.6	100 (100)
			Run 104 466.6-468.4	100 (89)

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PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-8
SITE Watana (South Bank) **SHEET NO.** 16 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC	LENGTH OF RUN (FT)	REC (RQD)
470 (407.0)	Quartz Diorite		Run 105 468.4 to 471.4	100 (100)
			Run 106 471.4 to 476.6	100 (100)
480 (415.7)		477.8-478.0 - Alteration zone, rock bleached white, moderately hydrothermally altered, soft and friable along joints at 50°.	Run 107 476.6 to 481.8	100 (75)
			Run 108 481.5-483.0	100 (100)
490 (424.4)			Run 109 483.0 to 486.8	92 (82)
			Run 110 486.8 to 491.6	100 (100)
			Run 111 491.6 to 496.6	90 (48)
500 (433.0)			494.2-496.8 - Alteration zone, rock bleached white, hydrothermally altered, soft and friable. Core loss 0.5 feet. Feldspars weathering to clay, slightly to moderately altered.	Run 112 496.6 to 501.7
	499.4-502.7 - Felsic dike, light gray, fine to medium grained, less than 10% mafics, hard.			

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Watana (South Bank)

JOB NO. P5700.05
HOLE NO. BH-8
SHEET NO. 17 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RCD)
510 (441.7)	Quartz Diorite	508.4-520.7 - Alteration zone, bleached white-gray, slightly to moderately hydrothermally altered, numerous healed joints. Feldspars altering to clay, moderately hard but friable in places, joints close at 30-70°.	Run 113 501.7 to 507.0	96 (87)
			Run 114 507.0 to 512.0	88 (28)
			Run 115 512.0 to 517.4	94 (0)
			Run 116 517.4 to 522.4	100 (34)
			Run 117 522.4 to 527.5	100 (98)
			Run 118 527.5 to 532.6	96 (92)
520 (450.3)				
530 (459.0)		531.5-540.9 - Alteration zone, bleached white-gray, slightly to moderately hydrothermally altered, moderately hard to soft. Feldspars altering to clay.		

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Watana (South Bank)

JOB NO. P5700.05
HOLE NO. BH-9
SHEET NO. 18 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RCD)
540 (467.7)	Quartz Diorite	535.0-536.3 - Occasional friable zones with clay up to 0.1 feet. Core loss 0.5 feet.	Run 119 532.6 to 537.9	96 (64)
			Run 120 537.9 to 542.9	98 (86)
			Run 121 542.9 to 548.1	100 (100)
			Run 122 548.1 to 552.8	100 (100)
			Run 123 552.8 to 554.2	100 (0)
			Run 124 554.2 to 558.0	100 (0)
550 (476.3)		553.0-569.9 - Fractured/alteration zone, bleached white-gray, slightly to moderately hydrothermally altered, joints very close to close at 30-60°, healed with carbonate, iron oxide stained. Moderately hard to soft, friable in places. Feldspars altering to clay. Core loss 0.2 feet.		
560 (485.0)			Run 125 558.0 to 562.8	98 (0)
			Run 126 562.8 to 567.8	96 (0)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
 SITE Watana (South Bank) SHEET NO. 19 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
570 (493.6)	Quartz Diorite		Run 126 562.8 to 567.8	96 (0)
		569.0-578.8 - Healed shears, closely spaced, less than 0.1 feet wide, healed with dark green, aphanitic quartz diorite, tight. Core loss 0.6 feet.	Run 127 567.8 to 573.2	94 (39)
		573.0 - Texture of quartz diorite changes. Quartz and white feldspar are fine grained and intergrown, green feldspar (20-30%) is medium grained.	Run 128 573.2 to 577.0	92 (87)
		577.6-586.6 - Joints close to moderately close, carbonate coating and iron staining.	Run 129 577.0 to 582.1	100 (98)
580 (502.3)	Quartz Diorite	581.6-582.5 - Alteration zone, bleached white, slightly altered hydrothermally, hard.	Run 130 582.1 to 587.2	100 (100)
		589.0-592.5 - Shear/alteration zone, bleached white-gray, slightly altered hydrothermally, healed and resheared. Numerous, very close shears healed with possible quartz/andesite, randomly oriented from 0-90°, hard.	Run 131 587.2 to 592.3	100 (71)
590 (511.0)	Quartz Diorite	589.0-589.3 } 592.1-592.5 } Zones of reshearing, breccia, and gouge, moderately soft and friable.	Run 132 592.3 to 597.6	98 (81)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
 SITE Watana (South Bank) SHEET NO. 20 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
600 (519.6)	Quartz Diorite	593.3 - Shear, 30°, 2 inches wide, breccia and gouge, moderately soft, sulphide mineralization and iron oxide staining.	Run 133 597.6 to 602.6	100 (74)
			Run 134 602.6- 605.6	97 (77)
			Run 135 605.6 to 610.6	100 (92)
610 (528.3)	Quartz Diorite	610.8-635.2 - Joints close to very close, many healed with carbonate.	Run 136 610.6- 614.0	100 (47)
			Run 137 614.0 to 619.2	96 (50)
620 (536.9)	Quartz Diorite		Run 138 619.2 to 622.6	100 (56)
		626.2-627.7 - Core broken by drilling, rock fragments 1-2 inches, possible fracture zone.	Run 139 622.6 to 627.8	100 (54)
			Run 140	

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
 SITE Watana (South Bank) SHEET NO. 21 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)	
630 (545.6)	Quartz Diorite	628.2-629.8 - Core badly broken, rock fragments 1.0-2.0 inches.	Run 140 627.8- 630.4	100 (27)	
			Run 141 630.4 to 635.6	100 (69)	
		635.2-700.0 - Joints moderately close, planar, smooth, most carbonate coated.	Run 142 635.6 to 640.9	91 (87)	
640 (554.3)			Run 143 640.9 to 645.1	100 (95)	
		646.7-650.1 - Shear/alteration zone, rock bleached white-gray, slightly hydrothermally altered, soft and friable. Breccia and clay zone 0.7 feet wide, joints close at 40-75°, carbonate coating.	Run 144 645.1 to 650.4	100 (94)	
			Run 145 650.4 to 655.4	100 (100)	
650 (562.9)				Run 146 655.4 to 660.7	98 (91)
660 (571.6)					

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
 SITE Watana (South Bank) SHEET NO. 22 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)	
	Quartz Diorite	671.1-676.4 - Core loss 0.3 feet.	Run 147 660.7 to 665.8	100 (100)	
			Run 148 665.8 to 671.1	100 (96)	
670 (580.2)				Run 149 671.1 to 676.4	94 (85)
			Run 150 676.4 to 681.6	100 (100)	
680 (588.9)				Run 151 681.6 to 686.9	100 (98)
			682.3-690.8 - Red staining, irregular and discontinuous, intergranular.	Run 152 686.9 to 692.2	100 (92)
690 (597.6)				Run 153	
			692.2-695.0 - Core barrel mismatched during drilling. Core loss 0.2 feet.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
 SITE Watana (South Bank) SHEET NO. 23 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
700 (606.2)	Quartz Diorite	700.0-752.4 - Joints closely spaced, planar, smooth to rough, carbonate coated.	Run 153 692.2-695.0	86 (71)
			Run 154 695.0 to 700.0	100 (74)
			Run 155 700.0 to 705.1	100 (86)
			Run 156 705.1 to 710.4	98 (83)
			Run 157 710.4 to 715.0	100 (100)
			Run 158 715.0 to 721.3	83 (60)
			Run 159 721.3 to 726.6	96 (77)
710 (614.9)		Run 158 redrilled.		
720 (623.5)		721.6-724.3 - Joints close, carbonate coating. Core loss 0.2 feet.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-8
 SITE Watana (South Bank) SHEET NO. 24 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
730 (632.2)	Quartz Diorite	731.9-747.1 - Numerous revealed joints.	Run 159	96 (77)
			Run 160 726.6 to 731.2	100 (87)
			Run 161 731.2 to 736.2	100 (96)
			Run 162 736.2 to 741.2	100 (88)
			Run 163 741.2 to 746.2	92 (92)
			Run 164 746.2 to 751.3	100 (73)
			Run 165	100 (100)
740 (640.9)				
750 (649.5)				
752.4 (651.6)		END OF BORING		

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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-8
 Site Watana (South Bank) Sheet No. 1 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER IOFT. 5 10 15 20	ROCK TYPE	REMARKS
0	1980					Overburden	TOP OF ROCK 8.0'
20							
40							
60	1937					Diorite/ Quartz Diorite	Fracture zone. Shear.
80							Fracture zone.
100	1893						Shear zone.
120							
140							Fracture.
160	1850						Shear/fracture zone
180							
200	1807						Shear, healed. Shear, healed.
220							
240							Shear, healed.
260	1763						
280						Quartz Diorite/ Granodiorite	Dike, granodiorite.
300	1720						Shear.
320							
340						Diorite/	



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-8
 Site Watana (South Bank) Sheet No. 2 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER IOFT. 5 10 15 20	ROCK TYPE	REMARKS
360						Diorite Porphyry	
380						Quartz Diorite	Dike, felsic.
400	1634						Fracture zone.
420							Shear.
440							
460	1590						Shear zone.
480							
500	1547						Dike, felsic.
520							Alteration zone.
540							Alteration zone.
560	1504						Fracture/alteration zone.
580							
600	1460						Shear zone.
620							
640							
660	1417						Shear/alteration zone.
680							
700	1374						



**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
 PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-12
 SITE: Watana (South Bank) SHEET NO. 1 OF 26
 CONTRACTOR: Interstate Exploration Inc. DRILLING DATES: July 18 TO August 5, 1981
 LOGGED BY: K.J. White, R.R. Henschel DATE: September 1981
 DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
 ROCK Diamond Core - Triple Tube CORE DIAMETER: NQ (1.75") O.D.
 LOCATION: LATITUDE N3,225,624 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
 DEPARTURE E744,515 GROUND SURFACE 1975.7
 AZIMUTH 220° ROCK SURFACE 1959.8
 DIP 36° BOTTOM OF HOLE 1505.9
 WATER TABLE
 NOTES: 1) Depths measured along hole. True depths in ().
 2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0	Overburden	Overburden of cobbles, boulders of granodiorite.	Run 1 0.0-2.0	0 (0)
10 (5.9)				
20 (11.8)				

APPROVED: *[Signature]*

DATE: February 1, 1982

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
 SITE Watana (South Bank) SHEET NO. 2 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENTH OF RUN (FT)	REC (RQD)
	Overburden			
27.0 (15.9)	Andesite	Light bluish-gray to greenish-gray, generally aphanitic to fine grained, contains numerous angular fragments of argillite ranging from 0.13 to 1.0 inch (average 0.25 to 0.38 inches), 2-5% of rock. Generally hard. Joint spacing varies from very close to closely spaced in altered zones, to widely spaced in hard zones. Heavily stained with iron oxides, slightly to moderately weathered and open. Penetrative weathering up to 0.25 inches. 27.0-31.8 - Moderately weathered along joints, penetrative to 0.5 inches, slightly friable. 37.8 - Heavy iron oxide staining. 49.8-51.7 - Fracture zone, very closely spaced fractures, intersecting joints at 50° and 0-20°. Slightly to moderately weathered with penetrative iron oxide staining to 0.75 inches. 51.7-52.1 - Yellow-brown sandy/clay layer, 0.25 feet thick, small fragments of highly weathered andesite. Sharp contacts at 50°.	Run 2 27.0 to 29.8	100 (55)
30 (17.6)			Run 3 29.8 to 34.7	100 (57)
			Run 4 34.7-36.6	100 (82)
			Run 5 36.6 to 39.8	0 (0)
			Run 6 37.4-39.8	88 (81)
40 (23.5)			Run 7 39.8 to 44.8	98 (93)
			Run 8 44.8 to 49.8	100 (94)
			Run 9 49.8-51.9	100 (0)
50 (29.4)			Run 10	97 (46)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
SITE Watana (South Bank) SHEET NO. 3 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
60 (35.3)	Andesite	54.1-54.4 - Shear, 20°, 0.25 inches wide. Clay layer intruded by quartz, friable. 55.4 - Shear, 35°, 0.25 inches wide. Clay layer containing breccia, soft, friable. 56.1 - Shear, 20°, 0.25 inches of sandy clay breccia.	Run 10 51.9 to 57.3	97 (46)
			Run 11 57.3- 59.4	100 (19)
			Run 12 59.4 to 62.0	100 (42)
			Run 13 62.0 to 67.2	100 (46)
			Run 14 67.2- 69.5	100
70 (41.2)	Andesite	70.0-73.0 - Shear/fracture zone, joints very close to closely spaced at 40°-60°, open, moderately weathered. Friable locally, iron oxide stained, some sandy clay.	Run 15 69.5- 71.4	84 (66)
			Run 16 71.4- 73.1	100 (35)
			Run 17 73.1- 75.1	100 (78)
80 (47.0)	Andesite	76.5-77.2 - Shear, 15°-20°, thin clayey breccia coating. 83.6-93.3 - Shear/alteration zone, slightly bleached hydrothermally. Numerous fractures at 30°-40°. Heavy iron oxide staining, moderately hard to friable locally. 85.1-86.6 - Shears, sandy clay gouge to	Run 18 75.1 to 79.6	97 (63)
			Run 19 79.6 to 84.6	94 (34)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
SITE Watana (South Bank) SHEET NO. 4 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
90 (52.9)	Andesite	0.25 inches. 86.6-87.6 - Open fractures, 0-10°, up to 0.5 inches wide, filled with highly weathered rock fragments, locally healed with calcite. 93.3-108.5 - Joints generally close to moderately closely spaced, tight to partially open. Fresh to moderately weathered with moderate iron oxide staining. Minor clay coating. 97.2-98.1 - Fracture zone, very closely spaced joints, slightly weathered, iron oxide stained, open. Moderately hard. 99.5-99.8 - Felsic dike, medium gray, very fine grained, very hard.	Run 20 84.6 to 89.6	100 (9)
			Run 21 89.6 to 92.5	97 (59)
			Run 22 92.5	80 (0)
			Run 23 93.5 to 98.5	100 (82)
			Run 24 98.5 to 103.5	100 (80)
			Run 25 103.5 to 108.5	100 (36)
			Run 26 108.5 to 114.0	96 (84)
			Run 27 114.0 to 119.0	100 (60)
108.7 (63.9)	Diorite	108.5-108.7 - Gradational contact. Light to medium gray, medium grained crystalline rock. Hard to very hard, fresh to slightly weathered along joints with minor iron oxide staining.		
110 (64.7)				

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-12
SITE Watana (South Bank) **SHEET NO.** 5 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
120 (70.6)	Diorite	118.7-124.7 - Felsic dike, medium blue-gray, very fine grained. Porphyritic locally, phenocrysts to 0.13 inches diameter, hard.	Run 27	100 (60)
			Run 28 119.0 to 124.0	100 (74)
			Run 29 124.0 to 129.1	100 (43)
130 (76.4)	Diorite	126.1 - Shear, 50°, silty clay gouge less than 1.0 inch. 127.0 - Shear, 15°, 0.1 inch gouge.	Run 30 129.1 to 134.5	98 (42)
			Run 31 134.5 to 139.5	100 (96)
140 (82.3)	Diorite	133.8-134.5 - Fracture zone, fractures very closely spaced, 50°, with carbonate coating.	Run 32 139.5 to 144.6	96 (88)
			Run 33 144.6 to 149.7	100 (83)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-12
SITE Watana (South Bank) **SHEET NO.** 6 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
150 (88.2)	Diorite	152.5 - Dike, 20°-30°, dark gray, very fine grained, 0.5 inches wide, hard.	Run 33	100(83)
			Run 34 149.7 to 154.9	100 (66)
			Run 35 154.9 to 159.7	100 (67)
160 (94.1)	Diorite	159.7-162.4 - Andesite dike, medium green-gray, very fine grained. Numerous very thin quartz stringers at 45°-60°. Very sharp contacts.	Run 36	100 (37)
			Run 37 161.2 to 166.0	94 (69)
170 (99.9)	Diorite	162.4 - Carbonate filling at contact, less than 0.06 inches thick, hard and brittle.	Run 38 166.0 to 169.9	97 (86)
			Run 39 169.9 to 174.9	100 (100)
180 (105.8)	Diorite	179.2-179.3 } Felsic dikes, light tan, very 180.5-180.6 } fine grained, hard.	Run 40 174.9 to 179.9	100 (100)
			Run 41	100(78)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
SITE Watana (South Bank) SHEET NO. 7 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
190 (111.7)	Diorite	180.6-183.6 - Alteration zone, bleached, slightly altered hydrothermally.	Run 41	
			179.9 to 185.0	100 (78)
			Run 42	
			185.0 to 189.9	100 (85)
			Run 43	
			189.9 to 195.1	100 (71)
			Run 44	
200 (117.6)	Diorite	197.2-197.8 - Shear zone, 50°, slightly friable, clay/breccia layer, 0.38 inches wide, stiff, slightly plastic. 197.7-197.8 - Brecciated zone, 0.25 inches wide, clay seam at 50°.	195.1 to 199.9	100 (44)
			Run 45	
210 (123.5)	Diorite	207.4-208.3 - Felsic dike, light gray, very fine grained.	199.9 to 204.9	100 (48)
			Run 46	
			204.9 to 209.8	98 (90)
			Run 47	
			209.8 to 214.9	100 (51)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
SITE Watana (South Bank) SHEET NO. 8 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
220 (129.4)	Diorite	212.6-213.4 - Shear/alteration zone, moderately to completely altered hydrothermally, very closely fractured but still intact. Original structure and texture of diorite preserved. 214.3-214.4 - Two clay seams 40° and 70°, 0.13 inches wide.	Run 47	100 (51)
			Run 48	
			214.9 to 219.8	100 (73)
			Run 49	
			219.8 to 224.9	100 (69)
			Run 50	
			224.9 to 229.8	98 (84)
230 (135.2)	Diorite	232.9-234.2 - Shear/fracture zone, fractures very closely spaced. Clay/breccia layer, 0.25 inches wide, friable. 234.2-235.0 - Alteration zone, bleached white, altered hydrothermally, hard.	Run 51	
			229.8 to 235.0	100 (69)
240 (141.1)	Diorite		Run 52	
			235.0 to 240.1	100 (75)
			Run 53	
			240.1 to 245.3	100 (61)

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
SITE Watana (South Bank) SHEET NO. 9 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
250 (147.0)	Diorite	251.8 - Joint, 60°, clay and rock fragments.	Run 54 245.3 to 250.2	100 (80)
			Run 55 250.2 to 255.5	98 (65)
			Run 56 255.5 to 260.2	100 (94)
			Run 57 260.2 to 265.3	100 (66)
			Run 58 265.3 to 270.2	100 (73)
			Run 59 270.2 to 275.3	100 (65)
			Run 60 100 (0)	
260 (152.9)	Diorite	273.7-276.1 - Shear/alteration zone, slightly altered hydrothermally. Fractures very closely spaced, friable, carbonate coating.	Run 61 276.2 to 279.8	97 (25)
			Run 62 279.8 to 284.5	100 (69)
270 (158.8)	Diorite		Run 63 284.5 to 289.7	100 (70)
			Run 64 289.7 to 294.2	100 (98)
			Run 65 294.2- 296.5	100 (76)
			Run 66 296.5 to 299.8	82 (77)
			Run 67 299.8 to 304.5	100 (79)
	Diorite	308.6-309.4 - Fracture zone, joints very closely spaced at 20°, 50°, and 80°.	Run 68 304.5 to 309.4	100 (80)

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SITE Watana (South Bank) SHEET NO. 10 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
280 (164.6)	Diorite	273.8 - Shear, 30°-35°, less than 0.13 inches. Soft, plastic, sandy clay. 274.2-276.4 - Core badly broken by drilling, pieces slightly friable. 276.2-280.6 - Joints very close to closely spaced.	Run 61 276.2 to 279.8	97 (25)
			Run 62 279.8 to 284.5	100 (69)
290 (170.5)	Diorite		Run 63 284.5 to 289.7	100 (70)
			Run 64 289.7 to 294.2	100 (98)
			Run 65 294.2- 296.5	100 (76)
300 (176.4)	Diorite		Run 66 296.5 to 299.8	82 (77)
			Run 67 299.8 to 304.5	100 (79)
			Run 68 304.5 to 309.4	100 (80)
			Run 69 309.4 to 314.0	100 (80)

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SITE Watana (South Bank)

JOB NO. P5700.05
HOLE NO. BH-12
SHEET NO. 11 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (REQ)
310 (182.3)	Diorite		Run 69 309.4 to 315.6	97 (73)
			Run 70 315.6 to 320.4	100 (83)
320 (188.2)		324.7-325.0 - Fracture zone, joints very closely spaced.	Run 71 320.4 to 325.0	100 (65)
			Run 72 325.0 to 330.0	100 (58)
330 (194.0)		332.7-332.9 - Fracture zone, joints very closely spaced.	Run 73 330.0 to 335.1	100 (45)
			Run 74 335.1 to 340.0	100 (47)
340 (200.0)		335.6-336.8 - Core broken by drilling.	Run 75	

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PROJECT Susitna Hydroelectric Project
SITE Watana (South Bank)

JOB NO. P5700.05
HOLE NO. BH-12
SHEET NO. 12 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (REQ)
350 (205.8)	Diorite	343.0-343.8 - Fracture zone, joints very closely spaced.	Run 75 340.0 to 343.6	94 (35)
			Run 76 343.6 to 348.3	100 (85)
360 (211.7)		355.8-362.6 - Alteration zone, bleached white, slightly to severely altered hydrothermally. Joints very close to closely spaced, moderately hard to very friable. Sharp contact at top, gradational at bottom. 355.9-356.9 } Severely altered zones. 358.0-358.9 }	Run 77 348.3 to 353.2	100 (69)
			Run 78 353.2 to 358.9	93 (39)
370 (217.6)		362.1-362.6 - Several joints at 40° with minor clay and rock fragments, less than 0.06 inches thick. 366.9-367.6 - Fracture zone, joints very closely spaced.	Run 79 358.9 to 364.2	98 (47)
			Run 80 364.2 to 369.3	100 (65)
			Run 81 369.3 to 374.6	100 (94)

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SITE Watana (South Bank) SHEET NO. 13 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 81	100 (94)
			Run 82 374.6 to 379.6	100 (100)
			Run 83	100 (88)
380 (223.4)		383.1-383.4 - Fracture zone, fractures very closely spaced.	Run 84 380.4 to 385.0	100 (87)
390 (229.3)		387.8-387.9 - Fracture zone, fractures very closely spaced. 389.3-389.8 - Fracture zone, fractures very closely spaced.	Run 85 385.0 to 389.8	100 (88)
			Run 86 389.8 to 395.0	98 (96)
			Run 87 395.0 to 398.3	100 (42)
400 (235.2)		396.1-404.2 - Fracture zone, fractures and joints very closely spaced, partly drilling induced. 397.0-397.3 - Quartz vein.	Run 88 398.3 to 401.4	100 (0)
			Run 89 401.4 to 404.2	29 (0)
			Run 90	100 (100)

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SITE Watana (South Bank) SHEET NO. 14 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Diorite		Run 90 404.2 to 409.1	100 (100)
			Run 91 409.1 to 414.2	100 (100)
			Run 92 414.2 to 419.2	100 (92)
410 (241.0)			Run 93 419.2 to 424.4	100 (100)
420 (247.0)			Run 94 424.4 to 429.4	100 (92)
			Run 95 429.4 to 434.7	100 (58)
			Run 96 434.7 to 439.7	100 (86)
430 (252.8)				

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SITE Watana (South Bank) SHEET NO. 15 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
440 (258.7)	Diorite	439.3-439.7 - Fracture zone, joints very closely spaced at 40°.	Run 96 434.7 to 439.7	100 (86)
			Run 97 439.7 to 444.8	100 (71)
450 (264.6)	Diorite	444.8-448.2 - Fracture zone, joints and fractures very closely spaced at 20°, 40°, and 50°, partly open to tight, coated with yellow-brown clayey material. 449.8-454.8 - Shear/alteration zone, rock bleached, slightly to severely altered hydrothermally. 449.8-451.8 - Green-gray, granular texture, moderately hard. Possible shear planes present. 451.8-454.8 - Bleached zone, quartz rich, very few mafics, very hard.	Run 98 444.8 to 449.5	100 (26)
			Run 99 449.5 to 454.6	100 (43)
			Run 100 454.6 to 459.5	96 (31)
			Run 101 459.5 to 464.5	100 (24)
460 (220.5)	Diorite	457.7-463.2 - Shear/fracture zone, joints very closely spaced, carbonate filling, chlorite/talc coating, slickensides. 463.2-465.2 - Alteration zone, bleached, slightly altered hydrothermally, hard. 464.5-465.2 - Shear zone, very thin shears at 60°-70°, calcareous clay filling, brecciated but intact.	Run 102 464.5 to 469.5	100 (62)

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SITE Watana (South Bank) SHEET NO. 16 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
470 (276.4)	Diorite	470.3 - Shear, 85°, 0.5 inches wide, sandy clay filling, chlorite coating, slickensides. 473.9-474.0 - Shear, 40°, less than 0.1 inches of breccia. Offset by 0.25 inches, healed. Moderately hard. 476.7 - Joints, 60°-65°, sandy clay filling, slight chlorite coating. 477.9-482.0 - Shear/alteration zone, slightly to moderately altered hydrothermally. Breccia and gouge material. Soft to moderately hard, friable. 480.8-480.9 - Possible healed shear, 1.0 inch of dark gray, very fine grained material. 483.2-483.7 - Joint, 15°-20°, quartz/carbonate coating with slickensides. 483.5 - Joint, 60°, sandy clay filling, slickensides. 484.6 - Shear/alteration zone, slightly to moderately altered hydrothermally, soft to moderately hard. Shears, 60°-70°, clay/sand breccia. 486.1-490.6 - Moderately hard, joints very close to closely spaced. 487.9-488.6 - Shear zone, 55°-70°, with approximately 0.5 inch spacing. Numerous very thin shears with clay gouge. 490.6-519.3 - Shear/alteration zone, slightly to moderately altered hydrothermally. Numerous very thin shear planes, brecciated but healed with calcareous sandy clay. Moderately hard to soft, friable. Joints moderately closely spaced, chlorite coating. 50% of joints healed with carbonate. Irregular patches of red staining.	Run 103 469.5 to 474.6	100 (63)
			Run 104 474.6 to 478.8	100 (81)
			Run 105 478.8 to 484.1	96 (19)
480 (282.2)	Diorite	484.6 - Shear/alteration zone, slightly to moderately altered hydrothermally, soft to moderately hard. Shears, 60°-70°, clay/sand breccia. 486.1-490.6 - Moderately hard, joints very close to closely spaced. 487.9-488.6 - Shear zone, 55°-70°, with approximately 0.5 inch spacing. Numerous very thin shears with clay gouge. 490.6-519.3 - Shear/alteration zone, slightly to moderately altered hydrothermally. Numerous very thin shear planes, brecciated but healed with calcareous sandy clay. Moderately hard to soft, friable. Joints moderately closely spaced, chlorite coating. 50% of joints healed with carbonate. Irregular patches of red staining.	Run 106 484.1 to 489.2	100 (18)
			Run 107 489.2 to 494.3	100 (8)
490 (288.1)	Diorite	484.6 - Shear/alteration zone, slightly to moderately altered hydrothermally, soft to moderately hard. Shears, 60°-70°, clay/sand breccia. 486.1-490.6 - Moderately hard, joints very close to closely spaced. 487.9-488.6 - Shear zone, 55°-70°, with approximately 0.5 inch spacing. Numerous very thin shears with clay gouge. 490.6-519.3 - Shear/alteration zone, slightly to moderately altered hydrothermally. Numerous very thin shear planes, brecciated but healed with calcareous sandy clay. Moderately hard to soft, friable. Joints moderately closely spaced, chlorite coating. 50% of joints healed with carbonate. Irregular patches of red staining.	Run 108 494.3 to 499.5	100 (52)
			Run 109 499.5 to 504.5	100 (100)
500 (294.0)	Diorite			

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 SITE Watana (South Bank) SHEET NO. 17 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
510 (299.9)	Diorite	498.6-499.1 - Fracture/alteration zone, yellow-green color, very closely spaced joints at 60° healed with carbonate. Feldspars stained but hard.	Run 109 499.5 to 503.7	100 (100)
		500.5 - Alteration zone, 2.0 inches wide, carbonate healed joint at 80°. Hard.	Run 110 503.7 to 509.0	100 (91)
		507.2-507.6 - Fracture zone, joints very closely spaced at 40°-70°, silt/clay coating.		
		509.1 - Joint, 30°, silt/clay coating.		
		511.2-512.8 - Joints, healed with carbonate.	Run 111 509.0 to 514.1	100 (67)
		512.8-513.5 - Shear/fracture zone, very closely spaced joints. Shear, 60°-70°, 0.5 inches breccia, partially healed with carbonate.		
		511.2-571.6 - Joints, closely spaced with zones of very closely spaced, chlorite coating, carbonate healed, tight, up to 2 feet long.	Run 112 514.1 to 519.1	100 (100)
		520.5-528.6 - Joints, 40°, closely spaced, healed with rusty orange carbonate. Slightly altered hydrothermally to 1.0 inch either side, 10-20% of feldspars altering to clay. Hard, tight.	Run 113 519.1 to 523.2	100 (100)
		530.9-538.8 - Fracture/shear zone, very closely spaced joints at 20° and 70°. Most joints healed and tight.	Run 114 523.2 to 528.5	94 (72)
		531.1 - Shear, 20°, 0.1 inches breccia/gouge.	Run 115 528.5 to 533.4	100 (48)
531.6 - Shear, 10°, 0.5 inches breccia, faint slickensides.				

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 SITE Watana (South Bank) SHEET NO. 18 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
540 (317.5)	Diorite	532.8 - Alteration zone, slightly altered hydrothermally, 1.0 inch wide.	Run 115	
		533.8 - Shear, 60°, 0.5 inches of breccia/gouge.	Run 116 533.4 to 538.4	100 (72)
		536.7 - Shear, 0°-10°, up to 0.3 inches breccia/gouge.		
		538.1 - Shear, 25°, less than 0.1 inch of gouge.		
		542.3-545.9 - Felsic dike, light gray, fine grained, 10% mafics, 5-15% quartz, 5% green feldspar phenocrysts. Very closely spaced joints, tight. Upper contact 50°, fractured, sheared, slickensides. Lower contact 30°, probably sheared, trace clay/silt.	Run 117 538.4 to 543.4	100 (52)
		545.9-549.2 - Fracture zone, very closely spaced joints, tight.	Run 118 544.5 to 549.7	91 (0)
		548.4 - Joint, 60°, clay coating.		
		549.2 - Joint, 80°, clay coating.		
		553.3 - Alteration zone, slightly altered hydrothermally, 10% of feldspars altering to clay, hard.	Run 119 544.5 to 549.7	100 (62)
		553.7-556.7 - Felsic dike (?), light gray, fine grained to aphanitic with fine to medium grained phenocrysts, 5-15% mafics, 5-15% feldspar. Tight joints very closely spaced. Upper contact, 40°, gradational 2.0 inches, tight. Lower, 50°, sheared with 0.5 inches of breccia partially healed with carbonate.	Run 120 549.7 to 554.7	98 (54)
		557.7 - Joint, 30°, silt/clay coating, 0.25 inches of alteration, 10% of feldspars altering to clay.	Run 121 554.7 to 559.7	100 (92)
565.7 - Joint, 60°, yellow orange carbonate/silt coating.	Run 122 559.7 to 564.9	100 (62)		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
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SITE Watana (South Bank) SHEET NO. 19 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (REQ)
570 (335.2)	Diorite	566.0-566.2 - Alteration zone, 10% feldspars altering to clay.	Run 123	
		567.6 - Alteration zone, 1 inch thick, slight hydrothermal alteration, 10% feldspars altering to clay.	564.9 to 570.0	100 (61)
		571.0-586.1 - Shear/fracture zone, joints very closely spaced, many carbonate healed.	Run 124	100(0)
		571.4 - Zone of light gray-green, fine grained material 0.5 inches wide, sharp contacts at 70°. Offset by 0.2 inches wide carbonate filled shear at 40°. Either silty clay layer or altered felsic dike.	Run 125	71 (45)
			570.3 to 575.9	
			Run 126	33 (0)
575.9 (338.6)	Quartz Diorite	Light gray, fine to medium grained crystalline rock. Mafic content, variable averaging 20-30%, 10-15% quartz. Slightly altered overall.	575.9- 578.0	61 (22)
		578.0-579.8 - Core loss 0.8 feet.	Run 127	96 (44)
580 (341.0)		578.6 - Shear, 25°, 2.0 inches of breccia partially healed with carbonate and 0.1 inch of gouge.	579.8 to 585.0	100 (88)
		582.0 - Shear, 50°, 1.0 inch breccia/gouge.	Run 128	
		582.0-586.1 - Alteration zone, bleached to yellow-orange hydrothermally, hard to moderately hard. Joints, 10° and 70°-80° with clay coating.	585.0	
		586.1-605.9 - Joints, closely spaced, healed with carbonate, tight.	Run 129	
		588.0-656.5 - Alteration zone, slightly to moderately altered. Feldspars bleached to yellow-gray. Very close to closely spaced joints. Minor sulphide mineralization. Hard.	585.0 to 589.8	100 (88)
590 (346.9)		590.2 - Shear, 20°, clay/silt coating, faint slickensides.	Run 130	100 (75)
	595.8 - Shear, 20°, 0.1-0.3 inches of gouge.	589.8 to 596.0		
	596.0-596.7			
	597.8-598.5	Alteration zones, moderately altered hydrothermally, 50% of feldspars altering to clay.	Run 131	100(92)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
SITE Watana (South Bank) SHEET NO. 20 OF 26

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (REQ)
600 (352.8)	Quartz Diorite	596.0-596.7 - Breccia, healed.	Run 131	100 (92)
		598.2 - Joint, 80°, talc coating.	596.0 to 599.8	
			Run 132	100 (100)
		599.8 to 604.9		
610 (358.7)		610.0-613.6 - Moderately altered, 20-30% of feldspars altered to clay.	Run 133	100 (98)
		613.2-613.5 - Shear, 80°, breccia/gouge.	604.9 to 609.8	
		614.3 - Shear, 30°, 0.5 inches breccia/gouge.	Run 134	100 (38)
		616.2 - Shear, 40-70°, 1.0-to 2.0 inches breccia/gouge.	609.8 to 615.0	
		619.0 - Shear, 25°, clay/gouge coating.	Run 135	100 (54)
		621.4 - Shear, 60°, 0.1-1.0 inches gouge.	615.0 to 620.1	
			Run 136	100 (45)
			620.1 to 625.0	
620 (364.6)		626.6 - Shear zone, 1.0 inch breccia/gouge.	Run 137	100 (87)
		626.8 - Shear, 40°, carbonate, gouge.	625.0 to 628.6	
			Run 138	
			628.6	

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
SITE Watana (South Bank) SHEET NO. 21 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
630 (370.4)	Quartz Diorite	631.3 - Shear, 45°, coating of clay gouge.	Run 138	100(73)
		633.5 - Shear, 70°, 0.1 inches of gouge.	Run 139	
		633.9-639.5 - Moderately altered, feldspars breaking down to clay.	629.7 to 634.7	100 (80)
		634.0 - Shear, 60°, 2.0 inches breccia/gouge.	Run 140	
		634.2 - Shear, 15°, clay coating.	634.7 to 639.8	100 (45)
		635.2 - Shear, 60°, clay coating.		
		635.7 - Shear, 50°, 0.3 inches of gouge.		
		637.4 - Shear, 40°, 0.5 to 1.0 inches wide, breccia and gouge.	Run 141	
		638.1 - Shear, 50°, clay coating.	639.8 to 645.0	100 (65)
		639.1 - Shear (?), 30°, clay coating.		
640 (376.3)		643.2 - Shear (?), 60°, clay coating.		
		643.6 - Shear, 30°, 0.5 inches wide, 0.1 inches of gouge along a healed shear of dark gray igneous material and carbonate.	Run 142	
		644.0 - Shear, 50°, clay coating, offsets a very thin vein of dark gray igneous material, 0.1 inches wide.	645.0 to 649.8	100 (100)
650 (382.2)		651.6-656.5 - Moderately altered, feldspars altering to clay.	Run 143	
			649.8 to 655.0	100 (88)
		654.5-655.7 - Shear, 80°, breccia/gouge.		
656.8 (386.2)	Granodiorite		Run 144	
			655.0 to 659.8	100 (92)
660 (388.1)		Light pink-gray, fine to medium grained crystalline rock. Mafics 20-30%, primarily hornblende/biotite, 5-15% quartz, and pink, green, and white feldspars. Hard, generally fresh to slightly hydrothermally altered. Alteration	Run 145	100 (100)

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DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
SITE Watana (South Bank) SHEET NO. 22 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
670 (394.0)	Granodiorite	along healed joints.	Run 145	
		656.8-681.4 - Joints, close to moderately closely spaced, most healed with carbonate.	659.8 to 665.0	100 (100)
		660.3-662.0 } Alteration zones, 10-20% of feldspars altering to clay, moderately hard.	662.9-663.5 }	
			Run 146	
			665.0 to 669.8	100 (94)
			Run 147	
			669.8 to 673.0	100 (100)
680 (400.7)		674.0 - Joint, 35°, penetrative alteration of 0.5 inches.	Run 148	
		674.1 - Within 1.0 inch zone, color has changed from pink (fresh rock) to light gray with less than 5% mafics and altered feldspars giving appearance of two rock types in texture and composition.	673.0 to 678.2	100 (88)
		677.4-678.5 } Alteration zone, moderate hydrothermal alteration of feldspars to clay.	681.2-681.4 }	
681.4 (400.7)	Quartz Diorite	Rock description as above.	Run 149	
		681.4-695.6 - Joints, close to very closely spaced, many healed with carbonate.	678.2 to 683.2	100 (92)
		683.4-688.3 - Alteration zone, altered hydrothermally with very thin to thin zones of bleached and altered rock with sulphide alteration.		
		684.2 - Joints, 20°, clay coated, possibly sheared.	Run 150	
690 (405.7)			683.2 to 688.2	100 (69)
		687.1-688.1 - Shears, 40-70°, very closely spaced, 0.5-1.0 inch breccia/gouge.	Run 151	
			688.2 to 693.4	100 (77)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
 SITE Watana (South Bank) SHEET NO. 25 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
760 (446.9)	Quartz Diorite		Run 164 754.9 to 759.9	100 (94)
			Run 165 759.9 to 764.9	100 (100)
763.6 (449.0)	Felsic Dike	Light gray yellow, aphanitic to medium grained, 5-10% dark gray green phenocrysts, 5-10% rusty orange feldspar phenocrysts. Moderately hard.	Run 166 764.9 to 767.5	96 (96)
768.5 (451.9)	Quartz Diorite	Rock description as above. 768.5 - Shear, 80° along lower contact, 2.0 inches wide breccia and gouge. 770.4 - Shear, 40°, clay coating with possible talc.	Run 167 767.5 to 769.8	100 (91)
			Run 168 769.8 to 775.0	100 (100)
780 (458.6)		775.9 - Shear, 50°, 0.1 inches of gouge, slickensides. 781.3-781.6 - Shear, 40°, shear planes very closely spaced, breccia, minor gouge, moderately altered hydrothermally. 786.9-787.5 - Alteration zone, moderately altered. 787.2 - Shear, 60°, 0.5 inches of breccia/gouge. 788.3-788.9 - Alteration zone, moderately altered hydrothermally. 788.3-788.4 - Two shears, very closely spaced at 70°, less than 0.1 inches gouge.	Run 169 775.0 to 780.1	100 (75)
			Run 170 780.1 to 785.1	100 (74)
			Run 171 785.1 to 790.1	98 (72)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-12
 SITE Watana (South Bank) SHEET NO. 26 OF 26

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
790 (464.5)	Quartz Diorite	790.2-797.3 - Joints close to moderately closely spaced.	Run 171	98 (72)
			Run 172 790.1 to 795.1	98 (96)
			Run 173 795.1 to 798.9	100 (82)
798.9 (469.8)		797.3-798.9 - Fracture zone, joints very closely spaced. Slight to moderate hydrothermal alteration.		
800 (470.4)		END OF BORING		

APPENDIX C
DEVIL CANYON DIAMOND CORE DRILLING LOGS

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-1
SITE: Devil Canyon (North Bank) SHEET NO. 1 OF 24

CONTRACTOR: The Drilling Company DRILLING DATES: August 23 to August 31, 1980
LOGGED BY: K.J. White, M.P. Bruen DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
ROCK Diamond Core - Triple Tube CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,223,408 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E615,930 GROUND SURFACE 1413.7
AZIMUTH 225° ROCK SURFACE 1402.8
DIP 67° BOTTOM OF HOLE 723.1
WATER TABLE 1221.7 (11-21-80)

- NOTES: 1) Depths measured along hole. True depths in ().
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	Sandy gravel with layer of silt and scattered cobbles. Not sampled.		
10 (12)				
11.8 (10.9)	Argillite	Medium to dark gray, fine grained, nonfoliated to weakly developed foliation parallel to bedding, 20°. Fresh to slightly weathered, hard, well indurated. Joints generally close spaced with iron oxide staining. Zones of quartz veins and stringers, minor sulfide mineralization.	Run 1 11.8 to 15.8	85 (23)
20 (18.4)		11.8-30.8 - Numerous quartz veins and stringers, highly folded bedding. Quartz veins (12.7-13.7, 20.8-22.2, 27.1-27.5) are highly fractured but tight, vuggy, cross-cutting foliation, contacts are irregular and rough. Quartz stringers are parallel to	Run 2 15.8 to 20.8	100 (86)

APPROVED:

DATE: February 1, 1982

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Devil Canyon (North Bank) SHEET NO. 2 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite	bedding/foliation at 0°-30°, less than 1 inch wide, folded, stretched, less fractured than veins, contacts generally tight. 11.8-80.1 Joint spacing generally close, generally planar and smooth, iron oxide stained, minor quartz and carbonate coating. 11.8-14.9 Core loss of 0.6 ft. Core broken by drilling, clay on some joints. 17.0-20.0 No drilling water return. 17.4-17.9 Core broken by drilling, clay on some joints. 20.8-35.0 Core loss of 1.8 feet.	Run 3 20.8 to 26.2	85 (78)
			Run 4 26.2 to 31.3	86 (80)
30 (27.6)				
		33.0-33.7 Core broken by drilling zone of quartz stringers 0.5 in. thick.	Run 5 31.3 to 35.0	92 (30)
		36.7 Bedding/foliation is at 20°. Rock does not tend to break along bedding/foliation.	Run 6 35.0 to 40.0	100 (80)
40 (36.8)				
			Run 7 40.0 to 45.0	100 (52)
42.5 (39.1)	Argillite/ Graywacke	Interbedded argillite and graywacke. Argillite as above, with very thin beds of graywacke, light to medium gray, 20 percent to 30 percent fine to medium sand in argillaceous matrix, grains elongate parallel to bedding/foliation generally at 20°, foliation is poorly developed. Fresh, hard and well indurated. Joint spacing is generally close, generally planar and rough, iron oxide stained, some carbonate and quartz filling.	Run 8 45.0 to 49.0	100 (90)
			Run 9 49.0 to 53.2	100 (45)
50 (46.0)				
		52.8-53.5 Clay on joint surface at 20°.		

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-1
SITE Devil Canyon (North Bank) **SHEET NO.** 3 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
60 (55.2)	Argillite/ Graywacke	54.3-61.2 Quartz stringers, spacing is very close to close, less than 0.1 in. wide, healed joints at 60° to 90° are quartz filled. 62.2 Bedding/foliation is at 20°. 63.5-67.7 Fracture zone, joint and fracture spacing is very close at 15° to 30° and 50° to 70°, planar, smooth to rough. Quartz veins. Bedding/foliation is highly folded and stretched. Core loss of 1.5 feet. 68.8-69.2 Quartz vein at 20° to 90°, highly fractured but tight, irregular, vuggy. 70.7-72.0, 72.3-72.6 Quartz veins, highly fractured but tight, vuggy, sulphide mineralization. 72.6-77.0 Quartz stringers, parallel to bedding/foliation at 0°, less than 0.5 in. wide. Contacts are tight. 77.2-105.0 No drilling water return. 80.1-108.5 Fracture zone, joint and "hairline" fracture spacing is very close, 0° to 20° and 60° to 90°, irregular and discontinuous, carbonate and iron oxide staining on most joints, silt on joints from 92.6 to 103.3, slickensides at 93.0 and 105.0 on joints at 0° to 15° and 80°.	Run 10 53.2 to 58.3	98 (71)
			Run 11 58.3 to 63.5	100 (85)
			Run 12 63.5 to 64.5	30 (0)
			Run 13 64.5 to 68.9	82 (34)
			Run 14 68.9 to 72.3	100 (76)
			Run 15 72.3 to 77.2	98 (90)
			Run 16 77.2 to 80.7	94 (69)
70 (64.4)	Argillite/ Graywacke	54.3-61.2 Quartz stringers, spacing is very close to close, less than 0.1 in. wide, healed joints at 60° to 90° are quartz filled. 62.2 Bedding/foliation is at 20°. 63.5-67.7 Fracture zone, joint and fracture spacing is very close at 15° to 30° and 50° to 70°, planar, smooth to rough. Quartz veins. Bedding/foliation is highly folded and stretched. Core loss of 1.5 feet. 68.8-69.2 Quartz vein at 20° to 90°, highly fractured but tight, irregular, vuggy. 70.7-72.0, 72.3-72.6 Quartz veins, highly fractured but tight, vuggy, sulphide mineralization. 72.6-77.0 Quartz stringers, parallel to bedding/foliation at 0°, less than 0.5 in. wide. Contacts are tight. 77.2-105.0 No drilling water return. 80.1-108.5 Fracture zone, joint and "hairline" fracture spacing is very close, 0° to 20° and 60° to 90°, irregular and discontinuous, carbonate and iron oxide staining on most joints, silt on joints from 92.6 to 103.3, slickensides at 93.0 and 105.0 on joints at 0° to 15° and 80°.	Run 17 80.7 to 84.0	82 (48)
			Run 18 84.0 to 90.0	83 (57)
80 (73.6)	Argillite/ Graywacke	54.3-61.2 Quartz stringers, spacing is very close to close, less than 0.1 in. wide, healed joints at 60° to 90° are quartz filled. 62.2 Bedding/foliation is at 20°. 63.5-67.7 Fracture zone, joint and fracture spacing is very close at 15° to 30° and 50° to 70°, planar, smooth to rough. Quartz veins. Bedding/foliation is highly folded and stretched. Core loss of 1.5 feet. 68.8-69.2 Quartz vein at 20° to 90°, highly fractured but tight, irregular, vuggy. 70.7-72.0, 72.3-72.6 Quartz veins, highly fractured but tight, vuggy, sulphide mineralization. 72.6-77.0 Quartz stringers, parallel to bedding/foliation at 0°, less than 0.5 in. wide. Contacts are tight. 77.2-105.0 No drilling water return. 80.1-108.5 Fracture zone, joint and "hairline" fracture spacing is very close, 0° to 20° and 60° to 90°, irregular and discontinuous, carbonate and iron oxide staining on most joints, silt on joints from 92.6 to 103.3, slickensides at 93.0 and 105.0 on joints at 0° to 15° and 80°.	Run 19 90.0 to 94.4	82 (39)
			Run 20 94.4 to 97.8	88 (53)
			Run 21 97.8 to 101.5	54 (8)
			Run 22 101.5 to 105.0	57 (31)
90 (82.8)	Argillite/ Graywacke	54.3-61.2 Quartz stringers, spacing is very close to close, less than 0.1 in. wide, healed joints at 60° to 90° are quartz filled. 62.2 Bedding/foliation is at 20°. 63.5-67.7 Fracture zone, joint and fracture spacing is very close at 15° to 30° and 50° to 70°, planar, smooth to rough. Quartz veins. Bedding/foliation is highly folded and stretched. Core loss of 1.5 feet. 68.8-69.2 Quartz vein at 20° to 90°, highly fractured but tight, irregular, vuggy. 70.7-72.0, 72.3-72.6 Quartz veins, highly fractured but tight, vuggy, sulphide mineralization. 72.6-77.0 Quartz stringers, parallel to bedding/foliation at 0°, less than 0.5 in. wide. Contacts are tight. 77.2-105.0 No drilling water return. 80.1-108.5 Fracture zone, joint and "hairline" fracture spacing is very close, 0° to 20° and 60° to 90°, irregular and discontinuous, carbonate and iron oxide staining on most joints, silt on joints from 92.6 to 103.3, slickensides at 93.0 and 105.0 on joints at 0° to 15° and 80°.	Run 23 105.0 to 109.1	98 (59)
			Run 24 109.1 to 112.5	100 (41)
			Run 25 112.5 to 117.6	86 (29)
100 (92.1)	Argillite/ Graywacke	54.3-61.2 Quartz stringers, spacing is very close to close, less than 0.1 in. wide, healed joints at 60° to 90° are quartz filled. 62.2 Bedding/foliation is at 20°. 63.5-67.7 Fracture zone, joint and fracture spacing is very close at 15° to 30° and 50° to 70°, planar, smooth to rough. Quartz veins. Bedding/foliation is highly folded and stretched. Core loss of 1.5 feet. 68.8-69.2 Quartz vein at 20° to 90°, highly fractured but tight, irregular, vuggy. 70.7-72.0, 72.3-72.6 Quartz veins, highly fractured but tight, vuggy, sulphide mineralization. 72.6-77.0 Quartz stringers, parallel to bedding/foliation at 0°, less than 0.5 in. wide. Contacts are tight. 77.2-105.0 No drilling water return. 80.1-108.5 Fracture zone, joint and "hairline" fracture spacing is very close, 0° to 20° and 60° to 90°, irregular and discontinuous, carbonate and iron oxide staining on most joints, silt on joints from 92.6 to 103.3, slickensides at 93.0 and 105.0 on joints at 0° to 15° and 80°.	Run 26 117.6 to 118.0	86 (29)
			Run 27 118.0 to 122.5	86 (29)
110 (101.3)	Argillite/ Graywacke	54.3-61.2 Quartz stringers, spacing is very close to close, less than 0.1 in. wide, healed joints at 60° to 90° are quartz filled. 62.2 Bedding/foliation is at 20°. 63.5-67.7 Fracture zone, joint and fracture spacing is very close at 15° to 30° and 50° to 70°, planar, smooth to rough. Quartz veins. Bedding/foliation is highly folded and stretched. Core loss of 1.5 feet. 68.8-69.2 Quartz vein at 20° to 90°, highly fractured but tight, irregular, vuggy. 70.7-72.0, 72.3-72.6 Quartz veins, highly fractured but tight, vuggy, sulphide mineralization. 72.6-77.0 Quartz stringers, parallel to bedding/foliation at 0°, less than 0.5 in. wide. Contacts are tight. 77.2-105.0 No drilling water return. 80.1-108.5 Fracture zone, joint and "hairline" fracture spacing is very close, 0° to 20° and 60° to 90°, irregular and discontinuous, carbonate and iron oxide staining on most joints, silt on joints from 92.6 to 103.3, slickensides at 93.0 and 105.0 on joints at 0° to 15° and 80°.	Run 28 122.5 to 127.0	86 (29)
			Run 29 127.0 to 131.5	86 (29)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-1
SITE Devil Canyon (North Bank) **SHEET NO.** 4 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
90 (82.8)	Argillite/ Graywacke	88.8-101.8 Quartz veins highly fractured but tight, discontinuous, vuggy. Contacts are irregular. Comprise 70 percent of rock. 105.0 Bedding/foliation is at 10° to 20°. Argillite is "spotted" with a dark mineral less than 0.05 inch (possibly biotite). 105.7-106.7 Quartz vein, highly fractured, fractures at 40° and 70°, vuggy, sulphide mineralization. Contacts are irregular at 0° to 10°. 108.5-175.0 Joint spacing is close to moderately close, joints are generally planar, smooth to rough iron oxide stained, few with carbonate or quartz filling. 110.3-113.9 Quartz stringers, close spacing, stretched, irregular, discontinuous, tight. 112.5-114.7 Core loss of 1.7 ft. 113.9-114.7 Quartz vein, highly fractured but tight, irregular, fractures at 30°, vuggy, minor iron oxide staining.	Run 18 84.0 to 90.0	83 (57)
			Run 19 90.0 to 94.4	82 (39)
			Run 20 94.4 to 97.8	88 (53)
			Run 21 97.8 to 101.5	54 (8)
			Run 22 101.5 to 105.0	57 (31)
100 (92.1)	Argillite/ Graywacke	88.8-101.8 Quartz veins highly fractured but tight, discontinuous, vuggy. Contacts are irregular. Comprise 70 percent of rock. 105.0 Bedding/foliation is at 10° to 20°. Argillite is "spotted" with a dark mineral less than 0.05 inch (possibly biotite). 105.7-106.7 Quartz vein, highly fractured, fractures at 40° and 70°, vuggy, sulphide mineralization. Contacts are irregular at 0° to 10°. 108.5-175.0 Joint spacing is close to moderately close, joints are generally planar, smooth to rough iron oxide stained, few with carbonate or quartz filling. 110.3-113.9 Quartz stringers, close spacing, stretched, irregular, discontinuous, tight. 112.5-114.7 Core loss of 1.7 ft. 113.9-114.7 Quartz vein, highly fractured but tight, irregular, fractures at 30°, vuggy, minor iron oxide staining.	Run 23 105.0 to 109.1	98 (59)
			Run 24 109.1 to 112.5	100 (41)
			Run 25 112.5 to 117.6	86 (29)
110 (101.3)	Argillite/ Graywacke	88.8-101.8 Quartz veins highly fractured but tight, discontinuous, vuggy. Contacts are irregular. Comprise 70 percent of rock. 105.0 Bedding/foliation is at 10° to 20°. Argillite is "spotted" with a dark mineral less than 0.05 inch (possibly biotite). 105.7-106.7 Quartz vein, highly fractured, fractures at 40° and 70°, vuggy, sulphide mineralization. Contacts are irregular at 0° to 10°. 108.5-175.0 Joint spacing is close to moderately close, joints are generally planar, smooth to rough iron oxide stained, few with carbonate or quartz filling. 110.3-113.9 Quartz stringers, close spacing, stretched, irregular, discontinuous, tight. 112.5-114.7 Core loss of 1.7 ft. 113.9-114.7 Quartz vein, highly fractured but tight, irregular, fractures at 30°, vuggy, minor iron oxide staining.	Run 26 117.6 to 122.5	86 (29)
			Run 27 122.5 to 127.0	86 (29)

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Devil Canyon (North Bank) SHEET NO. 5 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
120.9 (111.3)	Argillite/ Graywacke	117.6-118.6 Quartz vein, highly fractured but tight, 1.5 inch wide. Contacts at 0° to 10°.	Run 26 117.6 to 120.9	100 (73)
	Argillite	Medium to dark gray, very fine grained, bedding and poorly developed foliation are at 5° to 15°; very thinly laminated, sulphide mineralization. Fresh, hard, well indurated. Joint spacing is close to moderately close, joints are generally planar, smooth to rough, very few with carbonate or quartz filling.	Run 27 120.9 to 125.4	100 (53)
130 (119.7)	Argillite	120.9-124.5 Quartz stringers, spacing is very close to close, mostly at 50° to 90°, some at 0°, less than 0.1 in. wide.	Run 28 125.4 to 129.0	100 (22)
		120.9-129.0 Clay filling in joints.		
		129.0-134.0 Healed fractures, quartz stringers irregular, discontinuous, tight, less than 0.1 in. wide.	Run 29 129.0 to 134.0	100 (78)
140 (128.9)	Argillite	133.2-134.0 Fracture zone, joint spacing very close, joints at 0° to 20°, iron oxide staining, trace clay and carbonate, slight weathering on joints. Core loss 0.4 feet.	Run 30 134.0 to 139.2	92 (93)
		139.5 Bedding/foliation, 20°.	Run 31 139.2 to 144.3	98 (92)
		143.0 Sulphide minerals up to 0.5 inches becoming abundant. Progressive replacement with quartz. 144.3-148.0 Core loss 0.2 feet.	Run 32 144.3 to 148.0	95 (81)
		148.5 Bedding/foliation, 10°.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Devil Canyon (North Bank) SHEET NO. 6 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
150 (138.1)	Argillite	149.0-157.9 Argillite interbedded with medium gray, fine grained graywacke, beds 2 inches to 2 feet wide, beds are highly folded, possible sheared along bedding planes, healed, tight, hard.	Run 33 148.0 to 153.2	100 (100)
			Run 34 153.2 to 156.2	100 (73)
160 (147.3)	Argillite	158.5-158.7 Quartz vein, discontinuous, irregular, tight, 0.5 inch wide.	Run 35 156.2 to 161.5	93 (81)
			Run 36 161.5 to 166.5	100 (100)
			Run 37 166.5 to 171.5	96 (96)
170 (156.5)	Argillite	175.0-276.1 Joint spacing is generally moderately close, joints are generally planar, rough to slick, very few with iron oxide staining or quartz filling.	Run 38 171.5 to 176.3	100 (92)
			Run 39 176.3 to 181.4	100 (100)
180 (165.7)				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Devil Canyon (North Bank) SHEET NO. 7 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
190 (174.9)	Argillite	182.2-184.0 Bedding/foliation highly folded, fractures are healed with quartz, tight, hard.	Run 40 181.4 to 186.3	100 (100)
			Run 41 186.3 to 191.5	100 (100)
191.5 (176.3)	Argillite/ Graywacke	Interbedded argillite and graywacke, Argillite is dark gray, very fine grained, very thin to thinly bedded, Graywacke is reddish gray, fine to medium grained, Bedding and poorly developed foliation are at 0° to 30°. Generally fresh, hard, well indurated, Joint spacing is moderately close. 193.7-199.2 Quartz stringers and pods, closely spaced, folded, parallel to and crosscutting bedding/foliation, tight, less than 0.5 in. wide. 207.3-207.4 Quartz vein, folded, tight. 209.0-209.9 Fracture zone, open, very close spacing, fractures parallel bedding/foliation at approximately 10°, slickensides, iron oxide staining, Core broken during drilling. 209.9-215.8 Fracture, joint spacing is very close to close, average 2 inches at 0° and 70° to 90°, irregular, tight, healed with quartz.	Run 42 191.5 to 196.4	100 (100)
Run 43 196.5 to 201.5			100 (100)	
Run 44 201.5 to 204.9			100 (94)	
Run 45 204.9 to 209.9			96 (72)	
Run 46 209.9 to 214.9			100 (84)	
200 (184.1)				
210 (193.3)				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Devil Canyon (North Bank) SHEET NO. 8 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
220 (202.5)	Argillite/ Graywacke	216.3-217.7 Lithic graywacke, subangular to subrounded argillite and graywacke fragments, up to 1 inch. 220.0-221.5 Fracture zone, joint spacing very close, at 0°. Core broken into fragments less than 1 inch, surfaces smooth and coated/filled with grayish green clay. Core loss of 0.6 feet. 222.5-223.1 Quartz pods, parallel to and crosscutting bedding, irregular, discontinuous.	Run 47 214.9 to 220.0	88 (87)
			Run 48 220.0 to 225.1	100 (65)
230 (211.7)		227.0 Bedding/foliation is at 10°. 230.2 Quartz vein at 50°, tight, 0.5 inch wide. 231.5-232.0 Quartz vein at 0°, 1 inch wide. 232.7-235.3 Healed shear/fracture zone, joint spacing is very close, beds offset, brecciated, healed with quartz, tight, hard, fractures irregular at approximately 70° to 90°. 235.0-240.1 Core loss of 0.9 feet.	Run 49 225.1 to 230.0	100 (100)
			Run 50 230.0 to 235.0	100 (100)
			Run 51 235.0 to 240.1	82 (82)
			Run 52 240.1 to 246.9	100 (88)
240 (220.9)		241.6-241.8 Fracture zone, joint spacing is very close, joints at 0° to 10°, clay coating. 241.8-249.0 Quartz stringers, spacing is very close to close, some offset along bedding/foliation, healed, tight.	Run 53 241.8 to 246.9	98 (98)

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SITE Devil Canyon (North Bank) **SHEET NO.** 9 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
250 (230.1)	Argillite/ Graywacke	246.0 Bedding/foliation is at 0° to 10°. 251.0-252.0 Joints at 10° and 30°, slickensides. 253.5 Bedding /foliation is at 30° 254.1-277.3 Joint spacing is close, chlorite/ talc coating.	Run 54 246.9 to 251.5	98 (98)
			Run 55 251.5 to 255.9	100 (84)
			Run 56 255.9 to 260.5	100 (100)
			Run 57 260.6- 262.5	100 (50)
256.0 (235.6)	Graywacke	Reddish gray, fine to medium grain sand in argillaceous matrix, bedding/developed foliation is at 0° to 10°. Generally fresh, hard, well indurated. 259.0-262.5 Bedding/foliation intensely folded, brecciated and healed with carbonate, tight, hard. 261.5-262.5 Fracture zone, joint spacing very close, 0° to 40°, irregular to planar, discontinuous, talc coating. 265.0-276.1 Quartz stringers at 40° to 70°, less than 0.1 inch wide, closely spaced. 265.8 Bedding/foliation is at 0° to 10°.	Run 58 262.5 to 265.5	94 (70)
			Run 59 265.6 to 270.3	98 (94)
			Run 60 270.3 to 274.2	69 (54)
			Run 61 274.2	100 (26)
260 (239.3)			Run 57 260.6- 262.5	100 (50)
			Run 58 262.5 to 265.5	94 (70)
270 (248.5) 271.8 (250.2)	Argillite	Dark gray, very fine grained, very thinly laminated, massive. Fresh, hard, well indurated. 274.2 Probable fracture zone, joint spacing very close, light green mineral coating. Core broken by drilling, core loss of 1.2 ft. 276.1-276.3 Contact zone, brecciated argillite.	Run 60 270.3 to 274.2	69 (54)
			Run 61 274.2	100 (26)

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PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-1
SITE Devil Canyon (North Bank) **SHEET NO.** 10 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
280 (257.7)	Mafic Dike (Diabase?)	Dark yellowish brown to dark green, fine grained feldspar laths, 5% white, radiating zeolites up to 0.2 in., flow structure at 30°. Joint spacing is close, slickensides on most joints. Slightly weathered, hard. 276.1-277.0 Chilled zone, very fine grained. 276.1-296.0 Drilling water return 50%. 276.1-310.8 Joint spacing is close to very close, joints are generally planar, slick and open, iron oxide staining on most joints, talc coating on few.	Run 62 276.1 to 280.3	98 (43)
			Run 63 280.3 to 285.2	100 (67)
			Run 64 285.2	100 (57)
			Run 65 286.6 to 291.5	94 (71)
290 (266.9)			Run 66 291.5 to 296.0	100 (93)
			Run 66 291.5 to 296.0	100 (93)
			Run 66 291.5 to 296.0	100 (93)
296.0 (272.5)	Graywacke	Reddish gray, fine grained, massive. Generally fresh, hard. 296.0-300.4 Shear/fracture zone, joint spacing is very close, joints at 40° to 60° and 20°, slickensides on many surfaces, talc/ chlorite coating, random, irregular fractures. Core loss of 0.6 feet. 297.0-298.9 Core broken by drilling. 301.0 Bedding is at 50°. 303.7-304.3 Healed fracture zone, fracture spacing very close, quartz filling, tight, hard. 305.0-308.5 Numerous healed joints and fractures, joints at 0° and 30°, fractures at 65° to 90°, talc/chlorite coating on many surfaces. Core broken by drilling, core loss of 0.6 feet.	Run 67 296.0 to 298.9	79 (28)
			Run 68 298.9 to 303.0	100 (100)
300 (276.2)			Run 69 303.0- 305.0	85 (85)
			Run 70 305.0	82 (0)
			Run 71 306.1- 311.0	98 (69)

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Devil Canyon (North Bank) SHEET NO. 11 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
310 (285.4)	Graywacke	310.8-598.2 Joint spacing generally close to moderately close, generally planar, smooth, carbonate, chlorite and talc coating.	Run 72	94
			311.0 to 315.7	(94)
			Run 73	100
			315.7 to 320.0	(95)
320 (294.6)		324.0-326.0 Healed breccia, fracture spacing is very close, quartz filling, tight, hard.	Run 74	100
			320.0 to 325.0	(92)
			Run 75	100
			325.0 to 329.7	(68)
330 (303.8)		329.7-334.7 Core loss of 0.4 feet.	Run 76	92
			329.7 to 334.7	(92)
			Run 77	98
			334.7 to 339.3	(96)
331.2 (304.9)	Graywacke (Conglomerate)	331.2 Sharp contact, tight. Reddish, medium to dark gray, fine grained argillaceous matrix with 50 percent to 60 percent angular to subrounded rock fragments of sedimentary, volcanic and plutonic origin, fragments 0.01 ft. to 0.3 ft., no foliation, massive, very thin interbeds of argillite. Fresh, hard. Joint spacing moderately close, chlorite/talc and carbonate coating.	Run 76	92
			334.7 to 339.3	(92)
340 (313.0)				

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SITE Devil Canyon (North Bank) SHEET NO. 12 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
350 (322.2)	Graywacke (Conglomerate)	345.0-381.5 Drilling water return less than 50 percent.	Run 78	98
			339.8 to 345.0	(92)
			Run 79	100
			345.0 to 349.7	(100)
			Run 80	100
			349.7 to 355.0	(89)
360.7 (332.0)	Felsic Dike (Rhodacite)	356.1-360.7 Graywacke conglomerate intercalated with reddish gray, aphanitic igneous rock containing subrounded to subangular felsic fragment up to 0.5 inches, hard, contacts at 50°, tight.	Run 81	100
			355.0 to 360.1	(100)
			Run 82	100
			360.1 to 361.3	(100)
			Run 83	100
			361.3-363.4	(100)
370.2 (340.8)	Graywacke (Conglomerate)	Light to medium gray, with reddish brown streaks, aphanitic, highly silicic, occasional plagioclase and quartz phenocrysts, inclusions of argillite and graywacke, flow structures at 50°. Fresh, very hard, tight contacts. Joint spacing close, are planar, smooth to rough.	Run 84	100
			363.4 to 369.3	(100)
			Run 85	100
			364.4 to 369.3	(100)
370.2 (340.8)	Graywacke (Conglomerate)	Rock description, as above.	Run 86	100
			369.3 to 373.6	(77)

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SITE Devil Canyon (North Bank) **SHEET NO.** 13 **OF** 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
380 (349.8)	Graywacke (Conglomerate)	373.4-373.5 Joint at 70° to 80°, clay filling and rock fragments.	Run 87 373.6 to 378.8	100 (100)
			Run 88 378.8 to 381.5	96 (67)
390 (359.0)	Graywacke (Conglomerate)	381.5-401.5 Core broken by drilling, joint spacing is moderately close, joints healed.	Run 89 381.5 to 386.5	100 (100)
			Run 90 386.5 to 391.4	94 (86)
400 (368.2)	Graywacke (Conglomerate)	386.5-391.4 Core loss of 0.3 feet.	Run 91 391.4 to 396.5	100 (94)
			Run 92 396.5 to 401.5	100 (66)
			Run 93 401.5 to 406.6	100 (100)
		401.0-405.7 Healed fractures at 30°, spacing is very close to close, discontinuous, carbonate filling.		

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SITE Devil Canyon (North Bank) **SHEET NO.** 14 **OF** 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
410 (377.4)	Graywacke (Conglomerate)	408.1-424.1 Core loss of 1.5 feet.	Run 94 406.6 to 411.5	88 (88)
			Run 95 411.5 to 415.3	97 (47)
420 (386.6)	Graywacke (Conglomerate)	413.4-413.8 Core badly broken, angular fragments up to 0.15 ft. Joint at 15°, slickensides, chlorite coating.	Run 96 415.3 to 420.3	96 (62)
			Run 97 420.3 to 424.1	84 (76)
430 (395.8)	Graywacke (Conglomerate)		Run 98 424.1 to 429.3	98 (98)
			Run 99 429.3 to 434.3	100 (100)
			Run 100 434.3- 439.4	98 (88)

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 SITE Devil Canyon (North Bank) SHEET NO. 15 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
440 (405.0)	Graywacke (Conglomerate)		Run 101	100
			439.4	(100)
			to	
			444.4	
			Run 102	100
			444.4	(100)
			to	
449.5				
450 (414.2)		454.7-514.8 Drilling water return 50%.	Run 103	100
			449.5	(96)
			to	
454.7				
460 (423.4)			Run 104	100
			454.7	(100)
			to	
			459.8	
			Run 105	100
459.8	(95)			
to				
463.8				
		468.6-497.0 Fracture and joint spacing is very close to close averaging 2 in., fractures and joints at 0° to 90° but mostly 30°, discontinuous, irregular, tight but some broken	Run 105	100
			463.8	(100)
			to	
			468.6	

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 SITE Devil Canyon (North Bank) SHEET NO. 16 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
470 (432.6)	Graywacke (Conglomerate)	by drilling. Talc/chlorite, quartz, carbonate and white mica coating. Core loss of 1.0 ft.	Run 107	100
			468.6	(100)
			to	
			473.1	
			Run 108	87
			473.1-	(81)
			475.3	
			Run 109	100
			475.3	(100)
			to	
			480.4	
480 (441.8)			Run 110	100
			480.4	(100)
			to	
			485.4	
			Run 111	100
485.4	(94)			
to				
488.7				
490 (451.0)			Run 112	96
			488.7	(63)
			to	
491.5				
497.0-500.0		Fracture and joint spacing generally close with zones of very close, discontinuous, tight. Talc, carbonate and minor quartz and white mica filling.	Run 113	92
			491.5	(79)
			to	
			496.7	
500 (460.3)			Run 114	100
			496.7	(96)
			to	
			501.4	

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 SITE Devil Canyon (North Bank) SHEET NO. 17 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
	Graywacke (Conglomerate)		Run 115 501.4 to 506.5	100 (100)
			Run 116 506.5 to 511.5	100 (100)
510 (469.5)			Run 117 511.5 to 514.8	100 (94)
			Run 118 514.8 to 519.9	100 (100)
520 (478.7)			Run 119 519.9 to 525.1	98 (98)
			Run 120 525.1 to 530.4	100 (94)
530 (487.9)			Run 121 530.4- 534.0	86 (87)
		530.4-539.0 Core loss of 0.5 feet.		

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 SITE Devil Canyon (North Bank) SHEET NO. 18 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
	Graywacke (Conglomerate)		Run 122 534.0 to 539.0	100 (100)
540 (497.1)			Run 123 539.0 to 544.3	100 (100)
		543.5 Joint at 35°, planar, slickensides on talc.	Run 124 544.3 to 549.2	98 (96)
550 (506.3)			Run 125 549.2 to 554.5	100 (100)
			Run 126 554.5 to 559.7	98 (92)
560 (515.5)			Run 127 559.7 to 564.8	100 (100)
			563.4 Quartz vein 0.1 feet wide. 564.3 Joint at 55°, planar, slickensides on chlorite/talc.	

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SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-1
SHEET NO. 19 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
570 (524.7)	Graywacke (Conglomerate)		Run 128 564.8 to 569.9	100 (96)
			Run 129 569.9 to 575.1	100 (96)
580 (533.9)	Graywacke (Conglomerate)	574.0-582.0 Lithic fragments increase to cobble size, up to 6 inches. 577.8-578.9 Joints at 40° to 50°, spacing is very close, joints healed, chlorite/talc coating, some slickensides. Core broken by drilling, angular pieces. 579.9-645.2 Drilling water return less than 50%.	Run 130 575.1 to 579.9	100 (85)
			Run 131 579.9 to 584.9	100 (100)
			Run 132 584.9 to 590.1	100 (100)
590 (543.1)	Graywacke (Conglomerate)		Run 133 590.1 to 595.1	100 (96)

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SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-1
SHEET NO. 20 OF 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
600 (552.3)	Graywacke (Conglomerate)	598.2-602.2 Healed fracture zone joint spacing very close, joints at 0° to 10° irregular, rough, carbonate healed, joints at 70° to 90° irregular, rough, carbonate healed, talc/chlorite filling. Most joints tight but some broken by drilling. 598.2-637.7 Joint spacing is generally close, planar, smooth, tight, coated with talc/chlorite and carbonate.	Run 134 595.1 to 599.5	98 (89)
			Run 135 599.5 to 604.2	100 (79)
610 (561.5)	Graywacke (Conglomerate)	612.4-613.3 Quartz vein, highly fractured, tight, irregular, inclusions of argillite. 614.9-620.5 Fracture zone, joint spacing is very close, joints at 30°, healed with talc/chlorite, tight but some broken by drilling. 615.0-630.0 Lithic fragments up to 0.7 feet.	Run 136 604.2 to 609.1	100 (100)
			Run 137 610.5 to 614.8	93 (57)
			Run 138 610.5 to 614.8	100 (100)
620 (570.7)	Graywacke (Conglomerate)	623.8 Increasing amounts of very thin to thin beds of argillite.	Run 139 614.8 to 619.8	100 (96)
			Run 140 619.8- 621.7	100 (84)
			Run 141 621.7 to 626.8	98 (98)

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SITE Devil Canyon (North Bank) SHEET NO. 21 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
630 (579.9)	Graywacke (Conglomerate)	630.0 Joint at 20°, 0.04 inch of calcareous clay.	Run 142 626.8 to 631.7	100 (100)
		632.0-634.0 Joint spacing is very close, at 30°, discontinuous, tight.	Run 143 631.7 to 636.7	100 (100)
640 (589.1)		637.7-721.3 Joint spacing is close to moderate close, joints generally planar, smooth, coated with carbonate, chlorite and talc.	Run 144 636.7 to 641.4	100 (100)
			Run 145 641.4 to 645.1	100 (100)
650 (598.3)		649.3-649.8 Core broken by drilling.	Run 146 645.1 to 650.0	100 (82)
			Run 147 650.0 to 655.2	100 (100)
660 (607.5)		655.2-660.9 No drilling water return.	Run 148 655.2 to 660.4	100 (87)

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PROJECT Susitna Hydroelectric Project HOLE NO. BH-1
SITE Devil Canyon (North Bank) SHEET NO. 22 OF 24

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
670 (616.7)	Graywacke (Conglomerate)		Run 149 660.4 to 665.6	90 (90)
			Run 150 665.6 to 670.8	96 (92)
			Run 151 670.8 to 675.8	100 (100)
680 (625.9)		678.9-683.8 Shear/fracture zone, fracture and joint spacing very close, joints at 70°, planar smooth, fractures irregular, rough. Carbonate and talc/chlorite coating on most surfaces, slickensides on some joints. 678.9-690.0 Core loss of 0.2 feet.	Run 152 675.0 to 680.5	89 (62)
			Run 153 680.5 to 683.9	85 (24)
690 (635.1)		689.8 Joint at 0°, planar, slickensides on chlorite. 690.1-693.0 Fracture zone, joint spacing is very close, joints at 30° to 40°, planar, smooth, healed with carbonate and chlorite, some broken by drilling.	Run 154 683.9 to 690.0	85 (60)
			Run 155 690.0- 695.2	100 (87)

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SITE Devil Canyon (North Bank) **SHEET NO.** 23 **OF** 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
700 (644.4)	Graywacke (Conglomerate)		Run 156 695.2 to 700.5	98 (98)
			Run 157 700.5 to 705.6	98 (98)
710 (653.6)		707.0-708.3 Shear/fracture zone, joint spacing very close, joints at 30° to 50°, chlorite and sulphide mineralization, slickensides on one joint.	Run 158 705.6 to 710.6	100 (100)
			Run 159 710.6 to 715.7	100 (100)
720 (662.8)		721.3-750.2 Joint spacing close to very close, joints generally planar, smooth, tight, coated with carbonate and talc.	Run 160 715.7 to 721.0	98 (98)
			Run 161 721.0 to 725.6	100 (91)

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SITE Devil Canyon (North Bank) **SHEET NO.** 24 **OF** 24

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
730 (672.0)	Graywacke (Conglomerate)	727.1 Joint 0.1 inch wide with clay filling and rock fragments. 731.4-732.1 Fracture zone, joint spacing very close, joints coated with carbonate and talc. Core loss of 0.6 feet. 733.0 Joint with clay filling.	Run 162 725.6- 727.4	100 (78)
			Run 163 727.4 to 731.8	95 (77)
740 (681.2)		737.6 Joint at 60°, 0.1 inch wide, carbonate and clay filling.	Run 164 731.8 to 737.1	94 (77)
			Run 165 737.1 to 741.5	93 (80)
750.2 (690.6)		745.4-748.0 Fracture zone, joint spacing very close, joints at 50°, planar, smooth; healed with carbonate, tight, some opened by drilling. 745.7-750.2 Core loss of 0.3 feet.	Run 166 741.5 to 745.7	100 (100)
			Run 167 745.7 to 750.2	93 (73)
		END OF BORING		

Acres American Incorporated - Consulting Engineers
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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-1
 Site Devil Canyon (North Bank) Sheet No. 1 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1414					Overburden	TOP OF ROCK 11.8'
20						Argillite	
40						Argillite/ Graywacke	Quartz stringers.
60	1368						Fracture zone. Quartz vein.
80							
100	1322					Argillite	Quartz stringers.
120							
140							
160	1284						
180							
200	1230					Argillite/ Graywacke	Quartz stringers. Fracture zone, healed with quartz. Shear fracture, healed. Quartz stringers.
220							
240							
260	1184					Graywacke	Quartz stringers.
280						Argillite Mafic Dike	
300	1138					Graywacke	Shear/fracture zone Fracture zone, healed. Breccia, healed.
320							
340							



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-1
 Site Devil Canyon (North Bank) Sheet No. 2 of 3

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
360						Graywacke	
380						Felsic Dike	
400	1046					Graywacke	Fracture zone, healed.
420							
440	1000						
460							
480							
500	954						
520							
540	908						Joint, slickensides
560							Joint, slickensides
580							
600	862						Fracture zone, healed.
620							Fracture zone, healed.
640							
660	826						
680							
700	720						Shear/fracture zone Fracture zone, healed.



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 BUFFALO, NEW YORK
 DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
 PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-2
 SITE: Devil Canyon (North Bank) SHEET NO. 1 OF 21
 CONTRACTOR: The Drilling Company DRILLING DATES: Sept. 10 to Sept. 15, 1980
 LOGGED BY: K.J. White, M.P. Bruen DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer ROCK Diamond Core - Triple Tube CASING DIAMETER: NW (3.0") I.D. CORE DIAMETER: NQ (1.75") O.D.
 LOCATION: LATITUDE N3,223,137. ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
 DEPARTURE E616,101 GROUND SURFACE 1213.4
 AZIMUTH 0° ROCK SURFACE 1211.7
 DIP 60° BOTTOM OF HOLE 645.7
 WATER TABLE 1208.4

NOTES: 1) Depths measured along hole. True depths in ().
 2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RGD)
0.0	Overburden	Dark brown, organic silt with trace of light gray ash, some angular cobbles. No samples taken. TOP OF ROCK		
2.0	Graywacke	Reddish dark gray, fine grained metasedimentary rock. Bedding coincident with weakly developed foliation at 40°. Very thin to thin beds of dark gray argillite. Generally fresh to slightly weathered, hard, well indurated, sulphide mineralization (5% of rock). 2.0-30.4 - Joints closely spaced, planar, rough to smooth, iron oxide staining, few with quartz filling. 6.0-13.0 - Fracture zone, joints and fractures very closely spaced, irregular, discontinuous, healed with quartz, tight. Core loss of 4.4 feet.	Run 1 2.0 to 6.0	90 (75)
			Run 2	50 (0)
			Run 3	64 (0)
			Run 4 8.1 to 10.5	63 (0)
10 (8.7)	Argillite	Dark gray, very fine grained metasedimentary rock. Very thin to thin bedding coincident with weakly developed foliation at 35° to 65°. Zones of phyllitic sheen, poor cleavage, very thin beds of fine grained graywacke. Generally fresh, hard, well indurated, sulphide mineralization.	Run 5 10.5 to 16.0	64 (48)
11.2 (9.7)				
			Run 6 16.0 to 21.0	100 (89)
20 (17.3)		21.0 - Core loss of 0.1 feet.		

APPROVED: *JM* DATE: February 1, 1982

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
 SITE Devil Canyon (North Bank) SHEET NO. 2 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RGD)
	Argillite	28.4-32.2 Numerous healed fractures, very closely spaced, healed with quartz, irregular and discontinuous. Core loss of 0.3 feet. 30.3, 30.9 Two healed shears, 30° and 50°, 1 in. wide, quartz healed breccia, tight. 30.4-90.9 Joints close to moderately closely spaced, planar, rough to smooth, iron oxide staining, some with quartz filling. 38.0-67.0 Drilling water return 50%.	Run 7 21.0 to 26.0	98 (82)
			Run 8 26.0- 28.0	100 (57)
			Run 9 28.0 to 33.0	94 (82)
			Run 10 33.0 to 38.0	100 (90)
30 (26.0)				
40 (34.6)				
	Argillite/ Graywacke	Argillite, dark gray, very fine grained meta-sedimentary rock interbedded with thin to thick beds of graywacke, light to reddish gray, fine to medium grained metasedimentary rock with elongated sand grains in an argillaceous matrix. Bedding coincident with weakly developed foliation at 40°. Generally fresh, hard, well indurated.	Run 11 38.0 to 42.0	95 (88)
			Run 12 42.0 to 46.9	100 (100)
46.0 (39.8)				
			Run 13 46.9 to 51.9	100 (96)
50 (43.3)				

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
 SITE Devil Canyon (North Bank) SHEET NO. 3 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REG (REQ)
60 (52.0)	Argillite/ Graywacke	56.0 End of intense iron oxide staining on joint surfaces. 58.6-61.2 Fracture zone, 0 ⁰ , very closely spaced fractures, healed with quartz, up to 1 inch wide.	Run 14 51.9 to 56.9	100 (100)
			Run 15 56.9 to 62.2	100 (94)
			Run 16 62.2 to 67.0	90 (90)
70 (60.6)	Argillite/ Graywacke	63.65 Core loss of 0.5 feet. 64.4 Quartz vein, less than 0.1 inch wide, stretched, parallel to bedding/foliation at 40 ⁰ , crosscut by quartz vein at 90 ⁰ which is offset along foliation planes. 64.4-67.4 Quartz stringers, less than 0.24 inch, closely spaced, parallel to and cross-cutting foliation. 68.95-69.05 Core loss of 0.1 foot.	Run 17 67.0 to 71.9	98 (98)
			Run 18 71.9 to 76.8	100 (100)
80 (69.3)	Argillite/ Graywacke	76.1-78.7 Felsic dike, light gray, aphanitic to fine grained groundmass, 50% quartz and plagioclase phenocrysts, medium grained, less than 5% mafics, granodiorite (?) composition. Contacts parallel to bedding/foliation at 60 ⁰ tight. Chilled zone in dike up to 1 inch wide. Baked zone in surrounding argillite up to 6 inches wide. 78.7 Argillite/graywacke, as above, but complexly folded and stretched, possibly brecciated, healed, tight.	Run 19 76.8 to 81.8	100 (84)
			Run 20 81.8 to 86.9	100 (91)

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DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
 SITE Devil Canyon (North Bank) SHEET NO. 4 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REG (REQ)
90 (77.9) 90.9 (78.7)	Argillite/ Graywacke	87.3-87.9 Core loss of 0.2 feet. 89.4-90.9 Felsic dike, as above, subparallel to bedding/foliation, 40 ⁰ -70 ⁰ , somewhat irregular, tight.	Run 20	
			Run 21 86.9 to 91.6	96 (70)
100 (86.6)	Argillite/ Graywacke	Reddish, dark gray, fine to medium grained metasedimentary rock with an argillaceous matrix. Bedding coincident with weakly developed foliation at 30 ⁰ to 40 ⁰ . Generally fresh, hard, well indurated. 90.9-138.6 Joints generally closely spaced, planar, smooth to rough, carbonate and quartz filling, very few with iron oxide staining.	Run 22 91.6 to 96.9	100 (91)
			Run 23 96.9 to 101.7	100 (100)
			Run 24 101.7 to 105.0	97 (76)
			Run 25 105.0 to 107.9	90 (66)
110 (95.3)	Argillite/ Graywacke	104.9 Core loss of 0.1 feet. 105.7-107.9 Core loss of 0.3 feet. 109.5-112.0 Core loss of 1.5 feet due to core barrel mismatch during drilling. Core badly broken.	Run 26 107.9 to 112.0	100 (56)
			Run 27 109.5- 112.0	40 (14)
			Run 28 112.0 to 114.6	100 (58)
		114.6-119.4 Core loss of 0.2 feet.	Run 29 114.6- 119.4	96 (96)

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-2
SITE Devil Canyon (North Bank) **SHEET NO.** 5 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
120 (103.9)	Graywacke	119.4-119.8 Quartz veins, folded, stretched, brecciated, healed, tight. 120.5 Bedding/foliation, 50° 121.7-123.2 Core badly broken, angular pieces less than 1 inch, some clay coating on joints at 0°. 125.9-132.0 Core loss of 2.5 ft. due to core barrel mislatch during drilling.	Run 29	
			Run 30 119.4 to 123.2	92 (53)
			Run 31 123.2 to 125.9	100 (59)
			Run 32 125.9 to 132.0	59 (0)
			Run 33 132.0 to 135.0	100 (73)
			Run 34 135.0-137.0	95 (85)
			Run 35 137.0 to 140.3	88 (30)
			Run 36 140.3 to 143.4	100 (74)
			Run 37 143.4-145.4	100 (65)
			Run 38 145.4-147.5	100 (100)
130 (112.6)	Mafic Dike (Diabase)	135.0-135.5 Quartz stringers, up to 0.5 inch wide, irregular, discontinuous. Healed sheared contact between argillite and graywacke beds. 136.7-140.3 Core badly broken by drilling. Core loss of 0.5 feet. 137.8 Mafic dike, 30°, 0.5 inch wide, tight contacts. 138.6-141.8 Shear/fracture zone, joints very closely spaced, 10° to 20°. 138.6-139.0 Joints generally close to very closely spaced, planar, smooth to rough open to partially open, many with slickensides. Dark green, fine to medium grained, feldspar laths form a fibrous texture, 5-10% white, radiating zeolite crystals up to 0.02 inch, quartz replacement of crystals. Upper contact at approximately 50°, irregular, tight, argillite unaltered. Joints closely spaced, slickensides, chlorite on most. 139.5-147.0 Chilled zone in dike: 139.5-139.8 Aphanitic. 139.8-147.0 Very fine grained. 141.3-144.0 Joints at 10° to 20°, surfaces with chlorite and slickensides.		
			Run 39 147.5 to 152.0	89 (89)
			Run 40 152.0 to 155.0	93 (0)
			Run 41 155.0 to 160.0	100 (82)
			Run 42 160.0 to 165.4	96 (80)
			Run 43 165.4 to 170.5	100 (100)
			Run 44 170.5 to 175.6	100 (96)
			Run 45 175.6 to 178.6	100 (87)
			Run 46 178.6-181.8	100 (47)
			139.5 (120.8)	

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-2
SITE Devil Canyon (North Bank) **SHEET NO.** 6 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
150 (129.9)	Mafic Dike (Diabase)	147.5-155.0 Core loss of 0.7 feet. 152.2-155.0 Shear/fracture zone, joints very closely spaced at 10° and 90°, friable, breccia and clay gouge, slickensides. Core badly broken. 156.4-172.9 Slickensides on many joint surfaces, some on quartz and chlorite fillings. 160.0-165.4 Core loss of 0.2 feet.	Run 39 147.5 to 152.0	89 (89)
			Run 40 152.0 to 155.0	93 (0)
			Run 41 155.0 to 160.0	100 (82)
			Run 42 160.0 to 165.4	96 (80)
			Run 43 165.4 to 170.5	100 (100)
			Run 44 170.5 to 175.6	100 (96)
			Run 45 175.6 to 178.6	100 (87)
			Run 46 178.6-181.8	100 (47)
			Run 47 181.8 to 185.0	100 (100)
			Run 48 185.0 to 188.0	100 (100)
160 (138.6)		174.6-183.1 Chilled zone: 174.6-178.5 Fine grained, less than 5% zeolites. 178.5-183.1 Very fine grained to aphanitic near contact. 179.0-183.8 Fracture zone, joints very closely spaced at 20°, 40° and 60°, chlorite, clay and slickensides on many surfaces. Core broken into angular pieces below 181.0.		
			Run 49 188.0 to 190.0	100 (100)
			Run 50 190.0 to 192.0	100 (100)
			Run 51 192.0 to 194.0	100 (100)
			Run 52 194.0 to 196.0	100 (100)
			Run 53 196.0 to 198.0	100 (100)
			Run 54 198.0 to 200.0	100 (100)
			Run 55 200.0 to 202.0	100 (100)
			Run 56 202.0 to 204.0	100 (100)
			Run 57 204.0 to 206.0	100 (100)
170 (147.2)				
			Run 58 206.0 to 208.0	100 (100)
			Run 59 208.0 to 210.0	100 (100)
			Run 60 210.0 to 212.0	100 (100)
			Run 61 212.0 to 214.0	100 (100)
			Run 62 214.0 to 216.0	100 (100)
			Run 63 216.0 to 218.0	100 (100)
			Run 64 218.0 to 220.0	100 (100)
			Run 65 220.0 to 222.0	100 (100)
			Run 66 222.0 to 224.0	100 (100)
180 (155.9)				
			Run 67 224.0 to 226.0	100 (100)
			Run 68 226.0 to 228.0	100 (100)
			Run 69 228.0 to 230.0	100 (100)
			Run 70 230.0 to 232.0	100 (100)
			Run 71 232.0 to 234.0	100 (100)
			Run 72 234.0 to 236.0	100 (100)
			Run 73 236.0 to 238.0	100 (100)
			Run 74 238.0 to 240.0	100 (100)
			Run 75 240.0 to 242.0	100 (100)

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DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Devil Canyon (North Bank) SHEET NO. 7 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
183.1 (158.6)	Mafic Dike (Diabase)		Run 47 181.8 to 185.9	100 (73)
190 (164.5)	Graywacke	Rock description, as above. 183.1 Contact at approximately 30°, irregular, tight, no shearing, no hornfels in graywacke. 186.3-192.2 Quartz stringers, very close to closely spaced at 20° to 70°, 0.04 to 0.2 inch wide, crosscutting bedding/foliation (50°), minor carbonate. 187.7-187.8 Shear, 50°, breccia and clay incompletely healed with carbonate and quartz, moderately soft and friable. 192.2-193.5 Limy sandstone, light gray, fine grained. Fresh, hard, well indurated. Gradational contacts. 192.5 Bedding and poorly developed foliation at 40°. 193.0-251.1 Joints generally close to moderately closely spaced, planar smooth to rough, tight, quartz and carbonate filling, no staining.	Run 48 185.9 to 190.8	100 (100)
200 (173.2)			Run 49 190.8 to 193.8	100 (100)
			Run 50 193.8 to 198.9	100 (100)
			Run 51 198.9 to 203.2	100 (100)
			Run 52 203.2 to 208.4	100 (100)
210 (181.9)		206.5-212.2 Fracture zone, fractures very closely spaced at 0° to 20°, irregular, healed with quartz and carbonate, tight, hard.	Run 53 208.4 to 211.7	100 (100)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Devil Canyon (North Bank) SHEET NO. 8 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
	Graywacke	213.4-213.7 Core broken along healed joints.	Run 54 211.7 to 216.9	100 (94)
220 (190.5)		218.1-218.3 Fracture zone, healed, as above, but fractures at 90°.	Run 55 216.9 to 220.7	100 (95)
			Run 56 220.7 to 226.0	100 (96)
			Run 57 226.0 to 231.2	100 (100)
230 (199.2)		230.0-231.0 Composition nearly quartzite, less than 20% fines in matrix. 231.2 Joint, 30°, slickensides.	Run 58 231.2 to 236.3	100 (100)
		233.0 Bedding/foliation at 40°.		
		235.0-238.3 Interbedded argillite, very thin to thin beds, dark gray.		
		236.0-236.6 Shears, 50°, healed quartz veins faulted and folded comprising 40% to 50% of rock, less than 0.5 in. wide, tight, hard, well indurated, tight contacts.	Run 59 236.3 to 241.0	100 (100)
240 (207.8)		241.0-242.0 Fracture zone, joints very close spaced at 50° and 0°, open and tight, slickensides, pyrite, chlorite. 241.0-244.0 Interbedded argillite, very thin to thin beds, dark gray.	Run 60 241.0 to 244.7	100 (89)

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-2
SHEET NO. 9 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
250 (216.5)	Graywacke	245.8-246.0 Two joints, 60° with slickensides.	Run 61 244.7 to 249.8	100 (90)
			Run 62 249.8 to 255.0	100 (100)
			Run 63 255.0 to 260.0	98 (94)
258.5 (223.9) 260 (225.2)	Argillite/ Graywacke	Interbedded argillite and graywacke, metasedimentary rock. Very thin beds (less than 1 inch wide) coincident with foliation at 40° to 50°, zones highly folded and stretched. Tight, hard. Sharp contact. Joints closely to moderately closely spaced, planar to irregular, slick to rough, tight to open, carbonate, chlorite and clay filling.	Run 64 260.0- 262.5	100 (76)
			Run 65 262.5 to 267.3	94 (83)
			Run 66 267.3- 269.5	100 (82)
			Run 67 269.5 to 274.7	100 (73)
			Run 68 274.7- 277.5	96 (50)
270 (233.8)				
273.9 (237.2)	Argillite	As above, bedding/foliation, 40° to 50°. 275.2-276.0 Fracture zone, joints very closely spaced at 0°, 50° and 70°, slickensides.		

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-2
SHEET NO. 10 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
280 (242.5)	Argillite	277.4-279.8 Shear/fracture zone, joints very closely to closely spaced at 0°, 20° and 50°, carbonate, chlorite and talc on most surfaces, clay and slickensides on joints at 0° and 20°. 279.5-281.4 Bedding/foliation folded and stretched. Numerous quartz veins up to 2 in. wide, mostly along foliation and joints, tight, hard. 279.5-287.0 Shear/fracture zone, joints very closely spaced at 0° and 10° to 20°, planar, smooth, tight, slickensides, talc coating, pyrite partially to completely replaced by quartz.	Run 69 277.5 to 281.5	100 (48)
			Run 70 281.5 to 287.0	100 (95)
287.0 (248.5)	Argillite/ Graywacke	Rock description, as above. Bedding/foliation at 30° to 40°, folded, stretched, offsets in bedding, argillite spotted with dark gray crystals 0.1 inches wide. 291.1, 294.8 Two joints, 70° and 60° respectively, trace clay. 293.6-294.0 Fracture zone, fractures very closely spaced, irregular and discontinuous, quartz healed, generally crosscutting foliation, tight. 297.0-304.0 Pyrite cubes up to 0.5 inches, partially replaced by quartz. 297.9 Quartz vein at 50°, 0.5 inches wide, slightly folded, parallel to bedding/foliation. 299.7 Joint at 50°, clay filling and sand size argillite fragments.	Run 71 287.0 to 292.0	100 (96)
			Run 72 292.0 to 297.0	100 (100)
300 (259.8)		300.5-300.7? Shear, healed, folded and brecciated fragments in quartz matrix, tight hard. 305.5-307.7 Fractures very closely spaced, irregular, discontinuous, quartz filling, slickensides at 306.5. 310.4-311.5 Core broken into angular fragments	Run 73 297.0 to 301.7	100 (87)
			Run 74 301.7 to 306.7	100 (100)
			Run 75 306.7- 309.4	100 (70)

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CLIENT ALASKA POWER AUTHORITY
 PROJECT Susitna Hydroelectric Project
 SITE Devil Canyon (North Bank)

JOB NO. P5700.05
 HOLE NO. BH-2
 SHEET NO. 11 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
310 (268.5)	Argillite/ Graywacke	up to 1 inch wide. Joint at 30 ⁰ , slickensides and talc; joint at 40 ⁰ planar, slickensides, joint at 10 ⁰ , planar, smooth, with 0.1 inches of silty fine to coarse grained sand.	Run 76 309.4- 311.5	67 (0)
311.5 (269.8)	Argillite	Rock description, as above, few interbeds of graywacke.	Run 77 311.5 to 316.7	100 (94)
		315.0-316.7 Fracture zone, irregular and discontinuous fractures, quartz filled, tight, hard.		
		318.6-424.1 Joints generally closely to moderately closely spaced, occasional zones very closely spaced, generally planar, slick to smooth, tight, chlorite and talc filling quartz carbonate and trace clay/silt.	Run 78 316.7 to 319.7	87 (37)
320 (277.1)		322.3-323.0 Breccia, 0 ⁰ , healed, tight, hard. 325.0-325.5 Bedding, 0 ⁰ , crosscut by foliation at 50 ⁰ .	Run 79 319.7 to 323.5	100 (74)
		325.5-326.6 Numerous quartz veins and stringers, parallel to bedding/foliation, very closely spaced, contorted, chlorite coating. 328.5 Joint, 45 ⁰ , carbonate, less than 0.1 inches of silty sand.	Run 80 323.5 to 326.9	100 (100)
		328.5 Argillite, reddish gray. 328.5-329.8 Quartz stringers, 60 ⁰ , closely spaced, up to 0.25 inches wide, tight.	Run 81 326.9 to 330.1	100 (91)
330 (285.8)		329.5-330.4 Quartz vein, 20 ⁰ , 0.5 to 2.0 inches wide, irregular, fractured, tight. 330.6-330.9 Quartz vein, 30 ⁰ , 1.5 inches wide, fractured, tight, chlorite. 332.6-337.5 Core loss of 1.6 feet.	Run 82 330.1- 332.6	92 (56)
		333.3-333.8 Shear/fracture zone, joints very closely spaced at 20 ⁰ , slickensides and silty sand coating.	Run 83 332.6 to 337.5	67 (53)
334.8 (289.9)	Graywacke	334.6-334.8 Shear, quartz healed, tight, hard. As above, lower contact at 30 ⁰ .		
			Run 84 337.5- 339.5	100 (70)
339.8 (294.3)	Argillite/ Graywacke	339.4-344.2 Numerous quartz stringers, contorted. Argillite, reddish, medium to dark gray, very	Run 85	

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CLIENT ALASKA POWER AUTHORITY
 PROJECT Susitna Hydroelectric Project
 SITE Devil Canyon (North Bank)

JOB NO. P5700.05
 HOLE NO. BH-2
 SHEET NO. 12 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
	Argillite/ Graywacke	fine grained medasedimentary rock thinly interbedded with graywacke, reddish, medium to dark gray, fine to medium grained metasedimentary rock with elongated sand grains. Occasional phyllitic sheen in argillite. Generally fresh, hard, well indurated.	Run 85 339.5- 343.1	100 (83)
		340.5-340.6 Quartz vein, folded, tight, hard, inclusions of argillite. 341.5-342.0 Quartz stringers, 0.25 inches wide, highly folded and contorted, some offset along foliation fracture cleavage at 40 ⁰ , tight, hard.	Run 86 343.1 to 347.1	100 (100)
		342.8-343.3 Quartz stringers, 0.25 inches wide, highly folded and contorted, some offset along foliation fracture cleavage at 40 ⁰ , tight, hard.	Run 87 347.1 to 352.2	100 (100)
350 (303.1)		344.0 Graywacke beds becoming fine to coarse grained, some graded beds, beds generally less than 6 inches wide.		
			Run 88 352.2 to 357.1	100 (100)
			Run 89 357.1 to 361.9	98 (98)
360 (311.8)		359.5-362.0 Fracture zone, joints very closely spaced at 30 ⁰ , tight. 361.4-364.7 Bedding/foliation at 50 ⁰ .		
		364.6 Core loss of 0.2 feet.	Run 90 361.9 to 366.7	96 (96)
			Run 91 366.7 to 372.0	96 (96)
370 (320.4)		366.5-366.9 Quartz vein, 40 ⁰ , irregular, parallel to and crosscutting bedding.		

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-2
SHEET NO. 13 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
380 (329.1)	Argillite Graywacke	374.0 Core loss of 0.2 feet. 375.3 Joint, 40°, silty sand filling. 383.9-389.5 Bedding highly folded and contorted, foliation at 40° to 60° parallel to and crosscutting bedding, offsets along foliation.	Run 92 372.0	95 (73)
			to 376.1	
			Run 93 376.1	100 (100)
			to 381.1	
390 (337.7)			Run 94 381.1	100 (100)
			to 386.2	
392.5 (339.9)	Graywacke	391.4-407.1 Core loss of 0.4 feet. Rock description, as above, few very thin to thin argillite beds. Joints closely to moderately closely spaced, generally planar, slick to smooth, tight, few chlorite and talc filled. 394.5 Quartz stringer, 70°, 0.1 inches wide, crosscutting foliation but slightly offset by fracture cleavage. 394.7 Quartz pod, 10°, 0.5 inches wide, 2 inches long, discontinuous. 400.7-406.0 Core loss of 0.1 feet.	Run 95 386.2	96 (96)
			to 391.4	
400 (346.4)			Run 96 391.4	98 (88)
			to 396.6	
			Run 97 396.6	98 (98)
			to 401.8	
			Run 98 401.8	92 (89)
			to 407.1	

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-2
SHEET NO. 14 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
410 (355.1)	Graywacke	406.2 Joint, 20°, clay filling. 410.7 Quartz pod with chlorite stringers, 1 inch wide.	Run 98	
			Run 99 407.1	100 (93)
			to 411.6	
414.0 (358.5)	Argillite/ Graywacke	Rock description, as above. Joints generally moderately closely spaced, zones very closely spaced, generally planar to irregular, smooth to rough, tight to open, quartz and carbonate filling, some chlorite staining. 415.9-416.6 Felsic dike (aplite), light gray, highly irregular contacts, stringers penetrating graywacke up to 2 inches, tight, hard.	Run 100 411.6	100 (100)
			to 416.9	
420 (363.7)			Run 101 416.9	100 (92)
			to 421.9	
430 (372.4)		420.8-421.2 Quartz stringers. 0.25 inches wide, folded, irregular and discontinuous, tight. 422.3-428.0 Quartz veins and stringers less than 1 inch wide, moderately closely to closely spaced, irregular, unfractured, tight, chlorite mineralization. 424.1-562.8 Joints generally moderately closely spaced, planar to irregular, smooth to rough, tight to open, some carbonate filling, very few with quartz and clay filling, some chlorite staining. 424.4 Less talc and chlorite on joints below. 426.6-431.9 Core loss of 0.4 feet. 431.5 Quartz vein, 2 inches wide, as above.	Run 102 421.9	100 (100)
			to 427.2	
			Run 103 427.2	100 (100)
			to 431.9	
			Run 104 431.9	100 (94)
			to 437.2	

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
 SITE Devil Canyon (North Bank) SHEET NO. 15 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
440 (381.1)	Argillite/ Graywacke	439.7-453.6 Quartz veins, 20 ⁰ to 50 ⁰ , parallel to subparallel to bedding/foliation, 3 inches to 6 inches wide, closely spaced, very closely fractured, 10% to 20% chlorite mineralization, tight contacts.	Run 105	96
			437.2	(96)
			to	
			442.2	
			Run 106	100
			442.2	(100)
			to	
444.9				
450 (389.7)	Argillite/ Graywacke	439.7-453.6 Quartz veins, 20 ⁰ to 50 ⁰ , parallel to subparallel to bedding/foliation, 3 inches to 6 inches wide, closely spaced, very closely fractured, 10% to 20% chlorite mineralization, tight contacts.	Run 107	98
			444.9	(98)
			to	
450.0				
460 (398.4)	Argillite/ Graywacke	439.7-453.6 Quartz veins, 20 ⁰ to 50 ⁰ , parallel to subparallel to bedding/foliation, 3 inches to 6 inches wide, closely spaced, very closely fractured, 10% to 20% chlorite mineralization, tight contacts.	Run 108	98
			450.0	(98)
			to	
			455.3	
			Run 109	100
455.3	(100)			
to				
460.1				
460 (398.4)	Argillite/ Graywacke	439.7-453.6 Quartz veins, 20 ⁰ to 50 ⁰ , parallel to subparallel to bedding/foliation, 3 inches to 6 inches wide, closely spaced, very closely fractured, 10% to 20% chlorite mineralization, tight contacts.	Run 110	100
			460.1	(100)
			to	
465.3				
460 (398.4)	Argillite/ Graywacke	439.7-453.6 Quartz veins, 20 ⁰ to 50 ⁰ , parallel to subparallel to bedding/foliation, 3 inches to 6 inches wide, closely spaced, very closely fractured, 10% to 20% chlorite mineralization, tight contacts.	Run 111	100
			465.3	(100)
			to	
470.3				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
 SITE Devil Canyon (North Bank) SHEET NO. 16 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
470 (407.0)	Argillite/ Graywacke	472.5-473.0 Core badly broken by drilling. 474.0 Quartz vein, 90 ⁰ , 1 inch wide, fractured, open joint with chlorite. 474.5 Quartz vein, 40 ⁰ , 1 inch wide, fractured, tight.	Run 111	
			Run 112	100
			470.3	(85)
			to	
			475.0	
			Run 113	100
			475.0-	(100)
			477.3	
			Run 114	100
			477.3	(100)
to				
481.9				
480 (415.7)	Argillite/ Graywacke	472.5-473.0 Core badly broken by drilling. 474.0 Quartz vein, 90 ⁰ , 1 inch wide, fractured, open joint with chlorite. 474.5 Quartz vein, 40 ⁰ , 1 inch wide, fractured, tight.	Run 115	100
			481.9	(69)
			to	
485.4				
480 (415.7)	Argillite/ Graywacke	472.5-473.0 Core badly broken by drilling. 474.0 Quartz vein, 90 ⁰ , 1 inch wide, fractured, open joint with chlorite. 474.5 Quartz vein, 40 ⁰ , 1 inch wide, fractured, tight.	Run 116	100
			485.4	(96)
			to	
490.3				
490 (424.4)	Argillite/ Graywacke	490.3-494.7 Shear/fracture zone, joints very closely to closely spaced at 30 ⁰ to 60 ⁰ , very thin breccia, clay gouge and carbonate on joint surfaces.	Run 117	100
			490.3-	(18)
			492.5	
			Run 118	100
492.5	(72)			
to				
495.4				
490 (424.4)	Argillite/ Graywacke	490.3-494.7 Shear/fracture zone, joints very closely to closely spaced at 30 ⁰ to 60 ⁰ , very thin breccia, clay gouge and carbonate on joint surfaces.	Run 119	100
			495.4	(98)
to				
499.4				
500 (433.0)	Argillite/ Graywacke	499.8 Joint, 50 ⁰ , clay coating. 500.5 Bedding/foliation, 50 ⁰ .		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Devil Canyon (North Bank) SHEET NO. 17 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
510 (441.7)	Argillite/ Graywacke	502.2-502.4 Quartz vein, approximately 90°, unfractured, tight, irregular contact. 503.0-503.1 Quartz vein, 60°, broken by drilling, tight contacts. 503.3-503.8 Quartz vein, approximately 0°, 0.5 inches to 1 inch wide, folded, unfractured, tight, irregular. 504.0-505.9 Quartz veins and stringers less than 1 inch wide, folded and offset along foliation, unfractured, tight, hard. 507.2 Quartz pods, 0.5 inches to 1 inch wide, as above. 510.2 Quartz vein, 70°, 0.5 inches wide, fractured, tight.	Run 120 499.4 to 504.7	98 (91)
			Run 121 504.7 to 509.1	100 (100)
			Run 122 509.1 to 514.0	100 (84)
			Run 123 514.0 to 519.1	100 (96)
			Run 124 519.1 to 524.3	100 (100)
520 (450.3)	Argillite/ Graywacke	514.3-514.5 Core broken by drilling. 519.5 Bedding/foliation, 60°.	Run 125 524.3 to 529.5	100 (92)
			Run 126 529.5 to 534.7	100 (85)
530 (459.0)	Argillite/ Graywacke	529.5 Joint, 50°, planar, smooth, clay filling. 530.3-531.2 Fracture zone, joints at 0°, irregular, rough talc and carbonate coating. Core badly broken. 531.2 Quartz vein, 50°, 0.5 inches to 1.5 inches wide, unfractured, tight.	Run 126 529.5 to 534.7	100 (85)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-2
SITE Devil Canyon (North Bank) SHEET NO. 18 OF 21

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
540 (467.7)	Argillite/ Graywacke	534.7 Core loss of 0.3 feet. 535.6-543.5 Fractures closely spaced, irregular, tight, quartz healed. 543.5-547.2 Shear/fracture zone, joint at 10°, irregular, sandy silt/clay breccia, joint at 70°, planar, smooth talc coating. Core badly broken. 548.7 Joint with clay filling.	Run 126	
			Run 127 534.7 to 538.3	94 (94)
			Run 128 538.3 to 542.0	81 (81)
			Run 129 542.0 to 547.2	100 (98)
			Run 130 547.2 to 552.0	100 (100)
			Run 131 552.0 to 557.1	94 (94)
			Run 132 557.1 to 562.0	100 (59)
550 (476.3)	Argillite/ Graywacke	557.1-557.5 Core broken into angular fragments, generally less than 0.5 inches. 562.8-621.0 Fractures and joints very closely to closely spaced, calcite and quartz healed, hard, tight.	Run 133 562.0 to 567.0	100 (88)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-2
SITE Devil Canyon (North Bank) **SHEET NO.** 19 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
570 (493.6)	Argillite/ Graywacke	562.9-592.0 Bedding highly folded, stretched and brecciated along foliation, tight, hard.	Run 133	
			Run 134	100
			567.0 to 572.1	(94)
580 (502.3)	Argillite/ Graywacke	574.4-598.0 Fracture zone, joints and fractures very closely spaced, most quartz healed generally tight, chlorite coated, joints at 0° to 20° and 50° to 70°, fractures, irregular and discontinuous. Some core broken by drilling.	Run 135	100
			572.1-574.6	(92)
			Run 136	100
590 (511.0)	Argillite/ Graywacke	584.9-589.6 Core loss of 0.2 feet.	574.6 to 579.9	(98)
			Run 137	100
			579.9 to 582.9	(90)
	Argillite/ Graywacke		Run 138	100
				(20)
			Run 139	96
	Argillite/ Graywacke		584.9 to 589.6	(55)
			Run 140	100
			589.6 to 594.6	(68)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-2
SITE Devil Canyon (North Bank) **SHEET NO.** 20 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
600 (519.6)	Argillite/ Graywacke	601.2-621.0 Fracture zone, joints and fractures very closely spaced, joints at 10° to 20°, planar smooth, some talc and carbonate coating, and at 40° to 70°, planar to irregular, trace talc and carbonate, fractures irregular and discontinuous, tight.	Run 141	100
			594.6 to 599.6	(96)
			Run 142	100
610 (528.3)	Argillite/ Graywacke		599.6-601.8	(82)
			Run 143	100
			601.8 to 604.0	(91)
620 (536.9)	Argillite/ Graywacke	621.0-656.2 Joints generally widely to very widely spaced, planar, smooth to rough, tight to open, carbonate and quartz filling.	Run 144	100
			604.0 to 609.2	(88)
			Run 145	100
	Argillite/ Graywacke		609.2 to 614.2	(76)
			Run 146	89
			614.2 to 619.5	(81)
	Argillite/ Graywacke	627.3 Shear, 60°, 1 inch wide, clay and breccia filling, friable. Core loss of 0.2 feet.	Run 147	100
			619.5 to 624.8	(89)
			Run 148	94
	Argillite/ Graywacke		624.8 to 630.1	(89)

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-2
SHEET NO. 21 OF 21

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
630 (545.6)	Argillite/ Graywacke		Run 148	
			Run 149 630.1 to 635.3	100 (100)
632.6 (547.8)	Quartz Diorite/ Granodiorite Dike	Light gray, quartz rich rock, porphyritic texture with medium to coarse grained plagioclase and quartz crystals in a fine grained to aphanitic groundmass of plagioclase and mafics. Overall less than 10% mafics. Generally very hard, fresh, well indurated.	Run 150	100
			635.3 to 640.5	(100)
640 (554.3)		Joints widely to very widely spaced at 30° and 60° to 70°, planar, smooth to rough, tight to open, quartz filling.	Run 151	98
			640.5 to 645.8	(92)
650 (562.9)		646.0-650.1 Quartz veins, closely spaced 1 inch to 6 inches wide, comprise 50% of rock, highly fractured, tight, minor chlorite, occasional vugs and recrystallization.	Run 152	100
			645.8 to 650.8	(100)
655.5 (567.7)		END OF BORING	Run 153	96
			650.8 to 655.5	(96)

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
Project Susitna Hydroelectric Project Hole No. BH-2
Site Devil Canyon (North Bank) Sheet No. 1 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40				60
0	1213												Graywacke	
20													Argillite	Shears, healed.
40														
60	1170												Argillite/Graywacke	
80														
100	1126												Graywacke	Fracture zone.
120														
140													Mafic Dike (Diabase)	<input type="checkbox"/> Joints, slicken-sides <input type="checkbox"/> Shear/fracture zone
160	1083													<input type="checkbox"/> Joints, slicken-sides. <input type="checkbox"/> Fracture zone.
180													Graywacke	Shear.
200	1040													Fracture zone, healed.
220														Joint, slicken-sides.
240														Shear zone.
260	996												Argillite/Graywacke	
280													Argillite	Shear/fracture zone
300	953													Shear/fracture zone
320														
340													Argillite/Graywacke	Shear/fracture zone



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
Project Susitna Hydroelectric Project Hole No. BH-2
Site Devil Canyon (North Bank) Sheet No. 2 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40				60
360													Argillite/Graywacke	
380														
400	863												Graywacke	
420													Argillite/Graywacke	Dike, felsic.
440														Quartz veins, numerous.
460	823													
480														
500	780													Shear/fracture zone
520														
540														Fracture zone, healed.
560	737													
580														Fracture zone.
600	689													Fracture zone.
620														
640														Quartz diorite dike
660	650													END OF BORING 655.5'



**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
 PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-3
 SITE: Devil Canyon (South Bank) SHEET NO. 1 OF 13
 CONTRACTOR: Interstate Exploration Inc. DRILLING DATES: June 28 TO July 13, 1981
 LOGGED BY: K.J. White, M.P. Bruen DATE: July 1981
 DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
 ROCK Diamond Core - Triple Tube CORE DIAMETER: NQ (1.75") O.D.
 LOCATION: LATITUDE N3,222,146 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
 DEPARTURE E615,883 GROUND SURFACE 1398.0
 AZIMUTH 058° ROCK SURFACE 1394.0
 DIP 32° BOTTOM OF HOLE 1190.7
 WATER TABLE
 NOTES: 1) Depths measured along hole. True depths in ().
 2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (ROD)	
0.0	Overburden	No samples taken.			
TOP OF ROCK					
7.5 (4.0)	Argillite	Medium to dark gray, very fine to fine grained metasedimentary rock. Very thin beds coincident with weakly to moderately developed primary foliation. Zones of minor secondary foliation. Occasional very thin to medium beds of light gray, fine grained graywacke. Minor zones of quartz veining. Joints close spaced, iron oxide stained. 7.5-11.4 - Joint spacing is close to very close, iron oxide staining. Bedding and primary foliation at 35° to 40° with weakly developed secondary foliation at 20°. 11.4-21.7 - Joints close to moderately close spaced, iron oxide staining.	Run 1	100(100)	
10 (5.3)			Run 2	8.0 to 10.9	93 (0)
			Run 3	10.9 to 14.7	100 (50)
			Run 4	14.7 to 17.8	100 (100)
20 (10.6)			Run 5	17.8 to 22.0	100 (67)

APPROVED: *[Signature]*

DATE: February 1, 1982

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
 SITE Devil Canyon (South Bank) SHEET NO. 2 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
30 (15.9)	Argillite	21.7-22.5 - Core broken by drilling, pieces 1 inch to 2 inches, iron oxide staining. 22.5-27.8 - Joints close spaced, iron oxide staining is lessening. 27.8-28.1 - Core broken by drilling, pieces average 1 inch, clay/silt coating. 28.1-51.7 - Joints close to moderately closely spaced, averaging 1 foot, minor iron oxide staining.	Run 5	
			Run 6	100 (53)
			22.0-23.9	
			Run 7	100 (38)
			23.9 to 27.9	
			Run 8	100 (56)
			27.9 to 31.9	
			Run 9	100 (96)
			31.9 to 37.0	
			Run 10	100 (94)
			37.0 to 42.0	
			Run 11	100 (94)
42.0 to 47.0				
Run 12	100 (83)			
47.0 to 51.7				
50 (26.5)		51.7-99.8 - Joints moderately close spaced, iron oxide staining, minor chlorite coating.		

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-3
SITE Devil Canyon (South Bank) **SHEET NO.** 3 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)		
60 (31.8)	Argillite	55.7 - Joint, 10 ⁰ , possible slickensides.	Run 13			
			51.7 to 56.5	100 (98)		
		63.3 - Joint, 90 ⁰ , open, irregular, heavy iron oxide coating compared to surrounding joints.	Run 14			
			56.5 to 61.6	100 (96)		
		70 (37.1)	Argillite	70.2 - Joint, 25 ⁰ , possibly open, irregular, rough, heavy iron oxide staining.	Run 15	
					61.6 to 66.1	100 (96)
80 (42.4)	Argillite	72.6 - Joint, 20 ⁰ , possibly open, irregular, rough, heavy iron oxide staining.	Run 16			
			66.1 to 71.1	100 (100)		
			Run 17			
	Argillite	76.3 - Joint, 20 ⁰ , possibly open, irregular, rough, heavy iron oxide staining.	71.1 to 76.3	100 (90)		
			Run 18			
	Argillite	80.4 - Joint, 30 ⁰ , open, planar, smooth, iron oxide staining. Core broken.	76.3 to 81.4	100 (96)		
	Argillite		Run 19			
	Argillite		81.4 to 86.5	100 (94)		

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-3
SITE Devil Canyon (South Bank) **SHEET NO.** 4 OF 13

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
90 (47.7)	Argillite	90.0 - Bedding/foliation highly folded, 55 ⁰ . Weakly developed secondary foliation at 20 ⁰ . 91.0-91.2 - Quartz pods, up to 1 inch wide, stretched, unfractured. 93.1-98.3 - Quartz stringers, close spacing, crosscutting bedding/foliation, generally 0.1 inch wide. 94.3 - Joint, 60 ⁰ , open, planar, smooth, iron oxide staining.	Run 19	
			Run 20	
			86.5 to 91.6	100 (100)
100 (53.0)	Argillite	99.8-101.8 - Quartz vein, highly fractured, broken by drilling along healed fractures, heavy iron oxide staining, possible open joints at 20 ⁰ . Contains inclusions of argillite up to 0.1 foot wide. Fractured at contacts. 99.8-112.0 - Joints closely spaced.	Run 21	
			91.6 to 96.8	100 (92)
110 (58.3)	Argillite	104.5-105.5 - Quartz vein, highly fractured, no iron oxide staining. Fractures generally tight. Drilling breaks at both contacts. 109.3 - Shear, 25 ⁰ , has approximately 0.5 inch breccia and gouge, slickensides.	Run 22	
			96.8 to 101.8	100 (62)
	Argillite	112.0-136.5 - Joints moderately close spaced. 113.0-128.7 - Sandy argillite and graywacke, bedding/foliation at 60 ⁰ .	Run 23	
	Argillite		101.8 to 107.0	100 (71)
	Argillite		Run 24	
	Argillite		107.0 to 112.6	93 (84)
	Argillite		Run 25	
	Argillite		112.6 to 117.4	100 (100)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
SITE Devil Canyon (South Bank) SHEET NO. 5 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
120 (63.6)	Argillite	122.4-389.5 - Generally no drilling water return. 123.5-147.0 - Numerous quartz pods and stringers, up to 1 inch wide, folded and stretched, unfractured, spacing moderately close to very close.	Run 26 117.4 to 122.4	100 (96)
			Run 27 122.4 to 127.4	100 (100)
130 (68.9)	Argillite	129.2 - Joint, 40°, open, irregular, rough, heavy iron oxide staining.	Run 28 127.4 to 132.4	100 (94)
			Run 29 132.4 to 137.4	100 (90)
140 (74.2)	Argillite	136.5-144.3 - Joint spacing is close to very closely spaced. 141.3 - Quartz vein, 0.1 feet wide, fractured but tight. 142.7 - Quartz vein, 0.05 feet wide, fractured but tight at 15°, subparallel to bedding. Upper contact open, lower tight. 143.0 - Joint, 60°, possibly open, clay/silt coating. 143.6 - Quartz vein, 60°, subparallel to bedding/foliation, approximately 0.05 feet wide.	Run 30 100 (76)	
			Run 31 139.1 to 144.3	100 (52)
			Run 32 144.3 to 149.4	100 (90)

**ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
SITE Devil Canyon (South Bank) SHEET NO. 6 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
150 (79.5)	Argillite	143.9 - Quartz vein, 50°, approximately 0.05 feet wide, core loss. Argillite has a phyllitic appearance at the contact. 144.3-165.6 - Joints close to moderately close spaced. 147.0 - Quartz vein, 20°, approximately 0.05 feet wide. Open contacts with iron oxide staining. 148.0 - Bedding/foliation, 40°. 149.6-150.1 - Graywacke, fine grained at top to medium grained at bottom, graded bedding at 30° and possibly inverted.	Run 33 149.4 to 152.6	98 (81)
			Run 34 152.6 to 157.4	100 (94)
			Run 35 157.4 to 162.4	100 (96)
160 (84.8)	Argillite	155.5 - Bedding/foliation, 40°, secondary foliation at 0° to 10°. Phyllitic sheen, poorly developed cleavage.	Run 36 162.4 to 167.4	90 (78)
			Run 37 167.4- 170.1	100 (59)
170 (90.1)	Argillite	174.1 - Joint, 30°, clay/silt coating, possibly slickensides. 174.2-189.6 - Joints closely spaced, light to heavy iron oxide staining.	Run 38 170.1 to 174.3	95 (55)
			Run 39 174.3 to 178.7	100 (95)
180 (95.4)	Argillite	180.0-183.0 - Quartz stringers, close to very close spaced, generally parallel to bedding, less than 0.1 inch but up to 1 inch. Contacts tight except open at 182.0.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
 SITE Devil Canyon (South Bank) SHEET NO. 7 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
190 (100.7)	Argillite	184.1 - Bedding/foliation, 30°.	Run 40 178.7- 183.5	96 (67)
			Run 41 183.5 to 187.4	90 (72)
			Run 42 187.4 to 192.6	100 (65)
			Run 43 192.6 to 197.4	100 (71)
			Run 44 197.4 to 202.6	100 (98)
			Run 45 202.6 to 207.7	100 (84)
			Run 46 207.7 to 212.6	100 (90)
200 (106.0)	Argillite	189.6-257.0 - Joints close to moderately close spaced, light to heavy iron oxide staining, tight to partially open.		
210 (111.3)	Argillite	193.9-195.0 - Quartz stringers and pods, crosscutting bedding, 0.1 inch to 1 inch wide, unfractured. Approximately 10 percent of the zone. 205.0 - Bedding/foliation, 30°. 206.2 - Joint, 30°, parallel to bedding, silt/clay coating.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-3
 SITE Devil Canyon (South Bank) SHEET NO. 8 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
220 (116.6)	Argillite	228.0 - Bedding/foliation, 30°.	Run 47 212.6 to 215.7	100 (61)
			Run 48	82 (76)
			Run 49 217.4 to 222.5	100 (100)
			Run 50 222.5 to 227.4	100 (98)
			Run 51 227.4 to 232.2	100 (75)
			Run 52 232.2 to 237.4	100 (94)
			Run 53 237.4 to 242.4	100 (94)
230 (121.9)	Argillite	234.3-253.0 - Quartz stringers, close spaced, parallel to and crosscutting bedding, 0.1 inch wide, unfractured. Contacts tight.		
240 (127.2)	Argillite			

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-3
SITE Devil Canyon (South Bank) **SHEET NO. 9 OF 13**

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
247.0 (130.9)	Argillite		Run 54	
250 (132.5)	Graywacke	Light to medium gray, mostly fine to medium grained metasedimentary rock with an argillaceous matrix, occasional thin beds of dark gray argillite. Fresh, hard, and well indurated. Joints close to very close spaced, iron oxide staining.	Run 55 247.4 to 252.2	100 (92)
		254.5 - Bedding/foliation, 25°.	Run 56 252.2 to 257.4	100 (60)
260 (137.8)		257.0-257.4 - Core broken by drilling, pieces 1 inch to 2 inches. 257.0-275.2 - Joints close to very close spaced.	Run 57 257.4 to 261.8	91 (25)
		258.8-259.2 - Fracture zone, joints very close spaced, 60°, iron oxide staining, light coating of silty clay. 260.3-260.6 - Core broken by drilling, pieces 1 inch to 2 inches. 263.3-264.7 - Fracture zone, joints very close spaced, 40° to 60°.	Run 58 261.8 to 267.0	100 (38)
270 (143.1)		268.2-269.5 - Fracture zone, joints very close spaced at 50° to 70°.	Run 59 267.0 to 270.3	85 (11)
		272.9-274.1 - Joint, 10°, open, heavy iron oxide staining.	Run 60 270.3 to 271.9	100 (31)
		274.4-286.7 - Joints close to moderately close spaced.	Run 61 271.9 to 276.7	100 (44)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-3
SITE Devil Canyon (South Bank) **SHEET NO. 10 OF 13**

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
280 (148.4)	Graywacke		Run 62 276.7 to 281.7	100 (88)
		282.9-283.5 - Fracture zone, joint spacing is very close, joints at 10° to 20°.	Run 63 281.7 to 286.7	82 (48)
286.7 (151.9)	Argillite	Rock description as above. 286.7-288.4 - Core loss of 1.4 feet. Core broken by drilling, pieces less than 0.2 feet. 288.4-303.6 - Probable fracture zone, joint spacing is close to very close, trace iron oxide staining. 289.4-289.7 - Core badly broken, pieces 1/2 inch to 1 inch. 289.7-296.8 - Joints at 30°, 40°, and 60°, fractures at 0° to 10° and 40° to 50°. 294.6-296.6 - Core loss of 1.5 feet. 296.8-299.3 - Core loss of 1.4 feet.	Run 64 Run 65 Run 66	0 (0) 75 (0) 90 (0)
290 (153.7)			Run 68 289.7-291.8	90 (0)
			Run 69 291.8-293.8	80 (0)
			Run 70 293.8 to 296.8	50 (0)
			Run 71 296.8-299.3	64 (36)
300 (159.0)		301.0-302.0 - Core badly broken by drilling, pieces 1 inch to 2 inches.	Run 72	100 (0)
		303.6-324.5 - Joints close spaced, trace iron oxide staining.	Run 73 Run 74	100 (0) 100 (50)
			Run 75 303.6 to 306.9	100 (65)
		308.2 - Bedding/foliation, 20°.		

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CLIENT ALASKA POWER AUTHORITY
 PROJECT Susitna Hydroelectric Project
 SITE Devil Canyon (South Bank)

JOB NO. P5700.05
 HOLE NO. BH-3
 SHEET NO. 11 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (FOD)
310 (164.3)	Argillite	311.1 - Quartz vein, irregular contact at 30°, unfractured, 0.2 feet wide. 312.2-312.8 - Core badly broken by drilling, pieces less than or equal to 0.1 feet.	Run 76 306.9 to 312.2	98 (84)
			Run 77 312.2 to 316.8	61 (26)
			Run 78 316.8 to 321.7	45 (18)
			Run 79 321.7 to 324.5	100(100)
320 (169.6)	Argillite	324.5-334.7 - Joints very close to close spaced, iron oxide staining. 237.9-328.7 - Core badly broken by drilling, pieces less than or equal to 0.1 feet. 329.9-331.9 - Core loss of 0.7 feet. Core badly broken. Hole grouted and redrilled. 331.8-334.7 - Core badly broken, pieces average 1/2 inch to 1 inch. 334.7-352.8 - Joints close spaced, iron oxide staining.	Run 80 322.6 to 326.8	98 (43)
			Run 81 326.8 to 329.9	68 (11)
			Run 83 329.9 to 331.9	60 (0)
			Run 84 331.9 to 333.8	N/A (0)
330 (174.9)	Argillite		Run 85 333.8 to 333.8	53 (0)
			Run 87 333.8 to 336.6	96 (0)
			Run 88 336.6 to 341.1	100 (84)
			Run 89 341.1 to 344.4	91 (12)
340 (180.2)	Argillite		Run 90 344.4 to 349.6	100 (58)
			Run 91 349.6 to 350.5	100(100)
			Run 92 350.5 to 351.1	42 (0)
			Run 93 351.1 to 354.7	50 (12)
360 (190.8)	Argillite	352.8-356.6 - Fracture zone, joints very close spaced at 30°, 50°, 60°, and 80°, fractures at 10° to 20°, iron oxide staining, minor carbonate coating. 357.8-362.2 - Joints closely spaced, iron oxide staining. 361.8-366.6 - Quartz stringers and pods, very close spaced, parallel to bedding, stretched, folded, less than 0.5 inch wide, generally fractured but tight. 362.2-363.1 - Fracture zone, possibly sheared, heavy iron oxide staining, silty clay coating on joints, possibly gouge, pieces 0.25 to 1 inch. 363.1-389.9 - Joints closely to moderately close spaced, very close in some zones, less than 0.3 feet wide.	Run 94 354.7 to 357.8	100 (19)
			Run 95 357.8 to 363.0	100 (75)
			Run 96 363.0 to 367.8	100 (57)
			Run 97 367.8 to 370.5	100 (44)
370 (196.1)	Argillite	370.0-370.3 - Fracture zone, joints very close spaced, fractures at 40° to 50°, silt/clay coating on joints, possible slickensides. 371.0 - Quartz vein at 30°, unfractured, 0.75 inch wide.	Run 98 370.3 to 374.4	100 (80)
			Run 99 374.4 to 377.0	100 (80)

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CLIENT ALASKA POWER AUTHORITY
 PROJECT Susitna Hydroelectric Project
 SITE Devil Canyon (South Bank)

JOB NO. P5700.05
 HOLE NO. BH-3
 SHEET NO. 12 OF 13

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (FOD)
344.1 (182.3)	Mafic Dike	Dark green, fine grained igneous rock. Fresh and hard. Sheared contacts with breccia and gouge. Joints close spaced, silty sand coating. 350.5-351.1 - Core loss of 0.3 feet. Core badly broken.	Run 89 341.1 to 344.4	91 (12)
			Run 90 344.4 to 349.6	100 (58)
350.9 (185.9)	Argillite	Rock description as above. 351.1-352.8 - Core loss of 0.7 feet. Core badly broken by drilling. 352.8-356.6 - Fracture zone, joints very close spaced at 30°, 50°, 60°, and 80°, fractures at 10° to 20°, iron oxide staining, minor carbonate coating. 357.8-362.2 - Joints closely spaced, iron oxide staining.	Run 91 349.6 to 350.5	100(100)
			Run 92 350.5 to 351.1	42 (0)
			Run 93 351.1 to 354.7	50 (12)
			Run 94 354.7 to 357.8	100 (19)
360 (190.8)	Argillite	361.8-366.6 - Quartz stringers and pods, very close spaced, parallel to bedding, stretched, folded, less than 0.5 inch wide, generally fractured but tight. 362.2-363.1 - Fracture zone, possibly sheared, heavy iron oxide staining, silty clay coating on joints, possibly gouge, pieces 0.25 to 1 inch. 363.1-389.9 - Joints closely to moderately close spaced, very close in some zones, less than 0.3 feet wide.	Run 95 357.8 to 363.0	100 (75)
			Run 96 363.0 to 367.8	100 (57)
			Run 97 367.8 to 370.5	100 (44)
			Run 98 370.3 to 374.4	100 (80)
370 (196.1)	Argillite	370.0-370.3 - Fracture zone, joints very close spaced, fractures at 40° to 50°, silt/clay coating on joints, possible slickensides. 371.0 - Quartz vein at 30°, unfractured, 0.75 inch wide.	Run 99 374.4 to 377.0	100 (80)
			Run 100 377.0 to 379.0	100 (80)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-3
SITE Devil Canyon (South Bank) **SHEET NO. 13 OF 13**

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC	LENGTH OF RUN (FT.)	REC (ROD)
	Argillite		Run 98	
			Run 99 374.4 to 377.8	100 (88)
380 (201.4)			Run 100 372.8 to 382.8	100 (88)
			Run 101 382.8 to 387.8	100 (94)
390 (206.7)			Run 102 387.8- 389.9	100 (52)
391.1 (207.3)		END OF BORING	Run 103	0 (0)

Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-3
 Site Devil Canyon (North Bank) Sheet No. 1 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	80	20	40	80			
0	1398											Overburden	TOP OF ROCK 7.5'
20												Argillite	
40													Joint, open.
60	1371												Joint, slickensides
80													Joint, open.
100	1345												Joint, open.
120												Argillite/ Graywacke	Quartz pods and stringers.
140												Argillite	
160	1318												
180													Quartz stringers.
200	1292												
220													Quartz stringers.
240													
260	1265											Graywacke	Fracture zone. Fracture zone.
280													
300	1239											Argillite	Fracture zone.
320													
340													Dike, mafic, sheared contacts.



Acres American Incorporated - Consulting Engineers
Buffalo, New York

SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-3
 Site Devil Canyon (North Bank) Sheet No. 2 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			RQD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	80	20	40	80			
360													Fracture zone.
380													
400	1186												END OF BORING 391.1'



ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS
BUFFALO, NEW YORK
DRILLING REPORT

CLIENT: ALASKA POWER AUTHORITY JOB NO.: P5700.05
PROJECT: Susitna Hydroelectric Project HOLE NO.: BH-4
SITE: Devil Canyon (South Bank) SHEET NO. 1 OF 16

CONTRACTOR: The Drilling Company DRILLING DATES: August 14 to August 19, 1980
LOGGED BY: K.J. White, M.P. Bruen DATE: July 1981

DRILLING METHOD: SOIL Casing Advancer CASING DIAMETER: NW (3.0") I.D.
ROCK Diamond Core - Triple Tube CORE DIAMETER: NQ (1.75") O.D.

LOCATION: LATITUDE N3,222,004 ELEVATIONS: DATUM MSL, A.S.P.C., Zone 4
DEPARTURE E615,992 GROUND SURFACE 1352.6
AZIMUTH 195° ROCK SURFACE 1345.5
DIP 60° BOTTOM OF HOLE 919.0
WATER TABLE 1321.6

NOTES: 1) Depths measured along hole. True depths in ().
2) All angles measured to the core axis.

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	RUN LENGTH	% REC (RQD)
0.0	Overburden	No samples taken.		
		TOP OF ROCK		
7.0 (6.1)	Argillite/ Graywacke	Argillite, medium to dark gray, fine grained, interbedded with graywacke, medium to dark gray, fine to medium sand grains in an argillaceous matrix, elongate grains parallel to bedding/foliation. Very thin to thin bedding coincident with weakly developed foliation at 20°. Fresh, hard, well indurated.	No Core Taken	
10 (8.7)		Joints generally close to very close, planar, smooth to rough, tight to open, quartz and carbonate filling, iron oxide staining. 12.0-15.2 - Core loss of 0.6 feet.	Run 1 12.0 to 15.2	75 (31)
		12.0-35.1 - Joints generally close to very close, planar, smooth to rough, tight to open, quartz and carbonate filling, iron oxide staining.	Run 2 15.2 to 18.8	100 (67)
20 (17.3)		20.0, 23.4, 29.8 - Joints, 20-30° with slickensides and iron oxide staining, parallel bedding/foliation.	Run 3	100 (50)

APPROVED: *KJW*

DATE: February 1, 1982

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CLIENT: ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT: Susitna Hydroelectric Project HOLE NO. BH-4
SITE: Devil Canyon (South Bank) SHEET NO. 2 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
	Argillite/ Graywacke	20.8 - Quartz vein, 50°, crosscutting bedding/foliation, 0.5 inches wide, stretched, tight. 23.0-29.0 - Quartz stringers, 0.1 inches wide, closely spaced, irregular, stretched, tight.	Run 4 20.4 to 25.4	100 (92)
			Run 5 25.4 to 30.5	100 (96)
30 (26.0)			Run 6 30.5 to 34.0	100 (49)
33.9 (29.4)	Graywacke	Medium to dark gray metasedimentary rock with medium to coarse grained sand in a fine grained argillaceous matrix, sand grains elongate parallel to bedding/foliation. Texture massive to weakly developed foliation coincident with bedding at 20-30°. 35.1-103.1 - Joints generally closely spaced, planar, smooth to rough, tight, carbonate, quartz, chlorite and talc filling, occasional iron oxide staining. 44.0-47.0 - No drilling water return. 45.2-46.4 - Fracture zone, 2 inches wide, joints very closely spaced at 15-20°, open, sandy silt/clay coating, iron oxide staining. 47.0-58.1 - Drilling water return 50%.	Run 7 34.0 to 39.0	100 (100)
			Run 8 39.0 to 44.0	100 (100)
40 (34.6)			Run 9 44.0 to 48.0	95 (88)
			Run 10 48.0 to 53.1	98 (98)
50 (43.3)		50.3 - No iron oxide staining below.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Devil Canyon (South Bank) SHEET NO. 3 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (REQ)
60 (52.0)	Graywacke		Run 11	
			53.1 to 58.2	100 (100)
			Run 12	
			58.2 to 61.5	100 (88)
			Run 13	
			61.5 to 65.7	100 (100)
70 (60.6)	Graywacke		Run 14	
			65.7 to 70.2	100 (100)
			Run 15	
			70.2 to 75.0	100 (98)
80 (69.3)	Graywacke		Run 16	
			75.0 to 80.2	92 (92)
			Run 17	100(86)
			Run 18	
			80.9 to 84.4	100 (100)
		83.2 - Quartz veins, 40°, 0.5 inches wide, tight, sulphide mineralization.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Devil Canyon (South Bank) SHEET NO. 4 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (REQ)
90 (77.9)	Graywacke	86.5 - Quartz vein, 40°, 0.5 inches wide, tight. 88.4-90.3 - Rock fragments 0.5 to 1 inch long, stretched, parallel bedding/foliation at 30°.	Run 19	
			84.4 to 89.4	100 (100)
			Run 20	
			89.4 to 93.8	100 (100)
			Run 21	
			93.8 to 98.2	100 (100)
100 (86.6)	Graywacke	102.3-103.1 - Numerous quartz veins and stringers, very closely spaced. 102.9 - Quartz vein, 50°, 0.75 inches wide, open contact, trace of sulphur-like mineral. 104.5 - Joint, 25°, planar, rough, slicken-sides, carbonate coating.	Run 22	
			98.2 to 103.4	100 (100)
			Run 23	
			103.4 to 108.1	100 (100)
108.4 (93.9)	Argillite/ Graywacke	Very thinly bedded graywacke, as above, inter-bedded with argillite, dark gray, very fine to fine grained, bedding coincident with weakly developed foliation at 5-10°, crosscut by microfolds, poor cleavage, phyllitic sheen in places. Joints moderately closely spaced at 20-30°, planar, rough to smooth, tight to open, some carbonate and trace silt filling.	Run 24	
110 (95.3)			108.1 to 113.3	100 (100)
114.9 (99.5)	Argillite	Rock description as above. Joints generally moderately closely to widely	Run 25	
			113.3 to 117.7	100 (100)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4
SITE Devil Canyon (South Bank) **SHEET NO.** 5 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)		
120 (103.9)	Argillite	spaced with zones very closely spaced, planar, few irregular, rough to smooth, tight to open, few slickensides, carbonate, quartz, talc, and chlorite coating.	Run 26 117.7- 120.0	100 (100)		
			Run 27 120.0 to 125.0	100 (100)		
			Run 28 125.0 to 130.2	100 (100)		
			Run 29 130.2 to 135.5	100 (100)		
			Run 30 135.5 to 140.5	94 (88)		
			Run 31 140.5 to 145.6	100 (100)		
			Run 32 145.6 to 150.8	100 (100)		
			135.5-140.5 - Core loss of 0.3 feet.			
			140.5-240.3 - Drill water return less than 50%.			
130 (112.6)						
140 (121.2)						

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-4
SITE Devil Canyon (South Bank) **SHEET NO.** 6 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)		
150 (129.9)	Argillite	spaced with zones very closely spaced, planar, few irregular, rough to smooth, tight to open, few slickensides, carbonate, quartz, talc, and chlorite coating.	Run 32			
			Run 33 150.8 to 155.9	100 (100)		
			157.0 - Joint, 20°, with slickensides.	Run 34 155.9 to 160.9	100 (100)	
			161.7 - Argillite becoming reddish, dark gray, massive to weakly developed foliation. Fresh, hard to very hard, well indurated.	Run 35 160.9 to 165.9	98 (98)	
			169.5-170.4 - Quartz veins.	Run 36 165.9 to 170.9	98 (96)	
			171.3-172.3 - Quartz veins and stringers, slickensides, sulphide mineralization, poorly indurated. Core broken and ground by drilling.	Run 37 170.9 to 176.1	100 (90)	
			178.5 - Joint, 35°, with slickensides. 178.5-181.6 - Joint surfaces talc coated. Core broken by drilling, fragments 0.05 to 0.1 feet.	Run 38 176.1 to 179.6	100 (77)	
			160 (138.6)			
			170 (147.2)			
180 (155.9)						

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Devil Canyon (South Bank) SHEET NO. 7 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
190 (164.5)	Argillite	184.2-188.5 - Joints, 15° and 30°, with slickensides.	Run 39 179.6 to 184.0	100 (100)
			Run 40 184.0 to 189.1	100 (100)
			Run 41 189.1 to 194.3	100 (94)
			Run 42 194.3 to 199.6	100 (100)
			Run 43 199.6 to 204.6	100 (100)
			Run 44 204.6 to 209.6	100 (100)
200 (173.2)	Argillite	199.8-201.6 - Quartz vein, 10°, 0.5 inches wide, fractured, possibly slickensides, talc coating, contact partially open.	Run 45 209.6 to 214.9	94 (75)
			Run 45 209.6 to 214.9	94 (75)
210 (181.9)	Argillite	206.8-207.4 - Quartz vein at 0°, 0.5 inches wide, irregular, stretched, tight. 207.6-211.6 - Fractures very closely spaced, irregular, discontinuous, some quartz filled.	Run 45 209.6 to 214.9	94 (75)
			Run 45 209.6 to 214.9	94 (75)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Devil Canyon (South Bank) SHEET NO. 8 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
220 (190.5)	Argillite	213.5-213.7 - Quartz veins, 0.5 inches wide, irregular, folded, tight. 214.2 - Quartz vein, 20°, parallel to bedding/foliation, 0.5 inches wide. 214.9 - Core loss of 0.3 feet. 216.8-220.0 - Quartz veins, closely spaced, less than 0.5 inches wide, tight, crosscutting bedding/foliation at 0-10° but offset along cleavage planes. 221.0-252.0 - Shear/fracture zone, healed, 30-40% folded and nonfolded quartz veins. Folded veins contorted and stretched in matrix of argillite breccia. Nonfolded veins crosscutting bedding/foliation, vuggy with chlorite and iron and lead sulphides. Generally tight.	Run 45	
			Run 46 214.9 to 220.2	100 (100)
			Run 47 220.2 to 225.3	100 (96)
			Run 48 225.3 to 230.1	98 (98)
			Run 49 230.1 to 235.5	96 (85)
			Run 50 235.5 to 240.3	100 (83)
			Run 51 240.3 to 245.6	98 (98)
230 (199.2)	Argillite	230.1-235.5 - Core loss of 0.2 feet.	Run 49 230.1 to 235.5	96 (85)
			Run 49 230.1 to 235.5	96 (85)
240 (207.8)	Argillite	233.8-328.3 - Joints generally closely spaced, planar, some curved and irregular, slick to rough, tight, some open, carbonate, quartz, chlorite, and talc coating. 236.2-240.9 - Fracture zone, very closely to closely spaced joints at 0° to 10°, slick, talc and carbonate coating, possible slickensides. 240.3-240.9 - Core loss of 0.1 feet.	Run 49 230.1 to 235.5	96 (85)
			Run 49 230.1 to 235.5	96 (85)
240 (207.8)	Argillite	243.9, 245.8, 249.6 - Faint slickensides.	Run 49 230.1 to 235.5	96 (85)
			Run 49 230.1 to 235.5	96 (85)

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CLIENT	ALASKA POWER AUTHORITY	JOB NO.	P5700.05
PROJECT	Susitna Hydroelectric Project	HOLE NO.	BH-4
SITE	Devil Canyon (South Bank)	SHEET NO.	9 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
250 (216.5)	Argillite	246.8-247.0 - Quartz vein, 0.6 feet wide, fractured, vuggy with iron and lead sulphides, carbonate and chlorite at contacts.	Run 52 245.6- 247.8	100 (100)
		248.8-249.1 - Quartz vein, 30°, fractured but tight, open joints at contacts with talc, chlorite and possibly slickensides.	Run 53 247.8- 250.3	96 (52)
			Run 54	
252.0 (218.2)	Argillite/ Graywacke	Interbedded argillite and graywacke, as above. Very thin to thin bedding. Joints generally closely spaced, planar, smooth, tight, quartz carbonate, chlorite and talc filling.	250.3 to 255.2	100 (100)
260 (225.2)		254.0-258.1 - Quartz veins, closely spaced, 0.5 to 1 inch wide, folded, tight.	Run 55	
		257.3 - Core loss of 0.1 feet.	255.2 to 260.3	98 (94)
		257.8 - Quartz vein, 20°, 1 inch wide, fractured but tight, vuggy with sulphide mineralization.	Run 56 260.3- 262.6	100 (100)
		262.3 - Quartz vein, 20°, 2 inches wide, vuggy with sulphide mineralization, tight.	Run 57	
		263.8-264.4 - Quartz vein, fractured, tight to partially open, vuggy with sulphide mineralization, lower contact open.	262.6 to 267.6	92 (72)
267.0 (231.2)	Argillite	264.7-308.5 - Argillite "spotted" with biotite (?), microfolds crosscutting foliation at 50°	Run 58	
		Rock description as above.	267.6 to 272.3	100 (91)
270 (233.8)	Argillite	266.8-279.5 - Numerous quartz veins and stringers. Veins closely to moderately closely spaced at 30° to 40°, crosscutting bedding/foliation, 0.5 inches to 8 inches wide, fractured but tight. Sulphide, chlorite and carbonate mineralization present. Between 270.6 to 272.4 broken by drilling. Stringers less than 0.5 inches wide, parallel to bedding/foliation, folded, stretched, tight.	Run 59 272.3 to 277.3	100 (98)

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CLIENT	ALASKA POWER AUTHORITY	JOB NO.	P5700.05
PROJECT	Susitna Hydroelectric Project	HOLE NO.	BH-4
SITE	Devil Canyon (South Bank)	SHEET NO.	10 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
280 (242.5)	Argillite	278.1-280.8 - Joints, 70° and 0°, with slickensides.	Run 60 277.3 to 281.0	100 (92)
		282.3-287.8 - Quartz vein, fractured but tight, chlorite and sulphide mineralization.	Run 61 281.0 to 286.0	100 (96)
290 (251.1)	Argillite	284.6-285.1 - Shear, 10°, 0.5 inches of breccia, chlorite, talc and carbonate coating.	Run 62	
		286.0 - Core loss of 0.4 feet.	286.0 to 290.5	91 (87)
		292.9-295.6 - Shear zone, 10°, parallel to foliation, slick surfaces with talc coating, breccia and gouge on some surfaces, fragment of breccia/gouge 2 inches wide at 295.5. Breccia contains angular fragments in a clay matrix. Core loss of 0.7 feet at 293.5.	Run 63 290.5 to 293.5	100 (33)
			Run 64	
			293.5 to 297.9	84 (55)
			Run 65	
300 (259.8)	Argillite	301.9-307.0 - Core loss of 0.7 feet.	297.9 to 301.9	90 (90)
			Run 66	
			301.9 to 307.0	94 (94)
	Argillite	307.6-309.6, 309.6-311.2 - Bedding planes, 10°, with slickensides.	Run 67	
	Argillite	308.1-311.5 - Joints subparallel to core axis.		

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CLIENT ALASKA POWER AUTHORITY		JOB NO. P5700.05		
PROJECT Susitna Hydroelectric Project		MOLE NO. BH-4		
SITE Devil Canyon (South Bank)		SHEET NO. 11 OF 16		
DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
310 (268.5)	Argillite	310.0-318.0 - Quartz veins and stringers, up to 1 inch wide, folded, parallel to bedding/foliation and crosscutting veins with open fractures and sulphide and talc mineralization. 312.2 - Core loss of 0.2 feet.	Run 67 307.0 to 312.2	96 (96)
			Run 68 312.2 to 317.0	100 (88)
			Run 69 317.0 to 322.0	100 (98)
			Run 70 322.0 to 327.2	98 (98)
			Run 71 327.2 to 332.2	100 (100)
320 (277.1)	Argillite	328.3-385.6 - Joints generally closely to moderately closely spaced, planar to irregular, smooth to rough, tight to open, quartz and carbonate filling, chlorite coating. 330.4-331.1 - Joint, 20°, open.	Run 72 332.2 to 337.3	98 (98)
			Run 73 337.3 to 342.4	96 (96)
330 (285.8)	Argillite	339.3 - Core loss of 0.2 feet.	Run 74 342.4 to 347.0	96 (91)
			Run 75 347.0 to 350.0	100 (97)
340 (294.4)	Argillite	349.8 - Joint, 20°, with slickensides.	Run 76 350.0 to 353.5	100 (100)
			Run 77 353.5 to 356.5	87 (77)
	Argillite	362.5-364.5 } 370.7-376.3 } Quartz vein, very closely spaced fractures, generally tight, some open, vuggy, chlorite, carbonate, and iron and lead sulphide mineralization, contacts at 10° to 20°, parallel to and crosscutting bedding/foliation at 10° and 20°, respectively. 371.0-379.4 - Core loss of 2.0 feet.	Run 78 356.5 to 361.0	93 (93)
			Run 79 361.0 to 366.3	100 (94)
	Argillite		Run 80 366.3 to 371.0	100 (100)
			Run 81 371.0 to 376.3	98 (98)

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CLIENT ALASKA POWER AUTHORITY		JOB NO. P5700.05		
PROJECT Susitna Hydroelectric Project		MOLE NO. BH-4		
SITE Devil Canyon (South Bank)		SHEET NO. 12 OF 16		
DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
350 (303.1)	Argillite	343.9-345.0 - Quartz vein. 347.0 - Core loss of 0.2 feet. 349.8 - Joint, 20°, with slickensides.	Run 73	
			Run 74 342.4 to 347.0	96 (91)
			Run 75 347.0 to 350.0	100 (97)
			Run 76 350.0 to 353.5	100 (100)
			Run 77 353.5 to 356.5	87 (77)
360 (311.8)	Argillite/ Graywacke	Interbedded argillite and graywacke, as above. Joints generally closely spaced, mostly planar, smooth to rough, tight to partially open, quartz and carbonate filling, 2 joints with chlorite coating. 353.5 - Core loss of 0.4 feet.	Run 78 356.5 to 361.0	93 (93)
			Run 79 361.0 to 366.3	100 (94)
362.5 (313.9)	Argillite	Rock description as above. 362.5-364.5 } 370.7-376.3 } Quartz vein, very closely spaced fractures, generally tight, some open, vuggy, chlorite, carbonate, and iron and lead sulphide mineralization, contacts at 10° to 20°, parallel to and crosscutting bedding/foliation at 10° and 20°, respectively. 371.0-379.4 - Core loss of 2.0 feet.	Run 80 366.3 to 371.0	100 (100)
			Run 81 371.0 to 376.3	98 (98)
370 (320.4)	Argillite		Run 82 376.3 to 381.0	100 (100)
			Run 83 381.0 to 385.6	98 (98)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Devil Canyon (South Bank) SHEET NO. 13 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
380 (329.1)	Argillite	376.3-387.0 - Foliation better developed at 10°-20°, phyllitic sheen, poor cleavage. 379.4-386.0 - Core barrel mismatched during drilling, core badly broken. Core loss of 0.2 feet. 385.6-437.8 - Joints generally closely to very closely spaced, planar, mostly smooth, tight, carbonate, quartz, chlorite and talc filling.	Run 81 371.0 to 376.5	100 (84)
			Run 82 376.5 to 379.4	90 (79)
			Run 83 379.4 to 386.0	97 (97)
			Run 84 386.0 to 390.8	92 (92)
387.1 (335.2)	Graywacke	Medium gray metasedimentary rock with fine to medium grained sand in an argillaceous matrix, with very thin argillite layers. Joints closely to moderately closely spaced, planar, slick to rough, tight, chlorite and talc filling. 390.8-396.0 - Core loss of 7.0 feet. 393.9 - Bedding/foliation, 20°.	Run 85 390.8 to 396.0	88 (88)
390 (337.7)	Argillite	Rock description as above.	Run 86 396.0 to 401.1	100 (88)
398.6 (345.2) 400 (346.4)			Run 87 401.1 to 406.1	98 (98)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Devil Canyon (South Bank) SHEET NO. 14 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
410 (355.1)	Argillite	406.5-410.4 - Graywacke interbedded with argillite, very thin to thin beds.	Run 87	
			Run 88 406.1 to 411.1	100 (96)
			Run 89 411.1 to 416.2	100 (100)
			Run 90 416.2 to 420.0	100 (100)
			Run 91 420.0 to 425.0	100 (100)
			Run 92 425.0 to 430.3	98 (98)
420 (363.7)	Argillite	435.2-435.6 - Quartz stringers, generally at 0°, less than 0.5 inches wide, parallel to and crosscutting bedding/foliation.	Run 93 430.3 to 435.1	100 (100)
430 (372.4)				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Devil Canyon (South Bank) SHEET NO. 15 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
440 (381.1) 441.8 (382.6)	Argillite		Run 94 435.1 to 440.1	100 (96)
450 (389.7) 460 (398.4)	Argillite/ Graywacke	Interbedded argillite and graywacke. Rock description as above. Thin bedding coincident with foliation at 15°. Foliation better developed in argillite than in graywacke, phyllitic sheen, poor cleavage. Joints generally closely to very closely spaced, at bedding contacts, joints very closely spaced in graywacke, without penetrating argillite. Joints generally planar, slick to smooth, tight, chlorite, talc and carbonate filling. 455.0-457.8 - Core broken during drilling along very closely to closely spaced joints at 20° to 40°, most surfaces coated with talc, chlorite, and carbonate.	Run 95 440.1 to 445.1	100 (100)
			Run 96 445.1 to 450.2	100 (94)
			Run 97 450.2 to 453.8	100 (100)
			Run 98 456.4 to 460.5	100 (44)
			Run 99 460.5 to 465.7	100(63)
			Run 100 465.7 to 471.5	100 (80)
			Run 101 465.7 to 471.5	100 (94)
465.8 (403.4)	Argillite	Rock description as above.	Run 102 465.7 to 471.5	100 (100)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-4
SITE Devil Canyon (South Bank) SHEET NO. 16 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
470 (407.0)	Argillite	471.0 - Bedding/foliation, 15°. 485.9 - Core loss of 0.2 feet.	Run 102	
480 (415.7)			Run 103 471.5 to 475.5	100 (100)
			Run 104 475.5 to 480.5	100 (94)
			Run 105 480.5 to 485.5	98 (98)
490 (424.4)			Run 106 485.5 to 490.5	96 (96)
			Run 107 490.5 to 495.7	100 (96)
			Run 108 495.7 to 500.7	100 (100)
			500.7 (433.6)	END OF BORING

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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-4
 Site Devil Canyon (South Bank) Sheet No. 1 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1353					Overburden	TOP OF ROCK 7.0'
20						Argillite/Graywacke	Joints, slickensides.
40						Graywacke	
60	1310						
80							
100	1266						
120						Argillite	
140							
160	1223						
180							
200	1180						
220							Fracture zone.
240							Fracture zone.
260	1136					Graywacke	Quartz veins.
280						Argillite	Quartz veins.
300	1093						Quartz veins.
320							
340							



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-4
 Site Devil Canyon (South Bank) Sheet No. 2 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
360						Argillite/Graywacke	Quartz veins.
380							
400	1007					Graywacke	
420						Argillite	
440							
460	963					Argillite/Graywacke	
480						Argillite	
500	919						END OF BORING 500.7'



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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-5a
SITE Devil Canyon (North Bank) SHEET NO. 3 OF 20

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
60 (42.4)	Argillite		Run 25	
			53.0 to 57.8	100 (96)
			Run 26	
			57.8 to 62.7	92 (92)
			Run 27	
			62.7 to 67.7	100 (94)
			Run 28	
			67.7 to 72.5	98 (94)
			Run 29	
			72.5 to 75.7	88 (78)
70 (49.5)	Argillite	67.9-70.8 - Joints, average 30° and 50°, iron oxide and silt fillings.	Run 30	100 (0)
			Run 31	
			76.3-78.3	95 (60)
			Run 32	
80 (56.6)	Argillite	73.9-74.4 - Fracture zone, healed with carbonate, hard.	Run 33	
			78.3-80.4	100 (90)
			Run 34	
			80.4-95.0 - Quartz stringers, 20°, crosscut bedding, very thin.	
		82.0-85.3 - Bedding/foliation, 15°.		

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-5a
SITE Devil Canyon (North Bank) SHEET NO. 4 OF 20

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
90 (63.6)	Argillite	86.1-87.0 - Joints, two, 15-20°, parallel bedding, slickensides, heavy iron oxide staining with calcareous clay.	Run 35	
			86.7 to 90.5	100 (29)
			Run 36	
			90.5 to 95.0	93 (82)
			Run 37	
			95.0 to 98.0	97 (87)
			Run 38	
			98.0 to 102.0	65 (35)
			Run 39	
			92 (0)	
100 (70.7)	Argillite	87.3 - Joint, 20°, crosscutting bedding, rough, faint slickensides, iron oxide stained.	Run 40	
			92 (50)	
			Run 41	
			104.5-106.0	100 (0)
			Run 42	
			87 (53)	
			Run 43	
			100 (50)	
			Run 44	
			108.0-109.6	100 (88)
110 (77.8)	Argillite	90.0 - Joint, 30°, faint slickensides, tight.	Run 45	
			109.6 to 114.1	92 (60)
			Run 46	
			100 (87)	
			Run 47	
			116.0 - Bedding/foliation, 10-15°, poorly to well developed. Composition approaching graywacke.	
			Run 48	
			113.5 - Joint, 20°, parallel bedding, slickensides, tight, thin iron oxide and clay coating.	
			Run 49	
			110.5 - Joint, 25°, crosscutting bedding, iron oxide staining.	

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CLIENT	ALASKA POWER AUTHORITY	JOB NO.	P5700.05
PROJECT	Susitna Hydroelectric Project	HOLE NO.	BH-5a
SITE	Devil Canyon (North Bank)	SHEET NO.	7 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
190 (134.4)	Argillite/ Graywacke	183.3-188.0 - Core barrel mismatch. Core loss 1.3 feet. 187.1-187.3 - Quartz vein, 20°. 188.0-191.9 - Fracture zone, well healed fractures. 190.2 } 190.4 } Joints, 30-50°, irregular, partly open, slickensides. 193.9 - Fracture, 50°, irregular, slickensides.	Run 64	
			Run 65	66 (23)
			Run 66	100 (77)
			Run 67	100 (100)
			Run 68	100 (100)
197 (139.3)	Argillite	Rock description as above, with thin interbeds of graywacke locally. Joints, tight.	Run 69	100 (88)
200 (141.4)		203.0-217.0 - Fractures, numerous, healed. 203.2 - Joint, 20°, crosscuts bedding, faint slickensides. 203.5-204.0 - Fracture and quartz stringers, 15°, tight, irregular, highly chloritized. 205.5-251.7 - Intermittant wavy bands and stringers of graywacke. Joints moderately close to widely spaced at 0-15°.	Run 70	100 (63)
			Run 71	96 (96)
			Run 72	
			Run 73	
210 (148.5)			Run 74	

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CLIENT	ALASKA POWER AUTHORITY	JOB NO.	P5700.05
PROJECT	Susitna Hydroelectric Project	HOLE NO.	BH-5a
SITE	Devil Canyon (North Bank)	SHEET NO.	8 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
220 (155.6)	Argillite	215.0 - Joint, 0-10°, possible shear, silt/sandy coating. 222.5-225.0 - Fractures, healed, very closely spaced and irregular, healed, small quartz vein.	Run 72	100 (80)
			Run 73	100 (93)
			Run 74	100 (100)
			Run 75	100 (100)
			Run 76	100 (100)
			Run 77	100 (100)
			Run 78	100 (100)
			Run 79	100 (89)
			Run 80	100 (100)
			240 (169.7)	
Run 80	100 (100)			

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-5a
SITE Devil Canyon (North Bank) SHEET NO. 9 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
250 (176.7)	Argillite	247.1-252.1 - Core loss 0.4 feet.	Run 81 244.4 to 247.4	93 (73)
		251.7-252.1 - Silty layer, 80°, with fresh angular rock fragments. Surrounding core fresh. Appears to be river silt. 251.7 - Fracture, 80-90°.	Run 82 247.4 to 252.4	100 (94)
		251.7-290.0 - Joints moderately closely spaced with zones of very close spacing. 252.1-252.4 - Joint, 30°, crosscuts apparent bedding/foliation. Filled by 1/8 inch clay/breccia. 252.4-253.9 - Fractures, irregular, 0-15°, clay/breccia filling.	Run 83 252.4 to 256.7	100 (65)
260 (183.8)	Argillite	264.5-266.1 - Fracture zone of very closely spaced joints at 5°. Chloritization present. Core loss 0.3 feet.	Run 84 256.7 to 261.8	100 (75)
			Run 85 261.8 to 266.4	93 (80)
		265.4-267.4 - Fracture zone, very closely spaced joints at 20° and 30-40°.	Run 86 266.4 to 271.2	100 (85)
		266.5 - Joint, 25°, crosscuts bedding, well developed slickensides at 60°, tight. 273.5 - Fracture, 25°, open. 274.8-276.0 - Fracture zone, very closely spaced joints at 0-10°, 40° and 60°. Core loss 0.2 feet.	Run 87 271.2 to 276.4	92 (71)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-5a
SITE Devil Canyon (North Bank) SHEET NO. 10 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
280 (198.0)	Argillite	285.6-288.0 - Quartz stringers, irregular. 288.0-289.7 - Fracture zone, closely spaced, open to healed joints at 30°, faint slickensides. 291.0-297.6 - Shear/fracture zone, joint very closely spaced at 0° and 20-30°, slickensides well developed. 291.0-292.9 - Joint surfaces slick, highly chloritized. 296.3-297.9 - Shear, 40°. 296.2-297.6 - Fracture zone, jointed 20-40°, highly chloritized, slickensides.	Run 88 276.4 to 281.6	96 (96)
			Run 89 281.6 to 284.2	100 (88)
			Run 90 284.2 to 288.6	98 (93)
			Run 91 288.6 to 292.4	72 (31)
			Run 92 289.9- 292.4	72 (48)
			Run 93 292.4 to 296.4	86 (10)
			Run 94 296.4 to 300.0	100 (0)
			Run 95 297.9 to 302.9	100 (92)
			Run 96 302.9 to 307.2	98 (86)
			Run 97 307.2 to 312.0	100 (90)
290 (205.0)	Argillite	285.6-288.0 - Quartz stringers, irregular. 288.0-289.7 - Fracture zone, closely spaced, open to healed joints at 30°, faint slickensides. 291.0-297.6 - Shear/fracture zone, joint very closely spaced at 0° and 20-30°, slickensides well developed. 291.0-292.9 - Joint surfaces slick, highly chloritized. 296.3-297.9 - Shear, 40°. 296.2-297.6 - Fracture zone, jointed 20-40°, highly chloritized, slickensides.		
297.7 (210.5)	Graywacke	Light to medium gray, fine grained graywacke with thin interbeds of argillite. Bedding/foliation highly deformed by syndepositional processes, generally at 15°. 297.7-367.4 - Joints moderately closely spaced with zones of very closely to closely spaced. Numerous weakly healed and rebroken. Generally at 20° and 40-50°. Faint slickensides.		
300 (212.1)	Graywacke			

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CLIENT ALASKA POWER AUTHORITY
 PROJECT Susitna Hydroelectric Project
 SITE Devil Canyon (North Bank)

JOB NO. P5700.05
 HOLE NO. BH-5a
 SHEET NO. 11 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
310 (219.2)	Graywacke	317.0-317.7 - Fracture zone, very closely spaced joints parallel to bedding/foliation. 320.5 - Joint, 20°, minor shear with 1/16 inch clay/breccia, highly chloritized. 322.0-323.6 - Fracture zone, healed with quartz, joints at 50-60°. 325.8-326.4 - Joint, 15°, minor shearing healed with carbonate, parallels bedding/foliation. 333.2-333.4 - Joint, 25°, crosscuts bedding, healed with clay/breccia and carbonate. 333.3-333.8 - Shear/fracture zone, very closely spaced joints, slickensides, chloritized. 338.0 - Joint, 15°, slickensides, tight, highly chloritized. 340.6 - Joint, 20-30°, curved, minor shearing, highly chloritized.	Run 97	
			Run 98	
			312.0 to 317.3	100 (85)
			Run 99	
			317.3 to 320.3	93 (43)
			Run 100	
			320.3 to 323.9	100 (78)
			Run 101	
			323.9 to 328.3	100 (89)
			Run 102	
328.3 to 333.3	100 (92)			
330 (226.2)	Graywacke		Run 103	
			333.3 to 333.3	93 (29)
			Run 104	
330 (233.3)	Graywacke		334.7 to 338.3	100 (89)
			Run 105	
338.3 to 343.3	98 (78)			
340 (240.4)	Graywacke		Run 106	
			338.3 to 343.3	98 (78)

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CLIENT ALASKA POWER AUTHORITY
 PROJECT Susitna Hydroelectric Project
 SITE Devil Canyon (North Bank)

JOB NO. P5700.05
 HOLE NO. BH-5a
 SHEET NO. 12 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
350 (247.5)	Graywacke	342.0-348.5 - Fracture/shear zone, very closely to closely spaced fractures, partially weakly healed. Joints at 20°, 25°, 30°, and 60°. Carbonate common. Possibly shearing. 342.0-343.5 - Highly fractured zone, numerous joints at 20-30°, weakly healed. Core loss 0.6 feet. 354.3 - Fracture, 10-15°, irregular, faint slickensides, chloritized.	Run 105	
			Run 106	
			343.3 to 346.4	90 (48)
			Run 107	
			347.7 to 350.5	100 (62)
			Run 108	
			350.5 to 354.7	100 (79)
			Run 109	
			354.7 to 358.1	94 (59)
			Run 110	
360 (254.5)	Graywacke	361.2-361.5 - Joint, 20°, tight, faint slickensides, planar, chloritized.	Run 111	
			358.1 to 363.1	100 (96)
370 (261.6)	Graywacke	367.4-392.4 - Joint spacing wide to very wide. Thickly bedded at approximately 0-10°.	Run 112	
			363.1 to 368.1	100 (98)
			Run 113	
368.1 to 373.1	100 (98)			

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-5a
SITE Devil Canyon (North Bank) **SHEET NO.** 13 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
380 (268.7)	Graywacke	386.2-387.1 - Fractures, very tight, healed.	Run 114 373.1 to 378.1	100 (106)
			Run 115 378.1- 380.5	100 (91)
			Run 116 380.5- 382.5	100 (100)
			Run 117	70 (50)
			Run 118 383.5 to 388.2	100 (94)
			Run 119	100 (73)
			Run 120	100 (67)
			Run 121 391.2- 393.4	100 (82)
			Run 122 393.4 to 396.5	100 (94)
			Run 123 396.5 to 401.3	100 (100)
			Run 124	100 (87)
			390 (275.7)	Argillite
392.4 (277.4)				
400 (282.8)	Graywacke	Rock description as above. Joint spacing wide to very wide. Healed fractures at 20° and 40°, faint slickensides on chloritized	Run 125 402.8- 404.6	100 (89)
403.1 (280.2)				

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PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-5a
SITE Devil Canyon (North Bank) **SHEET NO.** 14 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
410 (289.9)	Graywacke	surfaces.	Run 126 404.6- 407.4	100 (96)
			Run 127 407.4 to 412.3	100 (92)
			Run 128 412.3 to 416.8	100 (89)
			Run 129 416.8 to 421.9	100 (94)
			Run 130	94 (56)
			Run 131 423.7 to 428.4	98 (87)
			Run 132 428.4 to 433.6	100 (90)
			Run 133 433.6 to 436.8	94 (88)
			Run 134	
			Run 135	
420 (296.9)	Argillite	Rock description as above. 425.7-456.6 - Joints moderately close to widely spaced, average 30°. Low angle set, 15°, highly chloritized.		
425.7 (301.0)	Argillite	425.7-456.6 - Joints moderately close to widely spaced, average 30°. Low angle set, 15°, highly chloritized.		
430 (304.0)				

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SITE Devil Canyon (North Bank) **SHEET NO.** 15 OF 20

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)	
440 (311.1)	Argillite	440.4-442.5 - Zone of very closely spaced joints at 30-35°, tight, chloritized. 441.5-442.5 - Shears, 20-25°, very closely spaced, highly chloritized, slickensides, carbonate/gouge/breccia coating.	Run 134	100 (81)	
			Run 135	438.4 to 442.9	97 (69)
			Run 136	442.9 to 446.9	100 (100)
450 (318.2)	Argillite	445.0 - Joint, 20°, healed, very tight, faint slickensides. 451.6-456.6 - Core barrel mismatch.	Run 137	446.9 to 452.0	98 (90)
			Run 138	452.0 to 457.0	72 (0)
460 (325.2)	Argillite	456.6-527.4 - Joint spacing generally wide to very wide with zones of very close to closely spaced. Occasional irregular, healed fractures and quartz stringers.	Run 139	457.0 to 461.9	100 (96)
			Run 140	461.9 to 466.9	100 (100)
			Run 141	466.9 to 471.9	100 (100)

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-5a
SITE Devil Canyon (North Bank) **SHEET NO.** 16 OF 20

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)	
470 (322.3)	Argillite	475.5-475.9 - Quartz vein, 5-10°, 1/2 inch wide. 476.8 - Joint, 50°, open, planar. 478.6 - Joint, 60°, part open, rough.	Run 141	466.9 to 471.9	100 (100)
			Run 142	471.9 to 476.9	100 (100)
			Run 143	476.9 to 481.9	100 (94)
480 (333.6)	Argillite		Run 144	481.9 to 486.9	100 (100)
			Run 145	486.9 to 491.9	100 (96)
490 (346.4)	Argillite		Run 146	491.9 to 497.0	100 (82)
			Run 147	497.0 to 502.0	100 (96)
500 (353.5)	Argillite				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-5a
SITE Devil Canyon (North Bank) SHEET NO. 17 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
510 (360.6)	Argillite		Run 147	
			Run 148	100 (93)
		505.2 - Joint, 20°, possible shear healed weakly with carbonate.	Run 149	
			503.4 to 508.4	100 (100)
		510.4 - Fracture, 60°, open, rough, irregular.	Run 150	
			508.4 to 513.7	100 (100)
		513.0 - Shear, 40°, highly chloritized, 1/16 inch clayey breccia, slickensides.	Run 151	
			513.7 to 518.4	96 (85)
		515.5-516.8 - Fracture, 0-20°, very irregular, highly chloritized.	Run 152	
			513.7 to 518.4	71 (29)
520 (367.6)	Argillite		Run 153	
			519.8 to 523.6	100 (84)
		522.7-527.4 - Shear/fracture zone, joints very closely spaced at 10° and 20°, generally irregular, slick, highly chloritized, well developed slickensides, carbonate. Core loss 2.4 feet.	Run 154	
			523.6 to 528.5	57 (12)
530 (374.7)	Argillite	527.4-538.1 - Fracture zone, closely to moderately closely spaced joints and fractures at 20-30° and 50°, highly chloritized with carbonate. Many are healed, rebroken by drilling.	Run 155	
			528.5 to 533.5	100 (94)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-5a
SITE Devil Canyon (North Bank) SHEET NO. 18 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)		
540 (381.8)	Argillite		Run 156			
			533.5 to 538.5	98 (90)		
		538.1-540.9 - Shear/fracture zone, healed. Joints, 0-5°, very closely spaced, weakly healed with carbonate, tight, highly chloritized.	Run 157			
			538.5- 540.7	100 (0)		
		540.9-597.7 - Joints, wide to very widely spaced, generally at 20°, healed with carbonate and rebroken by drilling, highly chloritized. Secondary set at 40-45°, moderately closely to widely spaced, tight.	Run 158			
			540.7 to 545.7	100 (46)		
		550 (388.9)	Argillite		Run 159	
					545.7 to 550.6	98 (86)
					Run 160	
			550.6 to 555.7	100 (100)		
560 (395.9)	Argillite		Run 161			
			555.7 to 560.9	100 (100)		
			Run 162			
	560.9 to 565.9	98 (88)				

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO BH-5a
SITE Devil Canyon (North Bank) SHEET NO. 19 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REG (RQD)
570 (403.0)	Argillite		Run 163 565.9 to 570.4	100 (100)
		Run 164 570.4 to 575.4	100 (92)	
		Run 165 575.4 to 580.7	100 (94)	
580 (410.1)		Run 166 580.7 to 583.7	100 (87)	
		Run 167 583.7 to 588.5	100 (94)	
590 (417.1)		Run 168 588.5 to 592.6	100 (100)	
		Run 169 592.6 to 597.9	92 (92)	

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO BH-5a
SITE Devil Canyon (North Bank) SHEET NO. 20 OF 20

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REG (RQD)
597.9 (422.7)	Argillite	END OF BORING	Run 169	92 (92)
600 (424.2)				

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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
Project Susitna Hydroelectric Project Hole No. BH-5a
Site Devil Canyon (North Bank) Sheet No. 1 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁵	10 ⁻⁴	10 ⁻²	20	40	80	20	40	80	5	10	15		
0	975													Argillite	
20		No Test Data												Fracture zone.	
40		No Test Data													
60	940														
80		No Test Data													
100	904														
120		No Test Data													
140		No Test Data													
160	869													Argillite/Graywacke	Joints, slickensides. Phyllitic sheen.
180		No Test Data													
200	834													Argillite	Fracture zone, healed.
220		No Test Data													
240		No Test Data													
260	798														
280		No Test Data												Shear/fracture zone	
300	763													Graywacke	Shear/fracture zone
320		No Test Data												Shear/fracture zone	
340		No Test Data												Shear/fracture zone	



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
Project Susitna Hydroelectric Project Hole No. BH-5a
Site Devil Canyon (North Bank) Sheet No. 2 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.			ROCK TYPE	REMARKS
		10 ⁻⁵	10 ⁻⁴	10 ⁻²	20	40	80	20	40	80	5	10	15		
360														Graywacke	
380		No Test Data													
400	692													Argillite Graywacke	
420		No Test Data													
440		No Test Data												Shear.	
460	657														
480		No Test Data													
500	621	No Test													Shear.
520		No Test Data												Shear/fracture zone	
540		No Test Data												Shear/fracture zone	
560	586														
580		No Test Data													
600	551														END OF BORING 597.9'



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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-5b
SHEET NO. 3 OF 7

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
60 (42.4)	Argillite	57.2-57.7 - Core broken by drilling, pieces 1 inch to 2 inches.	Run 19	
			52.1 to 57.0	96 (61)
			Run 20	
		58.2-58.7 - Quartz stringers, 0.5 inch to 1 inch, folded, fractured but tight.	57.0-59.4	100 (54)
			Run 21	
		59.2-59.4 - Core broken by drilling, pieces 1 inch to 2 inches.	59.4 to 62.9	91 (74)
			Run 22	
		66.5 - Joint, 40°, silt coating.	62.9 to 66.6	97 (76)
			Run 23	
			66.6 to 69.3	100 (89)
Run 24				
68.0 - Joint, 50°, trace of silt.	69.3 to 71.8	100 (96)		
	Run 25			
70 (49.5)	Argillite	69.6-69.8 - Joints very close spaced. Joint at 40° has slickensides.	71.8 to 76.2	98 (71)
			Run 27	
		71.5-72.2 - Core broken by drilling, pieces 1 inch to 2 inches, minor iron oxide staining.	76.2-77.9	100 (68)
			Run 28	
			79.3 to 83.0	95 (76)
80 (56.6)	Argillite	80.0 - Bedding/foliation at 10° to 20°.	Run 29	
			83.0-84.8	100 (50)
		82.5-83.8 - Core broken by drilling, pieces 0.5 inch to 2 inches. Joints at 20° to 60°, some have chlorite coating and slickensides.	83.0-84.8	

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-5b
SHEET NO. 4 OF 7

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)		
90 (63.6)	Argillite	84.9-86.9 - Core loss of 0.8 feet. Core broken by drilling, pieces 0.5 inch to 2 inches.	Run 30	76 (0)		
			84.8-86.9			
		88.3-90.7 - Shear/fracture zone, joints very close spaced, joints at 25° to 70°, chlorite and silt coating, some have slickensides.	Run 31	100 (67)		
			85.9-89.3			
		88.3-102.0 - Joints close to very close spaced, chlorite coating.	Run 32	100 (67)		
			89.3 to 92.3			
		92.3 to 96.1	Run 33	100 (68)		
			Run 34			
		96.1 to 99.1	99.1 to 101.6	100 (70)		
			Run 35			
		100 (70.7)	Argillite	99.1-101.6	Run 36	100 (56)
					Run 37	
		110 (77.8)	Argillite	102.0 - Bedding/foliation at 30° to 40°.	Run 38	97 (51)
101.6 to 105.1						
102.0-200.3 - Joints close to moderately close spaced, average 1 foot, trace of carbonate and chlorite coating.	Run 39			100 (83)		
	Run 40					
109.7 - Shear, 30°, 0.1 inch of breccia, slickensides, chlorite coating.	108.0 to 112.0			99 (99)		
	Run 41					
112.0 to 116.0	95 (83)					
115.5 - Bedding/foliation at 50°.	116.0 - Joint, 50°, slickensides.					

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-5b
SITE Devil Canyon (North Bank) **SHEET NO.** 5 OF 7

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)
120 (84.9)	Argillite	123.7-124.1 - Core broken by drilling, pieces 0.5 inch to 1 inch. 126.7-127.6 - Numerous quartz stringers, less than 0.5 inch wide, folded, unfractured. Comprise approximately 25% of rock. 130.0 - Bedding/foliation at 40° to 50°.	Run 42 116.0- 119.3	94 (88)
			Run 43 119.3 to 124.2	100 (90)
Run 44 124.2 to 129.3			96 (90)	
Run 45 129.3 to 134.3			100 (88)	
Run 46 134.3 to 139.3			100 (96)	
Run 47 139.3 to 143.7			100 (86)	
Run 48 143.7 to 145.2			90 (83)	
Run 49 145.2 to 149.3			95 (89)	
130 (91.9)				
140 (99.0)				

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-5b
SITE Devil Canyon (North Bank) **SHEET NO.** 6 OF 7

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (RQD)		
150 (106.1)	Argillite	154.5 - Bedding/foliation at 50°. 158.0-159.3 - Shear/fracture zone, joints very close spaced. Shears at 30° and 50°, 0.1 inch of breccia, clay, and chlorite, fractures at 40°. Core badly broken, pieces average 1 inch, many have slickensides and clay coating. Core loss of 0.5 feet. 159.3 - Quartz vein at 40°, 0.5 inch wide, unfractured, upper contact has slickensides, lower contact is tight. 162.9-163.9 - Core loss of 0.8 feet. Core broken by drilling, pieces average 1 inch. 167.1-168.0 - Core loss of 0.6 feet. Core broken by drilling, pieces 0.5 inch to 1 inch. 174.0 - Bedding/foliation at 40°. 176.6-177.3 - Shear/fracture zone, joint spacing is very close. Joint at 40° has slickensides and chlorite coating. Other joints at 30° and 50°. Core loss of 0.3 feet. 178.8 - Joint, 50°, silt/clay coating. No evidence of shearing. 180.1-181.5 - Core broken by drilling, pieces 0.1 feet to 0.2 feet.	Run 50 149.3 to 154.5	99 (96)		
			Run 51 154.5 to 159.3	100 (90)		
Run 52 159.3 to 164.3			80 (77)			
Run 53 164.3 to 169.3			94 (90)			
Run 54 169.3 to 174.1			100 (86)			
Run 55 174.1 to 179.3			100 (86)			
Run 56 179.3 to 180.1			100 (80)			
160 (113.1)						
170 (120.2)						
180 (127.3)						

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (North Bank)

JOB NO. P5700.05
HOLE NO. BH-5b
SHEET NO. 7 OF 7

DEPTH (FT)	ROCK TYPE	DESCRIPTION - COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
190 (134.4)	Argillite	187.0-188.7 - Shear/fracture zone, joints very close spaced. Joints at 20° and 50° have slickensides and chlorite coating. 188.7 - Breccia is less than 0.1 inch wide. 194.7-195.3 - Shear/fracture zone, joints very close spaced, joints at 20° have slickensides, most have a trace of silt coating. Core loss of 0.2 feet. 199.9 - Shear, 50°, slickensides, less than 0.1 inch of gouge.	Run 57	
			182.3 to 187.3	100 (94)
			Run 58	85 (62)
			187.3-189.3	
			Run 59	
			189.3 to 192.7	100 (100)
200.3 (141.6)		END OF BORING	Run 60	92 (69)
			192.7 to 195.3	
			Run 61	100 (96)
			195.3 to 200.3	

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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-5b
 Site Devil Canyon (North Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS
			20	40	60	80	20	40			
0	977								Argillite		
20											
40											
60	942									Shear/fracture.	
80		No Test Data								Shear/fracture zone	
100	906										
120											
140											
160	971									Shear/fracture.	
180										Shear/fracture.	
200	835									Shear/fracture.	
										END OF BORING 200.3'	



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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-7
 SITE Devil Canyon (South Bank) SHEET NO. 3 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (REQ)
	Argillite		Run 14	60 (0)
			Run 15	54.1 to 59.0 100 (94)
59.0 (41.7) 60 (42.4)	Quartz Diorite	Light gray, fine to medium grained dike material, very hard, sharp contacts. Joints moderately close to widely spaced at generally 10-20° and 70-80°.	Run 16	59.0 to 63.0 100 (70)
70 (49.5)			Run 17	63.0 to 67.7 100 (97)
	73.3 (51.8)	Argillite/Graywacke	Run 18	100 (73)
Run 19			100 (83)	
80 (56.6)		83.5-86.4 - Core broken by drilling. Fragments 0.25 to 2 inches with chlorite coating, possible fracture zone.	Run 20	69.6 to 74.9 100 (80)
			Run 21	74.9 to 78.9 100 (45)
			Run 22	78.9 to 83.5 85 (61)
			Run 23	100 (0)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
 PROJECT Susitna Hydroelectric Project HOLE NO. BH-7
 SITE Devil Canyon (South Bank) SHEET NO. 4 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (REQ)
90 (63.6)	Argillite/Graywacke	87.0-104.8 - Shear/fracture zone at very closely to closely spaced joints, highly chloritized breccia and gouge, faint slickensides. 87.0-91.0 - Core loss 1.3 feet. 94.4-104.8 - Joints, 70-80° paralleling bedding and 0-10°. Core loss 3.3 feet.	Run 24	84.1 to 89.1 94 (0)
			Run 25	89.1 to 94.3 81 (42)
100 (70.7)			Run 26	94.3 to 99.3 64 (0)
			Run 27	99.3 to 104.1 54 (0)
110 (77.8)		108.3-122.4 - Shear/fracture zone, very closely spaced joints. Extensive chloritization on rock fragments and joints. 109.0-110.0 - Breccia/gouge. 110.0-113.0 - Joint, 40° and 20°, very closely spaced. 112.0-115.0 - Breccia/gouge.	Run 28	104.1 to 108.7 93 (9)
			Run 29	77 (0)
			Run 30	110.0 to 115.0 56 (0)
			Run 31	24 (0)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-7
SITE Devil Canyon (South Bank) SHEET NO. 5 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
120 (84.8)	Argillite/ Graywacke	125.9-130.7 - Shear/fracture zone, very closely to closely spaced joints at 0-10°, 50°, 80-90°, healed with carbonate, chloritized gouge. 125.9-126.1 - Breccia/gouge on joints at 80-90°, possible slickensides. 126.9-127.3 - Gouge on fracture at 30°, 1/4 inch thick. Core loss 0.6 feet. 130.1 - Foliation well developed, 30-35°. Phyllitic texture locally. 133.0-133.4 - Fracture zone, very closely spaced joints at 30-50° and 0-10°. 135.4 - Joint, 60-70°, slickensides.	Run 31 115.0 119.1	24 (0)
			Run 32	6 (0)
			Run 33 120.2- 122.4	69 (0)
			Run 34 122.4 to 126.1	100 (27)
130 (91.9)	Argillite/ Graywacke	125.9-130.7 - Shear/fracture zone, very closely to closely spaced joints at 0-10°, 50°, 80-90°, healed with carbonate, chloritized gouge. 125.9-126.1 - Breccia/gouge on joints at 80-90°, possible slickensides. 126.9-127.3 - Gouge on fracture at 30°, 1/4 inch thick. Core loss 0.6 feet. 130.1 - Foliation well developed, 30-35°. Phyllitic texture locally. 133.0-133.4 - Fracture zone, very closely spaced joints at 30-50° and 0-10°. 135.4 - Joint, 60-70°, slickensides.	Run 35 126.1- 128.2	86 (0)
			Run 36	90 (0)
			Run 37 130.1 to 133.7	89 (58)
			Run 38 133.7 to 138.6	100 (99)
140 (99.0)	Argillite/ Graywacke	125.9-130.7 - Shear/fracture zone, very closely to closely spaced joints at 0-10°, 50°, 80-90°, healed with carbonate, chloritized gouge. 125.9-126.1 - Breccia/gouge on joints at 80-90°, possible slickensides. 126.9-127.3 - Gouge on fracture at 30°, 1/4 inch thick. Core loss 0.6 feet. 130.1 - Foliation well developed, 30-35°. Phyllitic texture locally. 133.0-133.4 - Fracture zone, very closely spaced joints at 30-50° and 0-10°. 135.4 - Joint, 60-70°, slickensides.	Run 39 138.6 to 142.1	100 (83)
			Run 40	100 (89)
			Run 41 Run 42	75 (0) 100(100)
			Run 43 Run 44 146.8- 149.6	100 (47) 100 (100)

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-7
SITE Devil Canyon (South Bank) SHEET NO. 6 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)
150 (106.1)	Graywacke	Light gray, fine grained metasedimentary rock, thickly bedded, disseminated sulphide minerals.	Run 45	
			149.6 to 154.5	100 (90)
			Run 46 154.5 to 159.6	100 (95)
157.2 (111.1)	Argillite/ Graywacke	Rock description as above. Foliation poorly to well developed, generally parallel to bedding. Fresh, hard. Joints closely to moderately closely spaced at 60-70°, 80°, and 0-10°. Carbonate filling common.	Run 47 159.6 to 164.4	100 (95)
			Run 48 164.4 to 169.4	100 (91)
170 (120.2)	Argillite/ Graywacke	Rock description as above. Foliation poorly to well developed, generally parallel to bedding. Fresh, hard. Joints closely to moderately closely spaced at 60-70°, 80°, and 0-10°. Carbonate filling common.	Run 49 169.4 to 174.4	100 (100)
			Run 50 174.4 to 179.5	100 (100)
			Run 51	

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-7
SITE Devil Canyon (South Bank) SHEET NO. 7 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)			
190 (134.3)	Argillite/ Graywacke	188.2-188.9 - Broken zone, low angle healed fractures rebroken by drilling.	Run 51 179.5 to 184.9	97 (93)			
			Run 52 184.9 to 188.8	100 (89)			
			Run 53 188.8 to 193.7	100 (86)			
			Run 54 193.7 to 198.9	96 (96)			
			Run 55 83 (67)				
			Run 56 200.1 to 203.7	100 (74)			
			Run 57 203.7 to 208.7	100 (88)			
			Run 58 208.7 to 213.7	100 (93)			
			200 (141.4)	Argillite/ Graywacke	208.2 - Shear, 0-10°, less than 1 inch of breccia/gouge.		
210 (148.5)	Argillite/ Graywacke						

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CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.05
PROJECT Susitna Hydroelectric Project HOLE NO. BH-7
SITE Devil Canyon (South Bank) SHEET NO. 8 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (ROD)			
220 (155.54)	Argillite/ Graywacke	226.6-227.2 - Quartz vein, 60-70°, part open contacts. 231.0-231.5 - Quartz vein, 10-15°. 233.7-237.8 } Bedding/foliation highly 245.0-248.0 } distorted and irregular. 248.8-251.2 } Numerous quartz stringers. Hard, fresh.	Run 59 213.7 to 218.9	100 (90)			
			Run 60 218.9 to 224.9	100 (90)			
			Run 61 224.9 to 229.5	98 (92)			
			Run 62 229.5 to 234.6	100 (86)			
			Run 63 234.6 to 239.6	98 (98)			
			Run 64 239.6 to 244.5	100 (100)			
			230 (162.6)	Argillite/ Graywacke			
			240 (169.7)	Argillite/ Graywacke			

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-7
SITE Devil Canyon (South Bank) **SHEET NO.** 9 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)		
250 (176.8)	Argillite/ Graywacke		Run 65 244.5 to 249.3	100 (92)		
			Run 66 249.3 to 254.3	98 (84)		
		254.1-254.3 - Fracture zone, very closely spaced joints at 0-10°, 45-50°, and 80-90°. Numerous thin contorted quartz stringers and veinlets, hard, tight.	Run 67 254.3 to 259.2	98 (86)		
			Run 68 259.2 to 264.1	100 (94)		
			Run 69 264.1 to 267.9	95 (95)		
		260 (183.8)	Argillite/ Graywacke	260.0 - Foliation well developed, 40-50°, bedding 70-80°.	Run 70	100 (75)
					Run 71 269.5 to 274.6	100 (82)
					Run 72	100 (84)
270 (190.9)	Argillite/ Graywacke					

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CLIENT ALASKA POWER AUTHORITY **JOB NO.** P5700.05
PROJECT Susitna Hydroelectric Project **HOLE NO.** BH-7
SITE Devil Canyon (South Bank) **SHEET NO.** 10 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)		
280 (198.0)	Argillite/ Graywacke		Run 72 274.6-279.6			
			Run 73 279.6 to 284.6	100 (98)		
			Run 74 284.6 to 289.6	100 (96)		
		290 (205.0)	Argillite/ Graywacke	292.1-314.4 - Quartz stringers, closely to moderately closely spaced, up to 3/8 inches thick.	Run 75 289.6 to 294.6	100 (98)
					Run 76 294.6 to 299.6	100 (100)
300 (212.1)	Argillite/ Graywacke	297.1 - Joint, 80°, chlorite, slickensides. 299.6 - Joint, 75°, faint slickensides.				
			Run 77 299.6 to 304.6	98 (62)		
			Run 78 304.6 to 309.6	100 (89)		
		301.0-332.6 - Predominantly graywacke composition, thick beds, joints closely spaced generally at 70-80° and 5-15°.				

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CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-7

SITE Devil Canyon (South Bank)

SHEET NO. 11 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
310 (219.2)	Argillite/ Graywacke		Run 79	
			309.6 to 314.6	100 (78)
			Run 80	
320 (226.2)			314.6 to 319.6	100 (96)
			Run 81	
			319.6 to 324.7	100 (92)
330 (233.3)		326.7-326.9 - Fracture zone, very closely spaced joints at 0-10°, 50-60°, and 80-90°, chloritized. 327.5-327.8 - Shear zone, 70-80°, several chloritized planes. 330.6-332.6 - Shear/fracture zone, very closely spaced joints at 0-10° and 70-80°, highly chloritized, quartz and carbonate coating. Core loss 0.4 feet.	Run 82	
			324.7 to 329.6	100 (80)
			Run 83	
			329.6 to 332.6	87 (20)
340 (240.4)			Run 84	
			332.6 to 337.7	100 (84)
			Run 85	
			337.7 to 342.1	100 (91)

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DRILLING REPORT**

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.05

PROJECT Susitna Hydroelectric Project

HOLE NO. BH-7

SITE Devil Canyon (South Bank)

SHEET NO. 12 OF 16

DEPTH (FT)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT)	REC (ROD)
350 (247.5)	Argillite/ Graywacke	343.0-344.9 - Shear/fracture zone, 80°, very closely spaced fractures with some very thin breccia clay gouge coating, highly chloritized.	Run 85	
			Run 86	
			342.1 to 347.8	91 (88)
			Run 87	
			347.8 to 352.9	100 (100)
			Run 88	
			100 (100)	
360 (254.5)		358.4-363.0 - Joint, 0-5°, slick, planar, highly chloritized, tight, offset by 3/16 inches. 358.2-372.8 - Predominantly graywacke, fine to medium grained.	Run 89	
			354.9 to 359.9	100 (83)
			Run 90	
370 (261.6)			359.9 to 364.6	100 (59)
			Run 91	
			364.6 to 369.6	100 (86)
			Run 92	
			369.6 to 374.6	100 (100)

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (South Bank)

JOB NO. P5700.05
HOLE NO. BH-7
SHEET NO. 13 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)	
374.6 (264.8)	Argillite/ Graywacke				
	Graywacke	Light to medium brownish gray metasedimentary rock with subrounded to elongate quartz grains. Bonded locally with dark gray argillaceous beds. Hard to very hard. Foliation poorly developed except in argillaceous layers, generally at 50°. Bedding, 70-85°, average 80°. Minor thin irregular quartz stringers. Joints moderately closely to widely spaced 0-10° and 70-80°.	Run 93 374.6 to 379.6	100 (98)	
380 (268.7)			Run 94 379.6 to 384.6	100 (100)	
			Run 95	100 (62)	
			Run 96 385.9 to 390.5	100 (82)	
390 (275.7)			Run 97 390.5 to 393.8	100 (76)	
			Run 98 393.8 to 398.8	100 (94)	
400 (282.8)			Run 99 398.8 to 403.8	94 (86)	
			Run 100		
			404.0-407.7 - Foliation weakly developed at 50-60°.		

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (South Bank)

JOB NO. P5700.05
HOLE NO. BH-7
SHEET NO. 14 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)
	Graywacke		Run 100 403.8 to 409.2	98 (98)
410 (289.9)			Run 101 409.2 to 414.5	98 (91)
		414.0-414.5 - Fracture zone, very closely spaced joints and fractures at 10° and 20°.		
		418.2-420.8 - Argillaceous zone with weakly developed foliation at 50°.	Run 102 414.5 to 419.6	100 (92)
420 (296.9)			Run 103 419.6 to 424.7	100 (88)
		427.0 - Shear, 1.8 inch wide, tight, chloritized, sulphides.		
		427.5-427.6 } Quartz veins. 428.6-428.8 }	Run 104 424.7 to 429.6	100 (76)
		429.6-432.8 - Argillaceous zone with bedding at 60-65°, phyllitic locally, closely spaced joints.		
430 (304.0)		433.4-446.6 - Quartz intrusions 70% of core. Highly irregular contorted quartz stringers, pods and veinlets destroying original structure of rock. Zones range from 1 inch to 8 inches thick.	Run 105 429.6 to 434.6	100 (98)
			Run 106 434.6- 437.7	100 (57)

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (South Bank)

JOB NO. P5700.05
HOLE NO. BH-7
SHEET NO. 15 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)	
440 (311.1)	Graywacke		Run 107		
			437.7 to 444.7	100 (88)	
450 (318.2)		450.6-456.7 - Argillaceous zone, hard, brittle, weakly developed foliation at 40-45°. Joints generally 50° and 70-80°.	Run 108		
			444.7 to 449.7	100 (90)	
460 (325.2)		457.9-460.7 - Quartz vein, massive, hard, sulphide mineralization.	Run 109		
			449.7 to 454.8	100 (98)	
		461.7-462.7 - Core loss 0.4 feet.	Run 110		
			454.8 to 459.7	100 (73)	
		463.0 - Shear zone, 65°, 1/4 inch wide breccia/gouge, healed with carbonate, chloritized, intact but friable, slickensides.	Run 111		
			459.7-461.7	80 (45)	
			Run 112		
				60 (0)	
			Run 113		
				462.7 to 467.6	100 (98)
			Run 114		

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CLIENT ALASKA POWER AUTHORITY
PROJECT Susitna Hydroelectric Project
SITE Devil Canyon (South Bank)

JOB NO. P5700.05
HOLE NO. BH-7
SHEET NO. 16 OF 16

DEPTH (FT.)	ROCK TYPE	DESCRIPTION: COLOR, TEXTURE, FOLIATION, JOINTING, FRACTURING, FAULTING, ALTERATION, WATER LOSS OR GAIN, CAVING, LOST CORE, CEMENTING, ETC.	LENGTH OF RUN (FT.)	REC (RQD)	
470 (332.3)	Graywacke		Run 114		
			467.6 to 472.6	100 (84)	
480 (339.4)		479.5-480.9 - Shear/fracture zone, 15-20°, very closely spaced joints and fractures, some breccia/gouge, chloritized, some carbonate.	Run 115		
			472.6 to 477.8	100 (100)	
490 (346.4)		488.7-490.5 - Foliation highly contorted and folded quartz stringers.	Run 116		
			477.8 to 480.3	100 (64)	
			Run 117		
				480.3 to 485.6	100 (90)
			Run 118		
				485.6 to 489.7	100 (71)
498.3 (352.3)			Run 119		
				489.7 to 494.7	100 (96)
500 (353.5)			Run 120		
				494.7 to 498.3	100 (100)
END OF BORING					

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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-7
 Site Devil Canyon (South Bank) Sheet No. 1 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	ROD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1351					Overburden	TOP OF ROCK 11.0'
20						Argillite/ Graywacke	Fracture zone.
40							
60	1316					Argillite	
80						Quartz Diorite	
100	1280					Argillite/ Graywacke	Shear/fracture zone
120							Shear/fracture zone
140							Shear/fracture zone
160	1245						
180							
200	1210						Shear.
220							
240							Quartz stringers.
260	1174						
280							
300	1139						Quartz stringers.
320							Shear/fracture zone
340							Shear/fracture zone



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. BH-7
 Site Devil Canyon (South Bank) Sheet No. 2 of 2

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	ROD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
360						Argillite/ Graywacke	
380						Graywacke	
400	1068						
420							Shear.
440							Quartz veins.
460	1033						Shear.
480							Shear/fracture zone
500	998						END OF BORING 498.3'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-1
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1420					Argillite	Zone permeated by quartz stringers. Fracture zone. Fracture zone. Fractures, open. Quartz vein. Fracture zone. Fracture zone.
20							
40							
60	1385						
80							
100	1349						
120							END OF BORING 118.2'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-5
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1374					Overburden	
20							
40							
60	1324					Graywacke	TOP OF ROCK 55.5'
80							Fracture zone.
100	1274						END OF BORING 86.2'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-6
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %			ROD % 20 40 60 80	NUMBER OF JOINTS PER IOFT. 5 10 15 20	ROCK TYPE	REMARKS
			20	40	60				
0	1370							Overburden	
20									
40									
60	1320								
80									TOP OF ROCK 87.5'
100	1270	No Test Data						Graywacke	Faint slickensides.
120	1250								END OF BORING 107.3'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-7
 Site Devil Canyon Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %			ROD % 20 40 60 80	NUMBER OF JOINTS PER IOFT. 5 10 15 20	ROCK TYPE	REMARKS
			20	40	60				
0	1376							Overburden	
20									
40									TOP OF ROCK 33.9'
60	1326							Argillite	Missing Core
									END OF BORING 59.5'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-8
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1448					Graywacke	
20						Argillite	Breccia zone, healed.
40	1423						
60							
80						Graywacke	Fracture zone.
100	1398						Numerous quartz stringers and blebs.
120							
140	1373						Fracture zone.
160							END OF BORING 150.5'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-9
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	1424					Graywacke	
20							Fracture zone.
40	1389						Fracture zone.
60							
80							Fracture zone.
100	1318						END OF BORING 87.0'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-10
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS				
0	1425	No Test Data				Graywacke					
20											
40											
60	1386										
80											
100	1346										
120	1315										
140											
							Fracture zone.				
							END OF BORING 122.7'				



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-11
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS			
0	894					Argillite				
20										
40	867									
							END OF BORING 31.2'			
							Note: Borehole daylighted.			



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-11A
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	ROD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	894					Argillite	
20							
40	866						END OF BORING 29.8'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-11B
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	ROD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	894					Argillite	Fracture zone.
20							
40	863						END OF BORING 33.9'

Note: Borehole
daylighted
in the river.



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
Project Susitna Hydroelectric Project Hole No. USBR DH-11C
Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	893					Argillite	
20							
40							
60	851	No Test Data	Core Missing				
80							
100	809						Sandy interbeds.
120						Graywacke	Fracture zone.
140							Fracture zone.
160	767						END OF BORING 151.1'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
Project Susitna Hydroelectric Project Hole No. USBR DH-12
Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	896					Argillite	
20							Graywacke
40							
60	861	Insufficient Data	Core Missing				
80							
100	825					Graywacke	
120							
140	797						END OF BORING 127.5'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-12A
 Site Devil Canyon (South Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	896					Argillite	Numerous thin quartz veins.
20							
40	861					Graywacke	
60						Argillite	
80							
100	825						
120							
140							Core Missing
160	783						END OF BORING 149.7'

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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-13
 Site Devil Canyon (North Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY % 20 40 60 80	RQD % 20 40 60 80	NUMBER OF JOINTS PER 10 FT. 5 10 15 20	ROCK TYPE	REMARKS
0	912					Graywacke	
20						Argillite	
40						Graywacke	
60	877						Core Missing
80							Negligible Flow
100	841						No Test Data.
120							
140	813						Breccia, healed. Breccia, healed.
							END OF BORING 137.0'



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-13A
 Site Devil Canyon (North Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS
			20	40	60			
0	912						Graywacke	
20		No Test Data					Argillite	
40							Graywacke	
60	882							
80	864						Dike, felsic, minor shearing at contact. END OF BORING 80.7'	



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SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-14
 Site Devil Canyon (North Bank) Sheet No. 1 of 1

DEPTH (FT.)	E.EV. (FT.)	PERMEABILITY (K) cm/sec. 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	CORE RECOVERY %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS
			20	40	60			
0	903						Argillite	
20								
40		No Flow						
60	868						END OF BORING 50.0'	
							Note: Borehole daylighted in the river.	



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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. USBR DH-14A
Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40				60
0	903											Argillite	Fracture zone.	
20														
40														
	863												Core Missing	
60														
80													Fracture zone, quartz healed.	
100	823												Interbeds of graywacke.	
120													Core Missing	
140	921												END OF BORING 130.4'	



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SUMMARY LOG

Client ALASKA POWER AUTHORITY
Project Susitna Hydroelectric Project
Site Devil Canyon (North Bank)

Job No. P5700.05
Hole No. USBR DH-14B
Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS	
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	60	80	20	40				60
0	902											Argillite		
20													Fracture zone.	
40														
	859												Joint, silt coating	
60														
80														
100	815												Joint, slickensides	
120												Graywacke	Fracture zone.	
140														
160	772												END OF BORING 146.2'	



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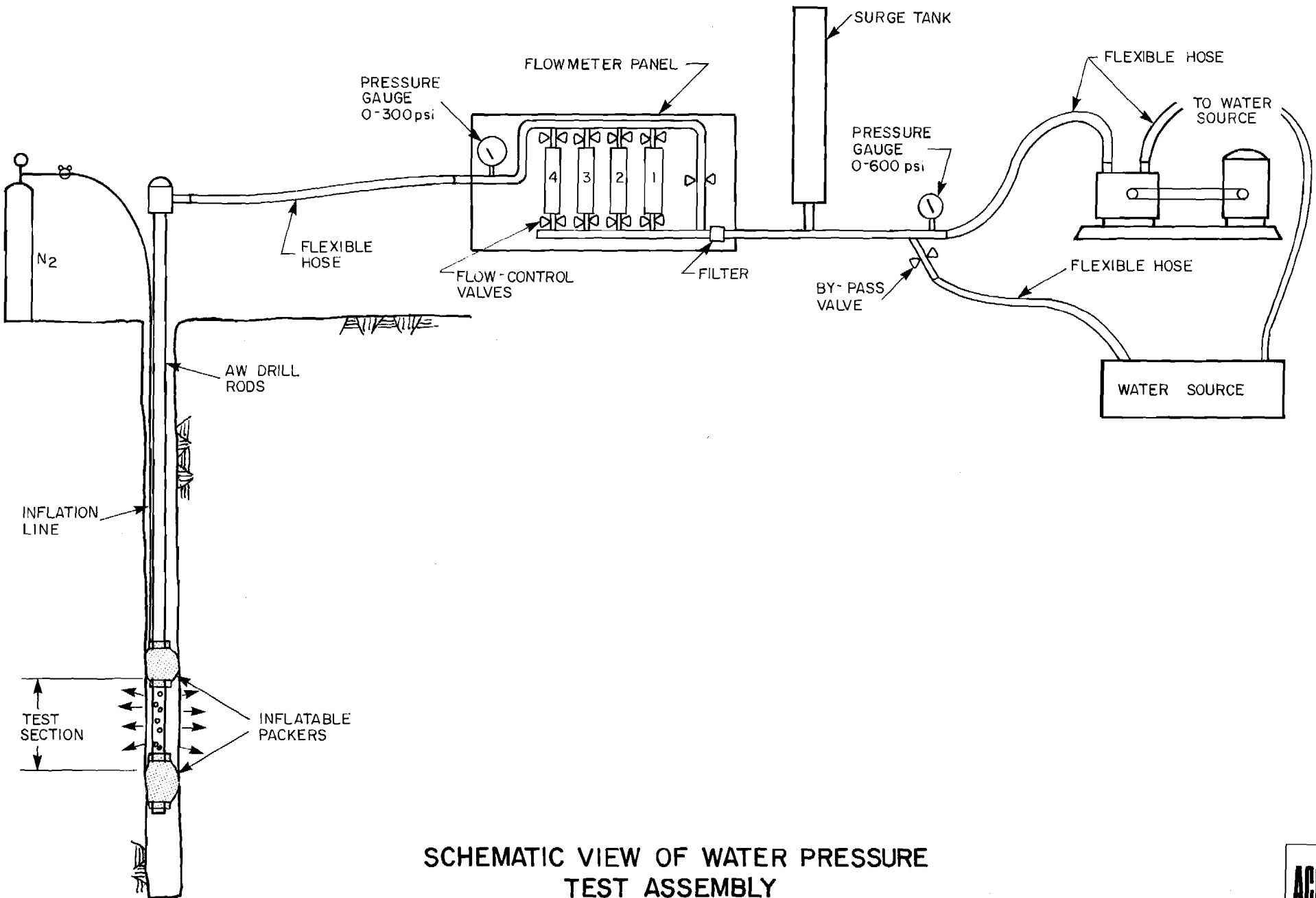
SUMMARY LOG

Client ALASKA POWER AUTHORITY Job No. P5700.05
 Project Susitna Hydroelectric Project Hole No. USBR DH-14C
 Site Devil Canyon (North Bank) Sheet No. 1 of 1

DEPTH (FT.)	ELEV. (FT.)	PERMEABILITY (K) cm/sec.			CORE RECOVERY %			ROD %			NUMBER OF JOINTS PER 10 FT.	ROCK TYPE	REMARKS
		10 ⁻⁶	10 ⁻⁴	10 ⁻²	20	40	80	20	40	80			
0	903											Graywacke	
20													Fracture zone.
40													
60	862												
80													
100	821												END OF BORING 82.2'



APPENDIX D
WATANA WATER PRESSURE TESTING DETAILS



**SCHEMATIC VIEW OF WATER PRESSURE
TEST ASSEMBLY**

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-1
 Location Watana
 Ground Surface Elevation 2049.7 ft.
 Static Water Level 1993.3 ft
 Dip of Hole 70⁰
 Stickup 7.1 ft.

Depth Tested		Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
From (feet)	To (feet)				
22.6	32.6	13	5	0.22	1.65×10^{-5}
30.0	40.0	18-20	6	0.10	5.65×10^{-6}
40.0	50.0	30-31	8	0.12	4.75×10^{-6}
50.0	60.0	28	3	0.0	0.0
60.0	70.0	35-36	9	0.45	1.36×10^{-5}
70.0	80.0	39	2	1.05	3.01×10^{-5}
80.0	91.1	45-46	8	5.4	1.41×10^{-4}
90.0	101.1	48-50	6	9.03	2.25×10^{-4}
100.0	111.1	53	6	>10	$>2.36 \times 10^{-4}$
110.0	121.1	60-63	8	0.48	1.02×10^{-5}
120.0	131.1	62-64	6	0.43	9.06×10^{-6}
130.0	141.1	69-73	8	0.90	1.74×10^{-5}
140.0	151.1	72	8	1.5	2.87×10^{-5}
150.0	161.1	76	6	>10	$>1.84 \times 10^{-4}$
160.0	171.1	81	6	>10	$>1.75 \times 10^{-4}$
171.1	200.0	No Test			
* 200.0	211.0	98-99	4	6.0	9.08×10^{-5}
210.0	221.0	105	10	7.1	1.02×10^{-4}
220.0	231.0	109-114	5	3.80	5.21×10^{-5}
230.0	241.0	112-115	6	1.41	1.90×10^{-5}
235.0	246.0	118-119	6	1.30	1.69×10^{-5}
250.0	261.0	120-122	6	1.35	1.73×10^{-5}
260.0	271.0	No Test			
270.0	281.0	133-138	10	2.0	2.34×10^{-5}

* Packers did not completely seal.

BH-1 (continued)

<u>Depth Tested</u>		<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>				
279.0	290.0	140-142	6	1.25	1.42×10^{-5}
180.0	300.0	90	8	3.0	6.84×10^{-6}
200.0	300.0	100	8	2.3	5.64×10^{-6}
220.0	300.0	110	8	2.15	5.91×10^{-6}
240.0	300.0	120	8	2.3	7.63×10^{-6}
260.0	300.0	130	8	2.2	9.43×10^{-6}
280.0	300.0	138	8	2.3	1.65×10^{-5}

NOTE: Section 180 ft to 300 ft depth, tests performed using single packer only.

SUMMARY OF WATER PRESSURE

TEST RESULTS

Borehole Number BH-2

Location Watana

Ground Surface Elevation 1838.8 feet

Static Water Level 1768.8 feet

Dip of Hole 55°

Stickup 0 feet

<u>Depth Tested</u>		<u>Gauge</u>	<u>Duration</u>	<u>Flow</u>	<u>Coefficient of</u>
<u>From</u>	<u>To</u>	<u>Pressure</u>	<u>of Test</u>	<u>Rate</u>	<u>Permeability</u>
<u>(feet)</u>	<u>(feet)</u>	<u>(psi)</u>	<u>(minutes)</u>	<u>(gpm)</u>	<u>(cm/sec)</u>
23.9	40	20	20	.32	1.44×10^{-5}
38.9	55	26	10	.18	5.96×10^{-6}
53.9	70	30	20	.42 to 2.5	1.14×10^{-5} to 6.8×10^{-5}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-3
 Location Watana
 Ground Surface Elevation 2150.7 ft.
 Static Water Level 2150.7 ft.
 Dip of Hole 55°
 Stickup 4.6 ft.

Depth Tested		Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
From (feet)	To (feet)				
34	45	19-20	8	0.07	6.21×10^{-6}
40	51	23	5	0.17	1.30×10^{-5}
50	61	27	4	0.20	1.32×10^{-5}
60	71	31	4	0.02	1.16×10^{-6}
70	81	35	5	3.10	1.60×10^{-4}
* 80	91	39	2	2.90	1.35×10^{-4}
90	101	43	5	0.06	2.54×10^{-6}
100	111	47-49	5	0.08	3.05×10^{-6}
*110	121	No Test			
120	131	54	10	0.32	1.09×10^{-5}
130	141	58	9	0.29	9.23×10^{-6}
140	151	64	9	0.03	9.53×10^{-7}
150	161	67	11	0.05	1.38×10^{-6}
160	171	72	11	0.03	8.00×10^{-7}
170	181	76	10	0.08	1.92×10^{-6}
180	191	80	16	0.07	1.63×10^{-6}
190	201	84	12	0.04	8.87×10^{-7}
200	211	88	12	0.04	8.65×10^{-7}
210	221	92	10	0.06	1.21×10^{-6}
220	231	96	8	0.06	1.16×10^{-6}
230	241	100	8	0.20	3.74×10^{-6}
240	251	104	10	0.48	8.63×10^{-6}
250	261	108	10	0.17	2.95×10^{-6}

*Packers did not completely seal.

BH-3 (continued)

<u>Depth Tested</u>		<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>				
260	271	112	8	0.16	2.66×10^{-6}
270	281	117	12	0.25	4.01×10^{-6}
280	291	121	8	0.15	2.33×10^{-6}
290	301	125	8	0.17	2.54×10^{-6}
300	311	129	8	0.12	1.75×10^{-6}
310	321	133	6	0.16	2.26×10^{-6}
320	331	137	6	0.22	3.02×10^{-6}
330	341	141	6	0.22	2.93×10^{-6}
340	351	145	6	0.36	4.67×10^{-6}
350	361	149	6	0.46	5.81×10^{-6}
360	371	153	6	0.70	8.61×10^{-6}
370	381	158	8	0.82	9.78×10^{-6}
380	391	162	5	0.40	4.65×10^{-6}
390	401	166	5	0.47	5.34×10^{-6}
400	411	170	5	0.98	1.09×10^{-5}
410	421	150	4	1.02	1.28×10^{-5}
420	431	178	5	2.8	2.97×10^{-5}
430	441	162	5	1.0	1.16×10^{-5}
440	451	187	12	2.2	2.22×10^{-5}
450	461	193	12	1.8	1.76×10^{-5}
460	471	195	6	2.2	2.13×10^{-5}
471	520	No Test			
520	531	215	8	0.59	5.19×10^{-6}
*530	541	190-200	6	3.22	3.12×10^{-5}
*540	551	100	8	0.95	1.78×10^{-5}
*550	561	180	10	0.59	6.18×10^{-6}
560	571	235	8	0.41	3.29×10^{-6}
570	581	240	8	0.22	1.73×10^{-6}
580	591	200-210	10	6.07	5.59×10^{-5}
*590	601	200	10	6.87	6.49×10^{-5}
600	611	224	10	0.09	7.60×10^{-5}
610	620	200	10	0.41	3.87×10^{-6}

*Packers did not completely seal.

BH-3 (continued)

Depth From (feet)	Depth Tested To (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
620	631	220	10	0.15	1.29×10^{-6}
*630	641	210	6	1.53	1.38×10^{-5}
640	651	240-250	8	5.05	3.90×10^{-5}
*650	661	220-235	8	3.63	3.02×10^{-5}
660	671	200-245	10	0.47	3.90×10^{-6}
670	681	200	10	0.61	5.76×10^{-6}
680	691	200	12	0.94	8.88×10^{-6}
690	701	220	10	0.23	1.98×10^{-6}
700	711	225	8	0.24	2.02×10^{-6}
710	721	225	8	0.24	2.02×10^{-6}
720	731	230	8	0.23	1.89×10^{-6}
730	741	235	8	0.24	1.93×10^{-6}
740	751	240	6	0.25	1.97×10^{-6}
750	761	240	8	0.25	1.97×10^{-6}
760	771	245	6	0.24	1.85×10^{-6}
770	781	250	8	2.35	1.78×10^{-5}
780	781	250	6	2.50	1.89×10^{-5}
790	801	250	8	2.23	1.69×10^{-5}
800	811	250	6	1.42	1.07×10^{-5}
810	821	250	8	1.60	1.21×10^{-5}
820	831	240	6	4.17	3.29×10^{-5}
830	841	245	8	1.29	9.96×10^{-6}
840	851	250	8	0.61	4.62×10^{-6}
850	861	160-165	8	0.57	6.63×10^{-6}
860	871	160	8	0.89	1.05×10^{-5}
870	881	210	10	0.98	8.82×10^{-6}
880	891	235-245	8	2.80	2.21×10^{-5}
890	955	235-240	8	2.45	4.61×10^{-6}
900	955	240-245	8	2.45	5.31×10^{-6}
911	955	240-250	8	2.00	5.05×10^{-6}
922	955	240-250	8	2.03	6.51×10^{-6}
933	955	240-250	10	2.11	9.41×10^{-6}
944	955	235-250	8	2.30	1.85×10^{-5}

*Packers did not completely seal

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-4
 Location Watana
 Ground Surface Elevation 2187.8 ft.
 Static Water Level 1687.8'
 Dip of Hole 58°
 Stick-up 0.0 ft.

<u>Depth Tested</u>		<u>Gauge Pressure</u>	<u>Duration of Test</u>	<u>Flow Rate</u>	<u>Coefficient of Permeability</u>
<u>From (feet)</u>	<u>To (feet)</u>	<u>(psi)</u>	<u>(min)</u>	<u>(gpm)</u>	<u>(cm/sec)</u>
40	51	22	8	0.06	2.96×10^{-6}
50	61	26	6	0.9	3.60×10^{-5}
60	71	30-40	10	0.02	6.73×10^{-7}
70	81	35	6	0.09	3.03×10^{-6}
80	91	40	6	0.11	3.40×10^{-6}
90	101	43	5	0.06	1.77×10^{-6}
100	111	47	5	0.10	2.78×10^{-6}
110	121	52	6	0.10	2.59×10^{-6}
120	131	56	6	0.05	1.23×10^{-6}
130	141	60	5	0.23	5.37×10^{-6}
140	151	64	5	0.10	2.23×10^{-6}
150	161	69	5	0.05	1.05×10^{-6}
160	171	73	5	0.05	1.01×10^{-6}
170	181	77	5	0.06	1.16×10^{-6}
180	191	81	5	0.15	2.79×10^{-6}
190	201	86	5	0.16	2.83×10^{-6}
200	211	90	5	0.55	9.40×10^{-6}
210	221	94	5	0.65	1.07×10^{-5}
220	231	98	7	0.86	1.37×10^{-5}
230	241	102	5	4.5	6.94×10^{-5}
*240	to 260	No Test			
260	271	115	7	1.3	1.81×10^{-5}
270	281	119	5	1.7	2.31×10^{-5}
280	291	124	8	0.97	1.27×10^{-5}

*Packers did not completely seal

BH-4 (continued)

<u>Depth Tested</u>		<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>				
290	301	128	6	1.6	2.04×10^{-5}
300	311	132	6	1.8	2.23×10^{-5}
310	321	136	6	1.2	1.45×10^{-5}
320	331	140	8	0.21	2.48×10^{-6}
330	341	145	6	0.80	9.16×10^{-6}
340	351	150	6	0.92	1.02×10^{-5}
350	361	153	6	0.14	1.53×10^{-6}
360	371	158	6	0.08	8.49×10^{-7}
370	381	162	6	0.83	8.62×10^{-6}
380	391	165	6	0.68	6.95×10^{-6}
390	401	170	6	0.77	7.66×10^{-6}
400	411	175	6	0.32	3.10×10^{-6}
410	421	179	6	0.24	2.28×10^{-6}
420	431	183	7	0.18	1.68×10^{-6}
430	441	188	9	0.19	1.73×10^{-6}
440	451	192	6	0.18	1.61×10^{-6}
450	461	196	6	0.17	1.49×10^{-6}
460	471	200	6	0.21	1.81×10^{-6}
470	481	204	6	0.48	4.06×10^{-6}
480	491	209	6	1.1	9.10×10^{-6}
490	501	213	6	0.81	6.58×10^{-6}
500	511	217	4	0.70	5.59×10^{-6}
510	521	220	7	0.90	7.10×10^{-6}
520	531	225	6	1.0	7.73×10^{-6}
530	541	230	6	0.52	3.94×10^{-6}
540	551	234	6	0.83	6.19×10^{-6}
550	561	240	6	2.1	1.53×10^{-5}
560	571	245	6	0.80	5.72×10^{-6}
570	581	250	6	0.92	6.47×10^{-6}
580	591	250	6	0.55	3.87×10^{-6}
590	601	250	6	0.70	4.92×10^{-6}
600	611	250	6	0.75	5.27×10^{-6}

BH-4 (continued)

<u>Depth Tested</u>		<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>				
610	621	250	6	0.90	6.32×10^{-6}
620	631	250	6	0.73	5.13×10^{-6}
630	641	250	6	0.97	6.82×10^{-6}
640	651	250	6	1.1	7.73×10^{-6}
650	661	250	5	0.84	5.90×10^{-6}
660	671	250	5	1.4	9.86×10^{-6}
670	681	250	6	2.9	2.04×10^{-5}
680	691	250	6	1.4	9.84×10^{-6}
690	701	250	6	0.97	6.82×10^{-6}
700	711	250	6	0.83	5.83×10^{-6}
710	720	250	6	1.0	7.03×10^{-6}
720	731	250	6	0.95	6.68×10^{-6}
730	741	250	6	0.73	5.13×10^{-6}
740	751	250	5	0.80	6.62×10^{-6}
750	761	250	5	1.5	1.05×10^{-5}
760	771	250	5	0.90	6.32×10^{-6}
770	781	250	5	0.92	6.47×10^{-6}
780	791	250	5	0.92	6.47×10^{-6}
790	801	250	5	1.1	7.73×10^{-6}
800	811	250	5	0.82	5.76×10^{-6}
810	821	250	5	0.84	5.90×10^{-6}
820	831	250	5	0.70	4.92×10^{-6}
*830	841	250	5	3.8	2.67×10^{-5}
*840	851	250	5	2.6	1.83×10^{-5}
850	861	250	6	1.1	7.73×10^{-6}
860	871	250	5	1.1	7.73×10^{-6}
870	881	250	5	1.5	1.05×10^{-5}
880	891	250	5	1.5	1.05×10^{-5}
890	901	250	5	1.0	7.03×10^{-6}
900	911	250	5	1.0	7.03×10^{-6}
910	921	250	5	1.0	7.03×10^{-6}
920	931	250	5	0.92	6.47×10^{-6}
*930	941	250	5	2.4	1.69×10^{-5}
940	951	250	6	1.0	7.03×10^{-6}

*Packers did not completely seal

SUMMARY OF WATER PRESSURE

TEST RESULTS

Borehole Number BH-6

Location Watana

Ground Surface Elevation 1608.8 ft

Static Water Level 1461.8 ft.

Dip of Hole 60°

Stickup 2.5 - 5.5 ft.

<u>Depth Tested</u>		<u>Stick-up</u> <u>(feet)</u>	<u>Gauge</u> <u>Pressure</u> <u>(psi)</u>	<u>Duration</u> <u>of Test</u> <u>(min)</u>	<u>Average</u> <u>Flow Rate</u> <u>(gpm)</u>	<u>Coefficient of</u> <u>Permeability</u> <u>(cm/sec)</u>
<u>From</u> <u>(feet)</u>	<u>To</u> <u>(feet)</u>					
33.9	50	2.5	16 to 18	10	11	4.59×10^{-4}
48.9	65	5.5	22 to 24	10	10.8	3.27×10^{-4}
63.9	80	2.5	28 to 30	10	6.4 to 8.0	1.5×10^{-4} to 1.98×10^{-4}
78.9	95	5.5	35 to 36	10	2.4	4.81×10^{-5}
43.9	110	2.5	41 to 44	10	2.2	3.80×10^{-5}
108.9	125	5.5	48 to 50	10	2.9	4.30×10^{-5}
123.9	140	2.5	54 to 58	10	4.4	5.84×10^{-5}
138.9	155	5.5	61 to 62	10	3.7	4.40×10^{-5}
153.9	170	2.5	66 to 68	10	4.3	4.72×10^{-5}
168.9	185	5.5	76 to 78	10	4.0	3.95×10^{-5}
183.9	200	2.5	82 to 88	10	1.3	1.23×10^{-5}
198.9	215	5.5	92 to 98	15	1.7	1.49×10^{-5}
213.9	230	2.5	98 to 104	10	1.4	1.19×10^{-5}
228.9	245	5.5	108	15	1.75	1.42×10^{-5}
243.9	260	2.5	114	25	1.0	7.91×10^{-6}
258.9	275	5.5	125	25	1.2	8.88×10^{-6}
273.9	290	2.5	125	45	1.2	8.94×10^{-6}
288.9	305	5.5	130	145	.51	3.90×10^{-6}
303.9	320	2.5	140	25	4.9	3.38×10^{-5}
318.9	335	5.5	140	10	6.2	4.25×10^{-5}

BH - 6 (continued)

<u>Depth Tested</u>		<u>Stick-up</u> <u>(feet)</u>	<u>Gauge</u> <u>Pressure</u> <u>(psi)</u>	<u>Duration</u> <u>of Test</u> <u>(min)</u>	<u>Average</u> <u>Flow Rate</u> <u>(gpm)</u>	<u>Coefficient of</u> <u>Permeability</u> <u>(cm/sec)</u>
<u>From</u> <u>(feet)</u>	<u>To</u> <u>(feet)</u>					
333.9	350	2.5	200	10	10 to 30	5.34×10^{-5} to 1.60×10^{-5}
348.9	365	5.5	200	50	.31 to 14.7	1.65×10^{-6} to 7.81×10^{-5}
363.9	380	2.5	204	10	15 to 30	7.89×10^{-5} to 1.58×10^{-4}
378.9	395	5.5	202	10	15 to 30	7.91×10^{-5} to 1.58×10^{-4}
393.9	410	2.5	204	10	6.6	3.47×10^{-5}
408.9	425	5.5	202	10	3.75	1.98×10^{-5}
423.9	440	2.5	202	10	5.7	3.02×10^{-5}
438.9	455	5.5	200	15	11 to 30	5.85×10^{-5} to 1.59×10^{-4}
453.9	470	2.5	200	10	11 to 30	5.88×10^{-5} to 1.60×10^{-4}
468.9	485	5.5	202	15	11 to 30	5.80×10^{-5} to 1.58×10^{-4}
483.9	500	2.5	200	10	11 to 30	5.88×10^{-5} to 1.60×10^{-4}
498.9	515	5.5	202	15	7.8	4.12×10^{-5}
513.9	530	2.5	204	15	7.5	3.95×10^{-5}
528.9	545	5.5	195	15	5.2	2.82×10^{-5}
243.9	560	2.5	205	10	3.8	1.99×10^{-5}
558.9	575	5.5	200	15	1.45	7.71×10^{-6}
573.9	590	2.5	195	10	5.2	2.83×10^{-5}
588.9	605	5.5	200	15	8.6	4.57×10^{-5}
603.9	520	2.5	205	10	2.95	1.55×10^{-5}
618.9	635	5.5	203	10	3.35	1.76×10^{-5}
633.9	650	2.5	198	20	.55	2.96×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-8
 Location Watana
 Ground Surface Elevation 1979.7 ft.
 Static Water Level 1804.7
 Dip of Hole 60°
 Stickup 1.2 to 6.2 ft.

Depth Tested From (feet)	To (feet)	Stick-up (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
31.9	48	1.2	20	13	4.55	1.81×10^{-4}
46.9	63	6.2	25	20	2.1	6.15×10^{-5}
61.9	78	1.2	31	5	.34	8.33×10^{-6}
76.9	93	6.2	38	10	4.0	7.80×10^{-5}
91.9	108	1.2	45	15	6.2	1.06×10^{-4}
106.9	123	6.2	51	20	3.2	4.67×10^{-5}
121.9	138	1.2	57	10	0.8	1.06×10^{-5}
136.9	153	6.2	64	5	3.2	3.74×10^{-5}
151.9	168	1.2	70	9	6.6	7.15×10^{-5}
166.9	183	6.2	77	10	3.0	2.92×10^{-5}
181.9	198	1.2	84	10	0.38	3.45×10^{-6}
196.9	213	6.2	90	10	1.2	1.01×10^{-5}
211.9	228	1.2	97	8	2.15	1.75×10^{-5}
226.9	243	6.2	104	8	3.7	2.87×10^{-5}
241.9	258	1.2	110	6	10.3	7.82×10^{-5}
256.9	273	6.2	116	5	7.5	5.45×10^{-5}
271.9	288	1.2	50	6	7.0	7.84×10^{-5}
286.9	305	6.2	50	7	3.85	4.24×10^{-5}
301.9	318	1.2	50	6	2.95	3.30×10^{-5}
316.9	333	6.2	142	5	7.8	5.00×10^{-5}
331.9	348	1.2	149	5	7.3	4.58×10^{-5}

BH-8 (Continued)

<u>Depth Tested</u>		<u>Stick-up (feet)</u>	<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>					
346.1	363	6.2	155	6	2.45	1.48×10^{-5}
361.9	378	1.2	162	5	2.75	1.63×10^{-5}
376.9	393	6.2	150	35	12.7	7.86×10^{-5}
391.9	428	1.2	110	40	10.9	8.27×10^{-5}
406.9	423	6.2	50	5	1.7	1.87×10^{-5}
421.9	438	1.2	188	6	.4	2.14×10^{-6}
436.9	453	6.2	195	5	2.4	1.24×10^{-6}
451.9	468	1.2	200	8	.36	1.84×10^{-6}
466.9	483	6.2	200	6	.54	2.74×10^{-6}
481.9	498	1.2	200	7	.54	2.76×10^{-6}
496.9	513	6.2	200	7	.60	3.05×10^{-6}
511.9	528	1.2	200	5	.55	2.81×10^{-6}
526.9	543	6.2	200	5	.96	4.87×10^{-6}
541.9	558	1.2	200	6	.85	4.35×10^{-6}
556.9	573	6.2	200	6	2.76	3.86×10^{-6}
571.9	588	1.2	200	7	2.05	1.05×10^{-5}
586.9	603	6.2	200	6	.85	4.32×10^{-6}
601.9	618	1.2	200	7	2.8	1.43×10^{-5}
616.9	633	6.2	200	6	.75	3.81×10^{-6}
631.9	648	1.2	200	6	.82	4.20×10^{-6}
646.9	663	6.2	225	8	1.60	7.46×10^{-6}
661.9	708	1.2	200	6	.80	4.09×10^{-6}
676.9	723	6.2	200	7	1.1	5.59×10^{-6}
691.9	738	1.2	200	6	1.08	5.53×10^{-6}
706.9		6.2	200	6	1.2	6.09×10^{-6}
721.9		1.2	200	12	1.0	5.12×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-12
 Location Watana
 Ground Surface Elevation 1975.7 ft.
 Static Water Level 1975.7 ft.
 Dip of Hole 36°
 Stickup 7.1 ft.

<u>Depth Tested</u>		<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>				
30.0	41.0	10	10	3.10	4.52×10^{-4}
30.0	41.0	8-10	10	3.00	4.73×10^{-4}
40.0	51.0	14	10	6.35	7.08×10^{-4}
50.0	61.0	15	6	2.91	3.07×10^{-4}
60.0	71.0	20	8	0.07	5.78×10^{-6}
70.0	81.0	22	10	0.036	2.73×10^{-6}
80.0	91.0	27	10	0.18	1.14×10^{-5}
90.0	101.0	30	8	0.45	2.59×10^{-5}
* 100.0	111.0	30	3	0.82	4.72×10^{-5}
* 105.0	116.0	30	4	0.99	5.70×10^{-5}
110.0	121.0	35	10	0.30	1.50×10^{-5}
120.0	131.0	38-40	10	0.32	1.42×10^{-5}
130.0	141.0	42	10	0.53	2.24×10^{-5}
140.0	151.0	44	12	0.19	7.70×10^{-6}
150.0	161.0	48-49	12	0.60	2.22×10^{-5}
160.0	171.0	51	6	0.17	6.00×10^{-6}
170.0	181.0	54	6	0.05	1.67×10^{-6}
180.0	191.0	58	6	0.02	6.29×10^{-7}
190.0	201.0	60	6	0.10	3.02×10^{-6}
200.0	211.0	65-66	6	0.39	1.08×10^{-5}
210.0	221.0	70-71	10	1.67	4.30×10^{-5}
220.0	231.0	71	6	0.30	7.72×10^{-6}
* 230.0	241.0	No Test			

* Packers did not completely seal

BH - 12 (continued)

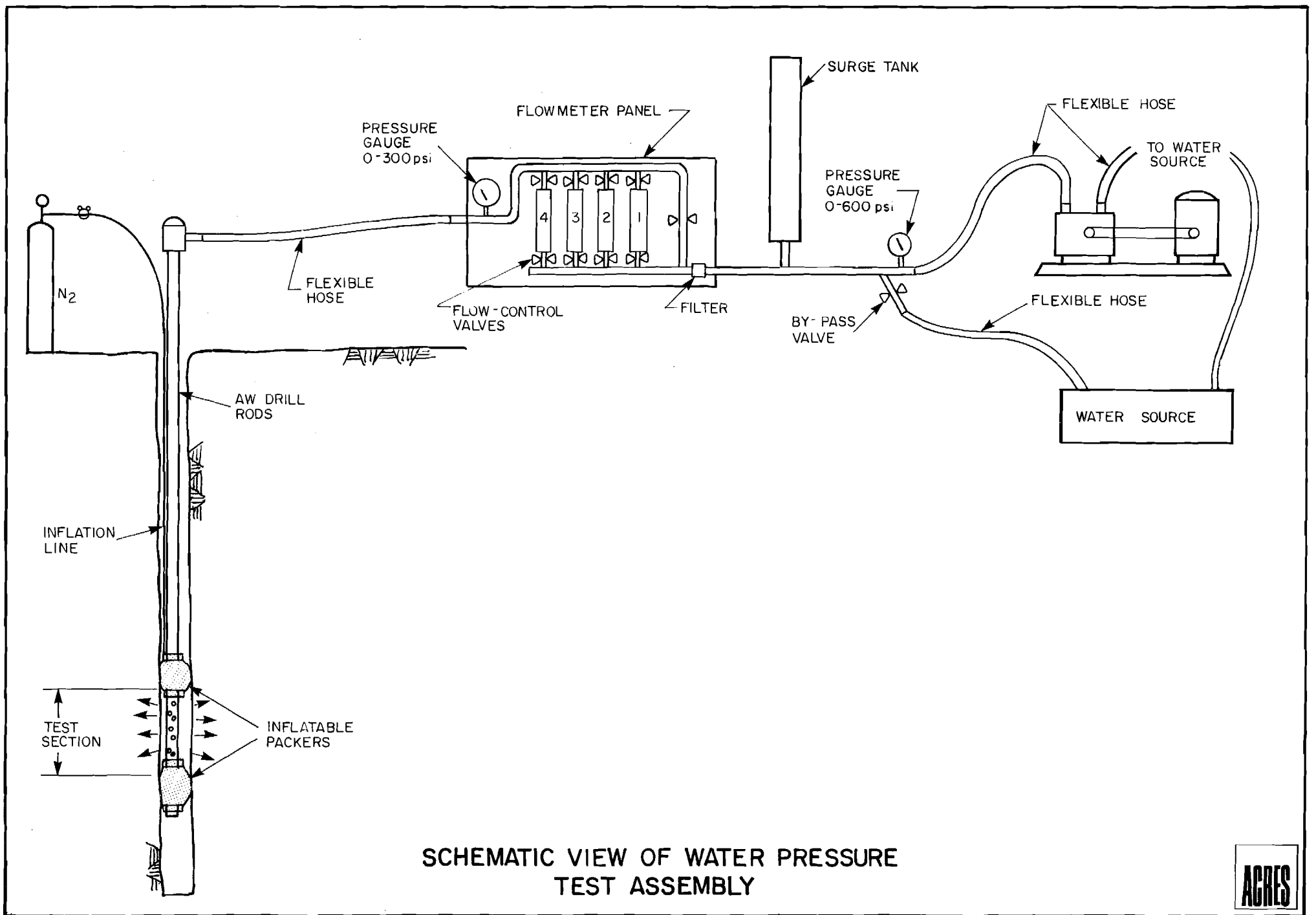
Depth Tested		Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
From (feet)	To (feet)				
235.0	246.0	73-74	6	0.21	5.27×10^{-6}
240.0	251.0	77	6	0.18	4.29×10^{-6}
250.0	261.0	80-82	6	2.54	5.76×10^{-5}
* 260.0	271.0	84-85	11	0.70	1.52×10^{-5}
270.0	281.0	88-92	8	2.45	5.02×10^{-5}
275.0	286.0	86-90	11	2.12	4.40×10^{-5}
* 286.0	289.0	No Test			
289.0	300.0	91-92	11	2.02	4.07×10^{-5}
299.0	310.0	92-98	10	1.00	1.94×10^{-5}
309.0	320.0	98-103	12	0.90	1.64×10^{-5}
* 310.0	321.0	98-99			
310.0	321.0	98-99	10	0.89	1.67×10^{-5}
* 321.0	324.0	No Test			
324.0	335.0	104-108	10	4.75	8.62×10^{-5}
329.0	350.0	No Test			
349.0	360.0	110	6	0.56	9.45×10^{-6}
359.0	370.0	114-116	8	1.05	1.70×10^{-5}
369.0	380.0	117-119	10	0.76	1.20×10^{-5}
380.0	391.0	120-122	10	0.79	1.21×10^{-5}
390.0	401.0	126-128	8	1.48	2.17×10^{-5}
400.0	411.0	128-132	10	1.77	2.54×10^{-5}
410.0	421.0	132-134	10	0.66	9.25×10^{-6}
420.0	431.0	134-136	8	0.84	1.16×10^{-5}
430.0	441.0	136-140	10	0.74	1.00×10^{-5}
440.0	451.0	140	10	0.89	1.19×10^{-5}
450.0	461.0	144	8	0.91	1.18×10^{-5}
460.0	700.0	Hole Caving, Redrilled and Tested From Bottom Up			
700.0	711.0	222-226	10	0.75	6.30×10^{-6}
710.0	721.0	226-228	6	0.75	6.22×10^{-6}
720.0	731.0	232-236	8	0.81	6.52×10^{-6}
730.0	741.0	230-234	6	0.80	6.49×10^{-6}
740.0	751.0	234	8	0.77	6.20×10^{-6}
750.0	761.0	238-244	8	1.59	1.24×10^{-5}

*Packers did not completely seal.

BH - 12 (continued)

<u>Depth Tested</u>		<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>				
760.0	771.0	240-246	10	1.27	9.84×10^{-6}
770.0	781.0	242-250	14	2.25	1.72×10^{-5}
780.0	791.0	250-256	10	2.10	1.56×10^{-5}

APPENDIX E
DEVIL CANYON WATER PRESSURE TESTING DETAILS



SCHEMATIC VIEW OF WATER PRESSURE TEST ASSEMBLY

SUMMARY OF WATER PRESSURE

TEST RESULTS

Borehole Number BH-1

Location Devil Canyon

Ground Surface Elevation 1413.7 ft.

Static Water Level 1221.7 ft.

Dip of Hole 67°

Stickup 3 to 8 ft.

Depth Tested		Stickup (feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
From (feet)	To (feet)					
38.9	55	8	20	11	.72	2.34×10^{-5}
53.9	70	3	30	10	4.06	1.03×10^{-4}
68.9	85	8	40	10	6.18	1.18×10^{-4}
83.9	100	3	45	10	.78	1.33×10^{-5}
98.9	115	8	55	10	5.17	7.23×10^{-5}
113.9	130	3	60	46	.90 to 5.40	1.16×10^{-5} to 6.95×10^{-5}
128.9	145	8	70	21	.77	8.50×10^{-6}
143.9	160	3	75	14	.83	8.57×10^{-6}
158.9	175	8	85	11	1.05	9.58×10^{-6}
173.9	190	3	90	10	.06	5.18×10^{-7}
188.9	205	8	100	10	2.16	1.68×10^{-5}
203.9	220	3	105	10	2.19	1.63×10^{-5}
218.9	285	8	115	10	0.84	5.89×10^{-6}
233.9	250	3	120	10	2.70	1.87×10^{-5}
248.9	265	8	130	10	5.37	3.50×10^{-5}
263.9	280	3	135	10	.25	1.61×10^{-6}
278.9	295	8	145	10	3.63	2.22×10^{-5}
292.9	310	3	150	10	2.05	1.24×10^{-5}
308.9	325	8	160	10	1.24	7.11×10^{-6}
323.9	390	3	165	10	.42	2.38×10^{-6}
338.9	355	8	170	10	1.48	8.15×10^{-6}
252.9	370	3	180	10	1.61	8.61×10^{-6}
368.9	385	8	190	10	2.15	1.10×10^{-5}
383.9	400	3	195	10	.26	1.32×10^{-6}

BH-1 (Continued)

<u>Depth Tested</u>		<u>Stickup (feet)</u>	<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>					
398.9	415	8	200	10	.40	1.97×10^{-6}
413.9	430	3	200	10	1.98	9.84×10^{-6}
428.9	445	8	200	10	.29	1.43×10^{-6}
443.9	460	3	200	10	1.15	5.72×10^{-6}
458.9	475	8	200	10	5.08	2.50×10^{-5}
473.9	490	3	200	10	7.21	3.58×10^{-5}
488.9	505	8	200	10	2.34	1.15×10^{-5}
503.9	420	3	200	10	1.48	7.35×10^{-6}
518.9	535	8	200	10	4.2	2.07×10^{-5}
533.9	550	3	200	10	.39	1.94×10^{-6}
548.9	565	8	200	10	4.51	2.22×10^{-5}
563.9	580	3	200	10	3.72	1.85×10^{-5}
578.9	595	8	200	10	3.9	1.92×10^{-5}
593.9	610	3	200	10	9.7	4.82×10^{-5}
608.9	625	8	150	13	2.58	1.54×10^{-5}
622.9	639	3	130	18	1.20	7.91×10^{-6}
638.9	655	8	130	11	1.63	4.11×10^{-6}
653.9	670	3	200	10	7.4	3.68×10^{-5}
668.9	685	8	130	11	1.03	6.72×10^{-6}
683.9	700	3	150	25	.45	2.71×10^{-6}
698.9	715	8	150	19	.69	4.12×10^{-6}
713.9	730	3	150	13	.23	1.39×10^{-6}
728.9	745	8	150	14	.78	4.66×10^{-6}

SUMMARY OF WATER PRESSURE

TEST RESULTS

Borehole Number BH-2

Location Devil Canyon

Ground Surface Elevation 1213.4 ft.

Static Water Level 1208.4 ft.

Dip of Hole 60°

Stickup 2 to 7 ft.

<u>Depth Tested</u>		<u>Stickup (feet)</u>	<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>					
13.9	30	7	12	10	.72	5.92×10^{-5}
28.9	45	2	18	10	1.1	7.39×10^{-5}
43.9	60	7	22	10	4.0	2.08×10^{-4}
58.9	75	2	25	10	1.16	5.85×10^{-5}
73.9	90	7	35	10	.15	5.27×10^{-6}
88.9	105	2	42	12	.67	2.10×10^{-5}
103.9	120	7	50	10	.31	7.94×10^{-6}
118.9	135	2	65	10	.25	6.09×10^{-6}
133.9	150	7	70	10	2.92	5.88×10^{-5}
148.9	165	2	82	10	1.27	2.46×10^{-5}
163.9	180	7	85	10	.35	5.67×10^{-6}
178.9	195	2	100	10	.15	2.41×10^{-6}
193.9	210	7	105	10	.49	6.58×10^{-6}
208.9	225	2	110	10	.46	6.02×10^{-6}
223.9	240	7	115	10	.37	4.54×10^{-6}
238.9	255	2	125	10	.08	9.58×10^{-7}
253.9	270	7	130	10	.21	2.28×10^{-6}
268.9	285	2	100	32	.68 to 3.1	7.22×10^{-6} to 3.29×10^{-5}
283.9	300	7	145	10	.99	1.33×10^{-5}
298.9	315	2	155	10	.21	2.01×10^{-6}
313.9	330	7	160	10	.25	2.21×10^{-6}
328.9	345	2	170	10	.36	3.12×10^{-6}
343.9	360	7	175	10	.26	2.10×10^{-6}
358.9	375	2	185	10	.71	5.64×10^{-6}
373.9	390	7	190	10	.60	4.46×10^{-6}

BH-2 (Continued)

<u>Depth Tested</u>		<u>Stickup</u> (feet)	<u>Gauge</u> <u>Pressure</u> (psi)	<u>Duration</u> <u>of Test</u> (min)	<u>Flow</u> <u>Rate</u> (gpm)	<u>Coefficient of</u> <u>Permeability</u> (cm/sec)
<u>From</u> (feet)	<u>To</u> (feet)					
388.9	405	2	190	10	.38	2.78×10^{-6}
403.9	420	7	200	10	.62	4.27×10^{-6}
418.9	435	2	200	10	.36	2.51×10^{-6}
433.9	450	7	200	10	.61	4.20×10^{-6}

SUMMARY OF WATER PRESSURE

TEST RESULTS

Borehole Number BH-3
 Location Devil Canyon
 Ground Surface Elevation 1398.0 ft.
 Static Water Level dry hole
 Dip of Hole 32°
 Stickup 7.1 ft.

<u>Depth Tested</u>		<u>Gauge Pressure</u>	<u>Duration of Test</u>	<u>Flow Rate</u>	<u>Coefficient of Permeability</u>
<u>From (Feet)</u>	<u>To (Feet)</u>	<u>(psi)</u>	<u>(min)</u>	<u>(gpm)</u>	<u>(cm/sec)</u>
20.0	31.0	18	10	1.35	9.5×10^{-5}
30.0	41.0	22	8	0.71	4.1×10^{-5}
40.0	51.0	12	8	0.36	2.7×10^{-5}
50.0	61.0	16-22	8	4.4	2.6×10^{-4}
60.0	71.0	22	8	0.72	3.4×10^{-5}
70.0	81.0	20-22	12	0.71	3.3×10^{-5}
80.0	91.0	25	10	0.98	3.9×10^{-5}
90.0	101.0	28-29	8	0.32	1.1×10^{-5}
100.0	111.0	30	12	0.28	9.3×10^{-6}
110.0	121.0	30	2	11.0	3.5×10^{-4}
120.0	131.0	35	8	2.4	6.8×10^{-5}
130.0	141.0	38	8	1.1	2.9×10^{-5}
140.0	151.0	41-46	6	11.0	2.6×10^{-4}
150.0	161.0	45-46	6	3.4	7.7×10^{-5}
160.0	171.0	46	2	11.0	2.4×10^{-4}
170.0	181.0	48	6	2.45	5.1×10^{-5}
180.0	191.0	52	10	5.6	1.1×10^{-4}
190.0	201.0	54	12	4.6	8.6×10^{-5}
200.0	211.0	60	20	2.2	3.8×10^{-5}
210.0	221.0	60	4	11.0	1.9×10^{-4}
220.0	231.0	64	10	0.80	1.3×10^{-5}
230.0	241.0	65	20	2.3	3.6×10^{-5}
240.0	251.0	68-77	14	0.58	8.4×10^{-6}
250.0	261.1	72-74	4	11.0	1.6×10^{-4}

BH-3 (Continued)

Depth Tested		Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
From (Feet)	To (Feet)				
260.0	271.0	72-75	8	5.6	7.8×10^{-5}
270.0	281.1	77	6	11.0	1.5×10^{-4}
280.0	291.1	79-80	6	5.3	6.8×10^{-5}
290.0	301.1	83	8	8.9	1.1×10^{-4}
300.0	311.1	86	8	5.7	6.8×10^{-5}
310.0	321.1	88-90	7	1.1	1.3×10^{-5}
320.0	331.1	80-91	8	8.7	1.0×10^{-4}
330.0*	341.1	92-94	7	11.0	1.2×10^{-4}
340.0*	351.1	96-97	6	11.0	1.2×10^{-4}
350.0*	361.1	100	6	11.0	1.1×10^{-4}
360.0	371.1	100-102	8	8.2	8.3×10^{-5}
370.0*	381.1	105	8	11.0	1.1×10^{-4}
380.0*	390.7	108	9	11.0	1.1×10^{-4}

SUMMARY OF WATER PRESSURE

TEST RESULTS

Borehole Number BH-4
 Location Devil Canyon
 Ground Surface Elevation 1352.6 ft
 Static Water Level 1321.6 ft
 Dip of Hole 60°
 Stickup 1 to 6 ft

<u>Depth Tested</u>		<u>Stickup (feet)</u>	<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>					
13.9	30	1	10	10	.046	3.48×10^{-6}
28.9	45	6	15	10	.252	1.15×10^{-6}
43.9	60	1	20	10	.247	1.03×10^{-5}
58.9	75	6	24	10	.039	1.38×10^{-6}
78.9	90	1	34	12	3.21	9.48×10^{-5}
88.9	105		UNABLE TO SEAT PACKERS			
108.9	125	14	50	10	.26	5.29×10^{-6}
118.9	135	6	55	10	3.75	7.46×10^{-5}
123.9	140	1	56	10	4.24	8.58×10^{-5}
138.9	155		UNABLE TO SEAT PACKERS			
148.9	165	6	70	10	.052	8.54×10^{-7}
153.9	170	1	50	10	1.042	2.31×10^{-5}
163.9	180	1	80	10	.622	9.37×10^{-6}
178.9	195	6	85	10	.041	5.74×10^{-7}
193.9	210	1	95	10	.034	4.41×10^{-7}
208.9	225	6	100	10	.02	2.44×10^{-7}
223.9	240	1	105	10	.029	3.45×10^{-7}
238.9	255	6	115	10	.048	5.18×10^{-7}
253.9	270	1	125	10	.034	3.46×10^{-7}
208.9	205	6	130	10	.036	3.48×10^{-7}
283.9	300	1	140	10	.028	2.57×10^{-7}
298.9	315	6	145	10	.105	9.22×10^{-7}
313.9	330	1	150	10	.033	2.85×10^{-7}
328.9	345	6	160	12	.423	3.40×10^{-6}

BH-4 (Continued)

<u>Depth Tested</u>		<u>Stickup (feet)</u>	<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>					
343.9	360	1	170	10	.208	1.60×10^{-6}
358.9	375	6	175	10	.113	8.36×10^{-7}
373.9	390	1	185	10	.92	6.54×10^{-6}
388.9	405	6	190	9	.09	6.17×10^{-7}
403.9	420	1	200	10	.151	9.98×10^{-7}
418.9	435	6	200	10	.121	7.92×10^{-7}
433.9	450	1	200	10	.119	7.87×10^{-7}
448.9	465	6	200	10	.099	6.48×10^{-7}
458.9	475	1	200	10	.103	6.81×10^{-7}

SUMMARY OF WATER PRESSURE

TEST RESULTS

Borehole Number BH-5a
 Location Devil Canyon
 Ground Surface Elevation 974.5 feet
 Static Water Level 935.6 feet
 Dip of Hole 45⁰
 Stickup 4.0 feet

<u>Depth Tested</u> From (feet)	<u>To</u> (feet)	<u>Gauge Pressure</u> (psi)	<u>Duration of Test</u> (minutes)	<u>Flow Rate</u> (gpm)	<u>Coefficient of Permeability</u> (cm/sec)
63.0	74.0	30	6	0.89	3.5×10^{-5}
73.0	84.0	30	6	0.93	3.6×10^{-5}
83.0	94.0	33	6	0.71	2.6×10^{-5}
93.0	104.0	36	6	1.0	3.5×10^{-5}
103.0	114	40	8	2.5	8.2×10^{-5}
114.0	115.9	No Test			
115.9	126.9	40	16	3.4	1.1×10^{-4}
126.9	135.6	No Test			
135.6	146.6	55	8	0.76	2.0×10^{-5}
143.0*	154.0	55	4	9.4	2.4×10^{-4}
153.0	164.0	60	2	0.01	2.4×10^{-7}
163.0*	174.0	60	6	9.2	2.2×10^{-4}
173.0	184.0	65	10	5.1	1.2×10^{-4}
183.0	194.0	70	4	0.06	1.3×10^{-6}
193.0	204.0	70	4	0.09	1.9×10^{-6}
203.0	214.0	75	6	0.04	8.2×10^{-7}
213.0	224.0	80	4	0.10	1.9×10^{-6}
223.0	234.0	85	8	0.14	2.6×10^{-6}
233.0	244.0	85	8	0.16	2.9×10^{-6}
243.0	254.0	90	6	0.10	1.8×10^{-6}

*Packers did not completely seal

BH-5a (Continued)

<u>Depth Tested</u>		<u>Gauge Pressure</u> (psi)	<u>Duration of Test</u> (minutes)	<u>Flow Rate</u> (gpm)	<u>Coefficient of Permeability</u> (cm/sec)
<u>From</u> (feet)	<u>To</u> (feet)				
253.0	264.0	95	6	0.14	2.4×10^{-6}
263.0	274.0	95	6	0.13	2.2×10^{-6}
273.0	284.0	100	6	0.58	9.3×10^{-6}
283.0	294.0	105	12	1.0	1.5×10^{-5}
293.0	304.0	110	12	1.1	1.6×10^{-5}
303.0	314.0	110	18	1.7	2.5×10^{-5}
313.0	324.0	115	8	1.4	2.0×10^{-5}
323.0	334.0	118-120	8	0.13	1.8×10^{-6}
333.0	344.0	124	8	0.07	9.4×10^{-7}
343.0	354.0	124	8	0.58	7.8×10^{-6}
353.0	364.0	132	8	0.21	2.7×10^{-6}
363.0	374.0	132	8	0.87	1.1×10^{-5}
373.0	384.0	134	8	0.40	5.0×10^{-6}
383.0	394.0	139	8	0.22	2.7×10^{-6}
393.0	404.0	144	8	0.45	5.3×10^{-6}
403.0	414.0	145	8	0.33	3.8×10^{-6}
413.0	424.0	148	8	0.30	3.4×10^{-6}
423.0	434.0	150	8	0.35	4.0×10^{-6}
433.0	444.0	155	8	1.7	1.9×10^{-5}
443.0	454.0	162	8	2.1	2.2×10^{-5}
453.0	464.0	164	7	0.29	3.0×10^{-6}
463.0	474.0	171	8	2.6	2.6×10^{-5}
473.0	484.0	170	6	5.9	6.0×10^{-5}
484.0	503.0	No Test			
503.0	514.0	180	10	0.82	7.9×10^{-6}
513.0	524.0	185	6	0.93	8.7×10^{-6}
523.0	534.0	190	8	3.7	3.4×10^{-5}
533.0	544.0	190	6	3.3	3.0×10^{-5}
543.0	554.0	195	6	5.4	4.8×10^{-5}
553.0	564.0	200	4	0.38	3.3×10^{-6}
563.0	574.0	200	6	0.66	5.8×10^{-6}
573.0	584.0	205	8	0.47	4.0×10^{-6}
581.7	592.7	210	6	0.43	3.6×10^{-6}

SUMMARY OF WATER PRESSURE
TEST RESULTS

Borehole Number BH-5b
 Location Devil Canyon
 Ground Surface Elevation 976.6 ft
 Static Water Level 946.2 ft
 Dip of Hole 45°
 Stickup 2.2 - 4.0 feet

<u>Depth Tested</u>		<u>Stickup</u> <u>(feet)</u>	<u>Gauge</u> <u>Pressure</u> <u>(psi)</u>	<u>Duration</u> <u>of Test</u> <u>(min)</u>	<u>Flow</u> <u>Rate</u> <u>(gpm)</u>	<u>Coefficient of</u> <u>Permeability</u> <u>(cm/sec)</u>
<u>From</u> <u>(feet)</u>	<u>To</u> <u>(feet)</u>					
23.0	34.0	4.4	21	7	0.51	3.1×10^{-5}
33.0	44.0	4.0	25	6	1.4	6.9×10^{-5}
43.0	54.0	4.0	28	6	11.0	4.9×10^{-4}
54.0	63.0		No Test			
63.0	74.0	4.0	32	6	0.06	2.4×10^{-6}
68.3	79.3	2.2	30	8	0.33	1.4×10^{-5}
79.3	116.0		No Test			
116.0	127.0	2.2	46	6	0.68	2.2×10^{-5}
126.0	137.0	2.2	52	6	0.10	2.9×10^{-5}
136.0	147.0	2.2	55	8	0.47	1.3×10^{-5}
146.0	157.0	2.2	58	6	0.71	1.9×10^{-5}
156.0	167.0	2.2	60	6	0.67	1.7×10^{-5}
166.0	177.0	2.2	65	8	1.7	4.1×10^{-5}
176.0	187.0	2.2	70	6	0.64	1.5×10^{-5}
186.0	197.0	2.2	70-72	8	0.18	4.0×10^{-6}

SUMMARY OF WATER PRESSURE

TEST RESULTS

Borehole Number BH-7
 Location Devil Canyon
 Ground Surface Elevation 1351.0 ft
 Static Water Level 1338.3 ft.
 Dip of Hole 45°
 Stickup As Noted

Depth Tested		Stickup (Feet)	Gauge Pressure (psi)	Duration of Test (min)	Flow Rate (gpm)	Coefficient of Permeability (cm/sec)
From (Feet)	To (Feet)					
30.0	47.0	6.1	20	8	5.2	2.6×10^{-4}
35.9	52.0	1.1	20	6	0.19	1.0×10^{-5}
50.9	67.0	6.1	20	6	0.38	1.9×10^{-5}
65.9	82.0	1.1	25	6	3.2	1.4×10^{-4}
80.9	97.0	6.1	30	14	3.6	1.3×10^{-4}
95.9	112.0	1.1	35	11	3.0	1.0×10^{-4}
110.9	127.0	6.1	40	8	1.9	5.6×10^{-5}
125.9	142.0	1.1	45	22	0.89	2.5×10^{-5}
138.9	155.0	7.0	48	20	0.04	1.1×10^{-6}
148.9	165.0	3.1	50	10	0.02	5.0×10^{-7}
163.9	180.0	3.1	55	10	0.03	6.9×10^{-7}
178.9	195.0	8.1	60	10	0.03	6.1×10^{-7}
188.9	205.0	8.1	60	12	0.22	4.5×10^{-6}
205.0	233.0		No Test			
233.9	253.1	3.1	80	9	0.38	6.2×10^{-6}
248.1	265.0	8.1	80	10	0.26	4.1×10^{-6}
263.9	280.0	3.1	85	6	0.22	3.4×10^{-6}
278.9	295.0	8.1	90	7	0.11	1.6×10^{-6}
293.9	310.0	3.1	95	10	0.07	9.7×10^{-6}
308.9	325.0	8.1	102	10	1.1	1.4×10^{-6}
323.9	340.0	3.1	105	10	0.43	5.4×10^{-6}
338.9	355.0	8.1	110	8	0.44	5.2×10^{-6}
353.9	370.0	3.1	115	10	0.61	7.1×10^{-6}

BH-7 (Continued)

<u>Depth Tested</u>		<u>Stickup (feet)</u>	<u>Gauge Pressure (psi)</u>	<u>Duration of Test (min)</u>	<u>Flow Rate (gpm)</u>	<u>Coefficient of Permeability (cm/sec)</u>
<u>From (feet)</u>	<u>To (feet)</u>					
368.9	385.0	8.1	120	10	0.78	8.5×10^{-6}
383.9	400.0	3.1	124	9	0.90	9.7×10^{-6}
398.9	415.0	8.1	128	10	0.58	6.0×10^{-6}
413.9	430.0	3.1	135	10	0.65	6.5×10^{-6}
428.9	445.0	8.1	140	10	0.56	5.3×10^{-6}
443.9	460.0	3.1	145	10	0.67	6.2×10^{-6}
458.9	475.0	8.1	150	10	0.63	5.6×10^{-6}
473.9	490.0	3.1	155	10	0.62	5.4×10^{-6}
478.2	494.3	8.1	158	12	0.70	5.9×10^{-6}

APPENDIX F
WATANA BORROW AREA INVESTIGATION

EXPLANATION OF SELECTED SYMBOLS

STANDARD SYMBOLS

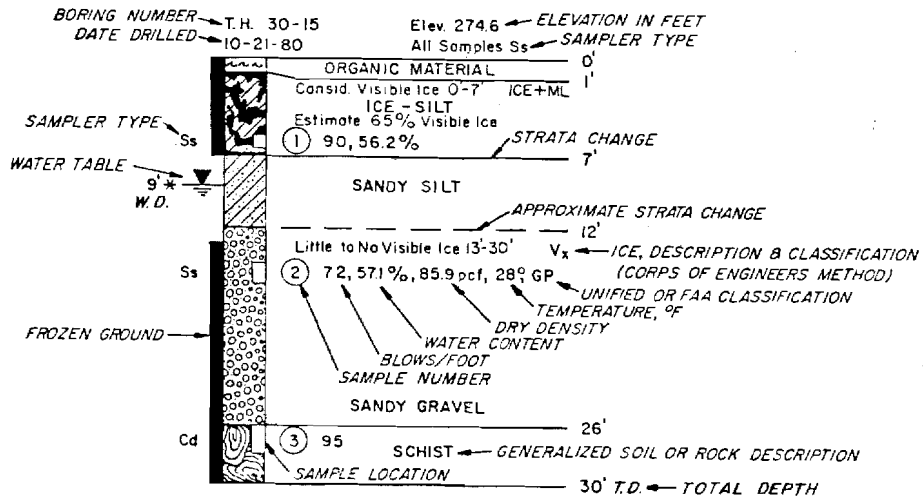
	ORGANIC MATERIAL		COBBLES & BOULDERS		IGNEOUS ROCK		SANDY SILT
	CLAY		CONGLOMERATE		METAMORPHIC ROCK		SILT GRADING TO SANDY SILT
	SILT		SANDSTONE		ICE, MASSIVE		SANDY GRAVEL, SCATTERED COBBLES (ROCK FRAGMENTS)
	SAND		MUDSTONE		ICE - SILT		INTERLAYERED SAND & SANDY GRAVEL
	GRAVEL		LIMESTONE		ORGANIC SILT		SILTY CLAY w/TR. SAND

SAMPLER TYPE SYMBOLS

S1 1.4" SPLIT SPOON WITH 47 # HAMMER	Ts SHELBY TUBE
Ss 1.4" SPLIT SPOON WITH 140 # HAMMER	Tm MODIFIED SHELBY TUBE
SI 2.5" SPLIT SPOON WITH 140 # HAMMER	Pb PITCHER BARREL
Sh 2.5" SPLIT SPOON WITH 340 # HAMMER	Cs CORE BARREL WITH SINGLE TUBE
Sx 2.0" SPLIT SPOON WITH 140 # HAMMER	Cd CORE BARREL WITH DOUBLE TUBE
Sz 1.4" SPLIT SPOON WITH 340 # HAMMER	Bs BULK SAMPLE
Sp 2.5" SPLIT SPOON, PUSHED	A AUGER SAMPLE
Hs 1.4" SPLIT SPOON DRIVEN WITH AIR HAMMER	G GRAB SAMPLE
HI 2.5" SPLIT SPOON DRIVEN WITH AIR HAMMER	

NOTE: SAMPLER TYPES ARE EITHER NOTED ABOVE THE BORING LOG OR ADJACENT TO IT AT THE RESPECTIVE SAMPLE DEPTH.

TYPICAL BORING LOG



DRILLING SYMBOLS

WD: While Drilling	AB: After Boring
WL: Water Level	TD: Total Depth
WS: While Sampling	

Note: Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious unfrozen soils, the indicated elevations are considered to represent actual ground water conditions. In impervious and frozen soils, accurate determinations of ground water elevations cannot be obtained within a limited period of observation and other evidence on ground water elevations and conditions are required.

PREPARED BY:



PREPARED FOR:

EXPLANATION OF SELECTED SYMBOLS



SOILS
CLASSIFICATION AND CONSISTENCY

CLASSIFICATION: Identification and classification of the soil is accomplished in accordance with the Unified Soil Classification System. Normally, the grain size distribution determines classification of the soil. The soil is defined according to major and minor constituents with the minor elements serving as modifiers of the major elements. Minor soil constituents may be added to the classification breakdown in accordance with the particle size proportions listed below; (i.e., sandy silt with some gravel, trace clay).

no call - 0-3% trace - 3-12% some - 13-30% sandy, silty, gravelly - >30%

Identification and classification of soil strata which have a significant cobble and boulder content is based on the unified classification of the minus 3 inch fraction augmented by a description (i.e., cobbles and boulders) of the plus 3 inch fraction. Where a gradation curve, which includes the plus 3 inch fraction, exists (samples from test trenches and pits) a modifier is used to describe independently the percentage of each of the two plus 3 inch components. If there is no gradation curve incorporating the plus 3-inch fraction (as in auger holes), the plus 3-inch material is described as a single component (i.e., cobbles and boulders), and a modifier is used to indicate the relative percentage of the plus 3-inch fraction based on the field logs. The modifiers in each case are used as follows:

Scattered - 0-40% Numerous - >40%

SOIL CONSISTENCY - CRITERIA: Soil consistency as defined below and determined by normal field and laboratory methods applies only to non-frozen material. For these materials, the influence of such factors as soil structure, i.e. fissure systems, shrinkage cracks, slickensides, etc., must be taken into consideration in making any correlation with the consistency values listed below. In permafrost zones, the consistency and strength of frozen soils may vary significantly and unexplainably with ice content, thermal regime and soil type.

<u>Cohesionless Soils</u>			<u>Cohesive Soils</u>		
	<u>N*</u>	<u>Relative Density</u>		<u>N*</u>	<u>qu - (tsf)</u>
	(blows/ft)			(blows/ft)	
Very Loose	0 - 4	20%	Very Soft	0 - 2	0 - 0.25
Loose	4 - 10	20 to 40%	Soft	2 - 4	0.25 - 0.5
Medium Dense	10 - 30	40 to 60%	Medium	4 - 8	0.5 - 1.0
Dense	30 - 50	60 to 80%	Stiff	8 - 15	1.0 - 2.0
Very Dense	>50	>80%	Very Stiff	15 - 30	2.0 - 4.0
			Hard	>30	>4.0

* Standard Penetration "N": Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch OD split-spoon except where noted.

Often the split-spoon samplers do not reach the total intended sample depth. Where this occurs the graphic log notes a refusal (Ref.) and give an indication of the cause of the refusal. Tight soils are indicated by a blow count value followed by a penetration length in inches. The presense of large rock fragments is indicated by a cobble and boulder callout following the refusal callout. In certain instances a blow count of 100+ may be listed to indicate tight soils where total sampler penetration is possible with more than 100 blows per foot.

PREPARED BY:

PREPARED FOR:



EXPLANATION OF ICE SYMBOLS

Percentage of visible ice has been grouped for the purpose of designating the amount of soil ice content. These groups have arbitrarily been set out as follows:

0%	No Visible Ice
1% - 10%	Little Visible Ice
11% - 20%	Occasional Visible Ice
21% - 35%	Some Visible Ice
>35%	Considerable Visible Ice

The ice description system is based on that presented by K. A. Linell, and C. W. Kaplar (1966). In this system, which is an extension of the Unified Soil Classification System, the amount and physical characteristics of the soil ice are accounted for. The following table is a brief summary of the salient points of their classification system as modified to meet the needs of this study.

ICE DESCRIPTIONS

GROUP SYMBOL	ICE VISIBILITY & CONTENT	SUBGROUP	
		DESCRIPTION	SYMBOL
N	Ice not visible	Poorly bonded or friable	N _f
		Well bonded	N _b
		No excess ice	N _{bn}
		Excess ice	N _{be}
V	Ice visible, <50%	Individual ice crystals or inclusions	V _x
		Ice coatings on particles	V _c
		Random or irregularly oriented ice formations	V _r
		Stratified or distinctly oriented ice formations	V _s
ICE	Ice visible, >50%	Ice with soil inclusions	ICE + soil type
	Individual layer >6" thick *	Ice without soil inclusions	ICE

* In some cases where the soil is ice poor a thin ice layer may be called out by special notation on the log, i.e. 2" ice lens at 7'

PREPARED BY:

PREPARED FOR:

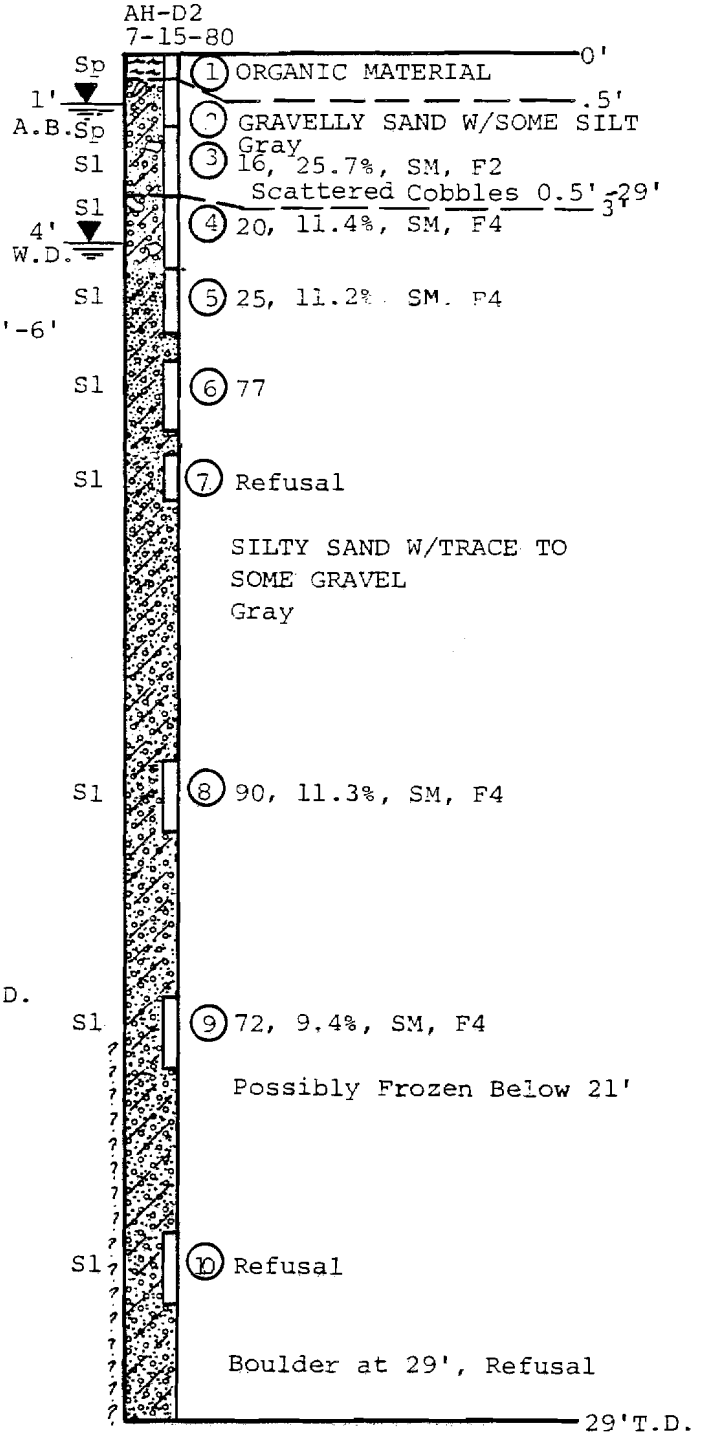
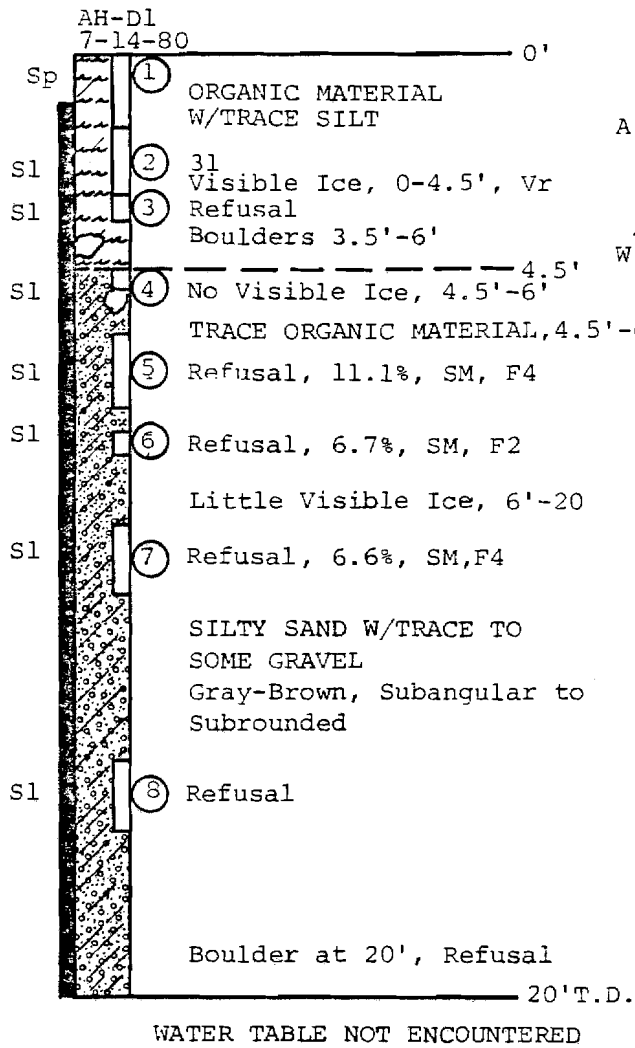


EXPLANATION OF ICE SYMBOLS



F.1 BORROW SITE D

AUGER HOLE LOGS



PREPARED BY:

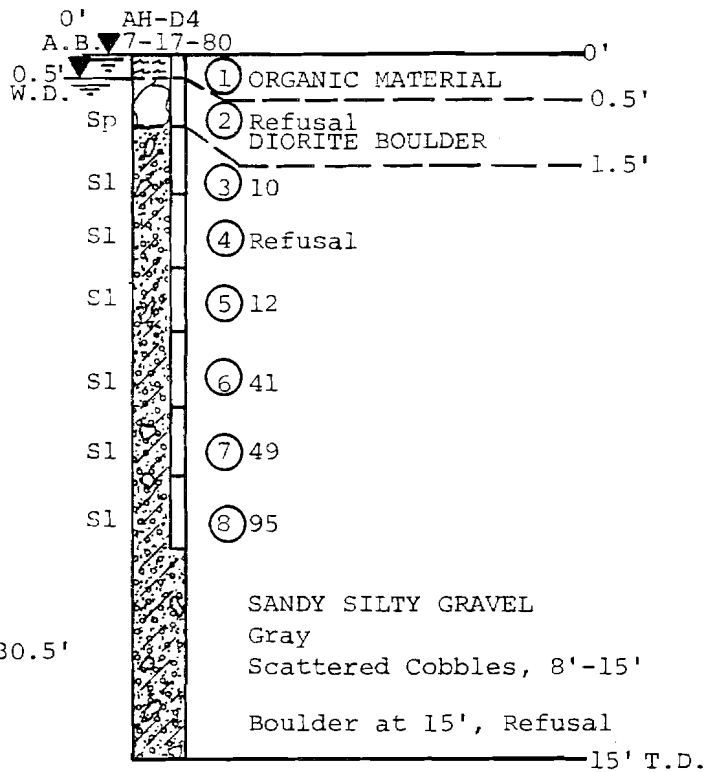
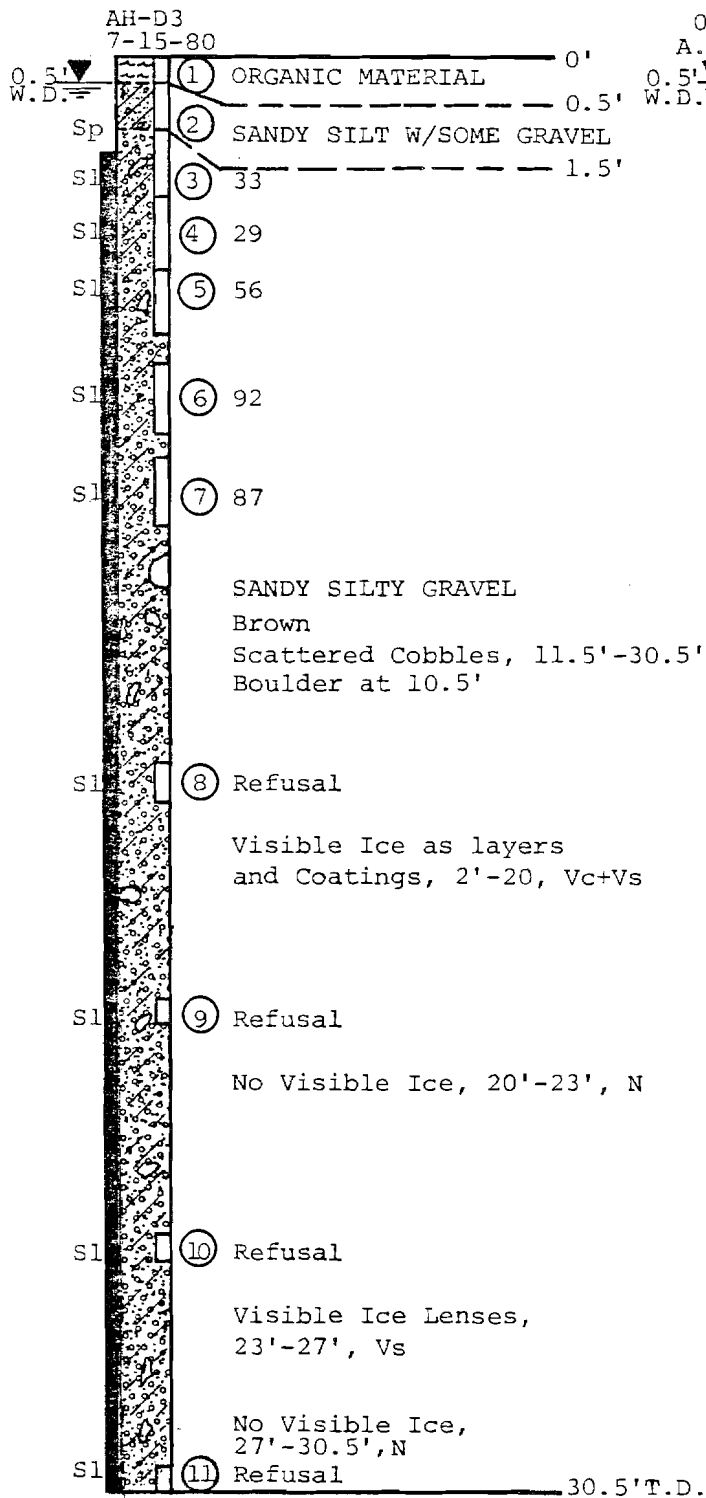


PREPARED FOR:

BORROW AREA D
AUGER HOLES AH-D1 AND AH-D2



Scale 1"=4'



PREPARED BY:

PREPARED FOR:

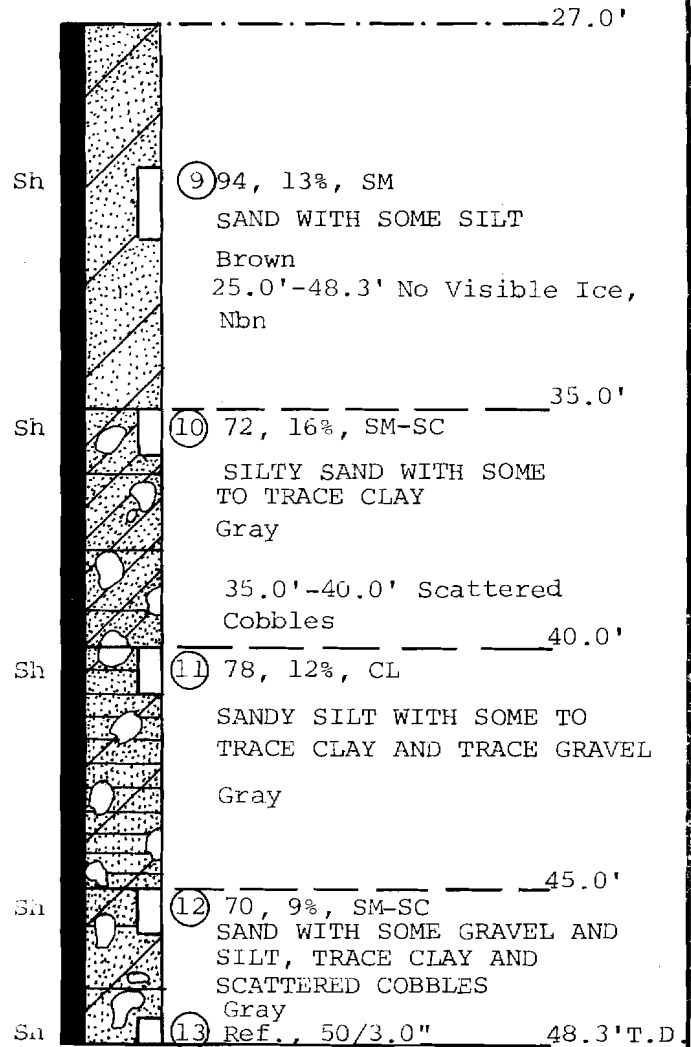
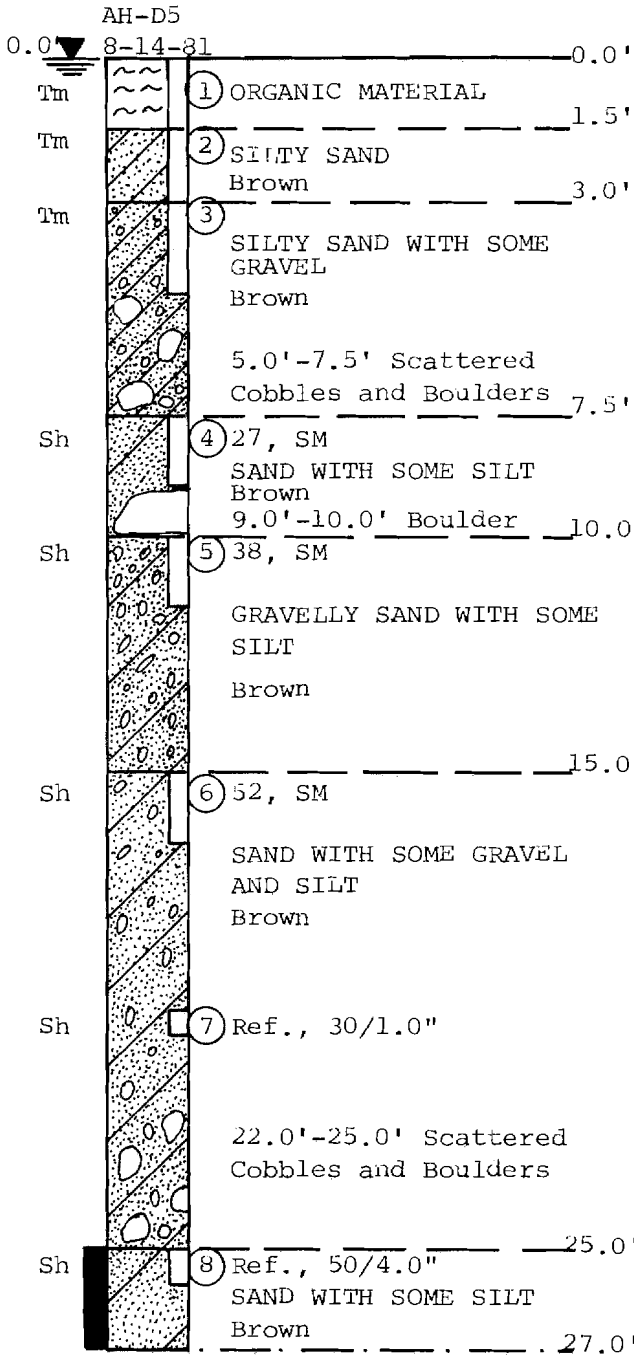


BORROW AREA D
AUGER HOLES AH-D3 AND AH-D4



Scale 1"=4'

Elevation 2221.6'



Thermal Probe Installed to 50.0'
Stand Pipe Piezometer Installed to 30.0'

PREPARED BY:

PREPARED FOR:



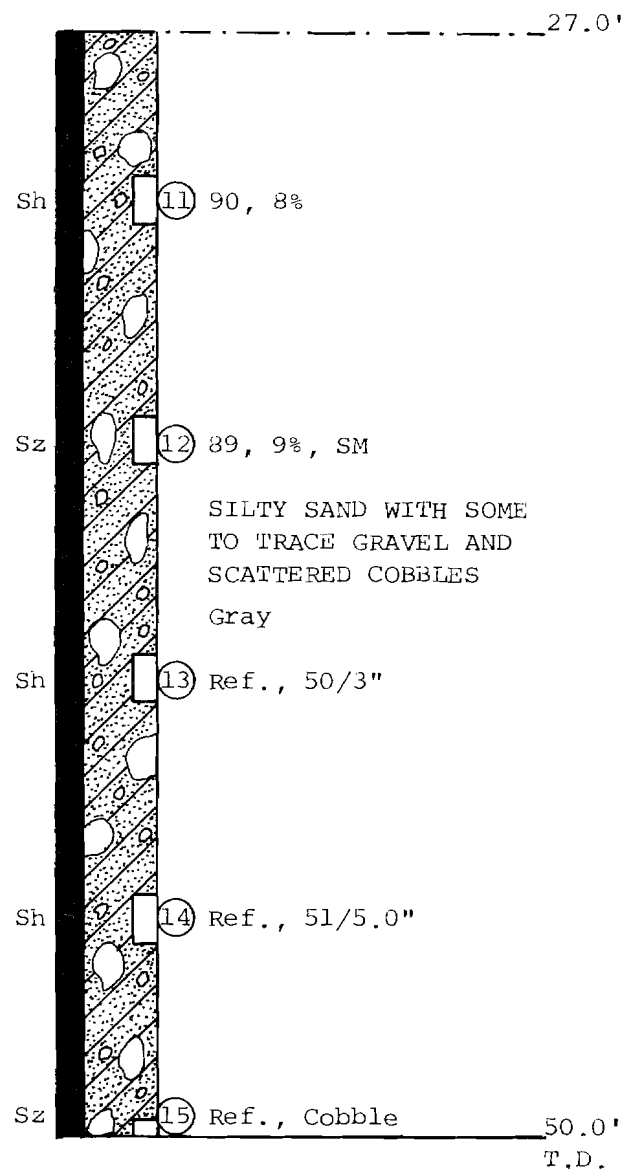
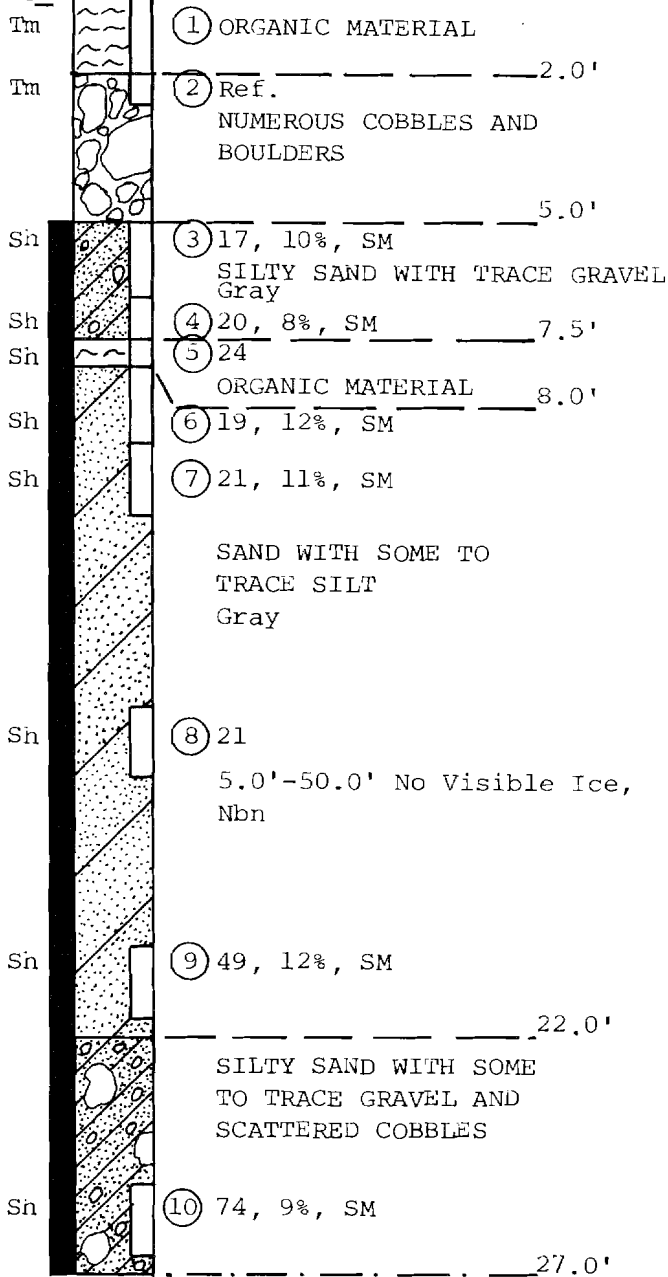
BORROW AREA D
AUGER HOLE AH-D5



Scale: 1"=4'

Elevation 2262.9'

AH-D6
8-22-81 0.0' 0.0'



Thermal Probe Installed to 50.0'
Stand Pipe Piezometer Installed to 50.0'

PREPARED BY:

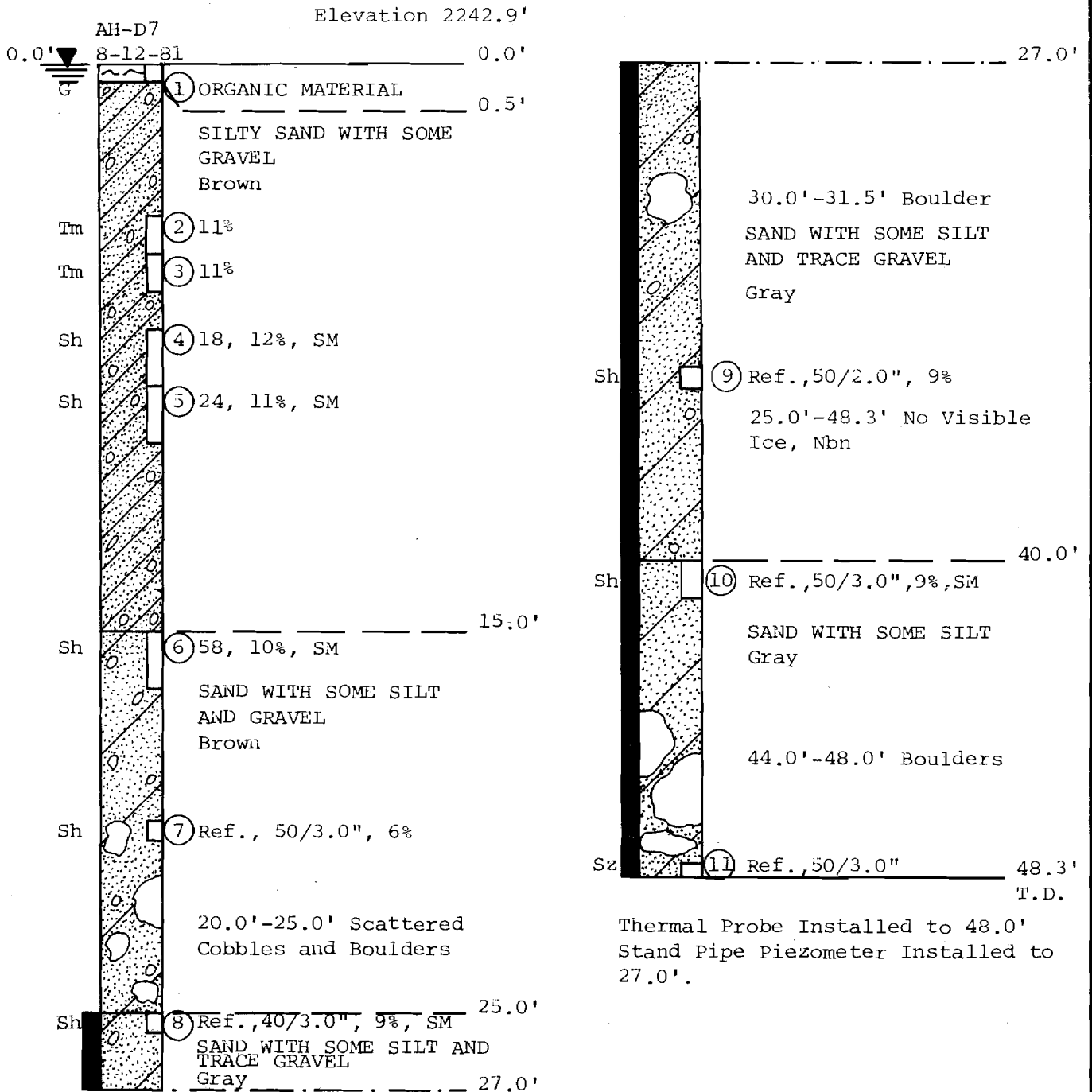
PREPARED FOR:



BORROW AREA D
AUGER HOLE AH-D6



Scale: 1"=4'



PREPARED BY:

PREPARED FOR:



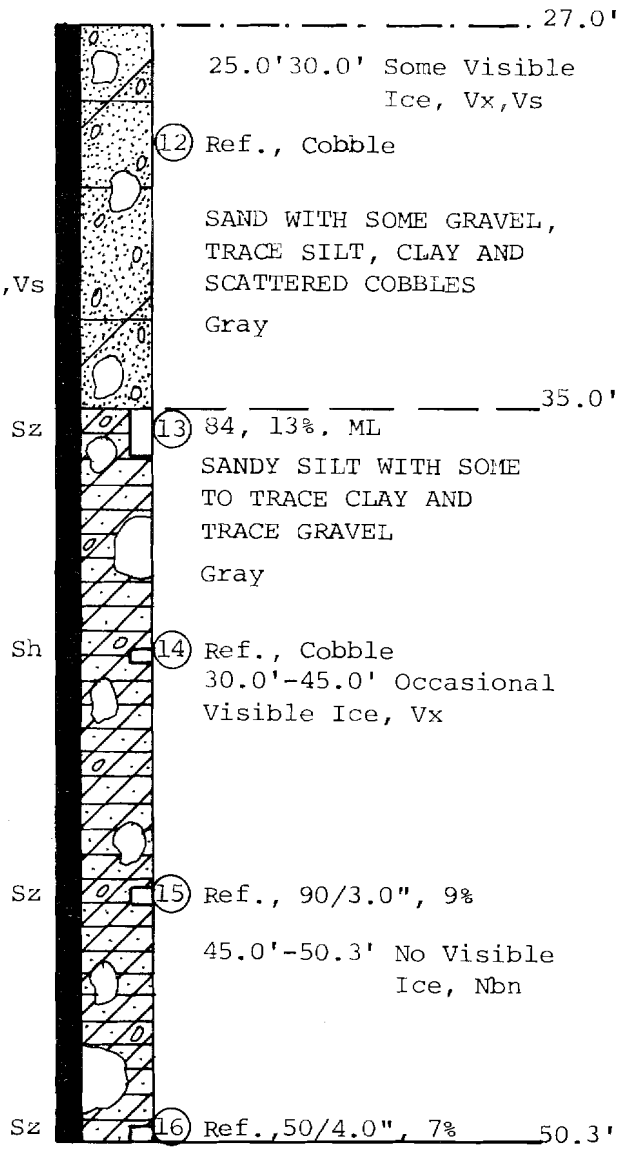
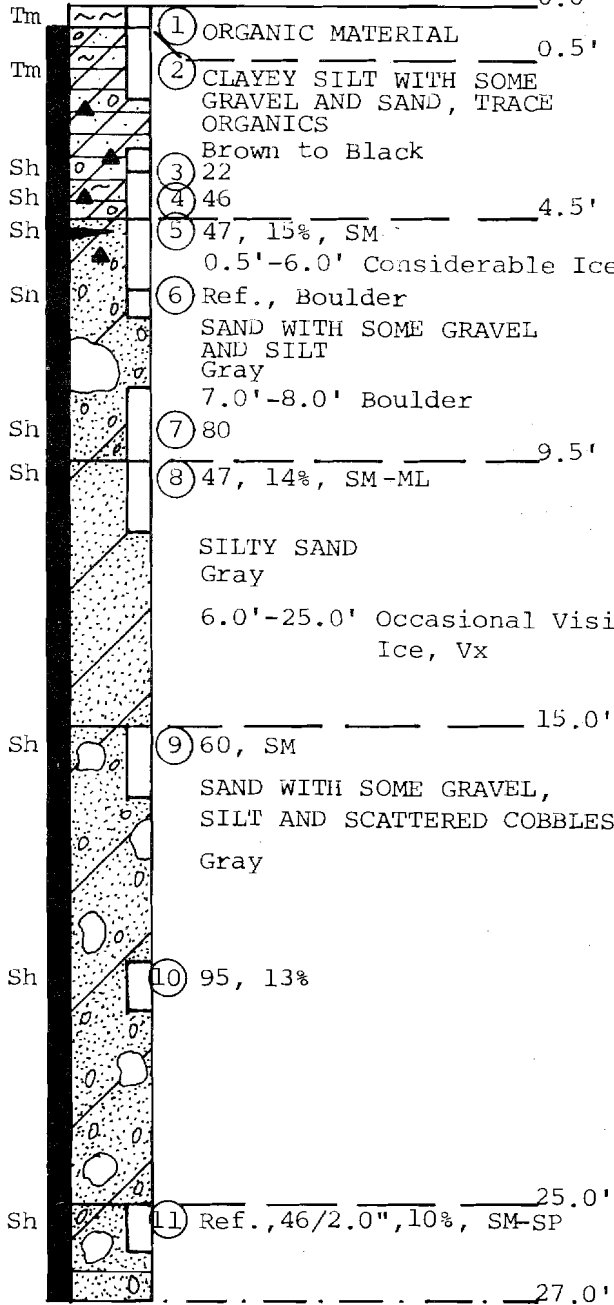
BORROW AREA D
AUGER HOLE AH-D7



Scale: 1"=4'

AH-D8 Elevation 2276.1'

8-9-81 0.0'



Water Table Not Encountered. T.D. Thermal Probe Installed to 50.3'

PREPARED BY:



BORROW AREA D
AUGER HOLE AH-D8

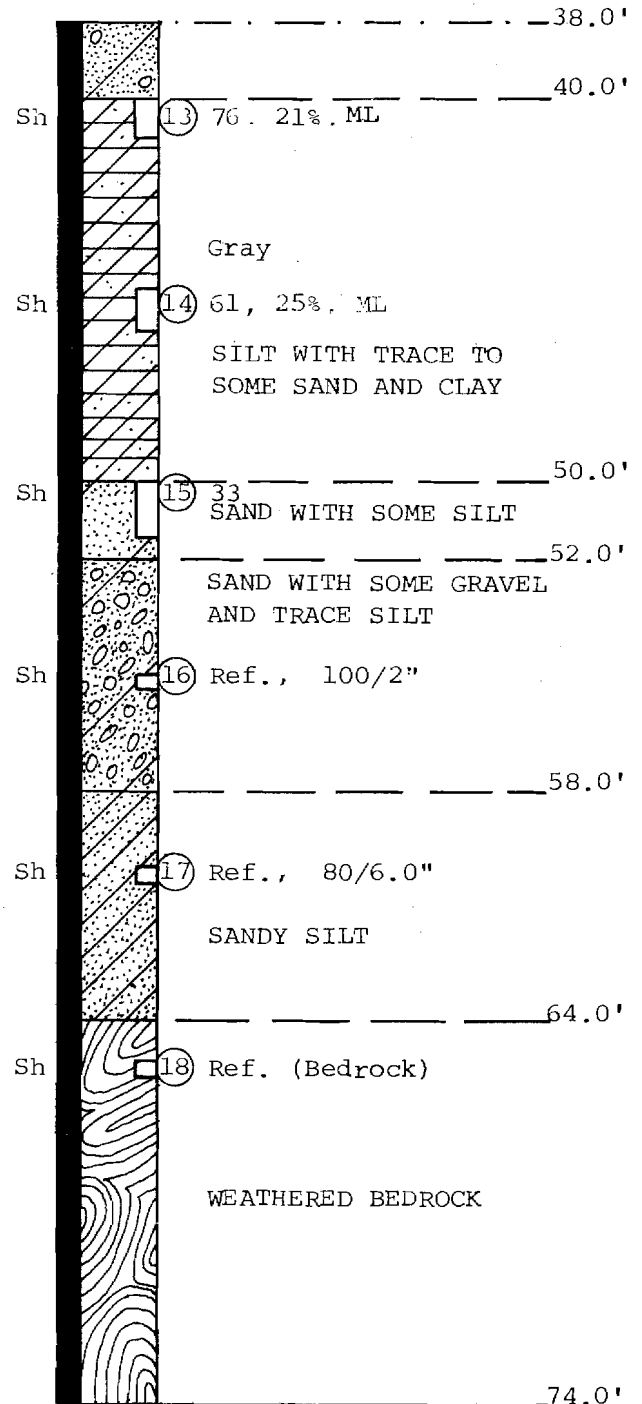
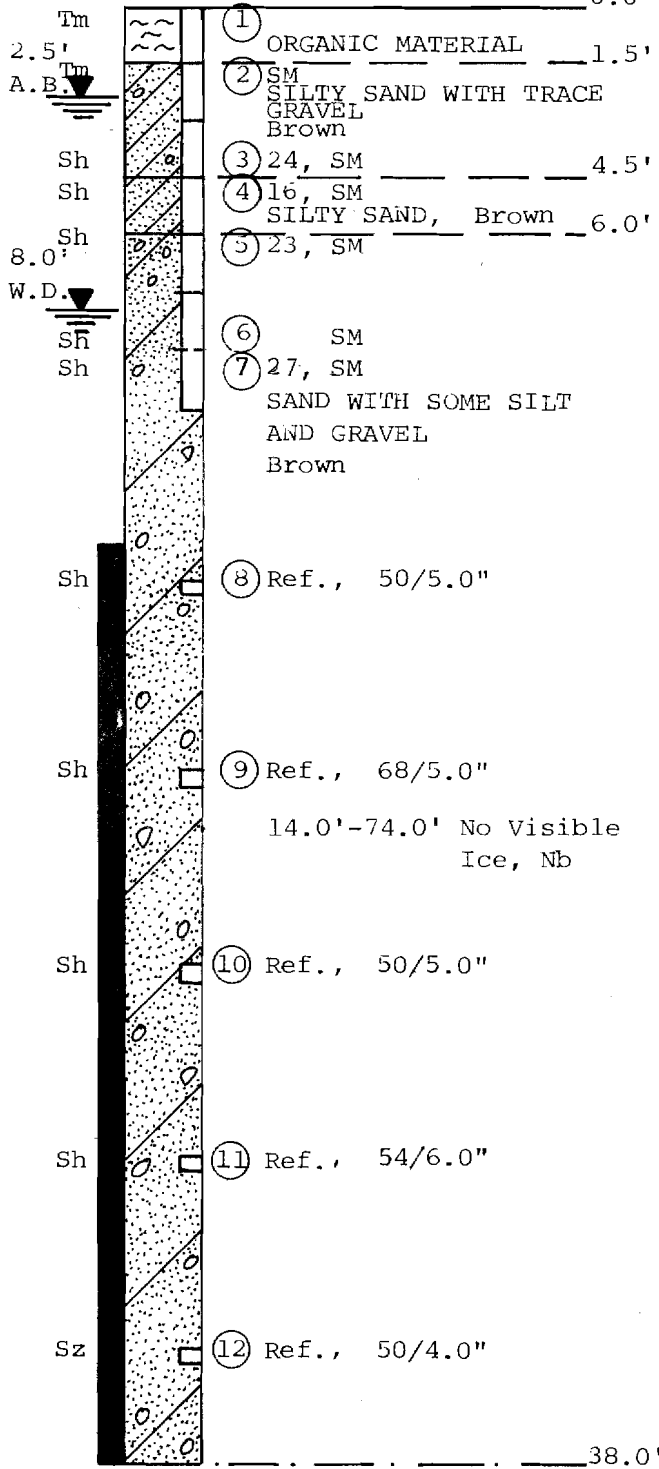
PREPARED FOR:



Scale: 1"=4'

Elevation 2319.1'

AH-D9
7-25-81



T.D.
 Thermal Probe Installed to 72.0'
 Stand Pipe Piezometer Installed to 66.0'

Prepared by:

Prepared for:



BORROW AREA D
 AUGER HOLE AH-D9



Scale: 1"-5

Elevation 2357.8'

0.0' AH-D10

A.B. 8-1-81

0.0'

1.0' W.D.

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① ORGANIC MATERIAL

②

③ SILTY SAND WITH TRACE GRAVEL

Brown

④

⑤

⑥

⑦ 15

⑧ 58

7.5'

SILTY SAND WITH SOME GRAVEL AND TRACE CLAY

Gray

7.5'-25.0' No Visible Ice, Nf

⑨ 14

⑩ Ref., 50/5.0"

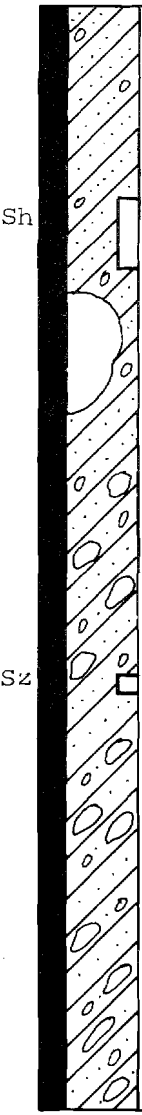
⑪ 22

CLAYEY SILT WITH SOME SAND AND GRAVEL

Gray

27.0'

27.0'



CLAYEY SILT WITH SOME SAND AND GRAVEL

Gray

25.0'-50.0' No Visible Ice, Nb

⑫ 35

33.0'-50.0' Scattered Cobbles and Boulders

⑬ Ref., 50/4.0"

50.0' T.D.

Thermal Probe Installed to 50.0'
Stand Pipe Piezometer Installed to 50.0'

PREPARED BY:

PREPARED FOR:

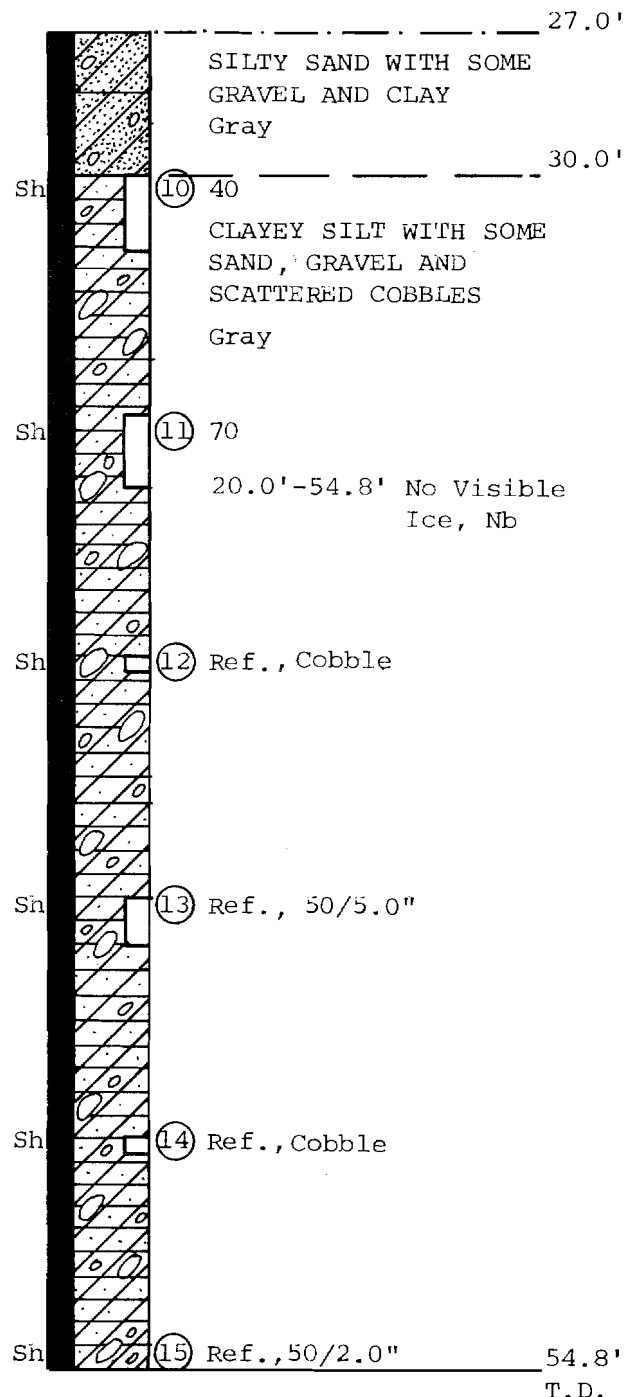
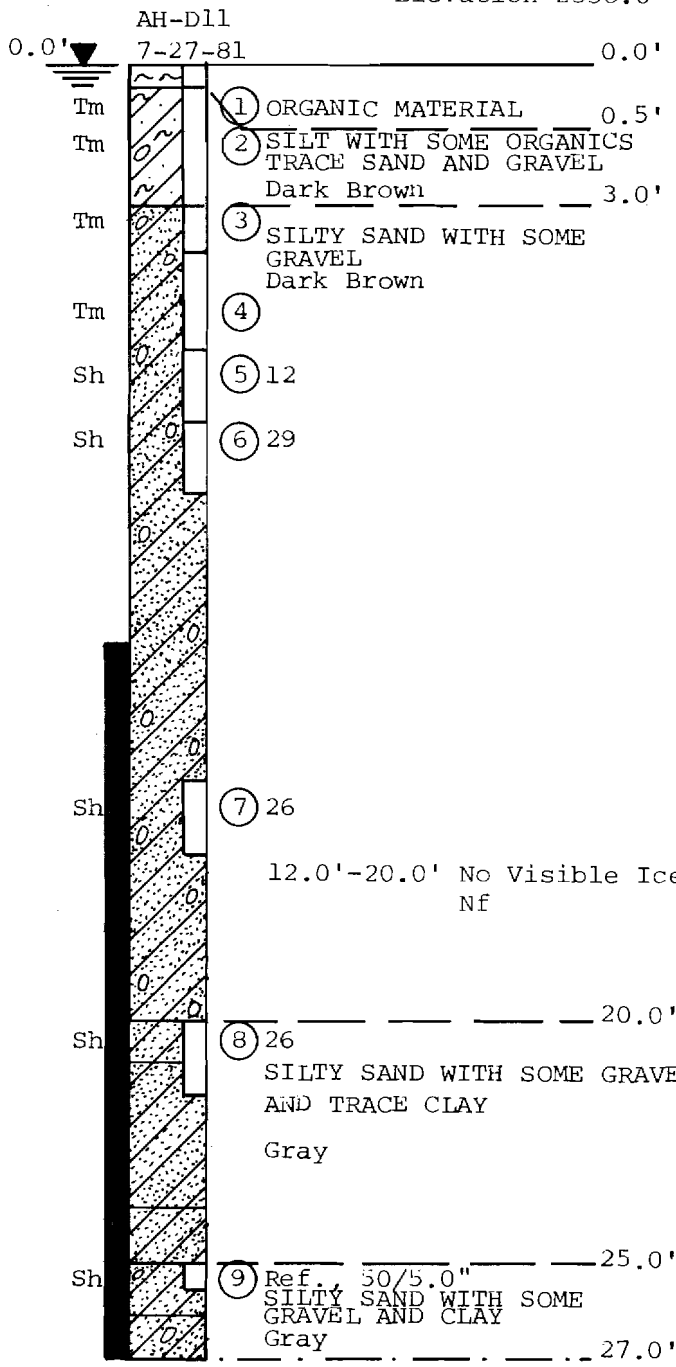


BORROW AREA D
AUGER HOLE AH-D10



Scale: 1"=4'

Elevation 2358.0'



Thermal Probe Installed to 54.8'
 Stand Pipe Piezometer Installed to
 54.8'

PREPARED BY:

PREPARED FOR:



BORROW AREA D
 AUGER HOLE AH-D11

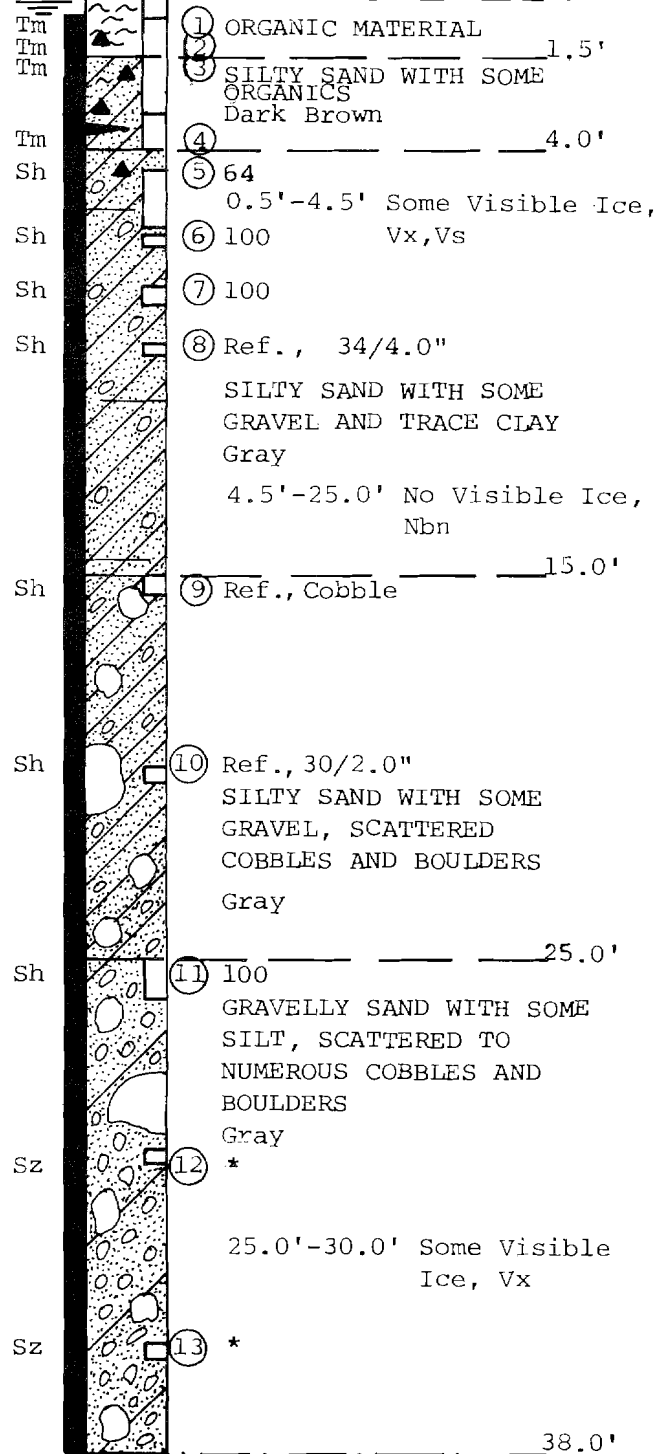


Scale: 1"=4'

Elevation 2337.9'

AH-D12

0.0' 7-30-81 0.0'



GRAVELLY SAND WITH SOME SILT, SCATTERED TO NUMEROUS COBBLES AND BOULDERS

⑭ *

60.0'
 Thermal Probe Installed to 28.0' T.D.
 * Tricone Cuttings Filling Hole, Unable to Sample Undisturbed Material

Prepared by:

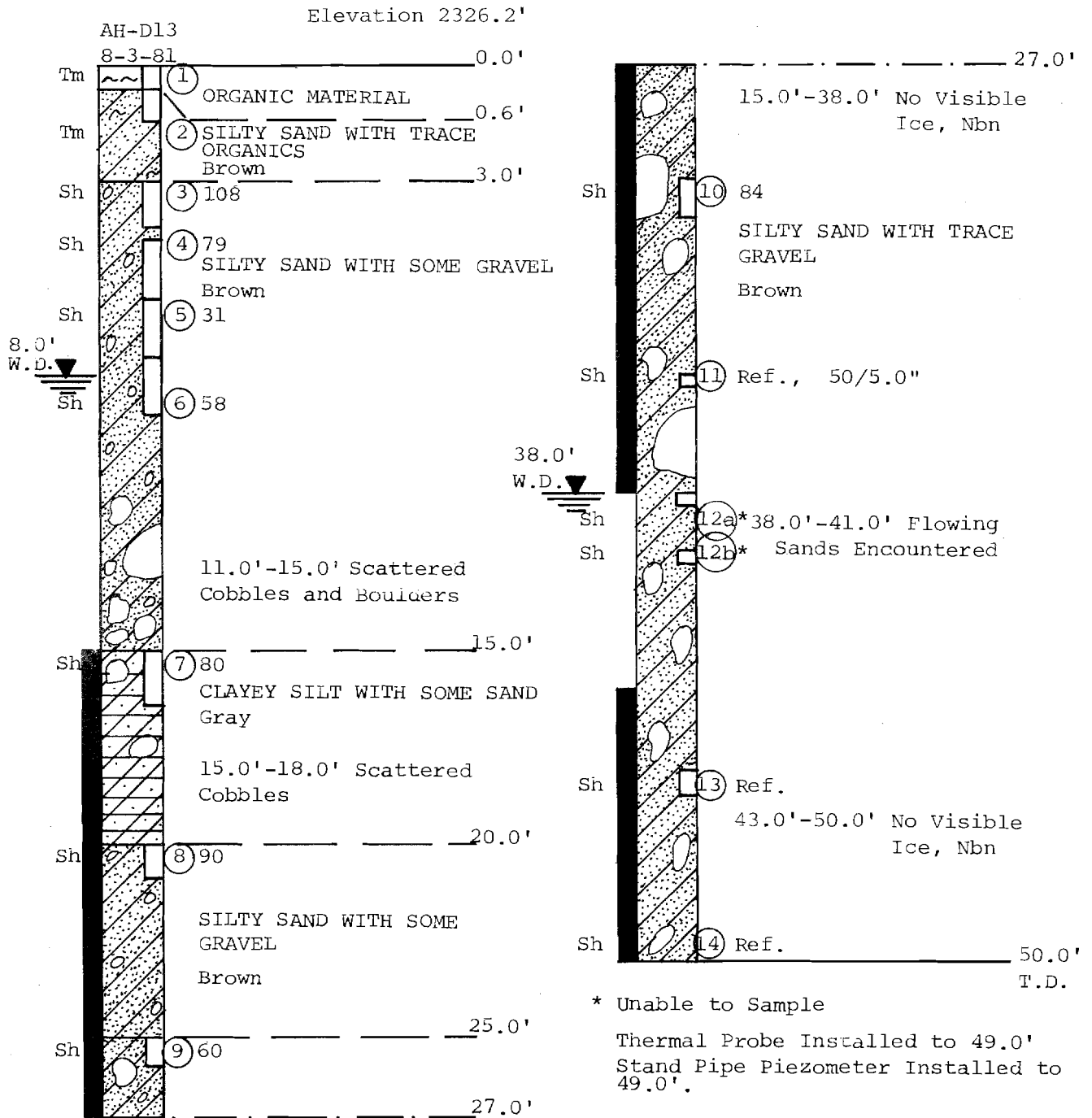
Prepared for:



BORROW AREA D
 AUGER HOLE AH-D12



Scale: 1"=5'



PREPARED BY:

PREPARED FOR:

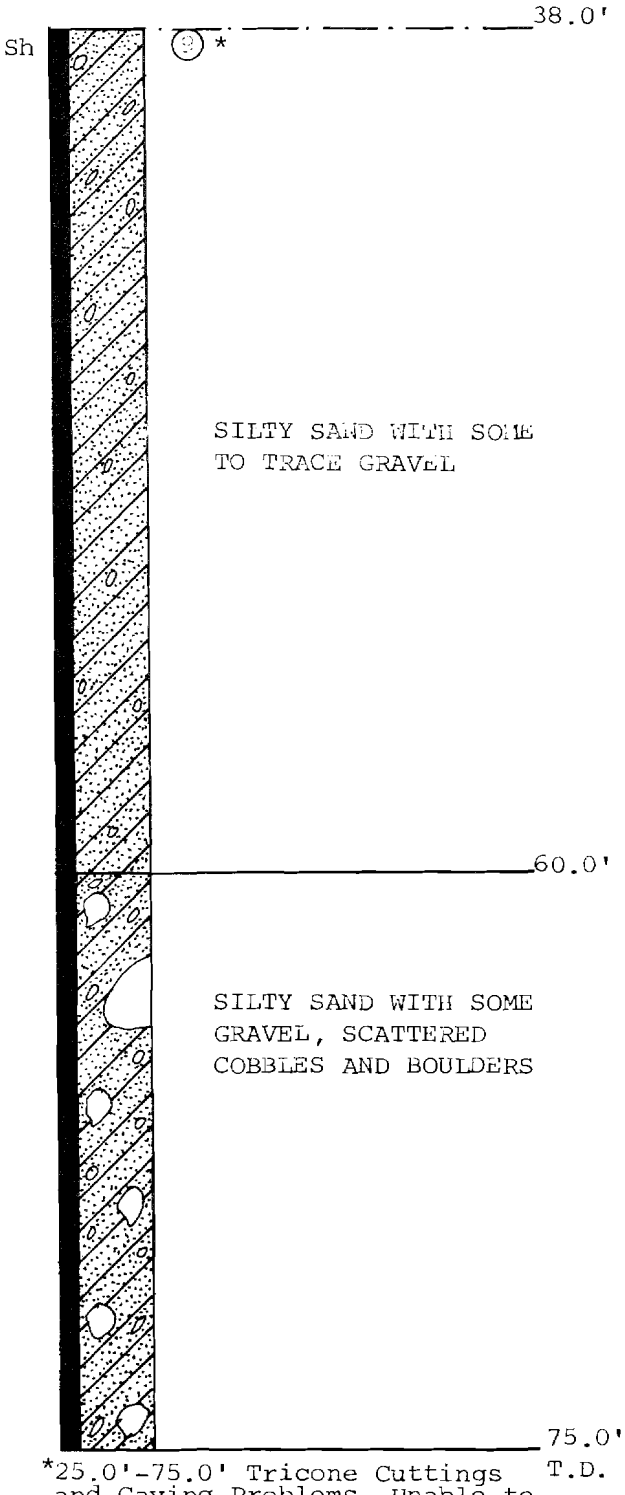
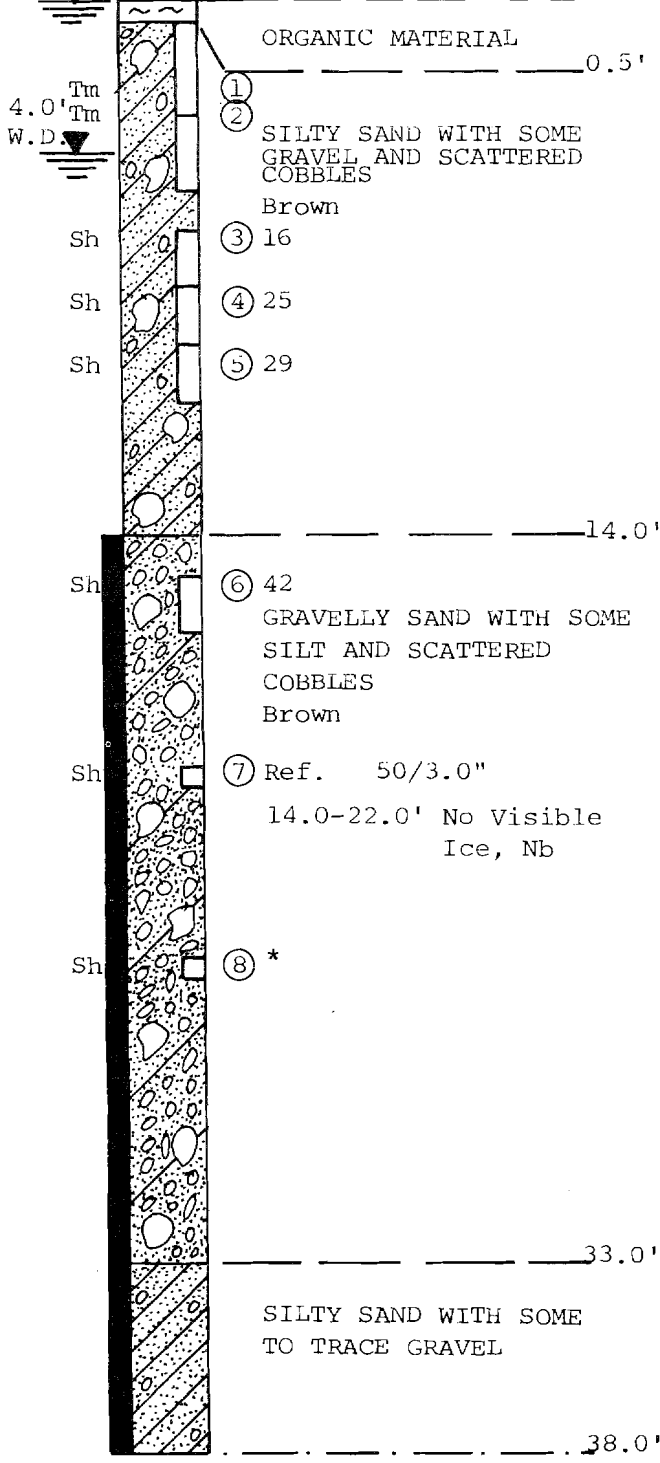


BORROW AREA D
AUGER HOLE AH-D13



Scale: 1"=4'

0.0' AH-D14 Elevation 2272.7'
 A.B. 8-27-81 0.0'



*25.0'-75.0' Tricone Cuttings T.D. and Caving Problems, Unable to Sample Undisturbed Material.
 Thermal Probe Installed to 31.0'
 Stand Pipe Piezometer Installed to 31.0'.

PREPARED BY:

PREPARED FOR:



BORROW AREA D
 AUGER HOLE AH-D14



Scale: 1"=5'

LABORATORY TEST DATA

PROJECT NO. 052504
 CLIENT: Acres American, Inc.
 PROJECT NAME Susitna Hydroelectric
 (Watana Dam Site)

R & M CONSULTANTS, INC.

DATE October 17, 1980

SUMMARY OF LABORATORY TEST DATA

PARTY NO. _____ PAGE NO. _____

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	4"	3"	2"	1½"	1"	¾"	½"	3/8"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.
AH-D1		5	6.0'- 7.5'					100	99	95	94	90	84	69	42.3	19.0	6.1	2.6	11.1	NV	NP	SM
AH-D1		6	8.0'- 8.5'				100	87	87	83	80	76	69	54	28.3	14.4	6.1	3.3	6.7			SM*
AH-D1		7	10.0'-10.3'						100	91	91	87	76	62	35.7	18.2	8.2	4.9	6.6			SM*
AH-D2		3	1.5'- 3.0'		100	80	80	80	77	73	72	67	61	47	28.5	12.0	3.2	2.9	25.7	NV	NP	SM
AH-D2		4	3.0'- 4.5'				100	94	92	90	89	86	79	62	35.0	21.2	4.1	2.4	11.4	13.9	NP	SM
AH-D2		5	4.5'- 6.0'					100	98	96	92	87	80	59	30.7	13.8	3.9	1.6	11.2	NV	NP	SM
AH-D2		8	15.0'-16.5'						100	99	97	93	87	70	44.0	22.5	8.9	4.0	11.3	15.5	2.2	SM
AH-D2		9	20.0'-21.5'				100	96	94	93	91	85	78	61	38.6	21.3	10.3	4.2	9.4	17.5	4.2	SM

REMARKS: * Estimated Value
** NV=Non Viscous NP=Non Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

APPROVED _____

PROJECT NO. 052504

CLIENT: Acres American, Inc.

PROJECT NAME Susitna Hydroelectric
(Watana Dam Site)

R & M CONSULTANTS, INC.

DATE October 17, 1980

PARTY NO. _____ PAGE NO. _____

SUMMARY OF LABORATORY TEST DATA

DESCRIPTION		4"	3"	2"	1½"	1"	¾"	½"	⅜"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.	
DEADMAN	W-80-282											100	99.5	81.3	69.6	50.8	42.1	55.9	33.2	CL-CH	
	(Grab Sample)																				
DEADMAN	W-80-300			100	95	93	89	87	86	80	76	58	26.9	9.2	3.0	1.3	6.6	NV**	NP**	SM	
	(Grab Sample)																				

REMARKS: * Estimated Value
** NV=Non Viscous, NP=Non Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
 Client: Acres American
 PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE September 1981

SUMMARY OF LABORATORY TEST DATA

PARTY NO. _____ PAGE NO. 1

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	1 1/2"	1"	3/4"	1/2"	3/8"	4	10	40	200	.02	.005	.002	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
D5	4		7.5'-9.0'						100	87	53	22.8										SM
D5	5		10.0'-11.5'	100	70	69	67	67	67	52	35	15.9										SM
D5	6		15.0'-16.5'			100	76	76	76	69	51	23.2										SM
D5	9		30.0'-31.5'						100	84	60	26.4					14	NP			13	SM
D5	10		35.0'-36.0'						100	85	63	44.6					17	6			16	SM-SC
D5	11		40.0'-41.5'			100	98	96	92	87	73	55.2					23	14			12	CL
D5	12		45.0'-46.0'		100	88	88	88	88	74	48	25.3					39	14			9	SM-SC
D6	3,4		5.0'-7.5' *					100	91	84	67	40.5					15	NP			10, 8	SM
D6	6,7		8.0'-11.0' *						100	80	55	23.2					13	NP			12, 11	SM
D6	9		20.0'-21.5'						100	80	40	11.7					17	2			12	SW-SM
D6	10		25.0'-26.5'	**	83	83	80	77	75	71	67	51	32.5				15	NP			9	SM
D6	11		30.0'-31.0'																		8	
D6	12		35.0'-36.0'			100	98	94	89	83	65	40.5					17	NP			9	SM
D6	13		40.0'-40.5'																		12	

REMARKS: * Sample Combined for Sieve Analysis and Atterberg Limits
** 100% Passing 2"
NP= Non-Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
 Client: Acres American
 PROJECT NAME Susitna Hydroelectric



DATE September 1981

PARTY NO. _____ PAGE NO. 2

SUMMARY OF LABORATORY TEST DATA

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	1 1/2"	1"	3/4"	1/2"	3/8"	4	10	40	200	.02	.005	.002	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	D7	2	4.0'-5.0'																		11	
	D7	3	5.0'-6.0'																		11	
	D7	4,5	7.0'-10.0' *	100	97	91	88	85	79	71	51	31.2									12,11	SM
	D7	6	15.0'-16.5'	100	90	88	86	84	80	72	52	26.6									10	SM
	D7	7	20.0'-20.2'																		6	
	D7	8	25.0'-25.7'		100	94	94	94	94	77	51	23.3				2.62					9	SM
	D7	9	35.0'-35.2'																		9	
	D7	10	40.0'-40.7'						100	79	50	19.8				2.73					9	SM
	D8	5	4.5'-6.0'				100	82	82	57	39	17.5					14	NP			15	SM
	D8	8	9.5'-11.0'						100	84	67	41.8					14	NP			14	SM-ML
	D8	9	15.0'-16.5'					100	88	73	47	17.7										SM
	D8	10	20.0'-21.0'																		13	
	D8	11	25.0'-25.7'	100	77	77	72	72	72	55	33	11.2					18	5			10	SM-SP
	D8	13	35.0'-36.0'			100	97	95	91	86	72	52.6									13	ML
	D8	15	45.0'-45.2'																		9	
	D8	16	50.0'-50.2'																		7	

REMARKS: * Sample Combined for Sieve Analysis
Np= Non-Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
 Client: Acres American
 PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE September 1981

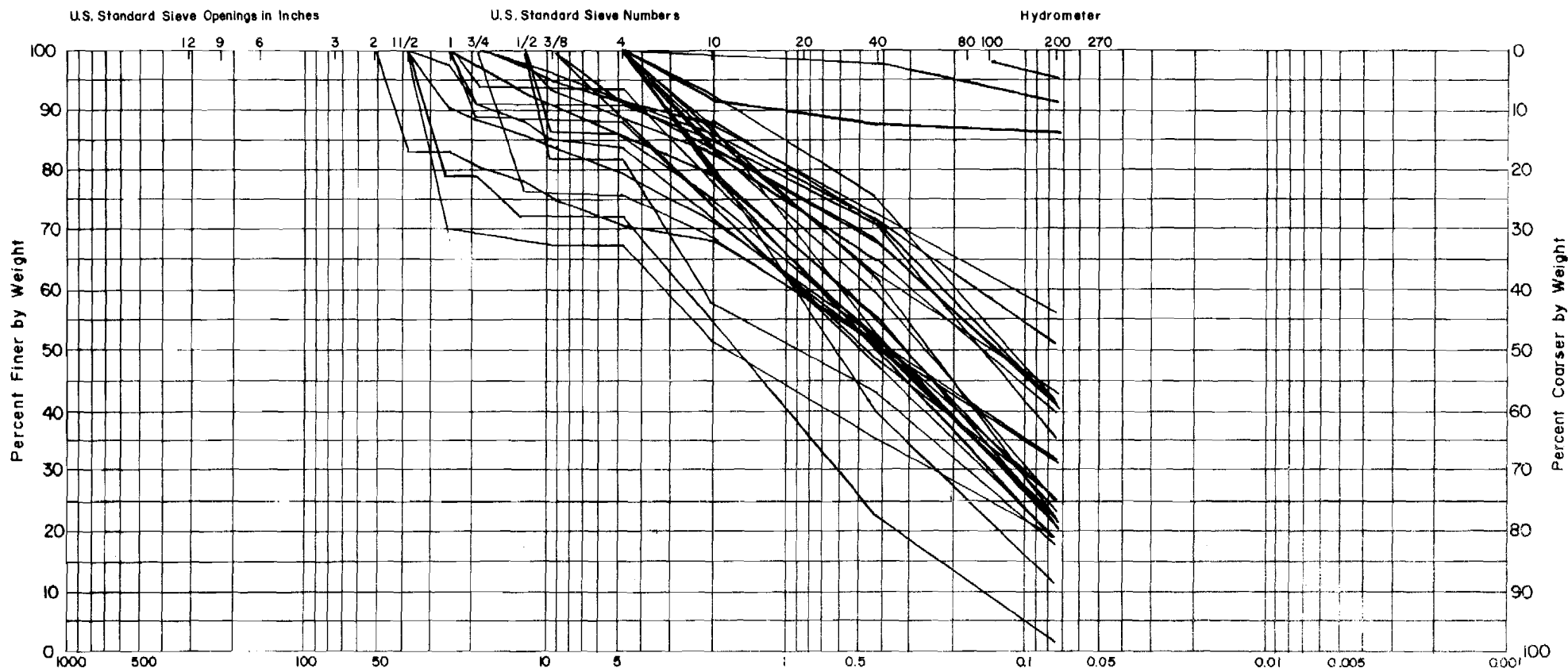
PARTY NO. _____ PAGE NO. 3

SUMMARY OF LABORATORY TEST DATA

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	1 1/2"	1"	3/4"	1/2"	3/8"	4	10	40	200	.02	.005	.002	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	D9	2	1.5'- 3.0'		100	91	91	91	91	85	71	35.4										SM
	D9	3	3.0'- 4.5'					100	91	87	71	41.4										SM
	D9	4	4.5'- 6.0'						100	93	75	41.6										SM
	D9	5	6.0'- 7.5'		100	97	93	91	86	79	55	20.9										SM
	D9	6	7.5'- 9.0'						100	86	61	23.0										SM
	D9	7	9.0'-10.5'				100	86	86	75	53	21.7										SM
	D9	13	40.0'-41.0'						100	99	98	91.7					21	NP			21	ML
	D9	14	45.0'-46.5'						100	92	87	82.7					35	7			25	ML
										*	*	*										
	BORROW	D								80	100	200										
	BULK	SAMPLE								100	98	95.1					59	23				MH

REMARKS: NP= Non-Plastic
*Sieve Size

NOTE: SIEVE ANALYSIS = PERCENT PASSING



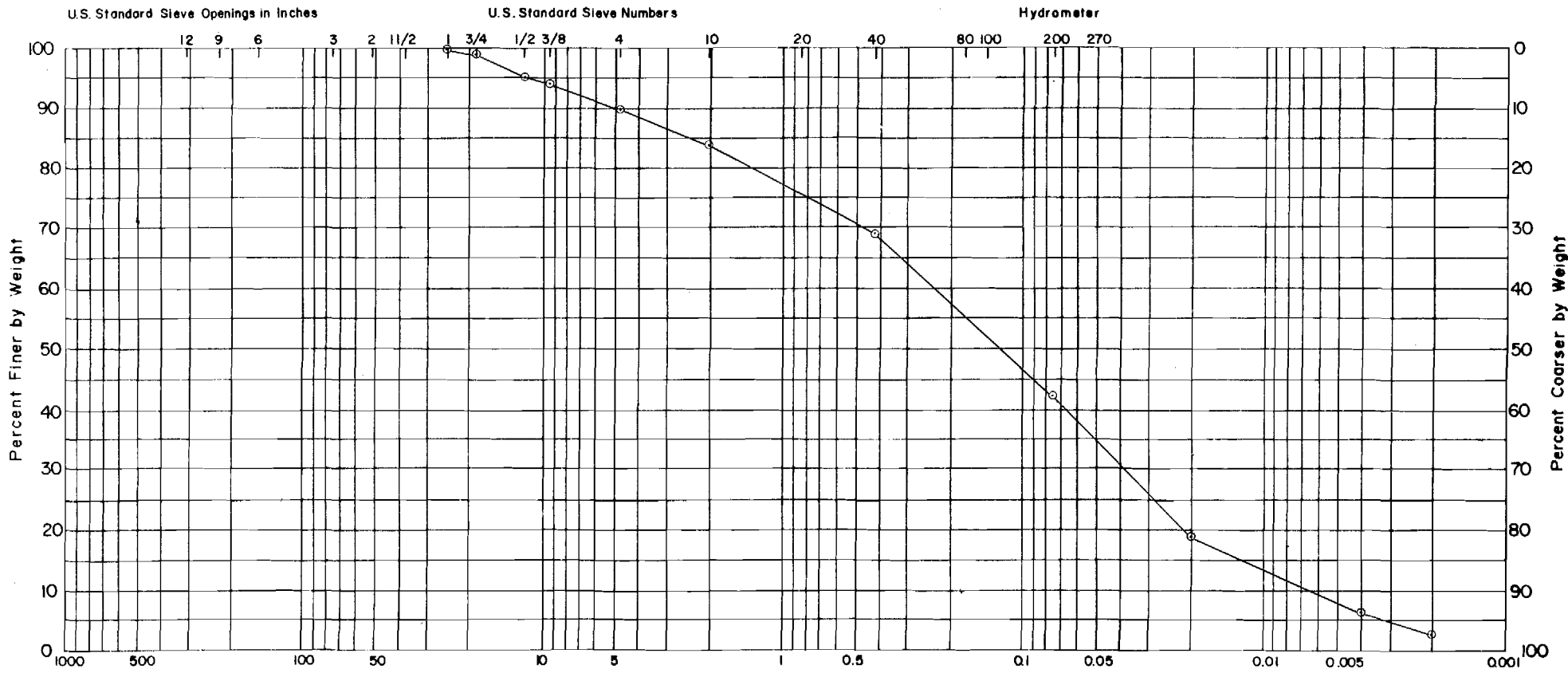
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION



BORROW AREA D
COMPOSITE GRADATION CURVE

DRAWN BY: _____
 APPROVED BY: _____
 DATE: _____
 PROJECT NO. _____



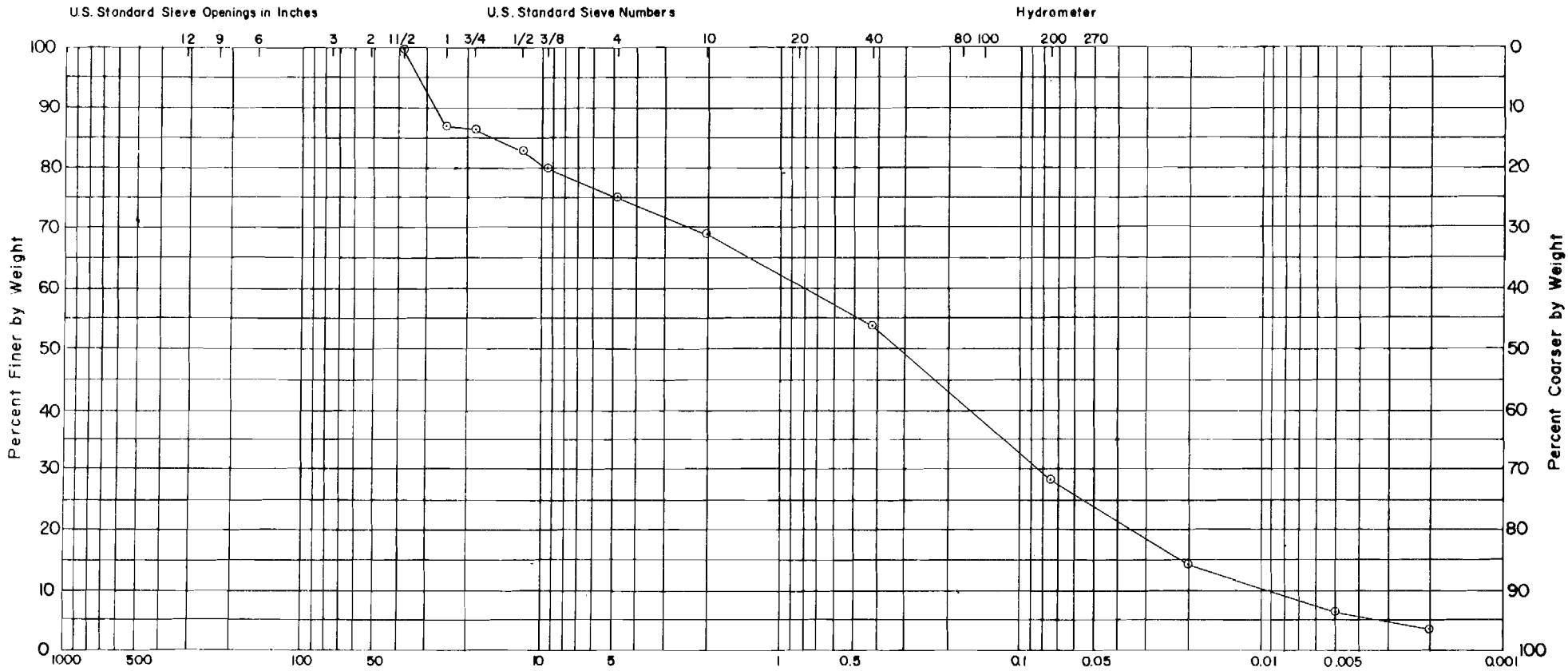
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-D1-5 (6.0-7.5')	11.1%		NV	NP	SM SILT AND SAND WITH TRACE GRAVEL AND TRACE CLAY Non Viscous, Non Plastic



BORROW AREA D

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



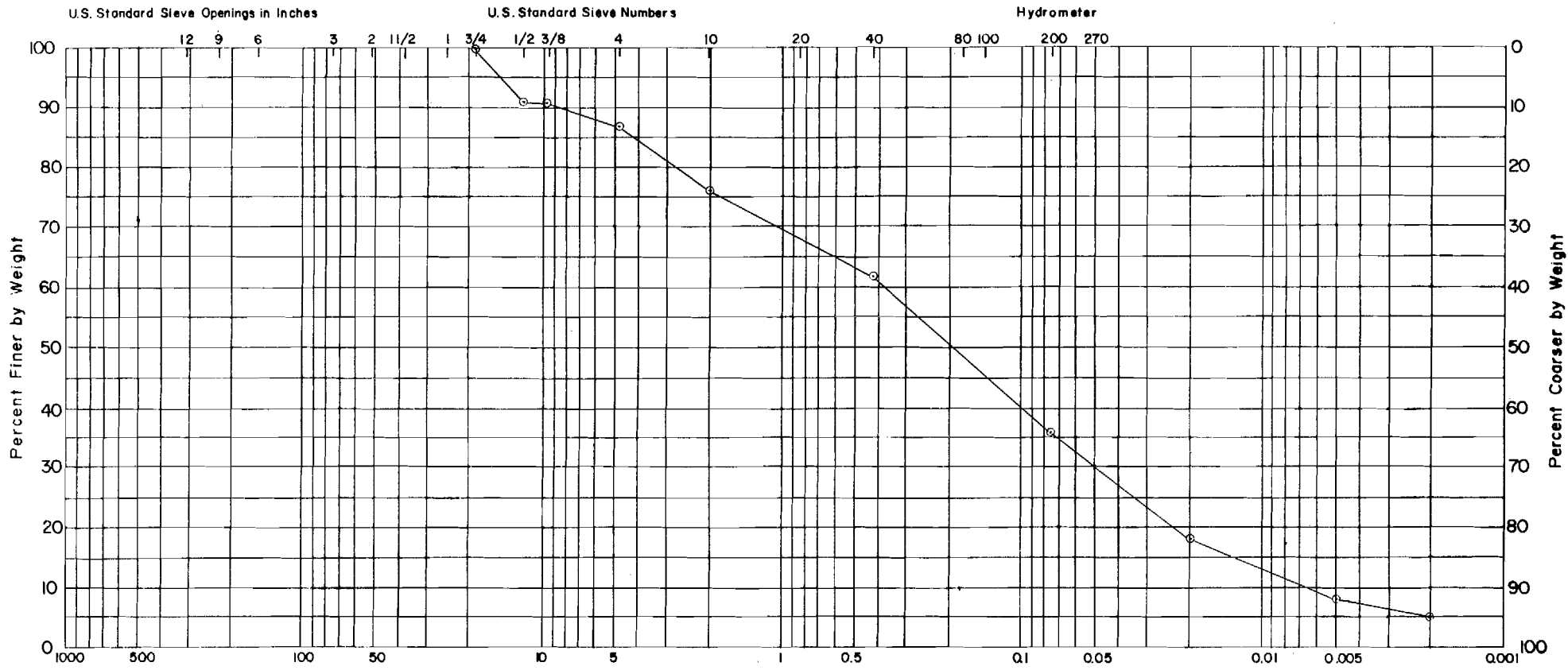
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D1-6 (8.0-8.5')	6.7%				SM	GRAVELLY SILTY SAND WITH TRACE CLAY



BORROW AREA D

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



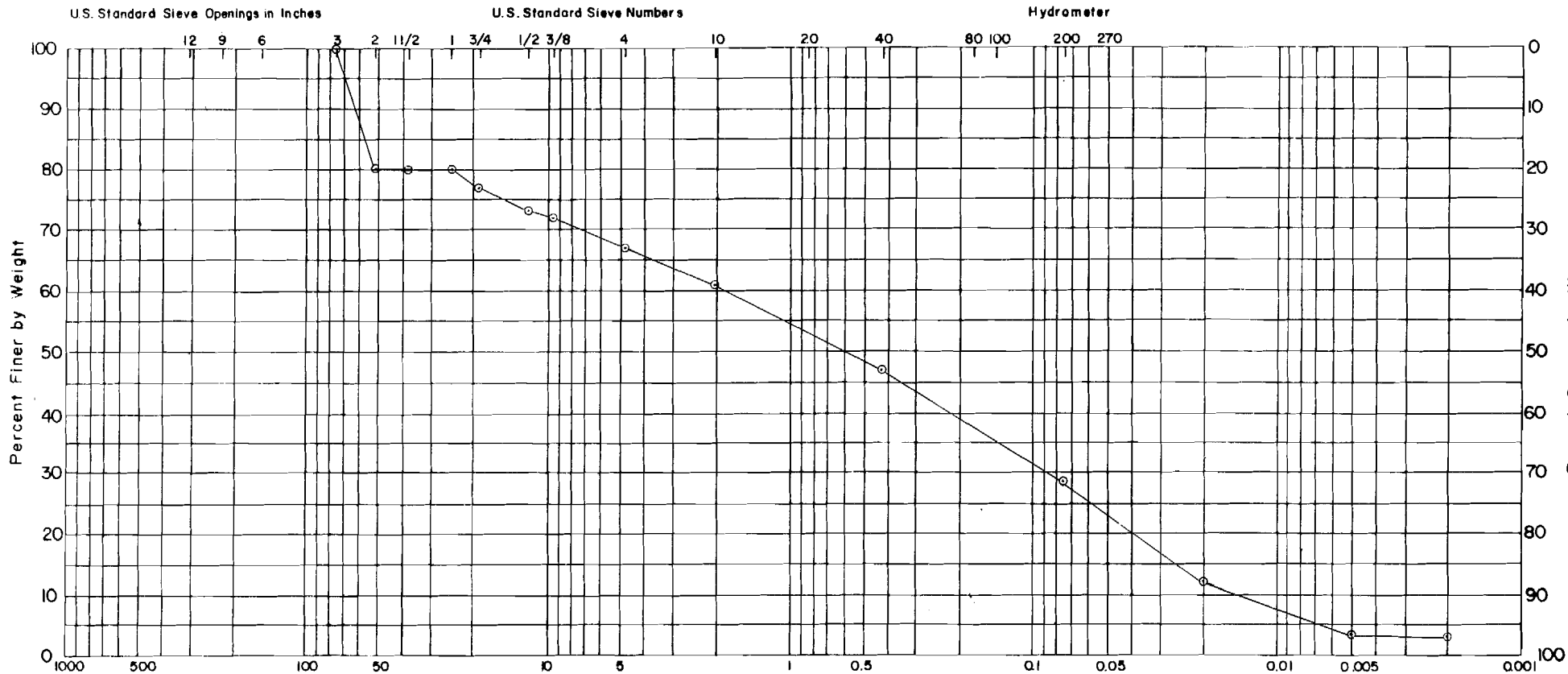
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-D1-7 (10.0-10.3')	6.6%				SM SILTY SAND WITH SOME GRAVEL, TRACE CLAY



BORROW AREA D

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



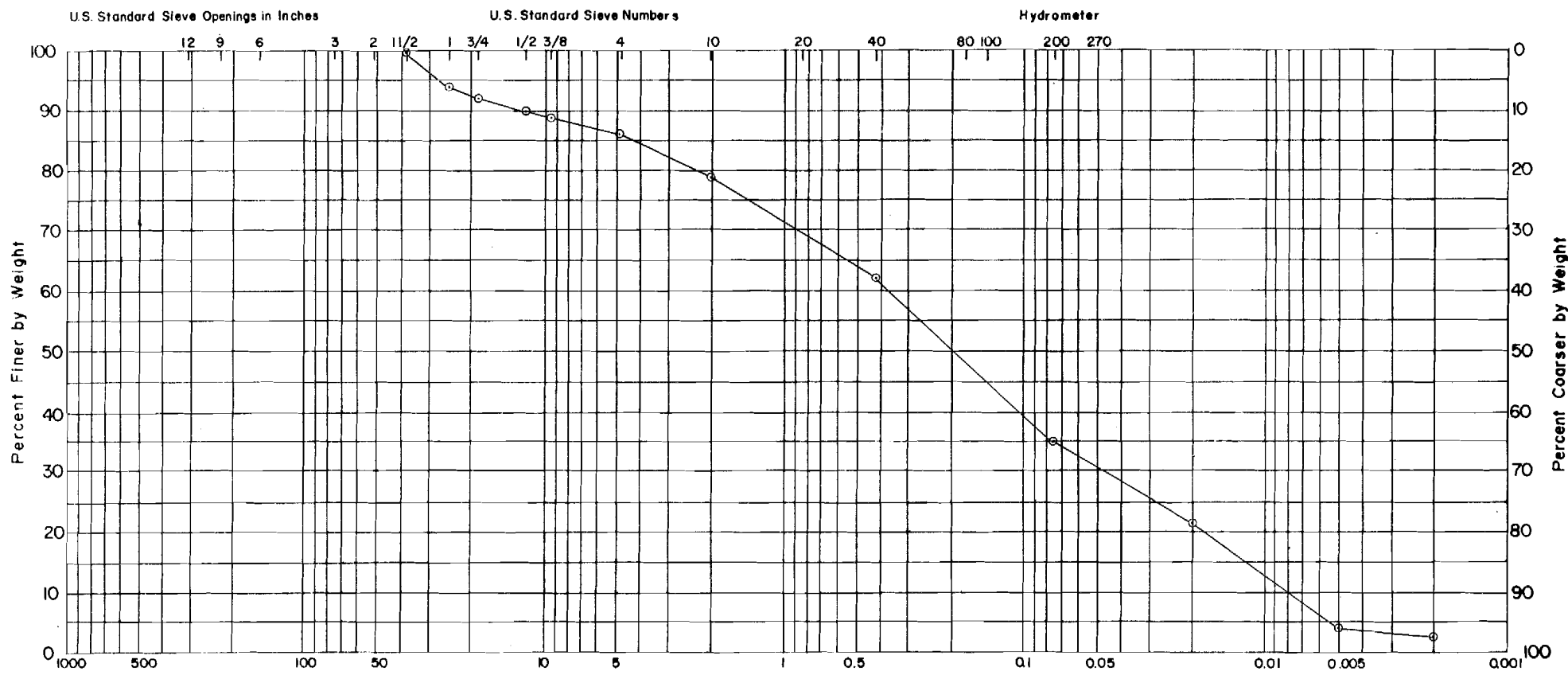
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D2-3 (1.5-3.0')	25.7%		NV	NP	SM	SILTY GRAVELLY SAND W/TRACE CLAY



BORROW AREA D

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



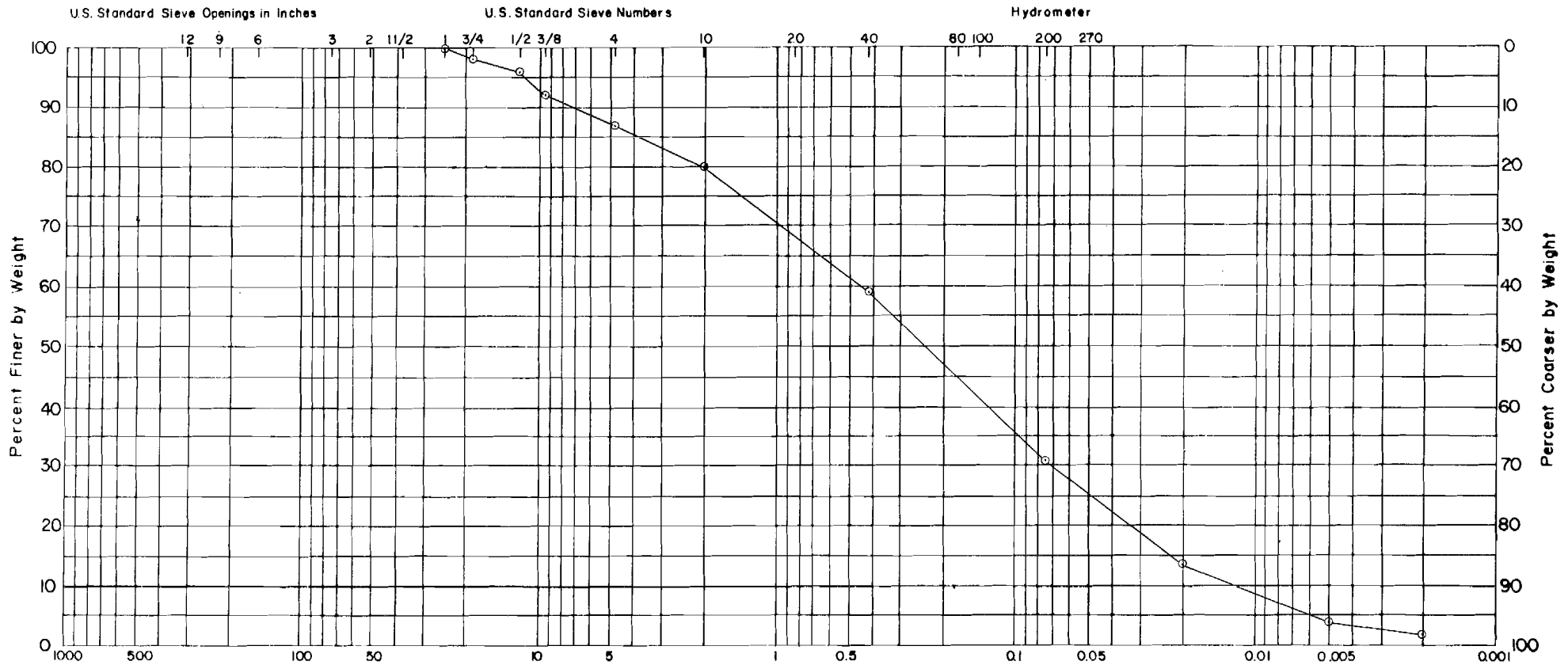
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D2-4 (3.0-4.5')	11.4%		13.9	NP	SM	SILTY SAND WITH SOME GRAVEL, TRACE CLAY Non Plastic



BOPROW AREA D

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



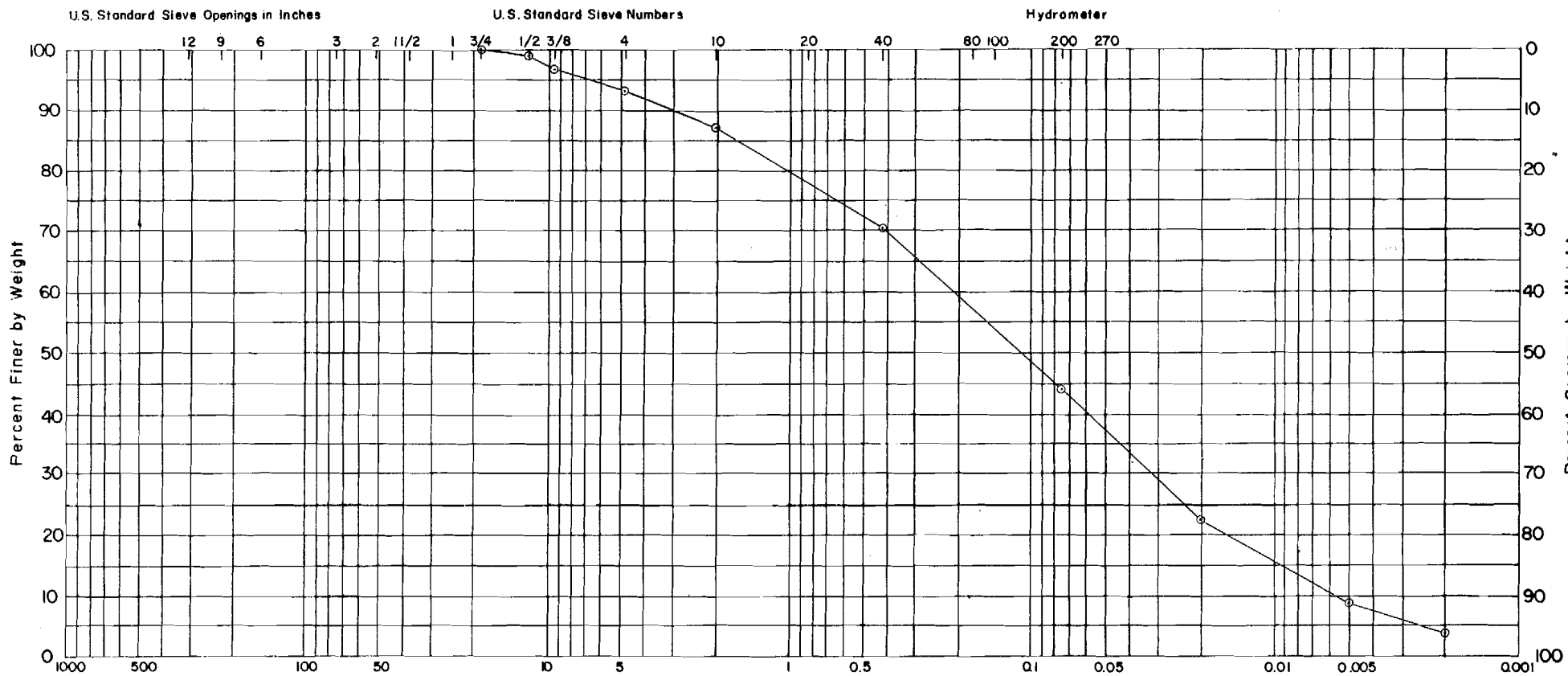
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	SM	CLASSIFICATION & DESCRIPTION
AH-D2-5 (4.5-6.0')	11.2%		NV	NP	SM	SILTY SAND WITH SOME GRAVEL, TRACE CLAY Non Viscous, Non Plastic



BORROW AREA D

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



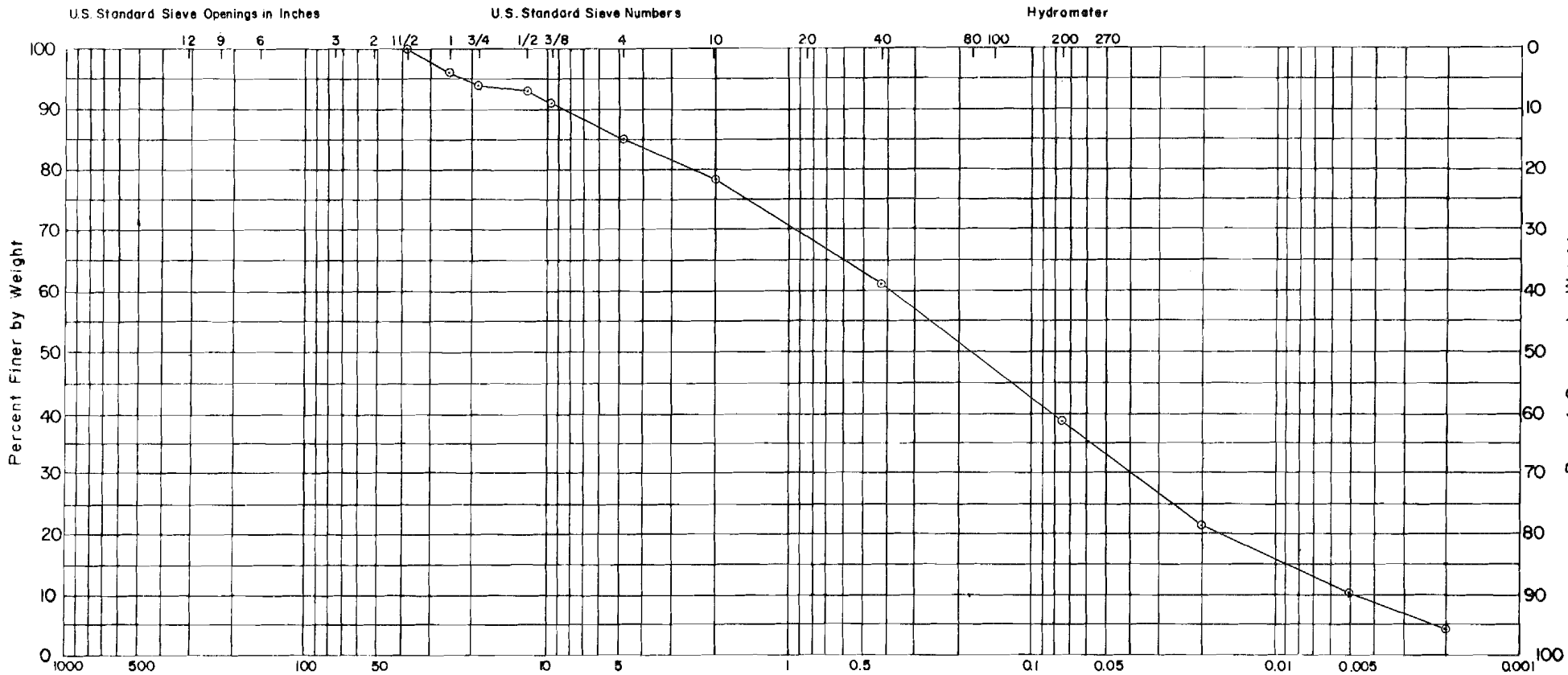
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
AH-D2-8 (15.0-16.5')	11.3%		15.5	2.2	SM	SILTY SAND WITH TRACE GRAVEL, TRACE CLAY



BORROW AREA D

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



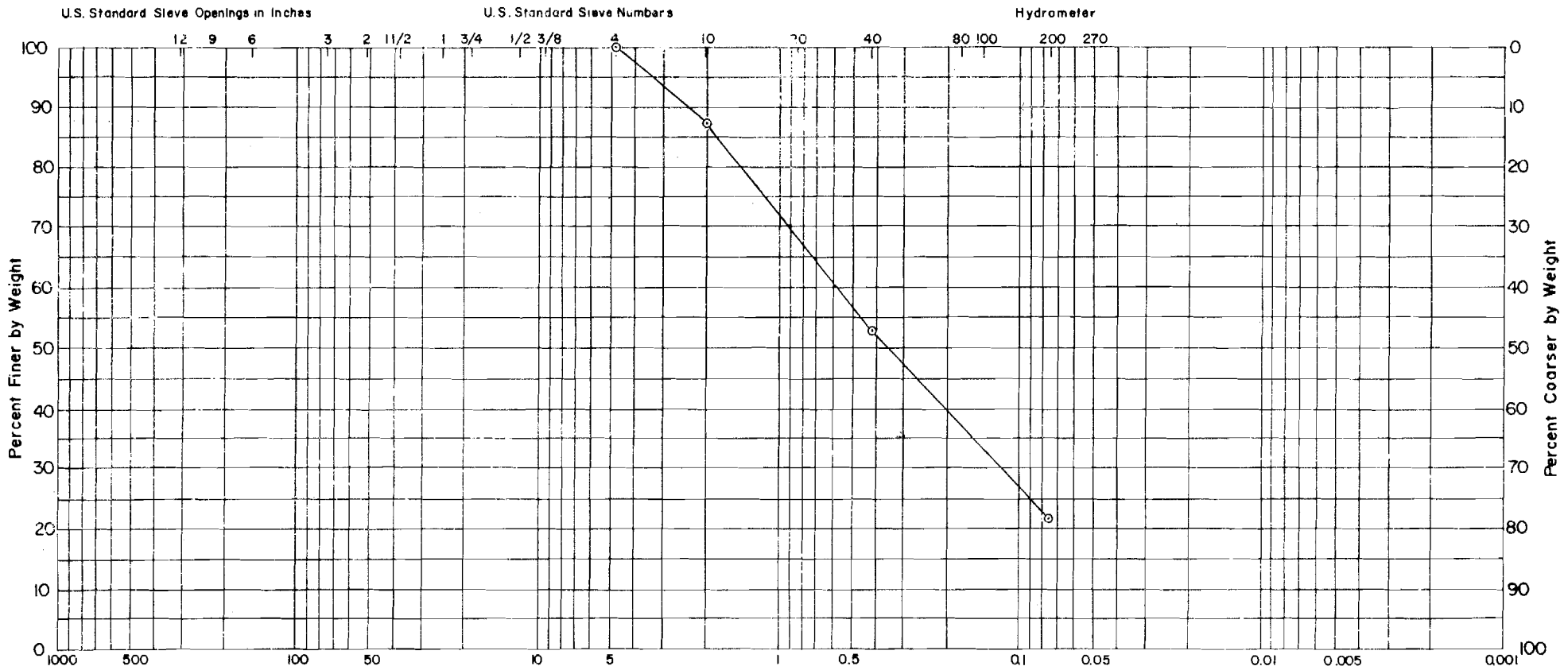
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-D2-9 (20.0-21.5')	9.4%		17.5	4.2	SM	SILTY SAND WITH SOME GRAVEL, CLAY



BORROW AREA D

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



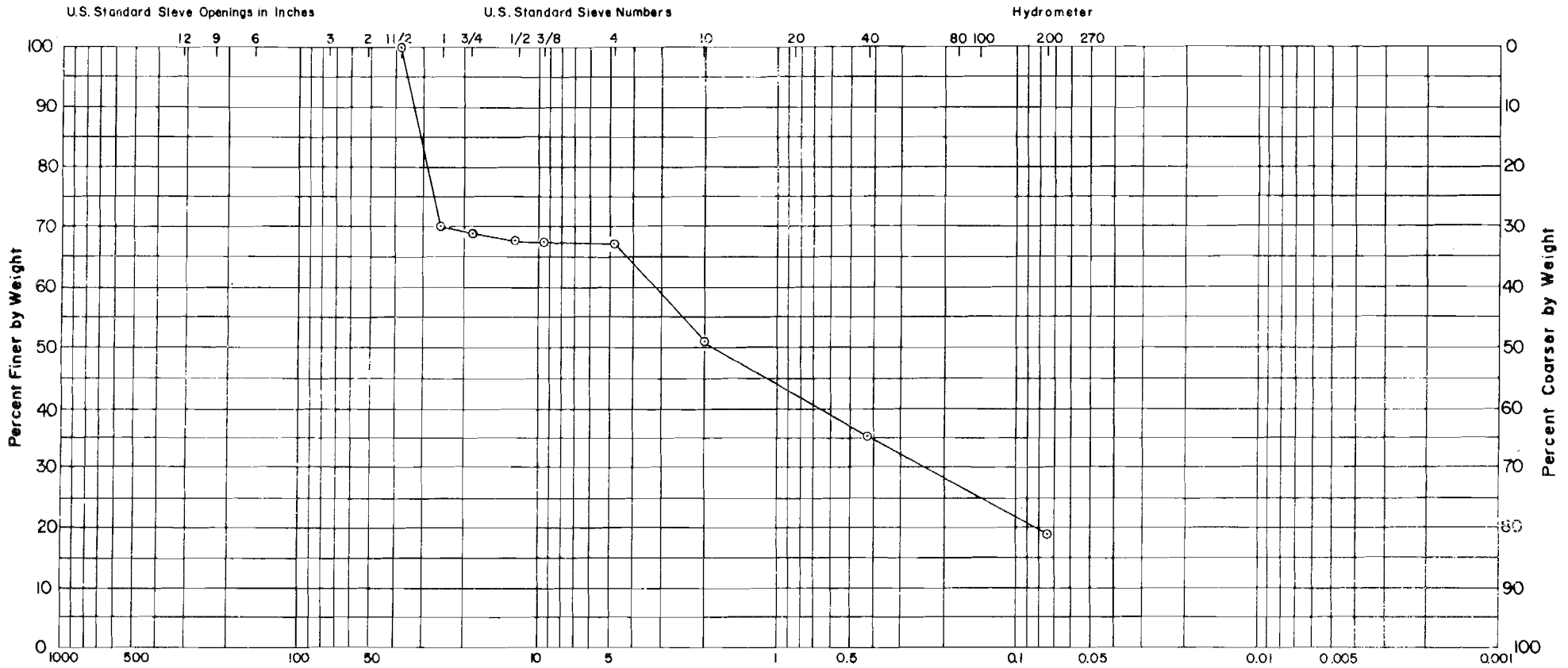
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 4					SM	SAND WITH SOME SILT



BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



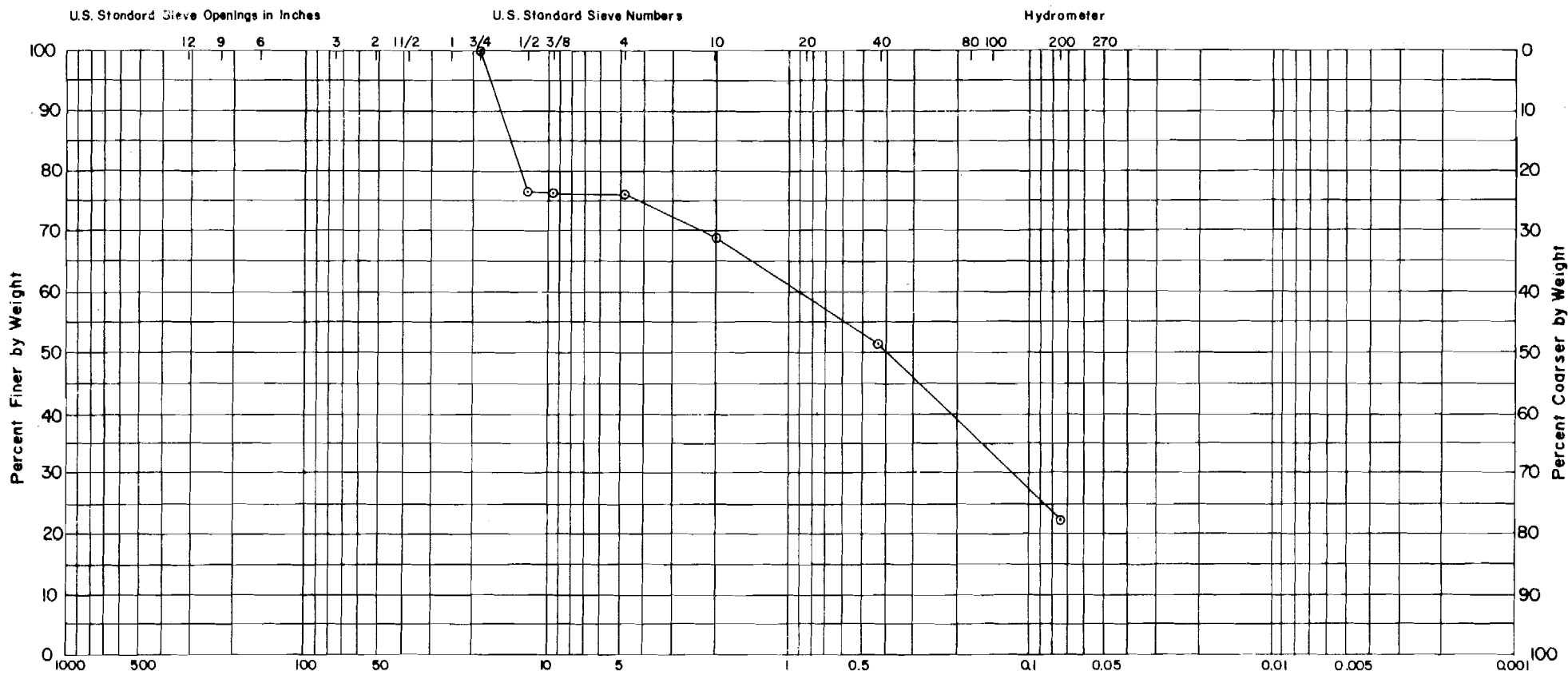
BOULDERS	COBBLES	GRAVEL			SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes	

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 5					SM	GRAVELLY SAND WITH SOME SILT



BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



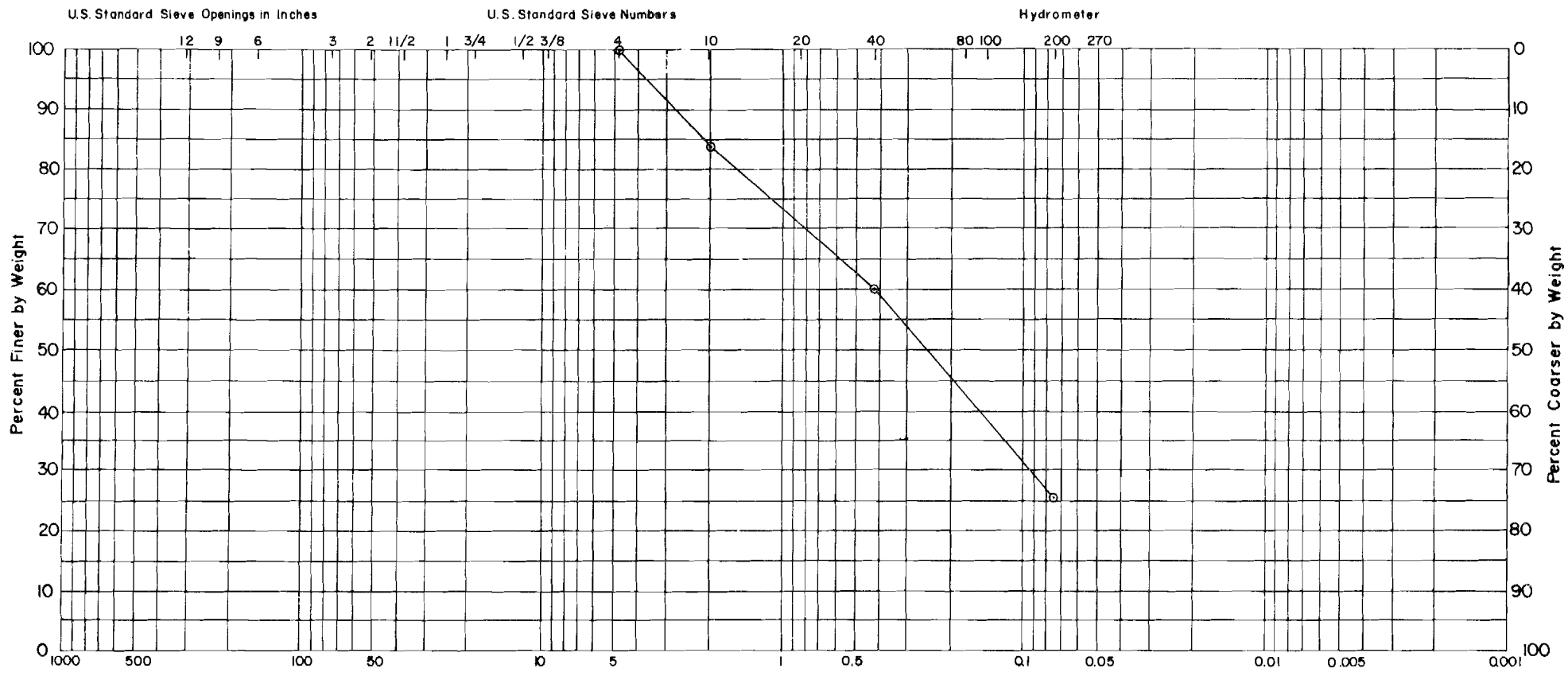
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOTSTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 6					SM	SAND WITH SOME GRAVEL AND SILT



BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



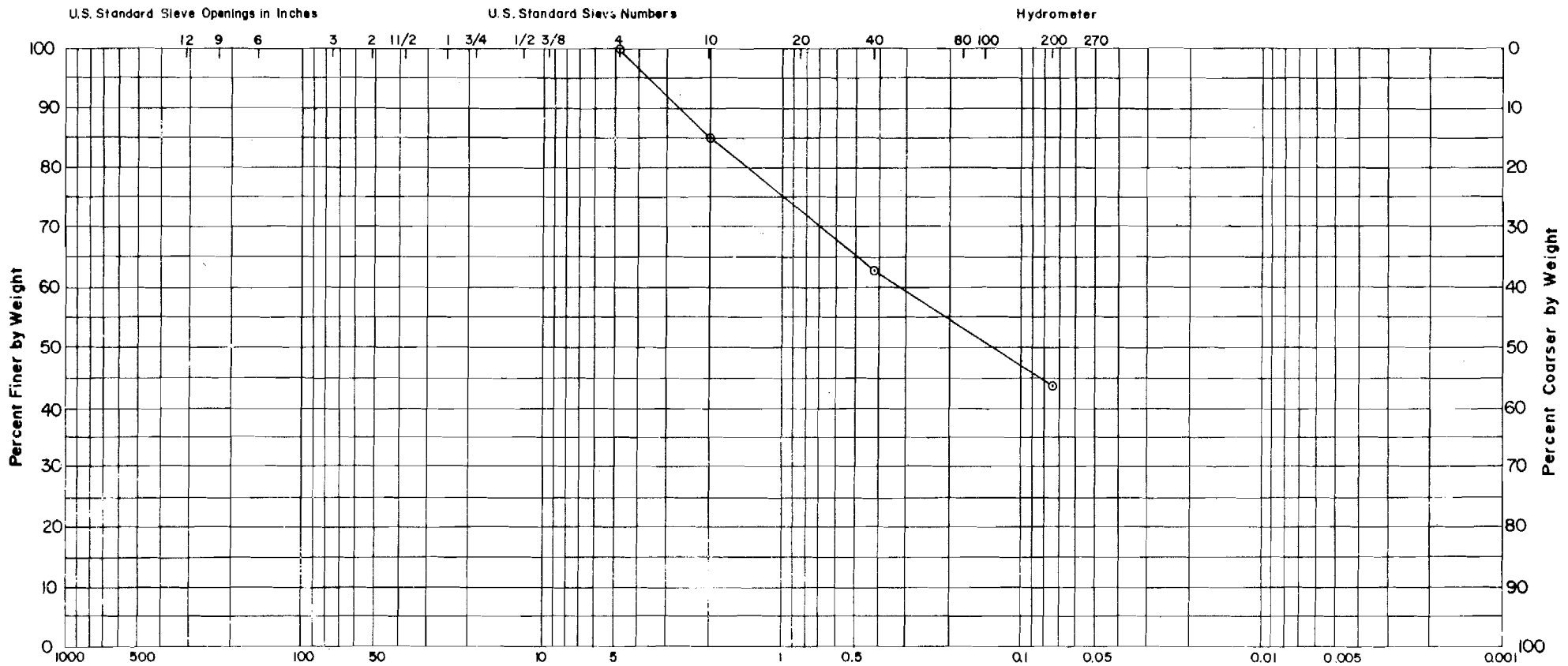
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 9	13		14	NP	SM	SAND WITH SOME SILT



BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



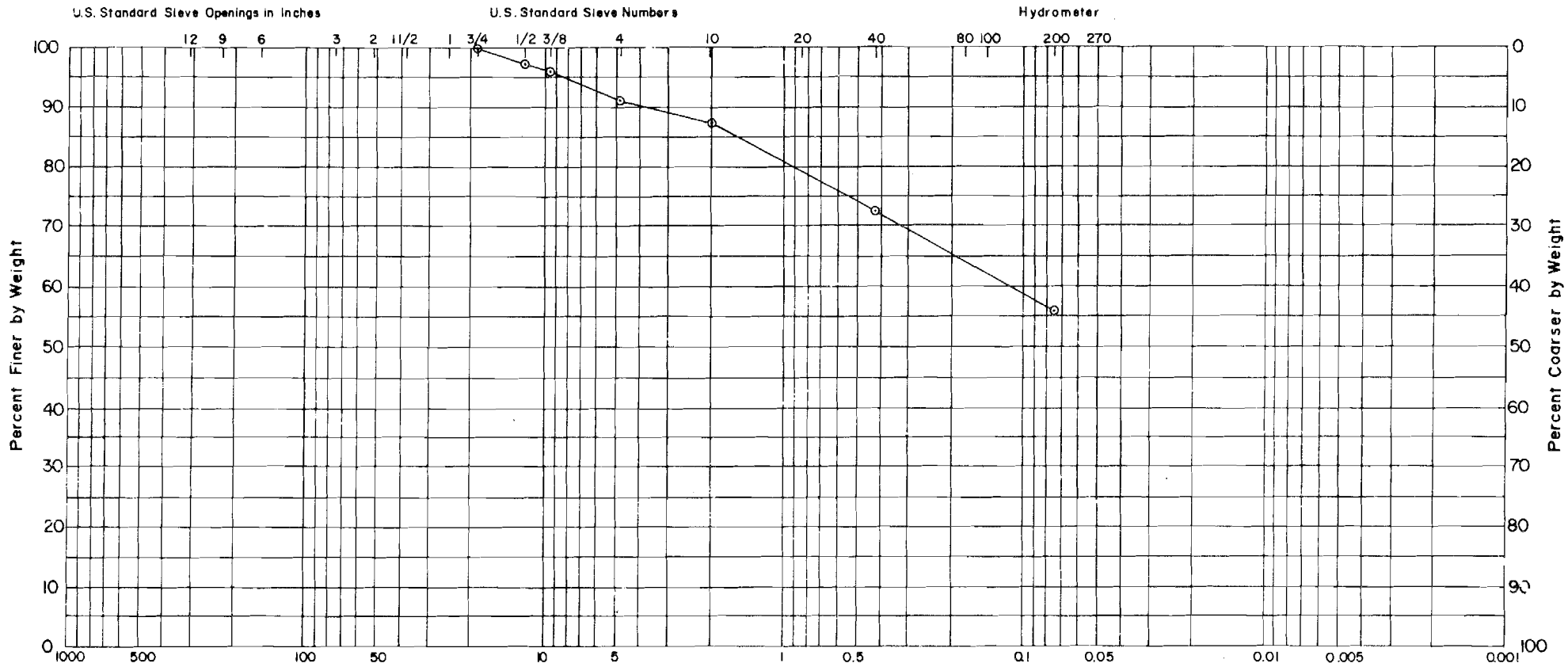
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 10	12		17	6	SM-SC	SILTY SAND WITH SOME TO TRACE CLAY



BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



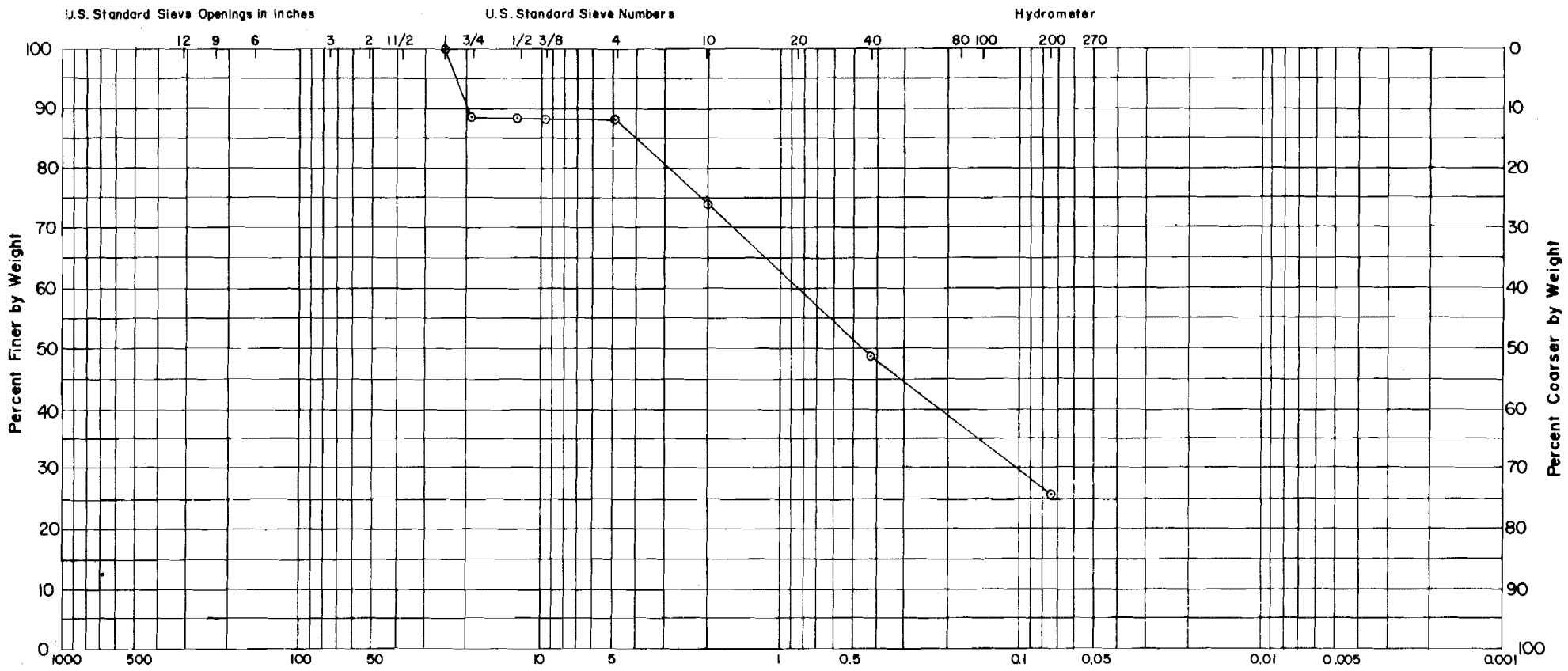
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOTIS TURE CONTENT	DR Y DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5-11	12		23	14	CL	SANDY SILT WITH SOME TO TRACE CLAY AND TRACE GRAVEL



BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



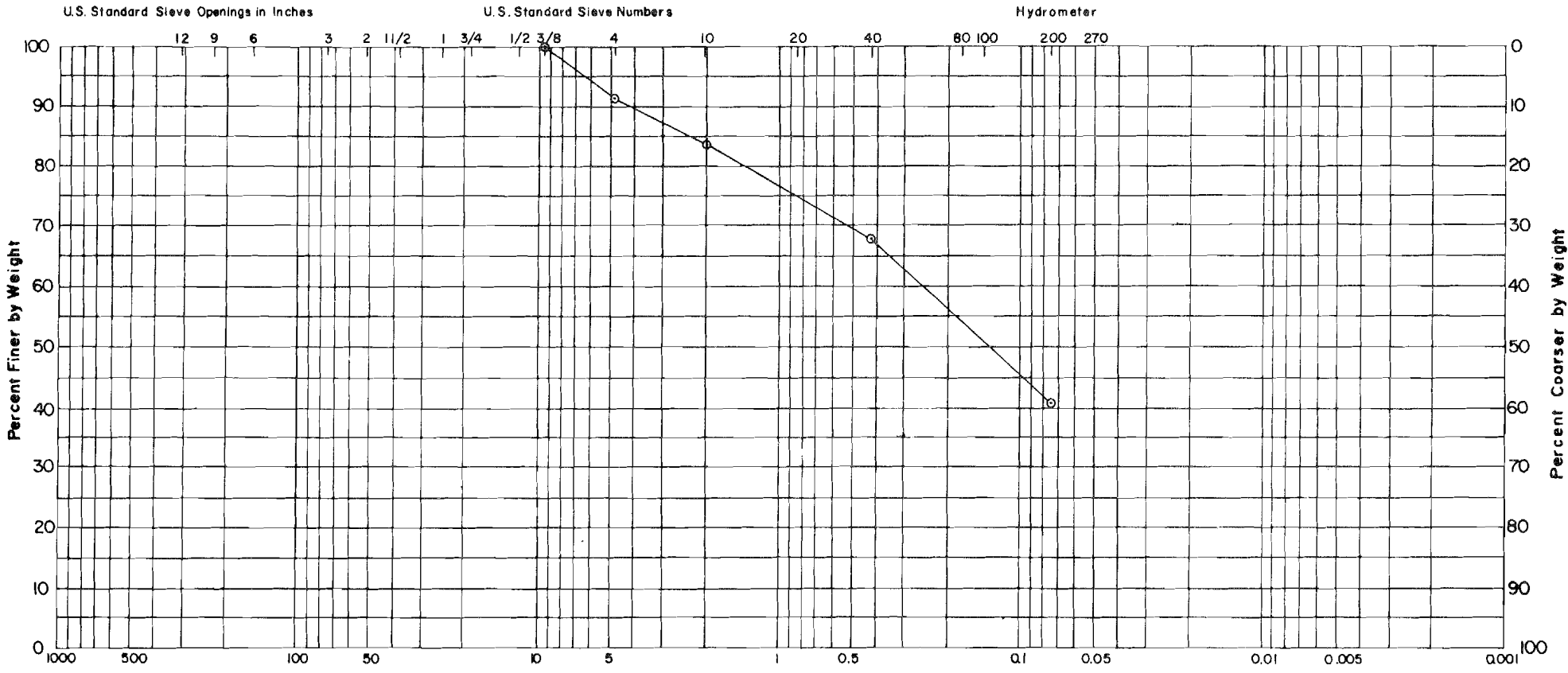
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D5 - 12	9		39	14	SM-SC	SAND WITH SOME GRAVEL AND SILT AND TRACE CLAY



BORROW AREA D
AUGER HOLE AH-D5

DRAWN BY: P.T.
 APPROVED BY: W.O.S.E.
 DATE: 12/81
 PROJECT NO. 052506



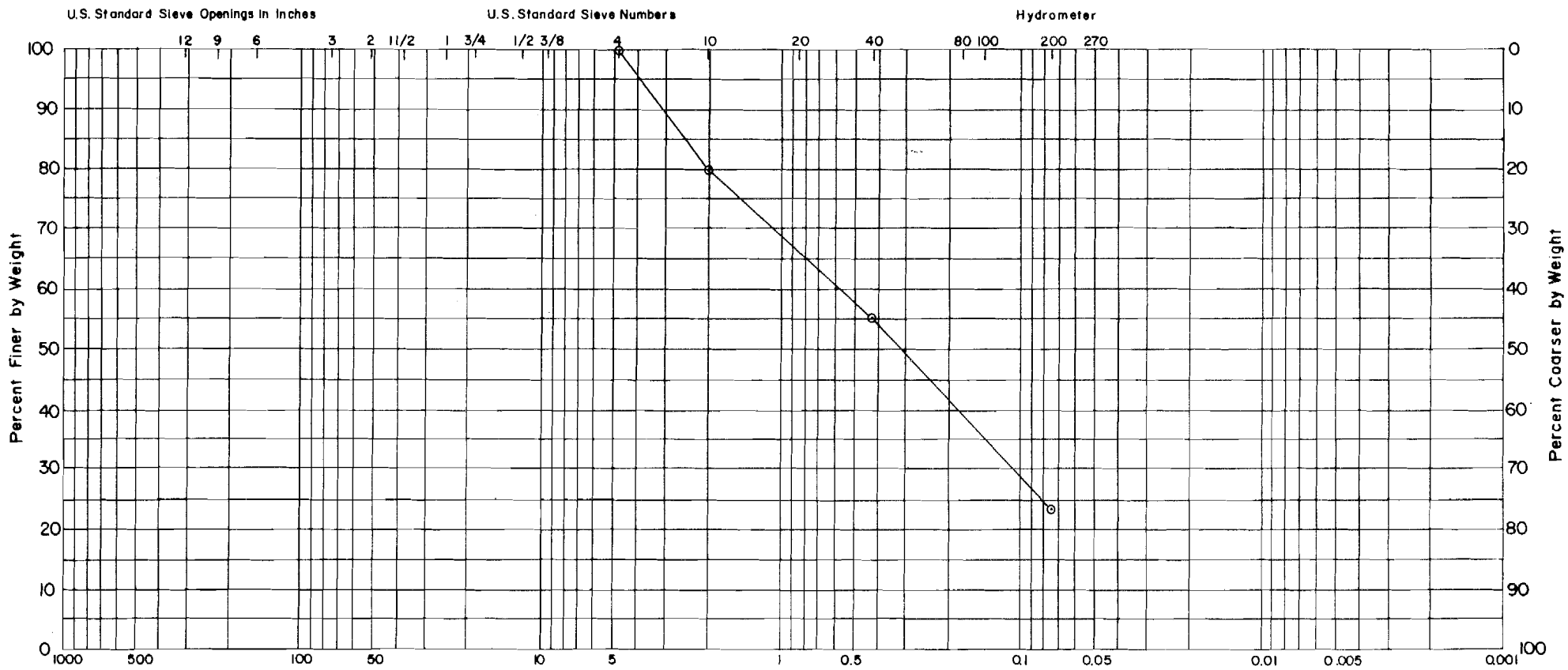
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 3,4,	10,8		15	NP	SM	SILTY SAND WITH TRACE GRAVEL



BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



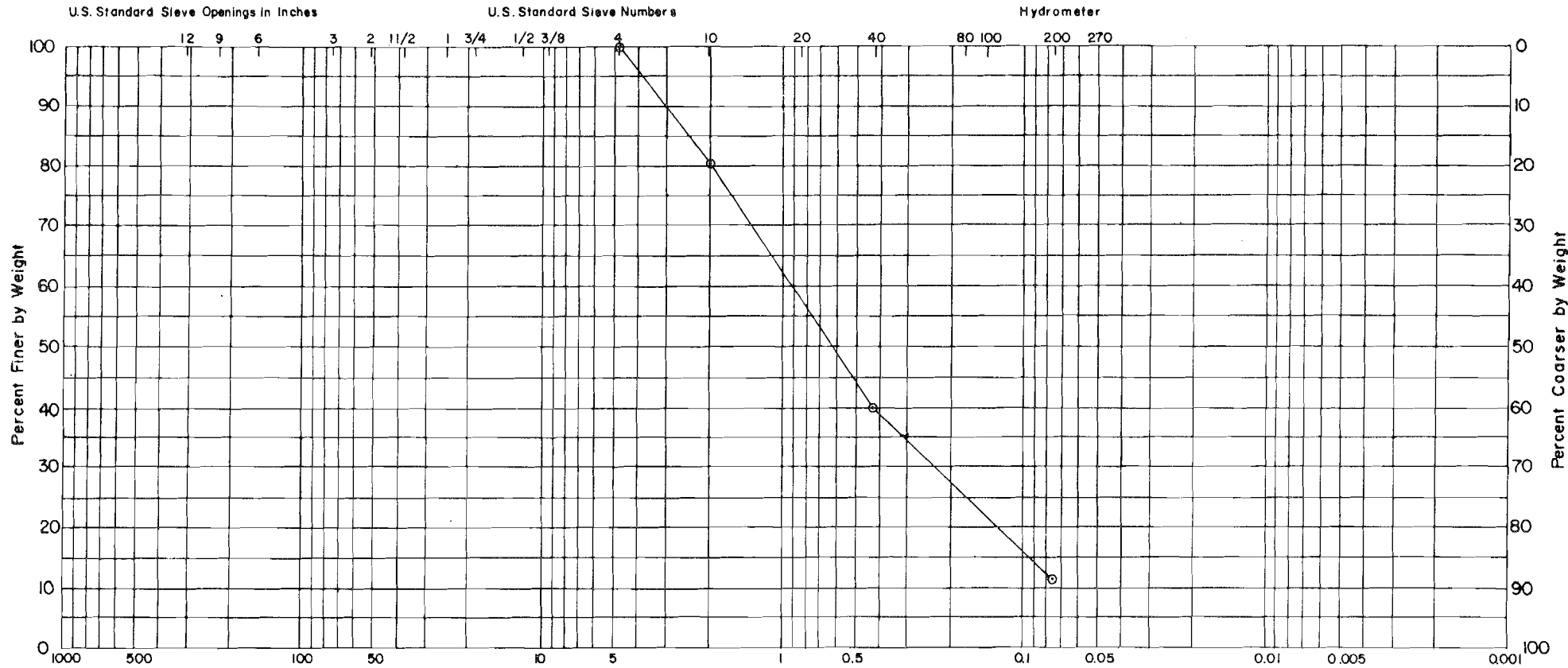
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 6,7	12,11		13	NP	SM	SAND WITH SOME SILT



BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



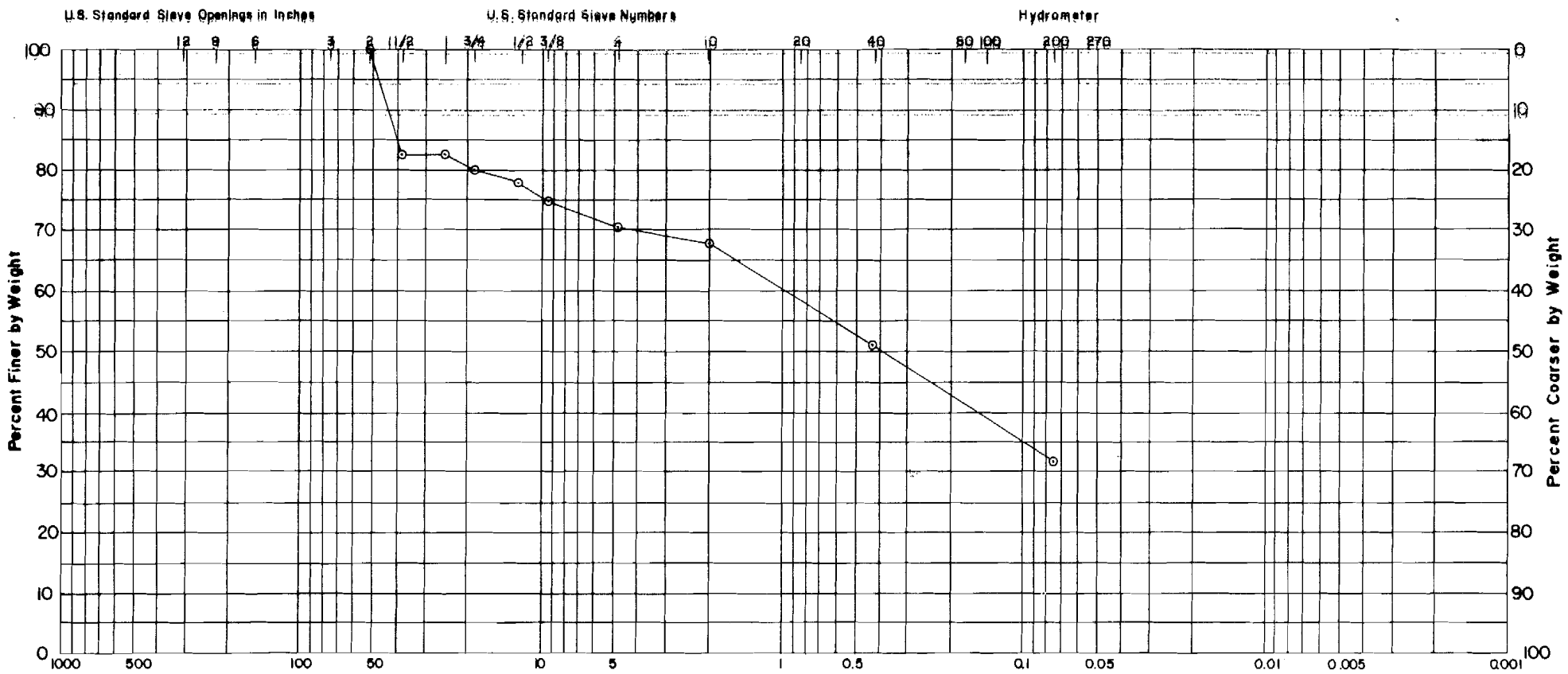
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 9	12		17	2	SW-SM	SAND WITH TRACE SILT



BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



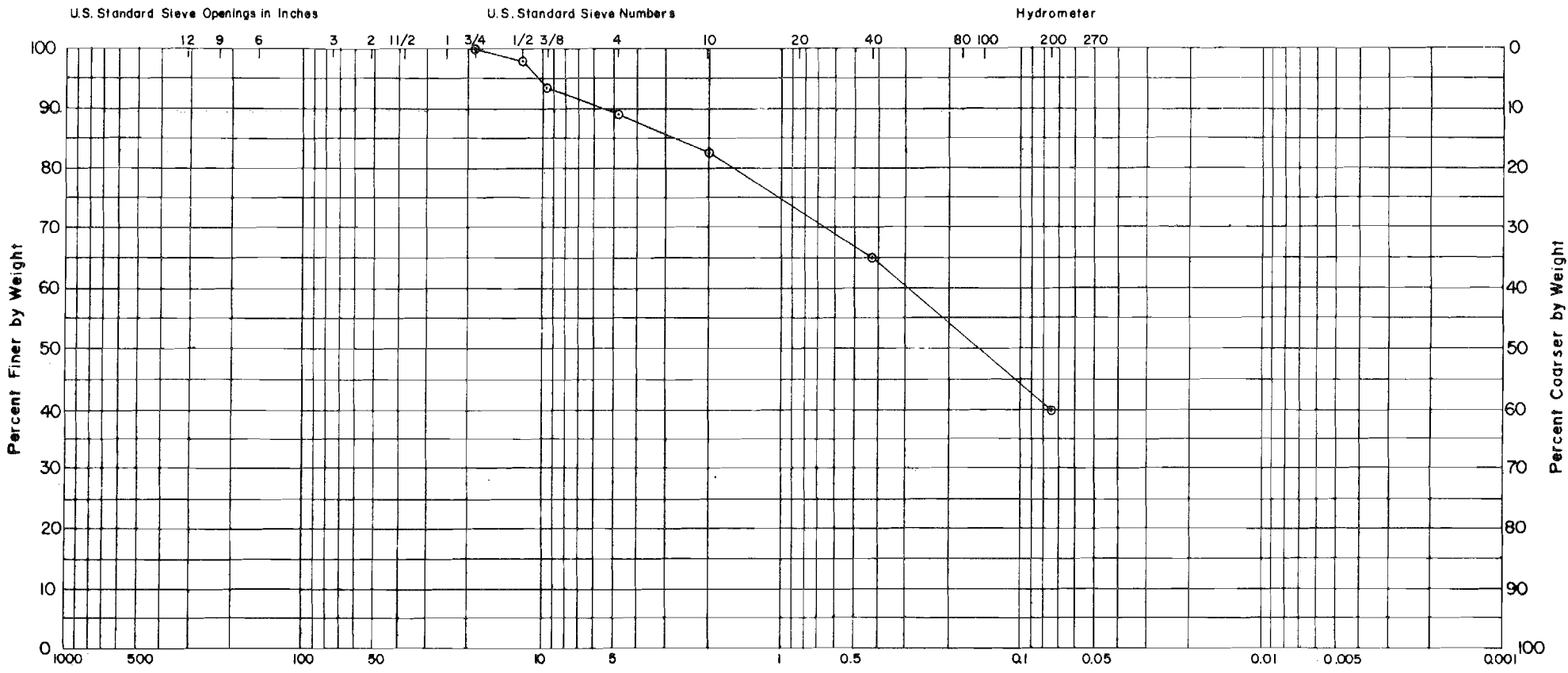
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 10	9		15	NP	SM	SILTY SAND WITH SOME GRAVEL



BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY: P.T.
 APPROVED BY: W.O.S.E.
 DATE: 12/81
 PROJECT NO. 052506



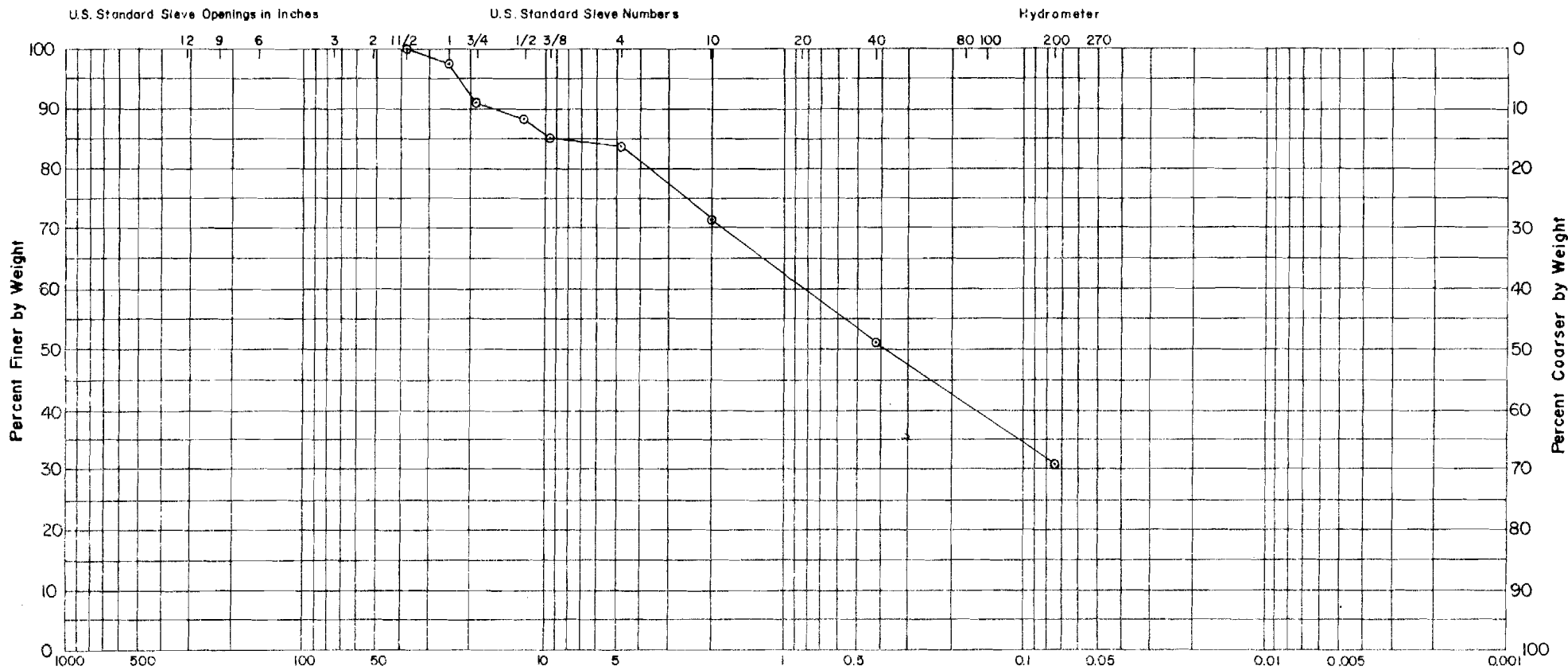
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D6 - 12	9		17	NP	SM	SILTY SAND WITH TRACE GRAVEL



BORROW AREA D
AUGER HOLE AH-D6

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



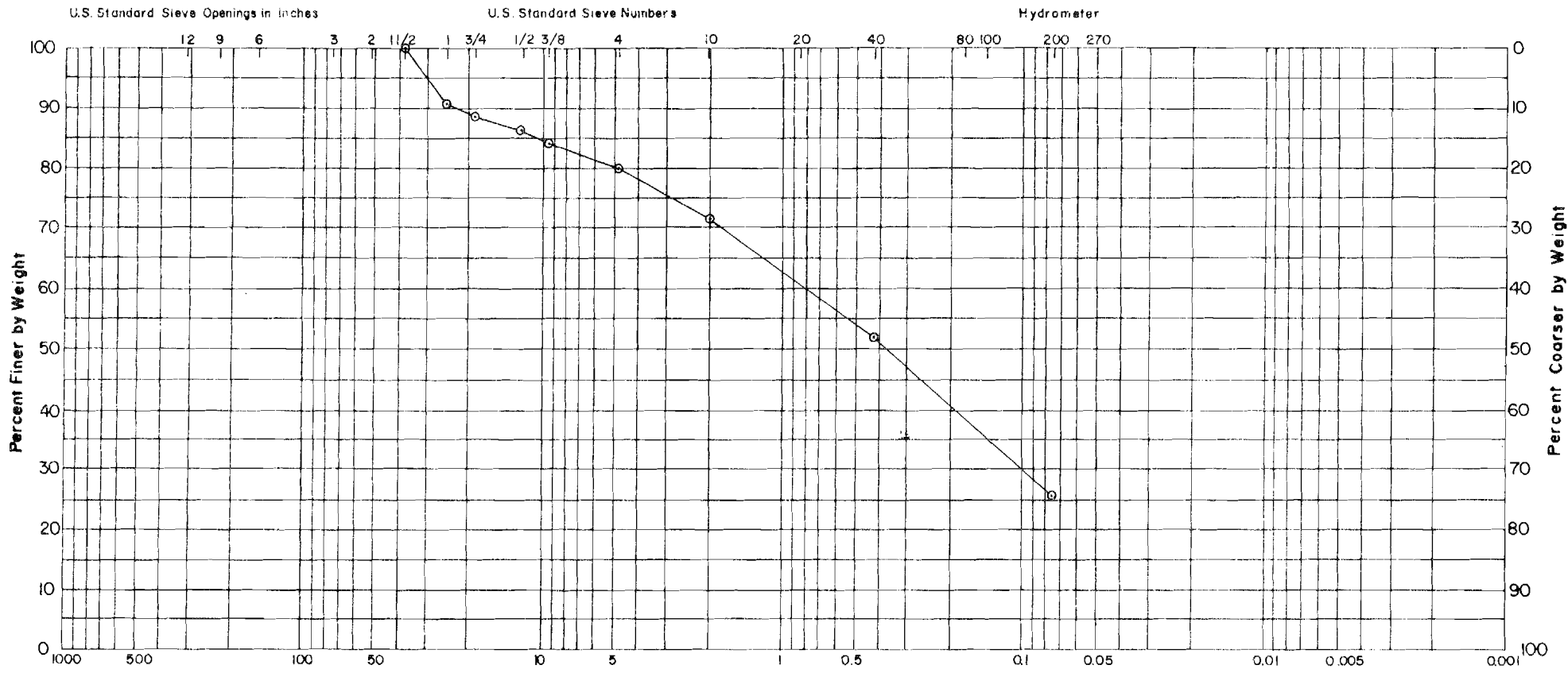
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D7 - 4,5	12,11				SM	SILTY SAND WITH SOME GRAVEL



BORROW AREA D
AUGER HOLE AH-D7

DRAWN BY:	P.T.
APPROVED BY:	W.O.S.E.
DATE:	12/81
PROJECT NO.	052506



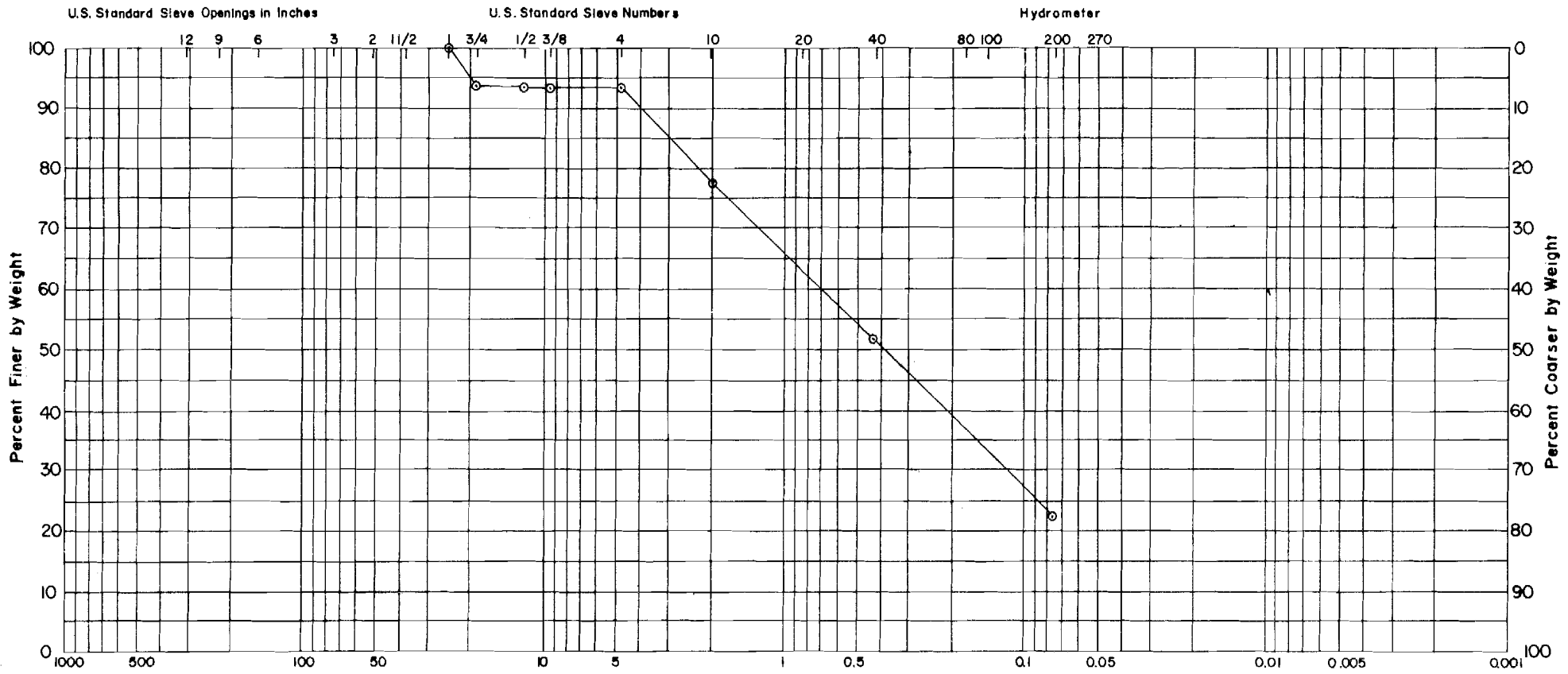
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D7 - 6	10				SM	SAND WITH SOME SILT AND GRAVEL



BORROW AREA D
AUGER HOLE AH-D7

DRAWN BY: P.T.
 APPROVED BY: W.O.S.E.
 DATE: 12/81
 PROJECT NO. 052506



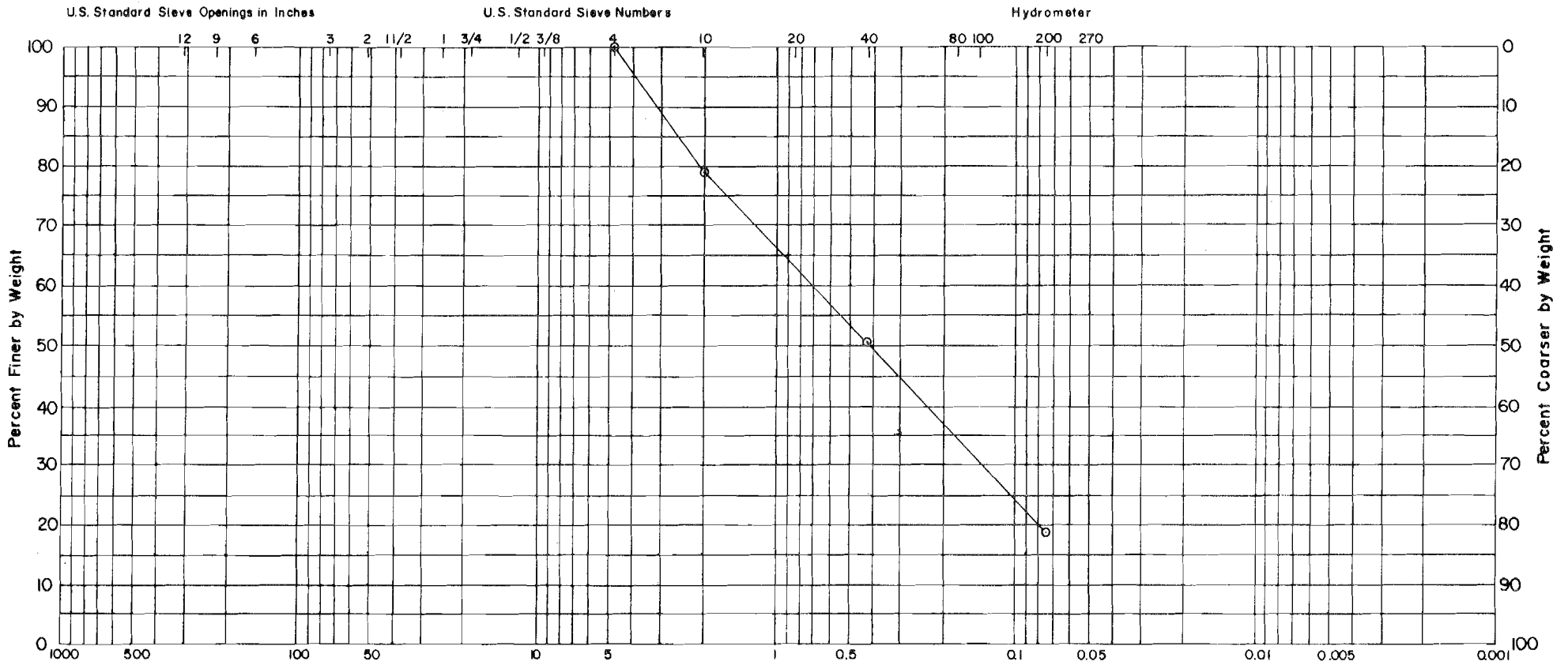
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOTISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D7 - 8	9				SM	SAND WITH SOME SILT, TRACE GRAVEL



BORROW AREA D
AUGER HOLE AH-D7

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



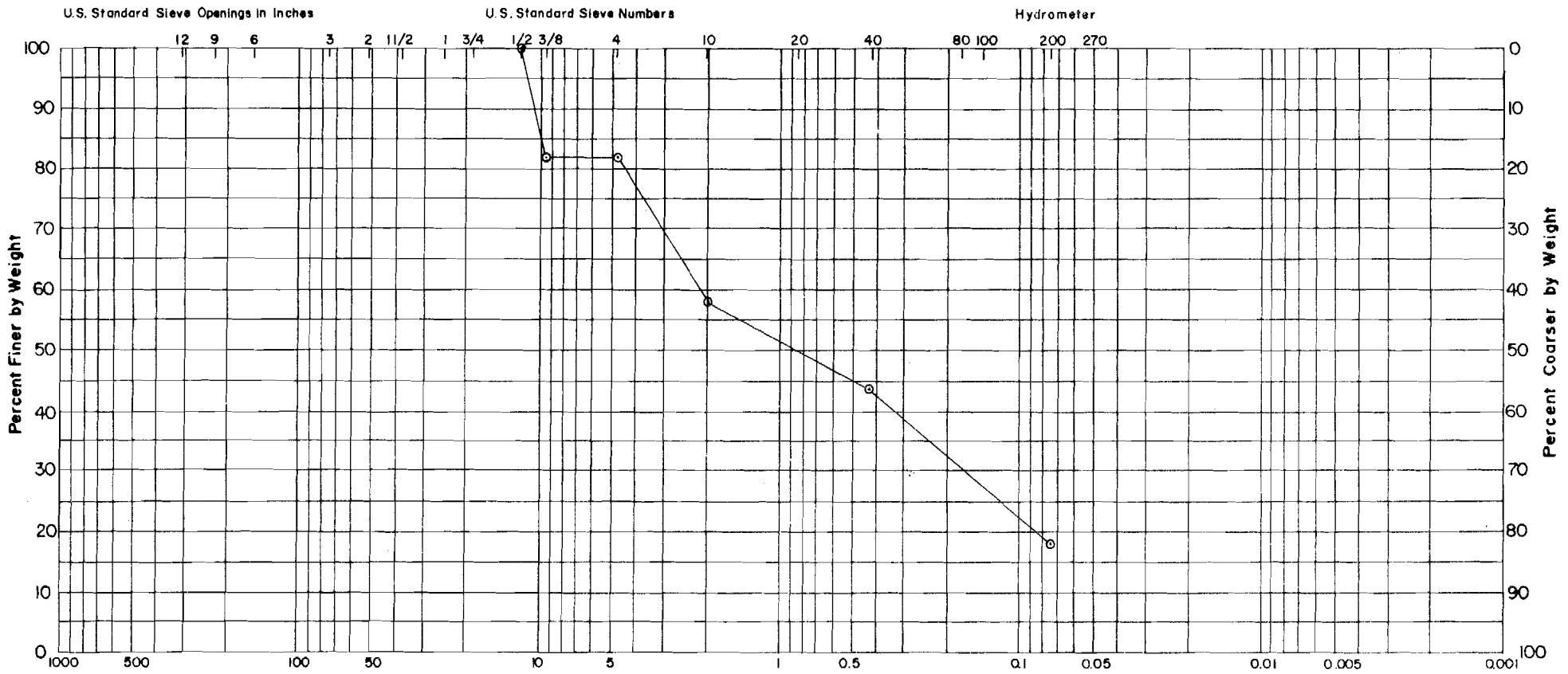
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D7 - 10	9				SM	SAND WITH SOME SILT



BORROW AREA D
AUGER HOLE AH-D7

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



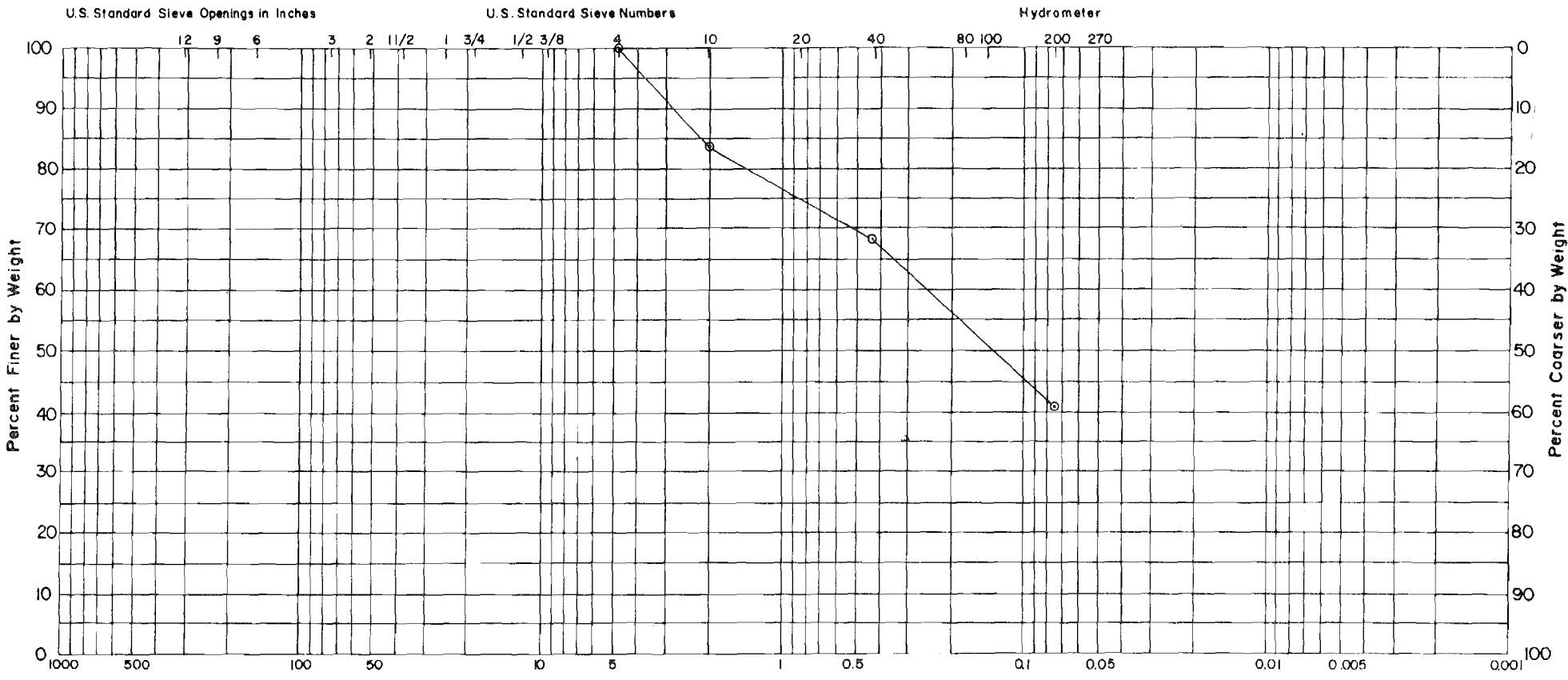
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 5	15		14	NP	SM	SAND WITH SOME GRAVEL AND SILT



BORROW AREA D
AUGER HOLE AH-D8

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



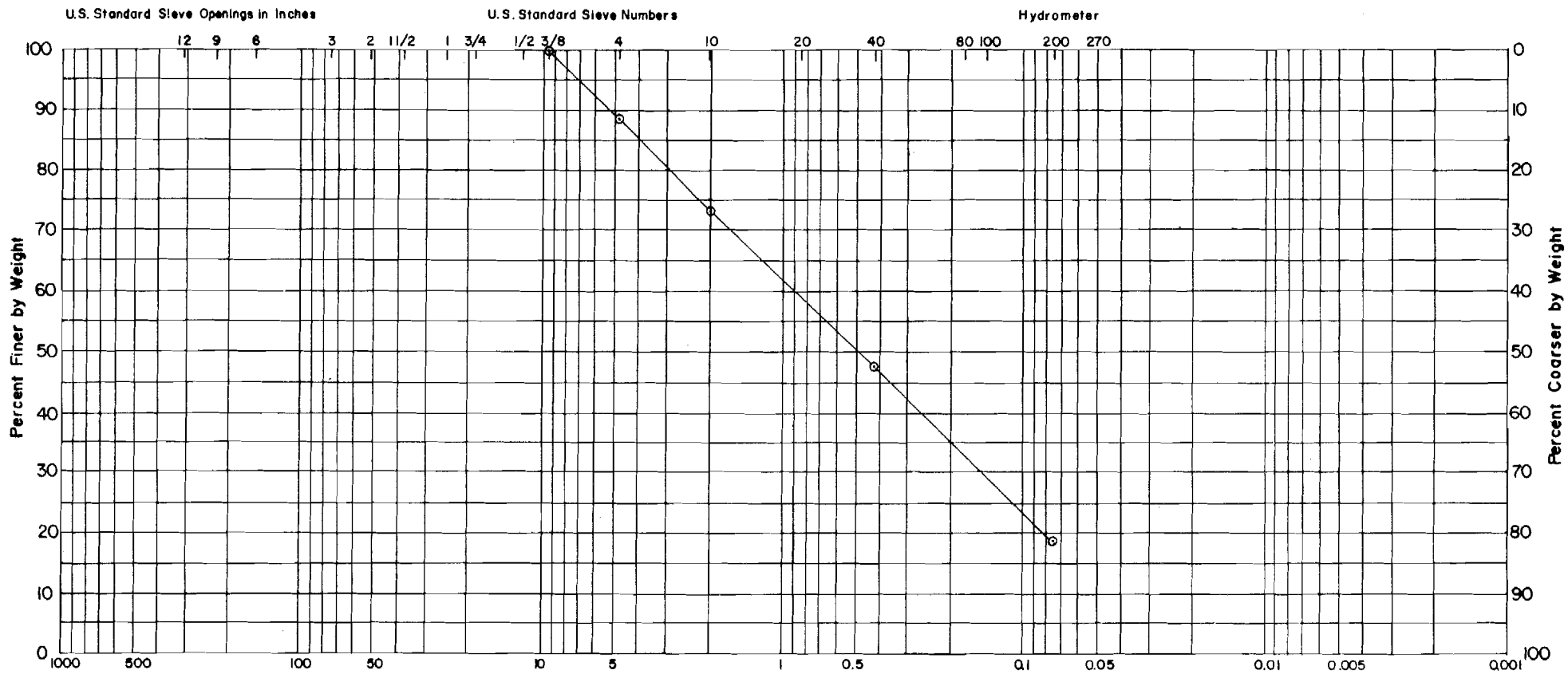
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 8	14		14	NP	SM-ML	SILTY SAND



BORROW AREA D
 AUGER HOLE AH-D8

DRAWN BY: P.T.
 APPROVED BY: W.O.S.E.
 DATE: 12/81
 PROJECT NO. 052506



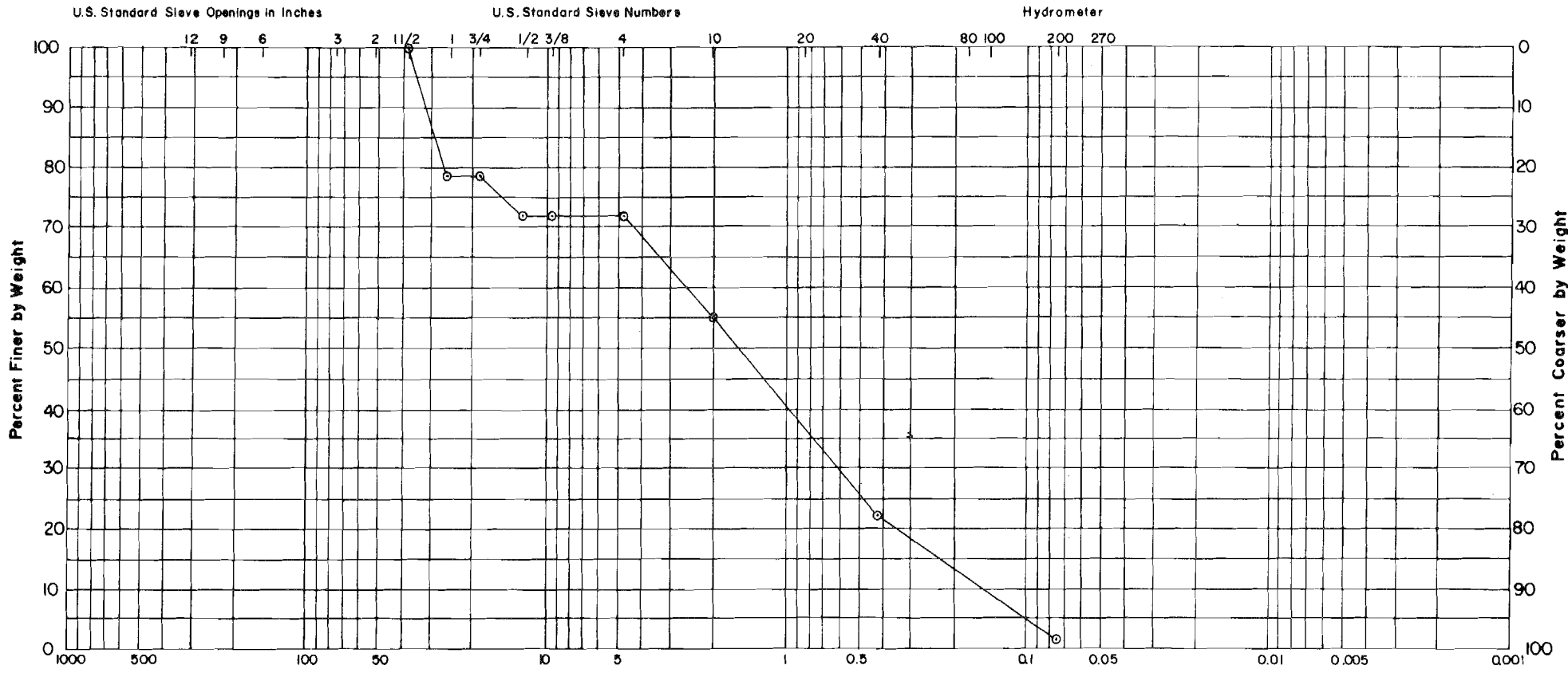
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 9					SM	SAND WITH SOME GRAVEL AND SILT



BORROW AREA D
AUGER HOLE AH-D8

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



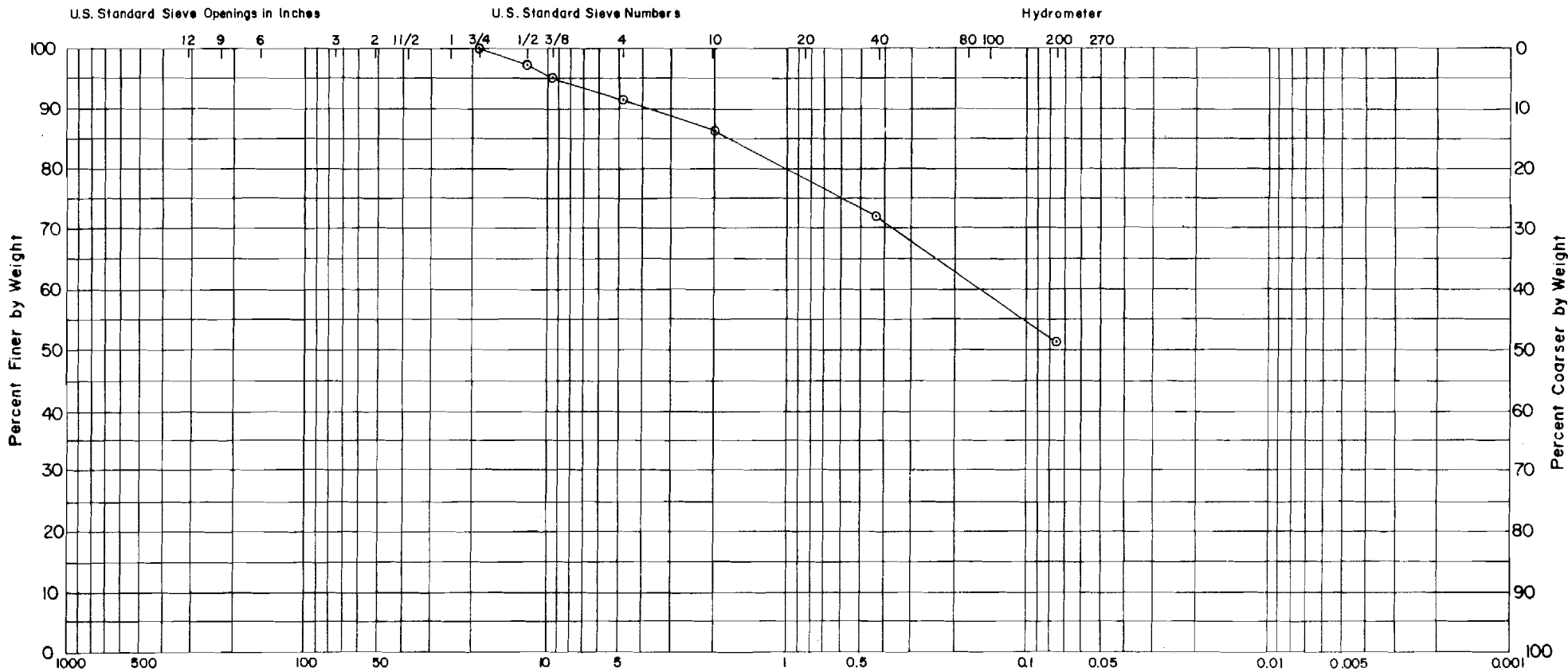
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 11	10		18	5	SP	SAND WITH SOME GRAVEL



BORROW AREA D
AUGER HOLE AH-D8

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



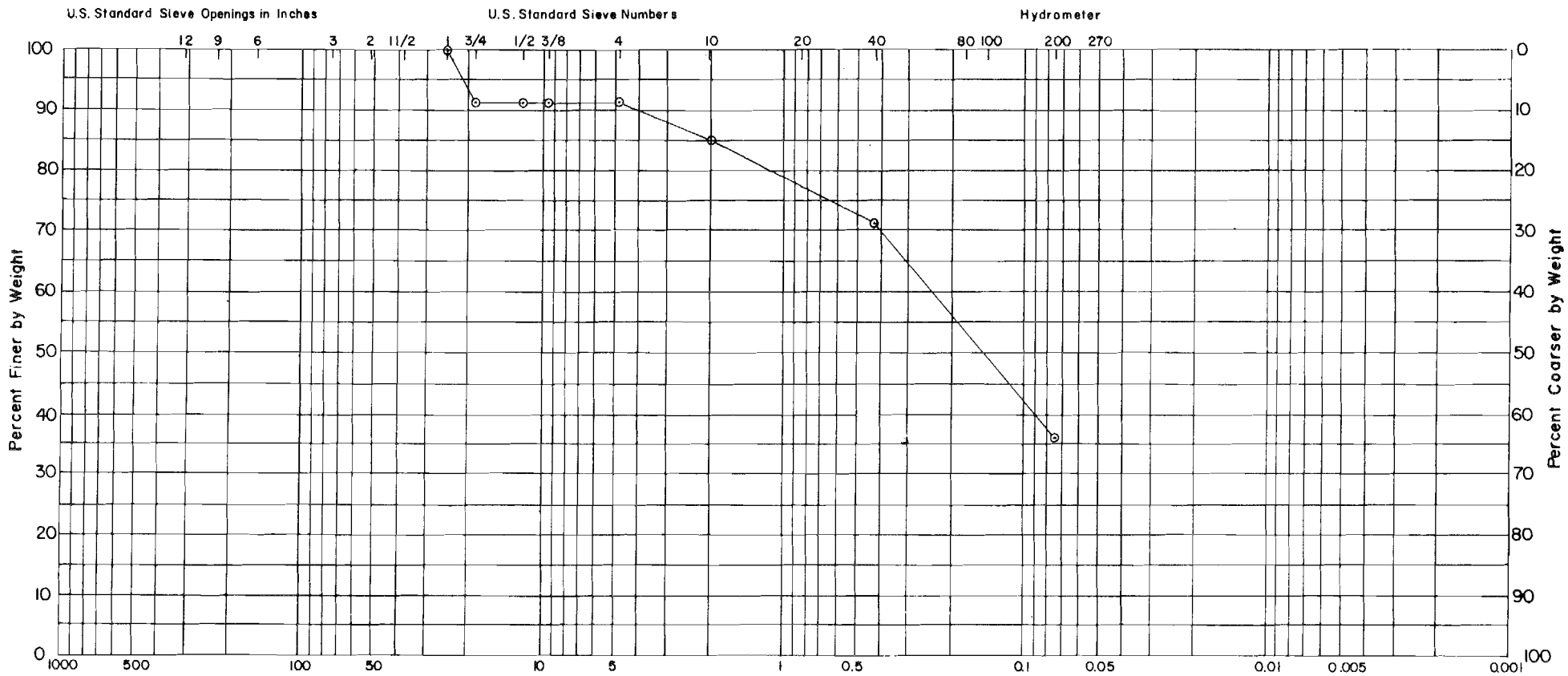
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D8 - 13	13				ML	SANDY SILT WITH SOME TO TRACE CLAY AND TRACE GRAVEL



BORROW AREA D
AUGER HOLE AH-D8

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



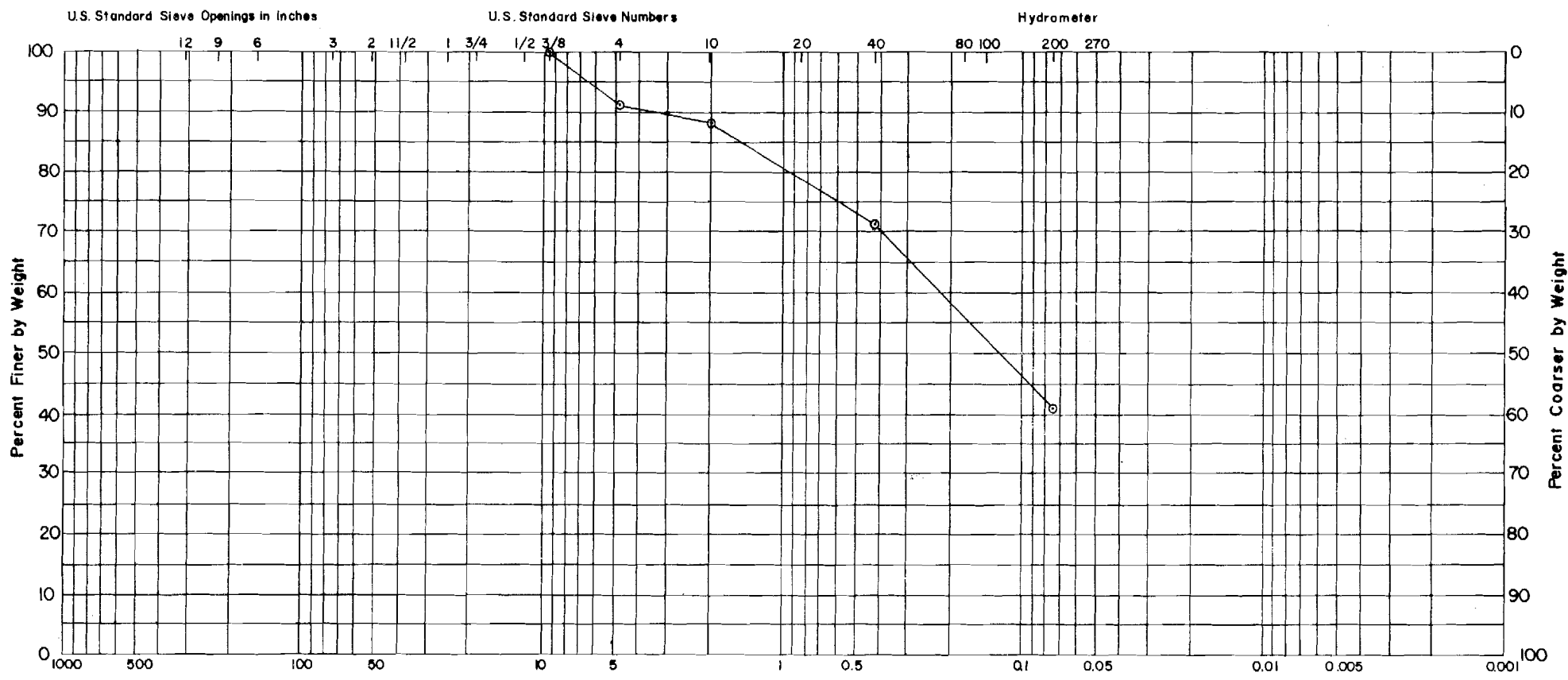
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 2					SM	SILTY SAND WITH TRACE GRAVEL



BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



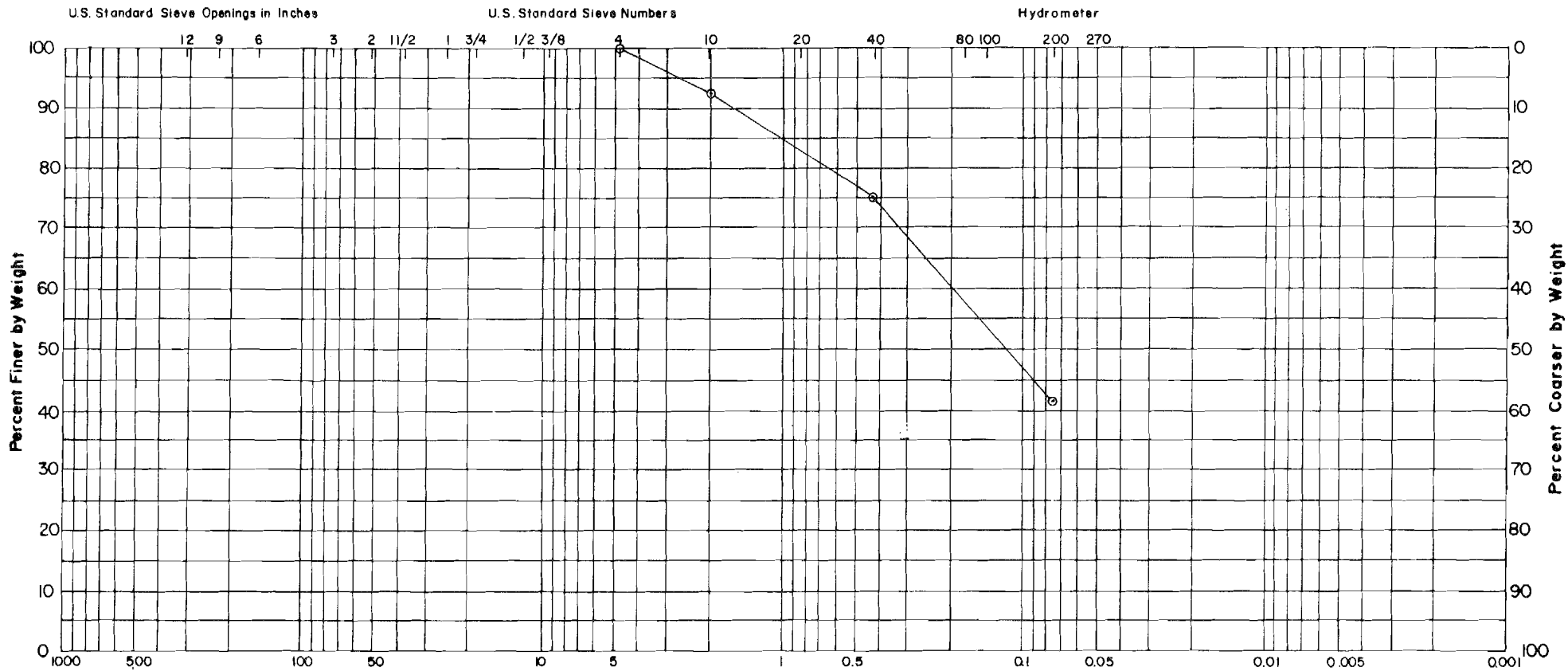
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 3					SM	SILTY SAND WITH TRACE GRAVEL



BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



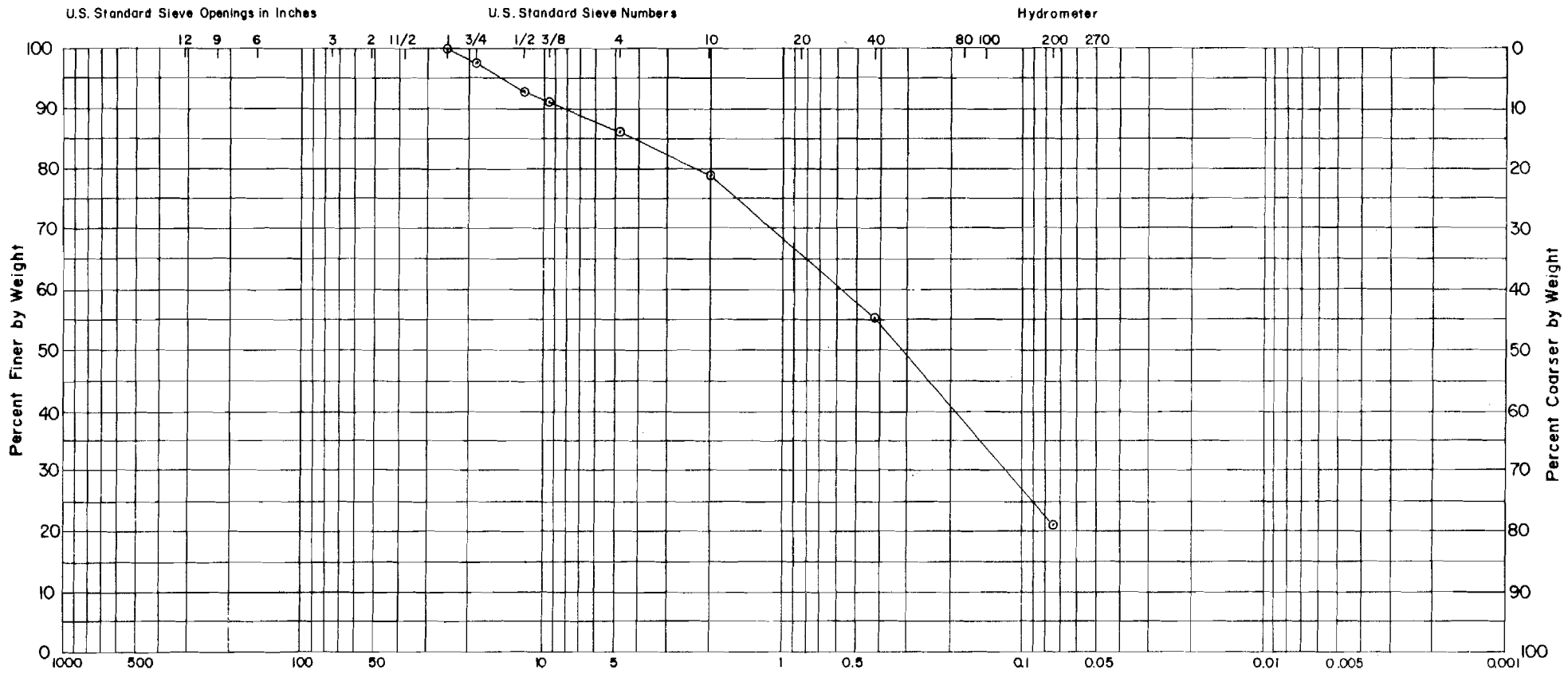
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 4					SM	SILTY SAND



BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



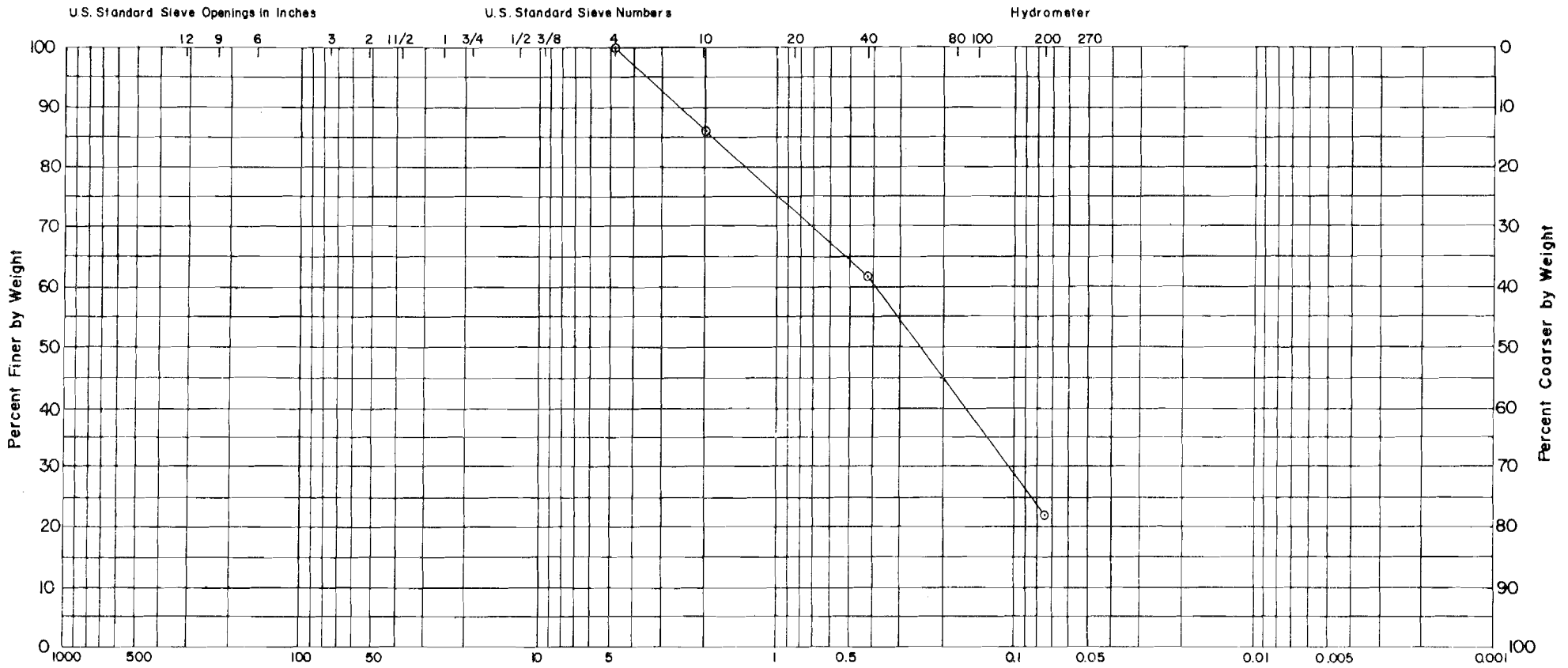
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 5					SM	SAND WITH SOME SILT AND GRAVEL



BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



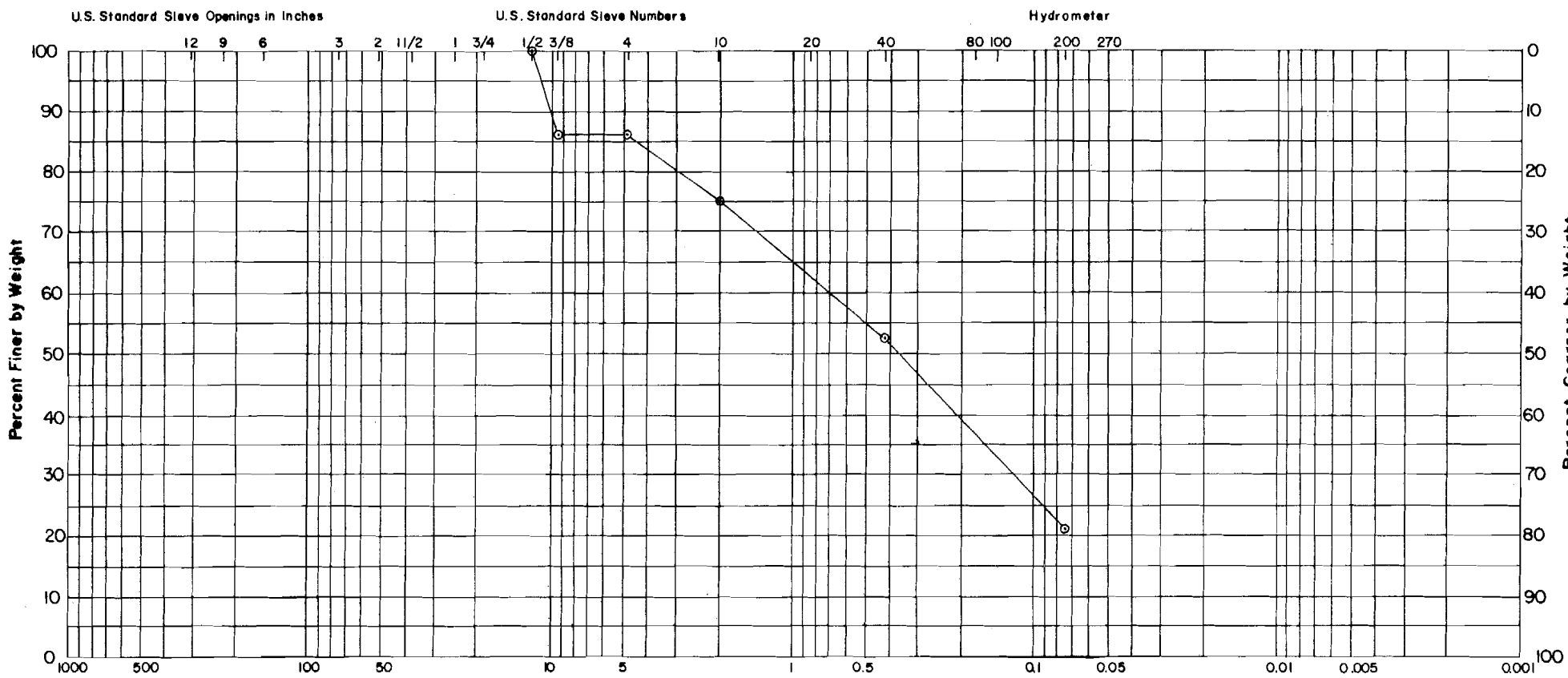
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOTISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 6					SM	SAND WITH SOME SILT



BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
 APPROVED BY: W.O.S.E.
 DATE: 12/81
 PROJECT NO. 052506



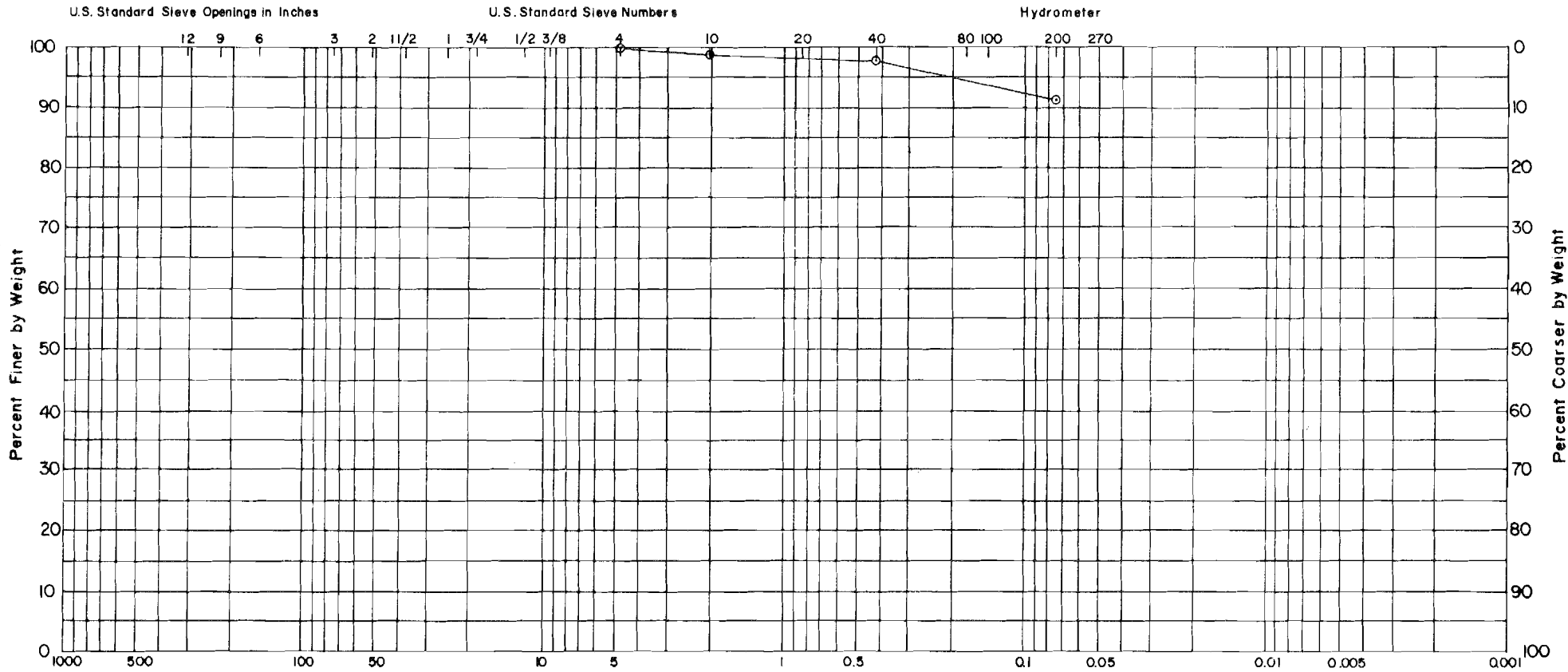
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 7					SM	SAND WITH SOME SILT AND GRAVEL



BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



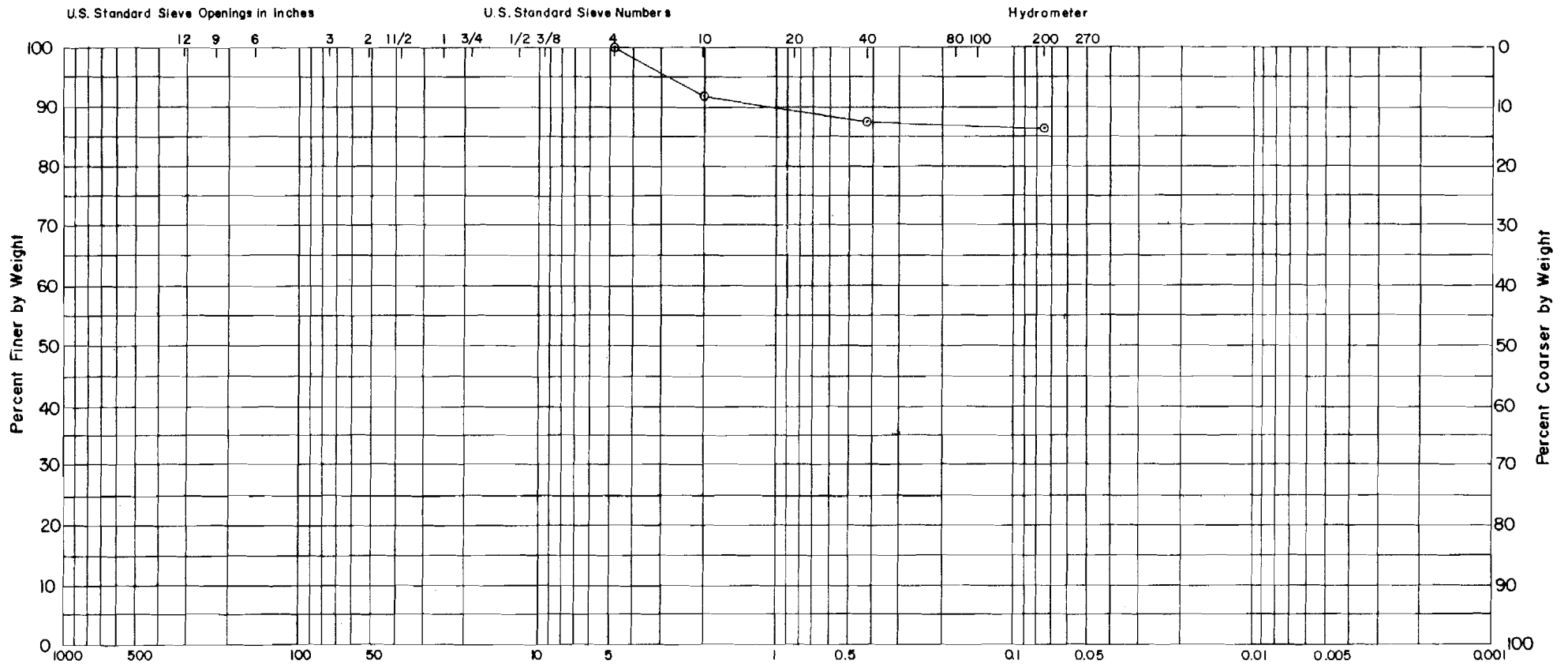
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 13	21		21	NP	ML	SILT WITH TRACE SAND AND TRACE TO SOME CLAY



BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
APPROVED BY: W.O.S.E.
DATE: 12/81
PROJECT NO. 052506



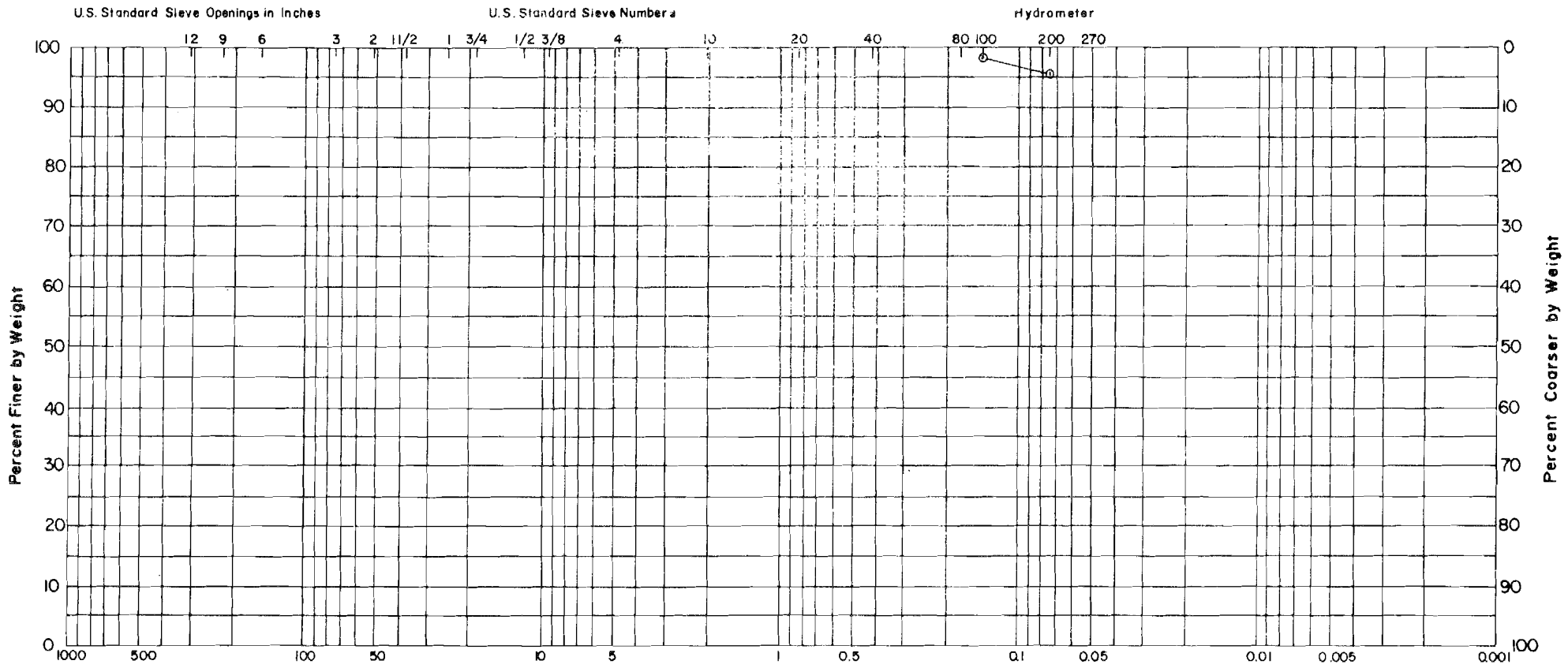
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
AH-D9 - 14	25		35	7	ML	SILT WITH SOME SAND AND TRACE TO SOME CLAY



BORROW AREA D
AUGER HOLE AH-D9

DRAWN BY: P.T.
 APPROVED BY: W.O.S.E.
 DATE: 12/81
 PROJECT NO. 052506



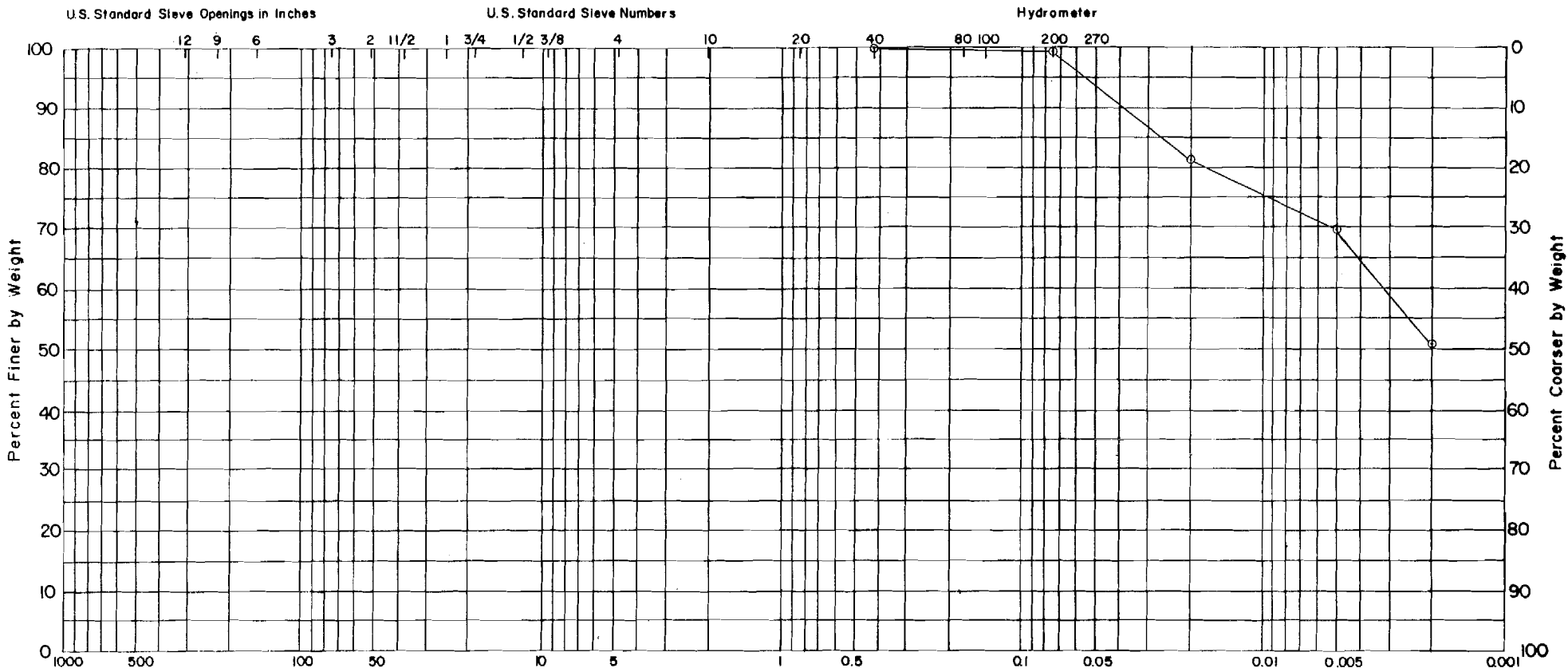
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
BORROW D BULK			59	23	MH	SILT WITH SOME TO TRACE CLAY AND TRACE SAND OR CLAYEY SILT WITH TRACE SAND



BORROW AREA D
BULK SAMPLE

DRAWN BY: P.T.
 APPROVED BY: W.O.S.E.
 DATE: 12/81
 PROJECT NO. 052506



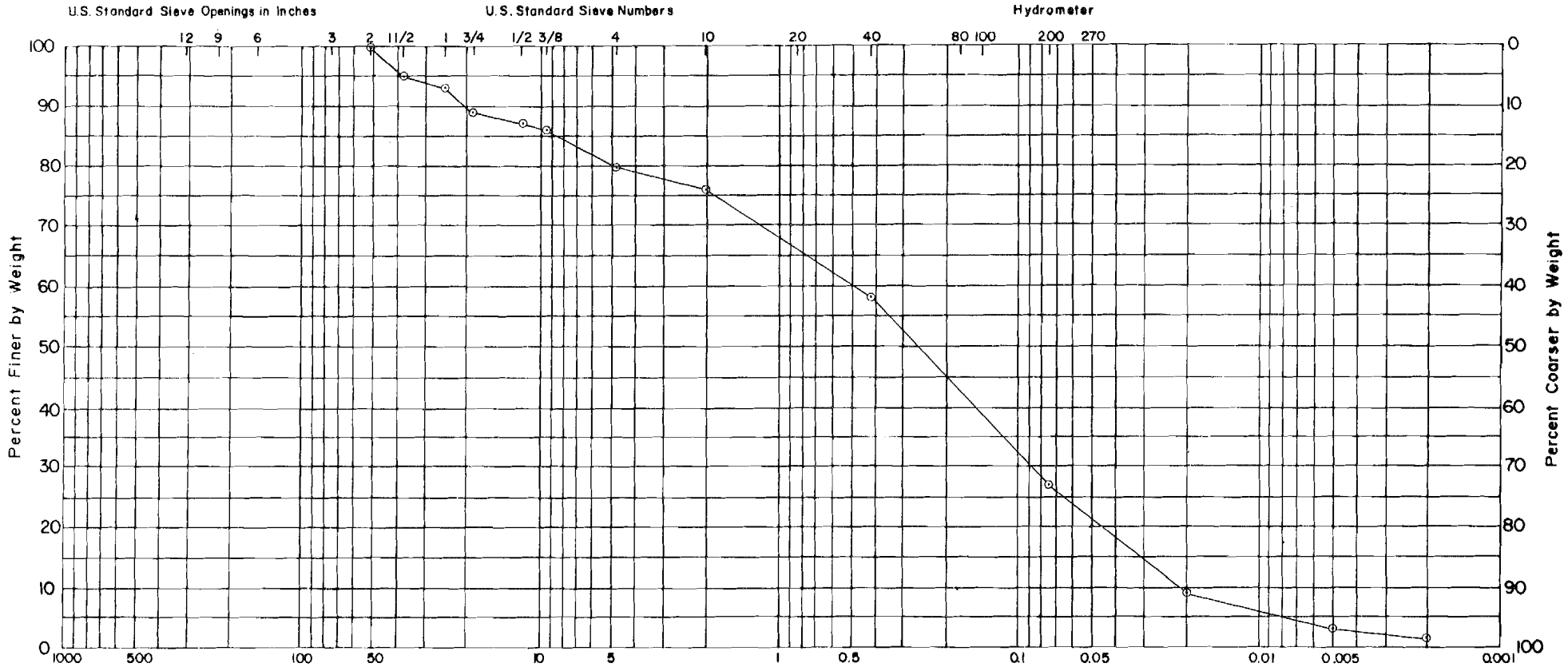
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
W-80-282 (Grab Sample)	42.1%		55.9	33.2	CL-CH SILT AND CLAY Medium to High Plasticity



DEADMAN BORROW AREA

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI		CLASSIFICATION & DESCRIPTION
W-80-300 (Grab Sample)	6.6%		NV	NP	SM	Sandy 'Till' with non plastic fines GRAVELLY SILTY SAND WITH TRACE CLAY Well graded



DEADMAN BORROW AREA

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504

R&M Consultant Inc.

LABORATORY COMPACTION CONTROL REPORT

Job Name and Location Susitna (Watana Dam Site)

Architect or Engineer Acres American Inc.

Contractor _____

A. Description of Soil: Well Graded 'Till'- GRAVELLY, SILTY SAND W/TRACE CLAY

Material Mark B Unified Classification SM AASHO Classification _____

Source of Material Deadman Creek Sample No. W-80-300

Natural Water Content 6.6% % Natural Dry Density _____ PCF Specific Gravity _____

Liquid Limit Non Viscous % Plastic Limit _____ % Plasticity Index Non Plastic

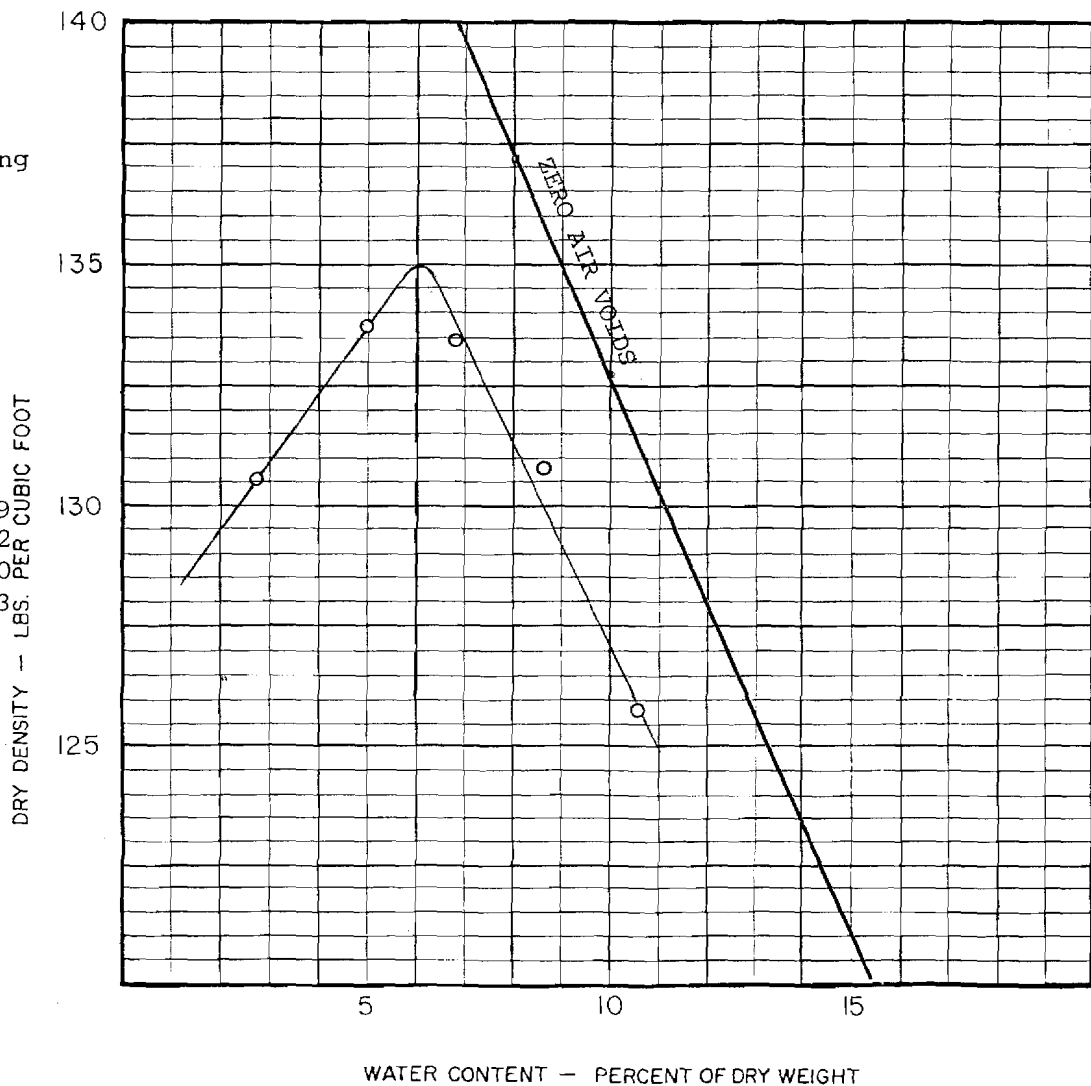
B. Test Procedure Used T-180 "D" - AASHTO

C. Test Results: Maximum Dry Density 135.0 PCF Optimum Water Content 6.0 %

Sieve Analysis

Size % Passing

2 "	100
1½ "	95
1 "	93
¾ "	89
½ "	87
⅜ "	86
# 4	80
# 10	76
# 40	58
# 200	26.9
.02mm	9.2
.005	3.0
.002	1.3



R&M Consultant Inc.

LABORATORY COMPACTION CONTROL REPORT

Job Name and Location Susitna (Watana Dam Site)

Architect or Engineer Acres American Inc.

Contractor _____

A. Description of Soil: SILT AND CLAY

Material Mark A Unified Classification CL-CH AASHO Classification _____

Source of Material Deadman Creek Sample No. W-80-282

Natural Water Content 42.1% % Natural Dry Density _____ PCF Specific Gravity _____

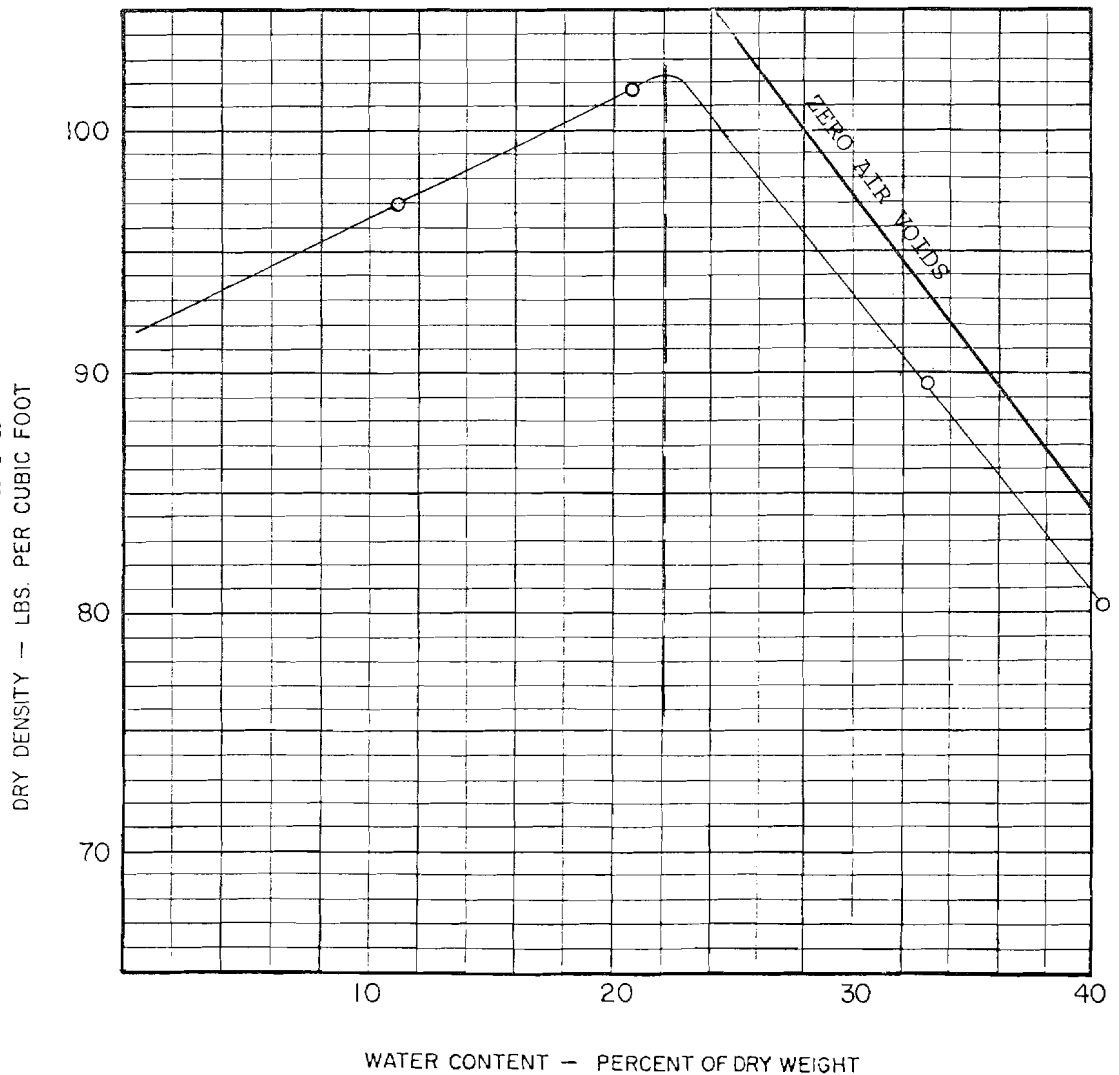
Liquid Limit 55.9 % Plastic Limit _____ % Plasticity Index 33.2

B. Test Procedure Used T-180 Method "A" - AASHTO

C. Test Results: Maximum Dry Density 102.5 PCF Optimum Water Content 22.0%

Sieve Analysis

Size	% Passing
# 40	100
#200	99.5
.02mm	81.3
.005	69.6
.002	50.8



F.2 BORROW SITE E

PROJECT NO. 052506

PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE 6-15-81

PARTY NO. _____ PAGE NO. _____

SUMMARY OF LABORATORY TEST DATA

BORING NO.	SAMPLE NO.	DEPTH	+12"	7"	3"	2"	1½"	1"	¾"	½"	3/8"	#4	#10	#20	#40	#80	#100	#200	CLASS		
E17	1	0.5'-1.0'										100	98	94	89	79	76	67.7	SM-MH		
E17	2	3.5'-4.0'												100	98	82	73	41.4	SM		
E17	3	10.0'-10.5'		76	75	70	64	56	51	46	42	35	27	19	13	7	6	4.5	GP-GM		
E18	1	0.25'-0.75'			100	92	89	76	69	61	55	45	34	20	12	5	4	2.0	GP		
E18	2	2.5'		100	90	88	88	84	84	83	82	80	79	78	73	50	45	28.1	SM		
E18	3	5.0'-5.5'			100	98	93	81	69	57	50	37	29	19	9	3	2	1.1	GP		
E18	4	10.0'-10.5'		80	65	60	56	48	43	39	36	29	22	15	9	4	4	2.4	GP		
E19	1	1.0'-1.5'												100	98	76	65	33.6	SM		
E19	2	2.5'-3.0'										100	99	95	95	53	44	21.2	SM		
E20	1	1.5'-2.0'										100	99	99	97	81	76	53.4	SM-ML		
E20	2	3.0'-3.5'	74	62	39	36	33	30	28	26	24	21	18	13	8	3	3	1.5	SP		
E20	3	7.5'-8.5'		100	91	85	84	84	83	82	82	81	79	72	65	49	45	31.4	SM		
E20	4	11.0'-11.5'		72	58	56	50	46	43	39	38	34	29	23	18	11	10	6.4	SP-SM		
E21	1	2.0'-2.5'											100	97	92	84	82	70.3	SP-SC		
E21	2	6.5'-7.0'		48	31	30	27	24	22	20	18	15	13	11	9	6	6	4.3	GP-GM		

REMARKS : _____

NOTE: SIEVE ANALYSIS = PERCENT PASSIN

PROJECT NO. 052506

PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE 6-15-81

PARTY NO. _____ PAGE NO. _____

SUMMARY OF LABORATORY TEST DATA

BORING NO.	SAMPLE NO.	DEPTH	+12"	7"	3"	2"	1½"	1"	¾"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	CLASS			
E9	3	2.5'			95	81	77	71	67	63	60	55	50	45	41	28	25	16.6	GM			
E10A	1	3.5'- 4.0'			82	78	71	63	58	51	46	37	31	28	21	8	6	2.5	GP			
E10A	2	6.5'- 7.5'											100	99	89	43	35	16.5	SM			
E10B	1	2.0'- 2.5'			100	91	86	77	66	54	48	36	28	18	11	4	3	2.1	GP			
E11	1	1.5'											100	99	94	65	58	37.7	SM			
E11	2	5.0'		83	73	70	66	60	56	51	47	39	33	38	22	13	11	7.8	GP-GM			
E12	1	2.0'- 2.5'		79	77	74	69	62	56	50	46	37	29	21	14.2	9	8	5.9	GP-GM			
E12	2	2.5'- 3.5'							100	94	91	90	88	86	80	59	53	38.4	SM			
E12	3	3.5'- 4.5'				79	79	75	74	73	72	71	70	66	58	40	35	23.8	SM			
E14	1	1.0'- 2.0'										100	97	85	61	20	14	5.3	SP-SM			
E14	2	6.0'- 7.0'		73	58	56	52	48	45	41	38	31	25	18	11	5	4	2.5	SP			
E15	1	3.0'- 3.5'	79	77	65	50	45	37	32	26	23	17	13	9	5	2	2	.9	GW			
E16	1	3.0'- 3.5'	74	72	61	61	59	53	50	45	41	34	24	13	7	3	2	1.5	SP			

REMARKS : _____

NOTE: SIEVE ANALYSIS = PERCENT PASS IN

PROJECT NO. 052506

PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE 6-15-81

PARTY NO. _____ PAGE NO. _____

SUMMARY OF LABORATORY TEST DATA

BORING NO.	SAMPLE NO.	DEPTH	+12"	7"	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	CLASS	
E1	1	2.5'-3.0'				96	92	82	72	61	56	47	38	33	27	18	15	8	GP-GM	
E1	2	7.0'-7.5'		77	53	51	48	43	39	34	32	26	21	17	10	4	3	1.5	GP	
E2	1	2.5'-3.0'		84	79	79	77	73	68	62	58	51	46	38	22	5	4	2.4	SP	
E2	2	5.5'-6.0'		64	55	54	52	45	40	35	31	23	17	12	7	2	1	.8	GW	
E3	1	2.5'-3.0'		78	54	54	49	41	37	32	28	22	16	11	7	3	2	1.3	GW	
E3	2	10.5'-11.0'		75	57	56	55	49	43	37	33	26	19	11	6	3	2	1.6	GP-GW	
E4	1	3.0'-3.5'		58	39	38	35	30	27	24	22	18	15	10	5	2	2	1.0	GP	
E4	2	10.5'-11.0'		61	42	40	39	32	29	25	22	18	14	9	5	2	2	1.2	GP	
E5	1	1.0'-2.0'		79	45	42	39	34	30	25	22	17	13	9	5	2	2	1.0	GW-GP	
E6	1	7.5'-8.0'				100	99	90	87	83	81	75	69	59	46	25	22	13.3	SM	
E8	1	2.5'-3.0'		74	73	72	69	59	51	41	35	24	16	10	6	2	2	1.0	GW	
E8	2	6.5'-7.0'				100	99	95	89	83	77	64	46	24	10	2	2	.9	SP	
E9	1	2.5'												100	99	96	95	90.5	ML	
E9	2	4.5'				91	89	87	86	85	83	81	78	76	74	70	45	38	19.9	SM

NOTE: SIEVE ANALYSIS = PERCENT PASS IN

REMARKS: _____

PROJECT NO. 052504
 CLIENT: Acres American, Inc.
 PROJECT NAME Susitna Hydroelectric
 (Watana Dam Site)

R & M CONSULTANTS, INC.

DATE October 17, 1980

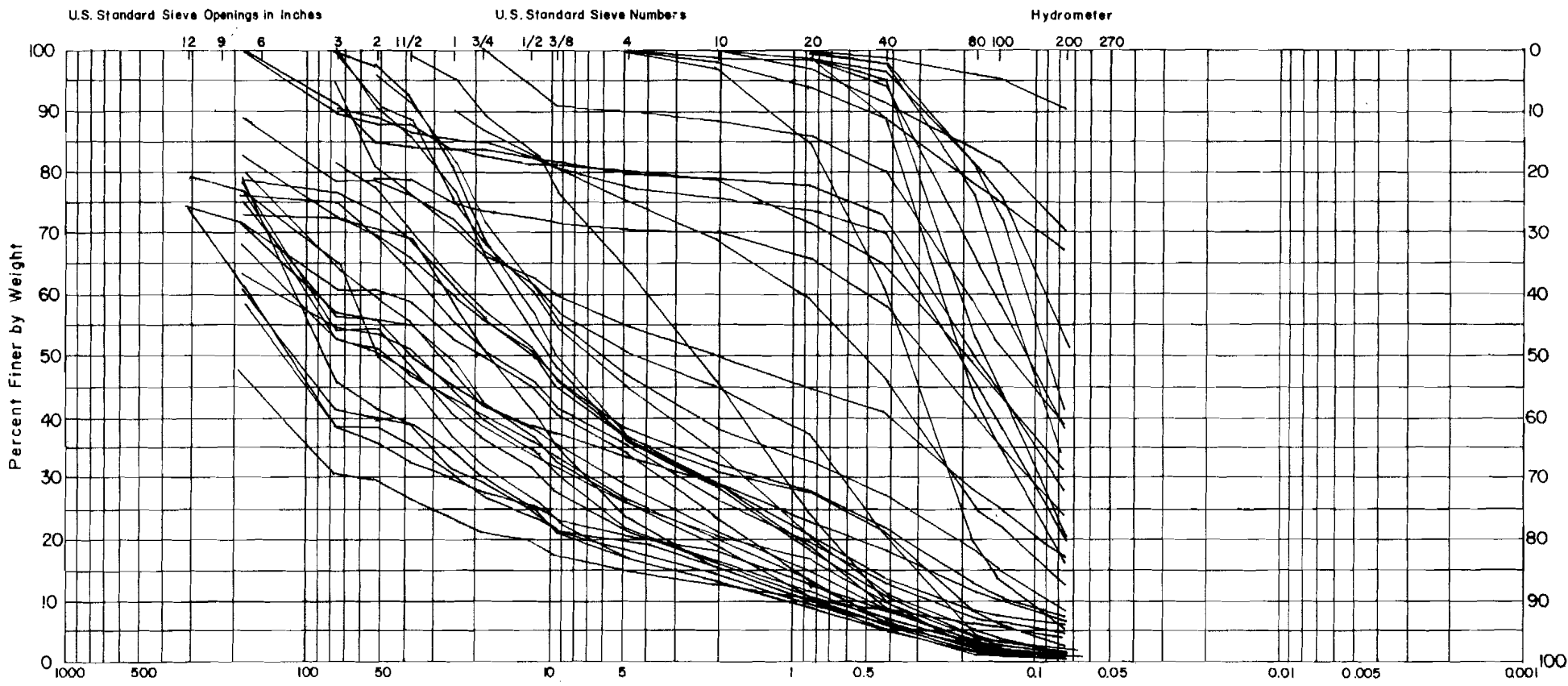
SUMMARY OF LABORATORY TEST DATA

PARTY NO. _____ PAGE NO. _____

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	4"	3"	2"	1½"	1"	¾"	½"	⅜"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.
AH-E1		3	1.0'- 1.5'										100	99	48.0				19.6			SM
AH-E1		4	2.0'- 3.5'										100	98	59.5				27.3			ML*
AH-E3		6	4.5'- 6.0'		100	89	89	83	80	76	72	62	52	28	6.2				4.4			SP-SM
AH-E3		7	6.5'- 8.0'			**	100	90	76	62	57	40	31	16	3.7				0.7			GW
AH-E4		6	5.0'- 6.5'							100	99	98	92	66	22.2				17.6			SM
AH-E7		3	2.0'- 3.0'				100	85	73	56	49	39	31	12	2.1				2.3			GP
AH-E9		2	1.5'- 3.0'										100	99	28.6				15.7			SM
AH-E9		6	6.5'- 8.0'				100	95	87	79	57	44	33	17.0					4.4			GM

REMARKS: ** 1-2" Rock Present in Sample
* Estimated Value

NOTE: SIEVE ANALYSIS = PERCENT PASSING



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

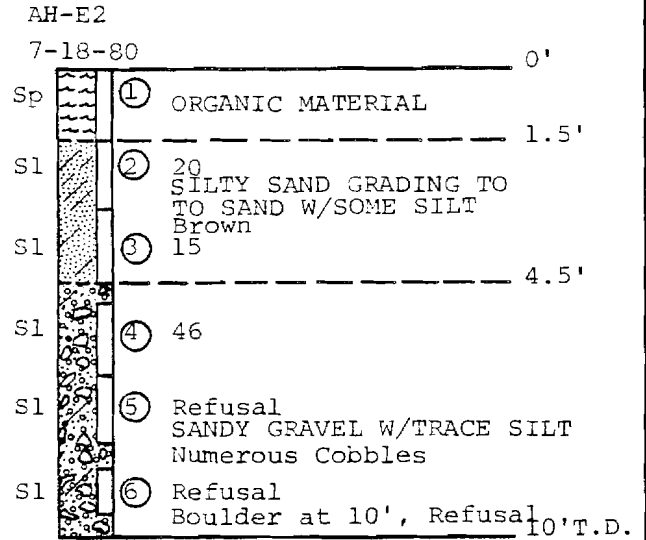
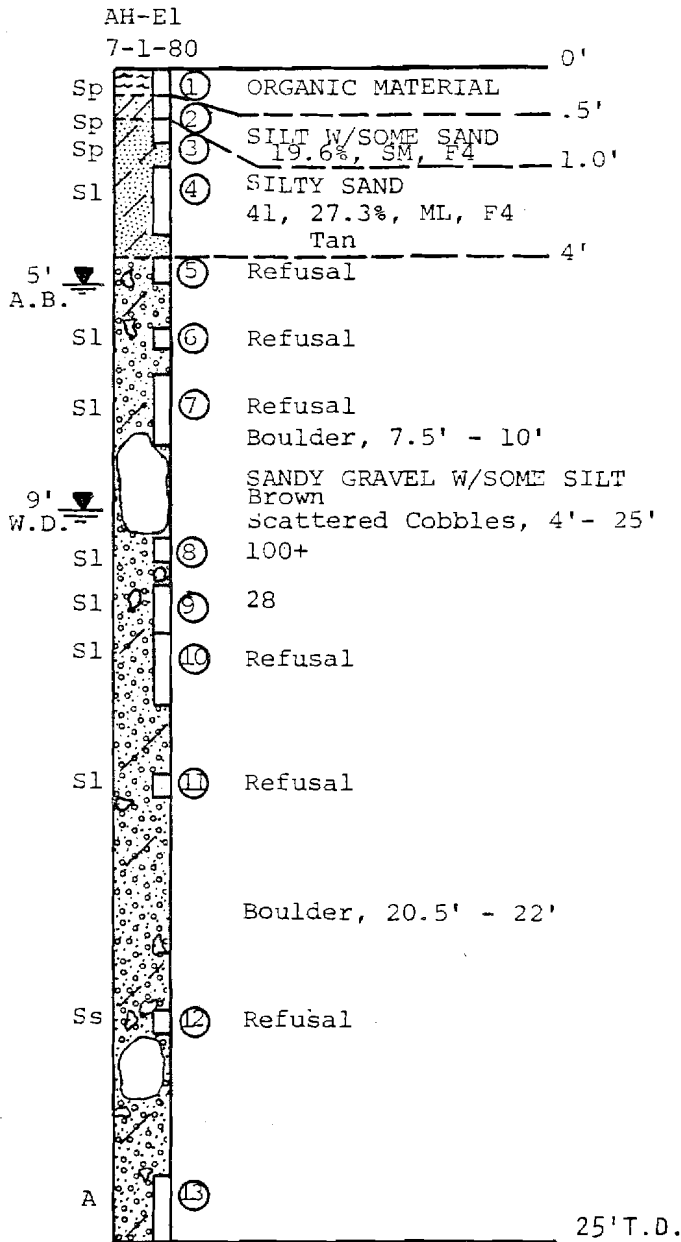
SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION



BORROW AREA E
COMPOSITE GRADATION CURVE

DRAWN BY: _____
 APPROVED BY: _____
 DATE: _____
 PROJECT NO. _____

AUGER HOLE LOGS



PREPARED BY:

PREPARED FOR:



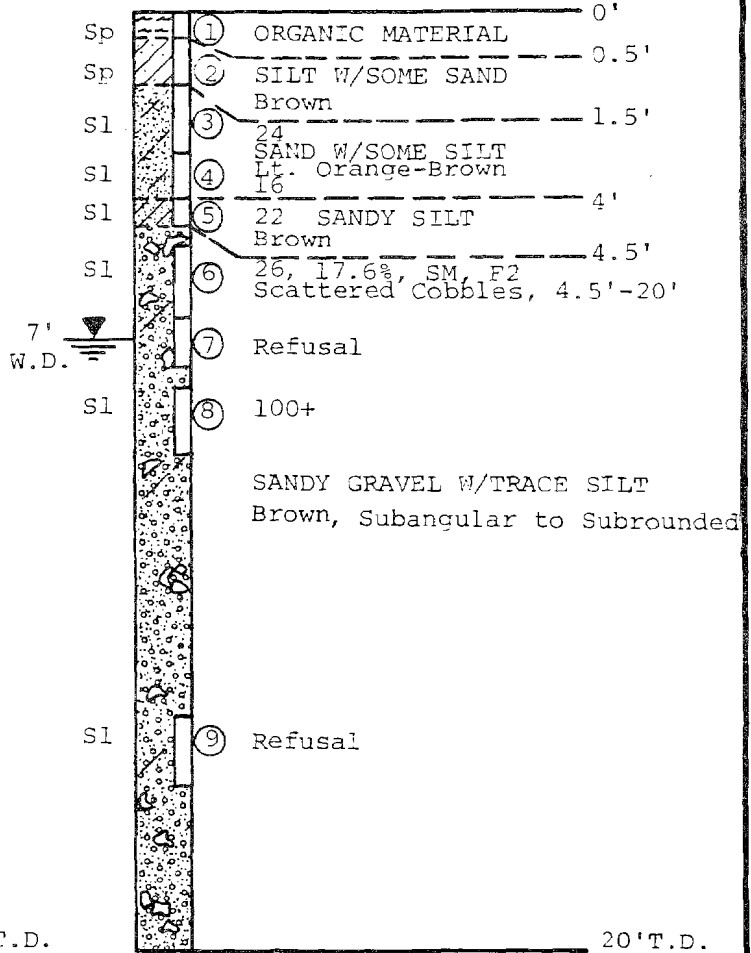
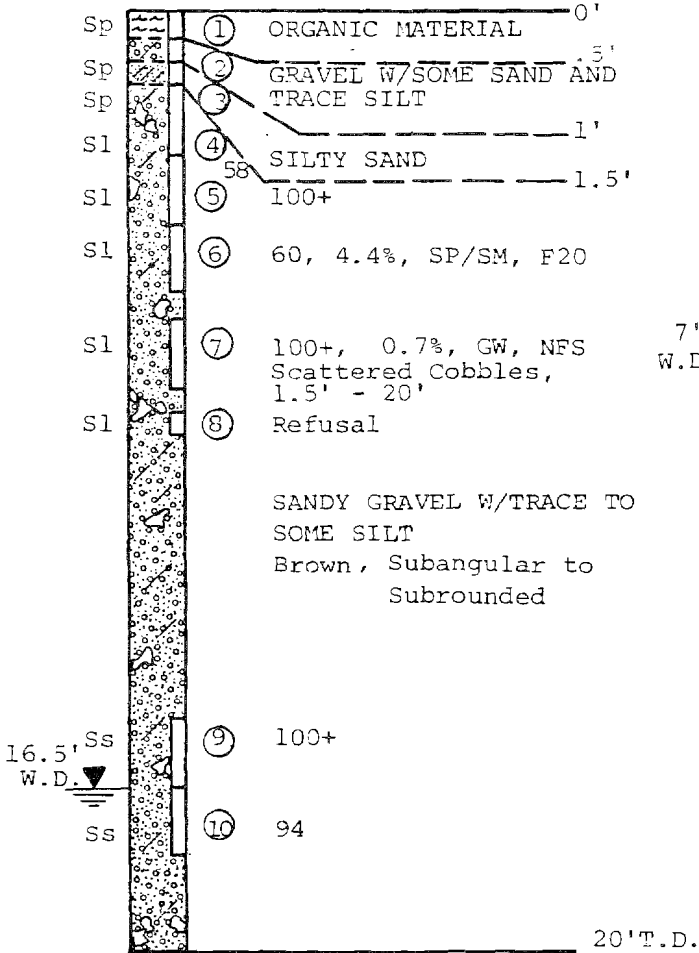
BORROW AREA E
AUGER HOLES AH-E1 AND AH-E2



Scale 1"=4'

AH-E3
7-3-80

AH-E4
7-17-80



PREPARED BY:

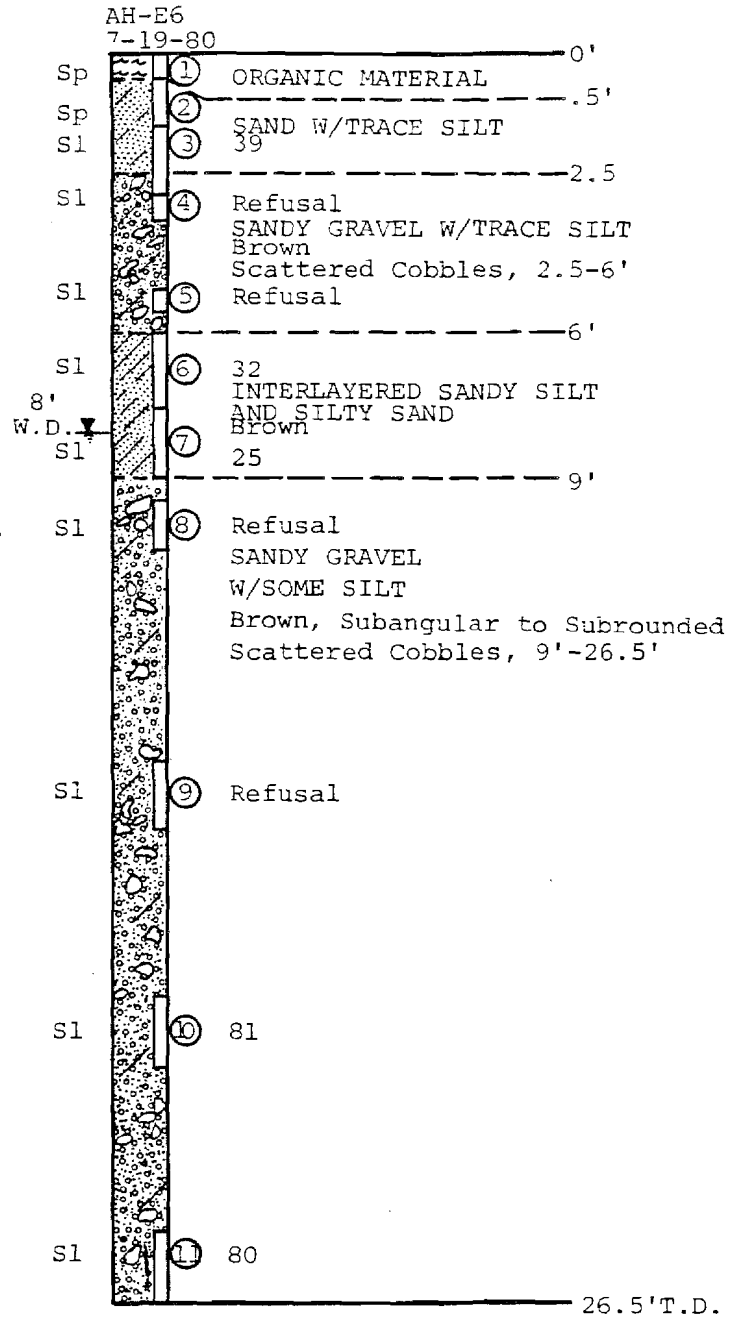
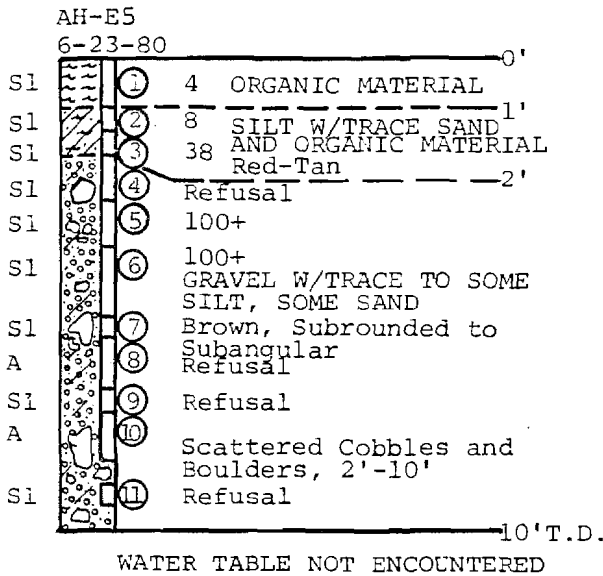
PREPARED FOR:



BORROW AREA E
AUGER HOLES AH-E3 AND AH-E4



Scale 1"=4'



PREPARED BY:



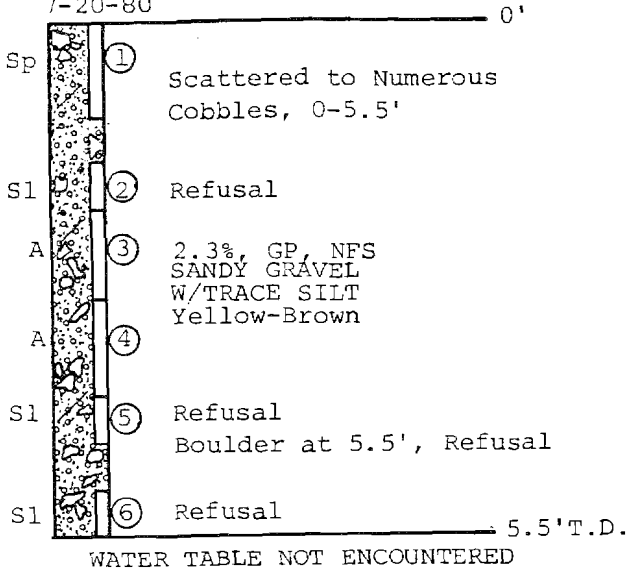
BORROW AREA E
 AUGER HOLES AH-E5 AND AH-E6

PREPARED FOR:

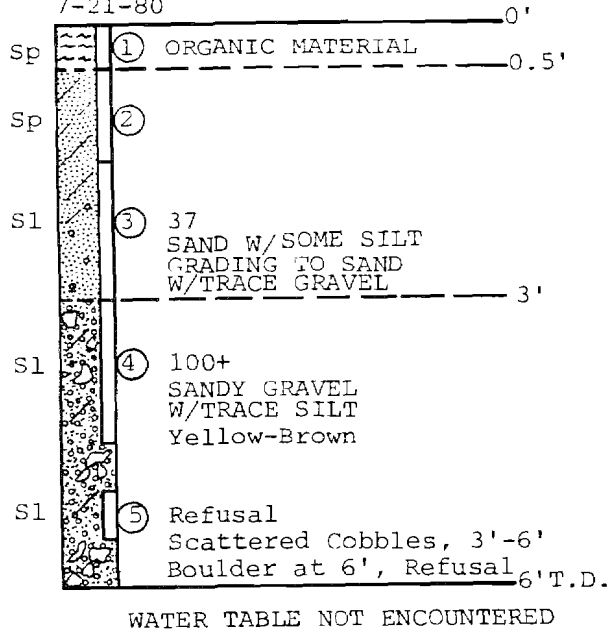


Scale 1"=4'

AH-E7
7-20-80



AH-E8
7-21-80



PREPARED BY:

PREPARED FOR:

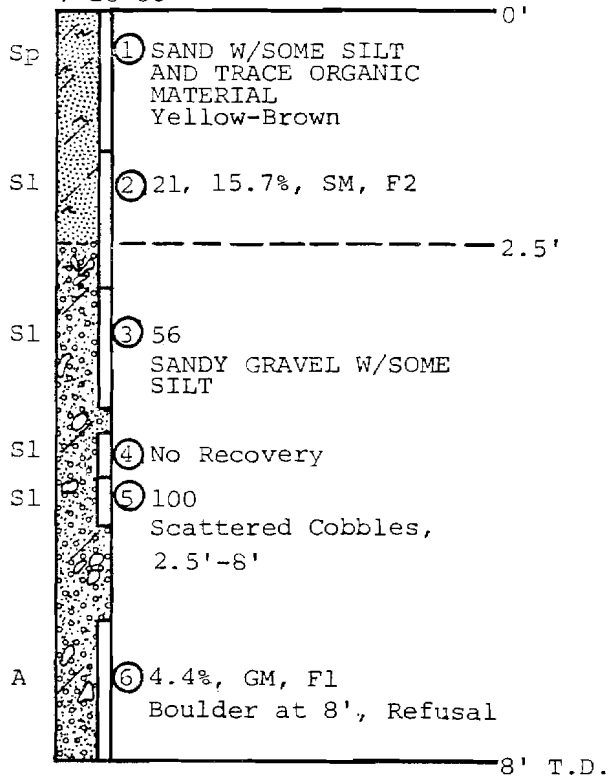


BORROW AREA E
AUGER HOLES AH-E7 AND AH-E8

Scale 1"=4'



AH-E9
7-20-80



WATER TABLE NOT ENCOUNTERED

PREPARED BY:



PREPARED FOR:

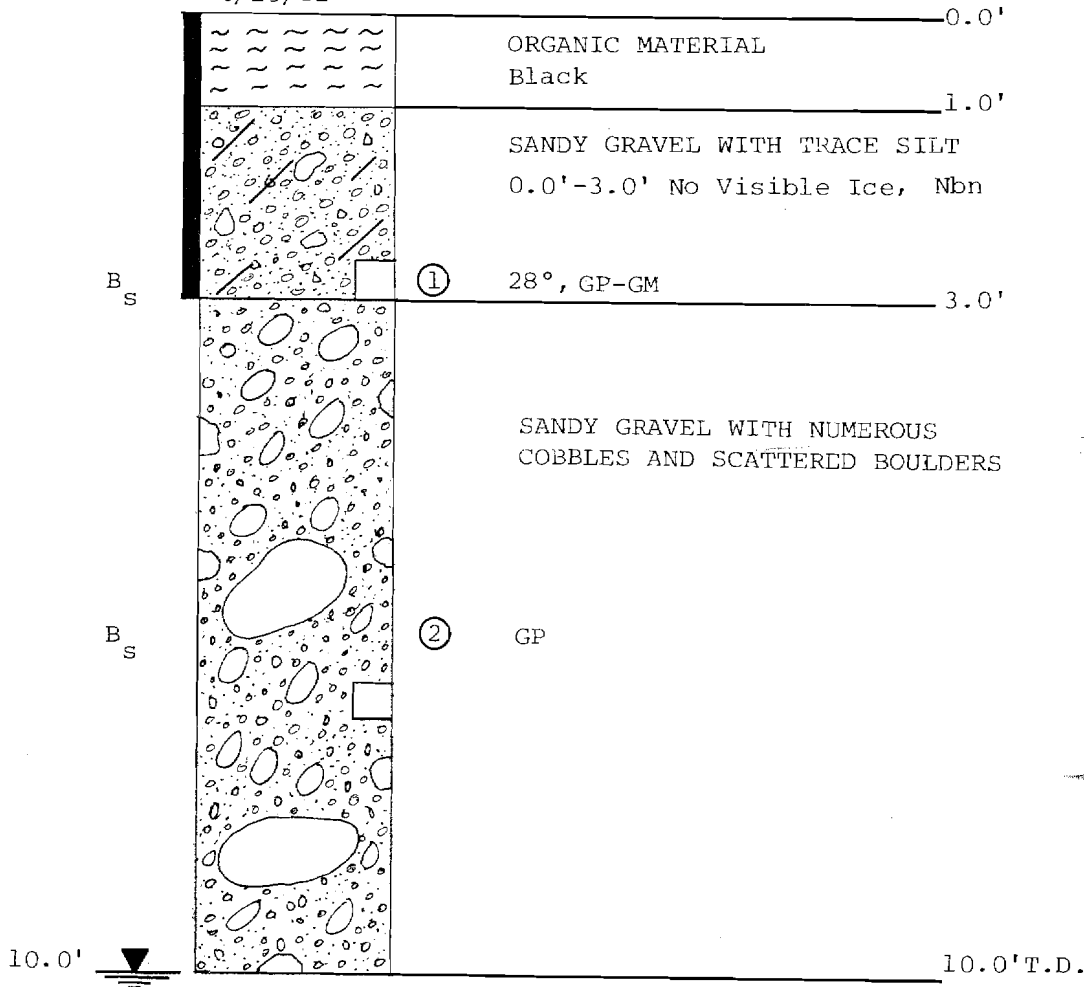
BORROW AREA E
AUGER HOLE AH-E9



Scale 1"=2'

TEST PIT/TEST TRENCH LOGS

TP-E1
4/19/81



PREPARED BY:



PREPARED FOR:

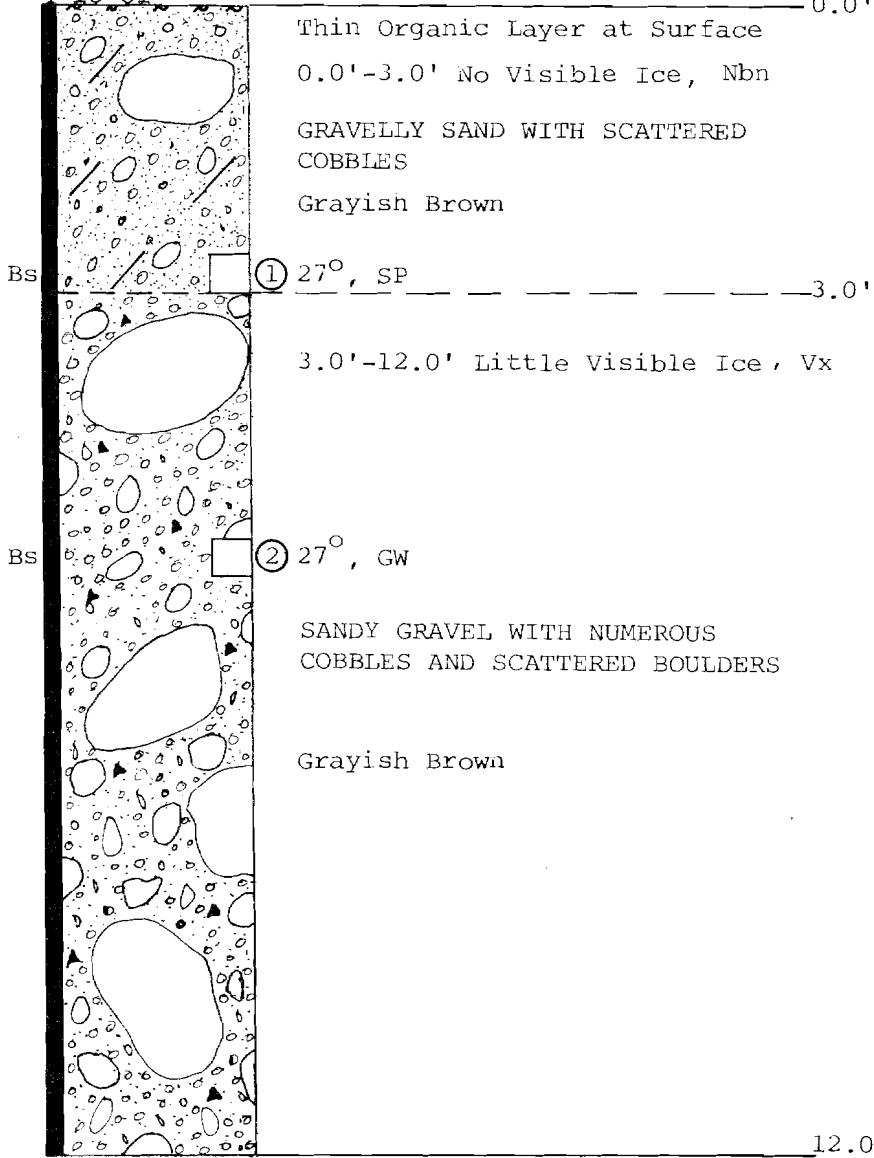
BORROW AREA E
TEST PIT TP-E1

Scale: 1"=2'



TP-E2
4-18-81

Elevation 1436.6'
0.0'



Groundwater Not Encountered.

PREPARED BY:



BORROW AREA E
TEST PIT TP-E2

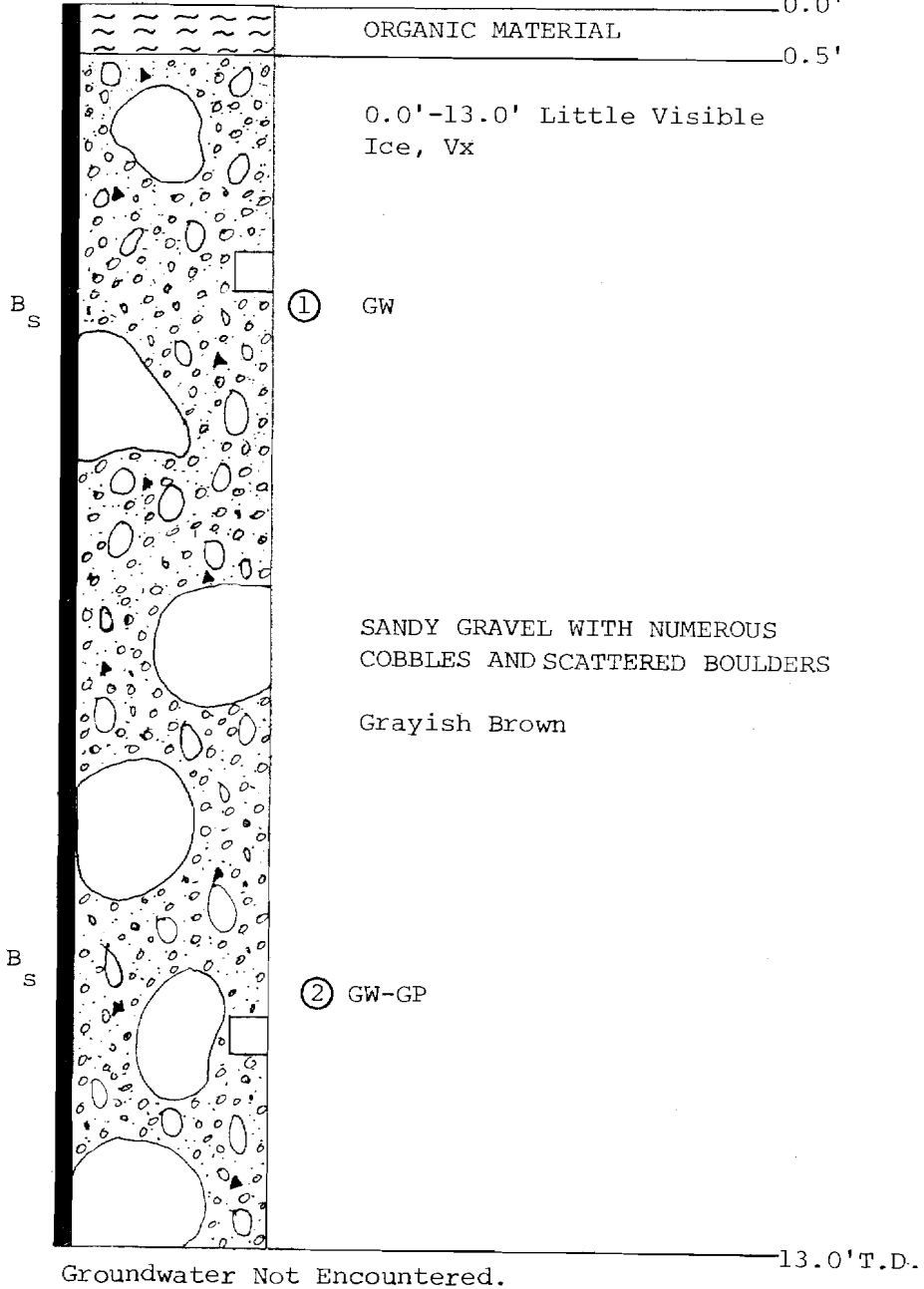
PREPARED FOR:



Scale: 1"=

TP-E3
4/17/81

Elevation: 1464.2'
0.0'



PREPARED BY:



BORROW AREA E
TEST PIT TP-E3

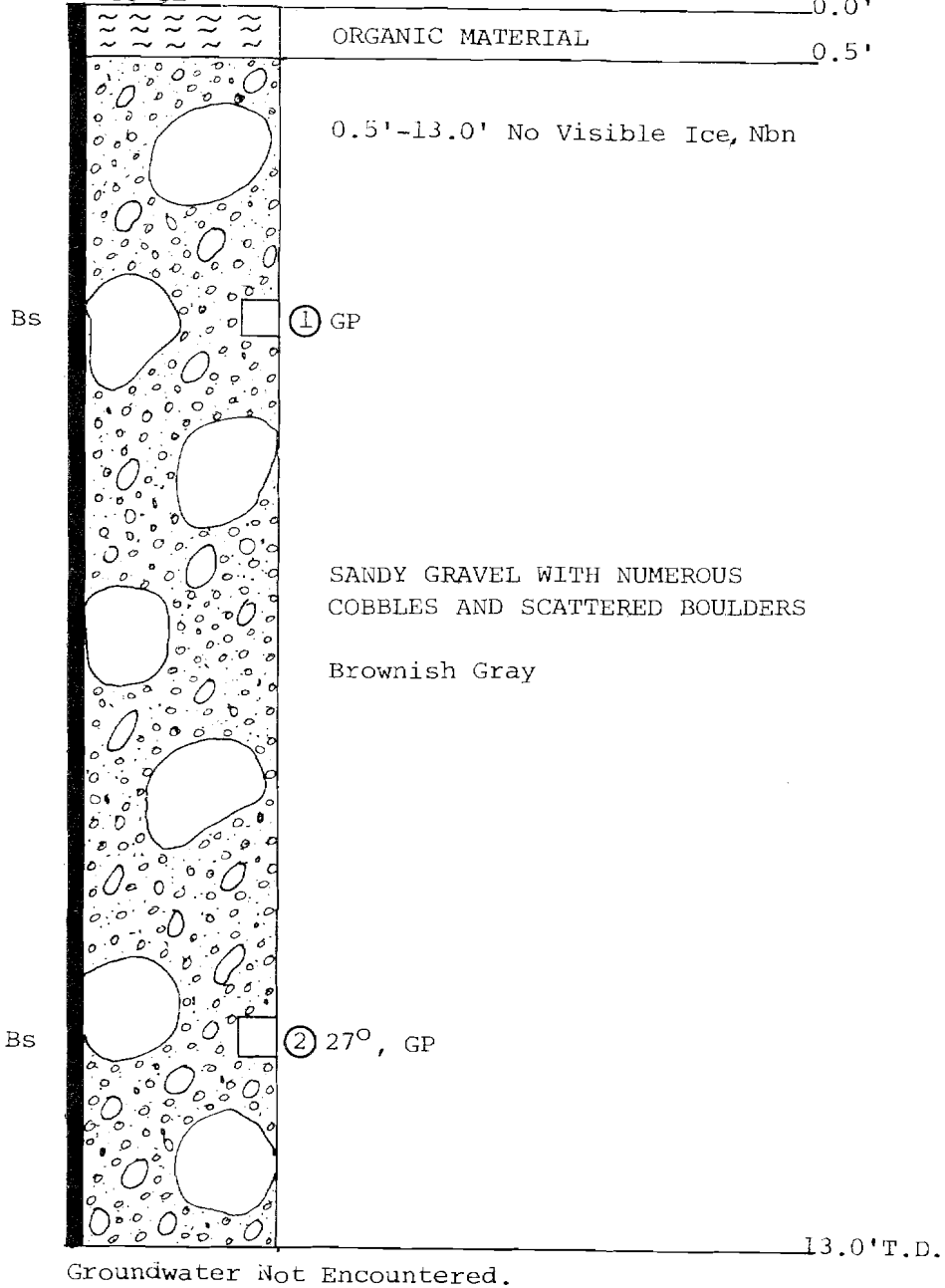
PREPARED FOR:



Scale: 1"=2'

TP-E4
4-18-81

Elevation: 1454.9'
0.0'



PREPARED BY:



PREPARED FOR:

BORROW AREA E
TEST PIT TP-E4



Scale: 1" = 1'

TP-E5
4-16-81

Elevation: 1470.1'

ORGANIC MATERIAL 0.0'
0.5'

Bs

① GW-GP



SANDY GRAVEL WITH NUMEROUS
COBBLES AND SCATTERED
BOULDERS
Brownish Gray

10.0' T.D.

Groundwater Not Encountered.

PREPARED BY:

PREPARED FOR:



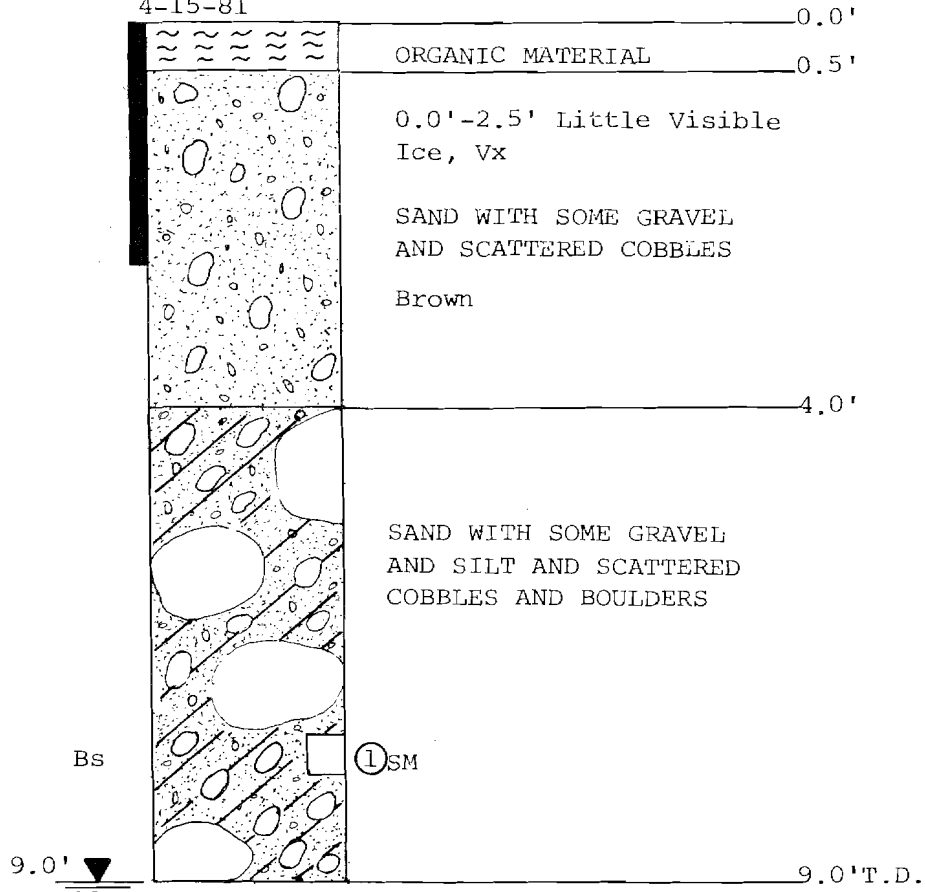
BORROW AREA E
TEST PIT TP-E5



Scale: 1"=2'

TP-E6
4-15-81

Elevation: 1443.4'



PREPARED BY:

PREPARED FOR:



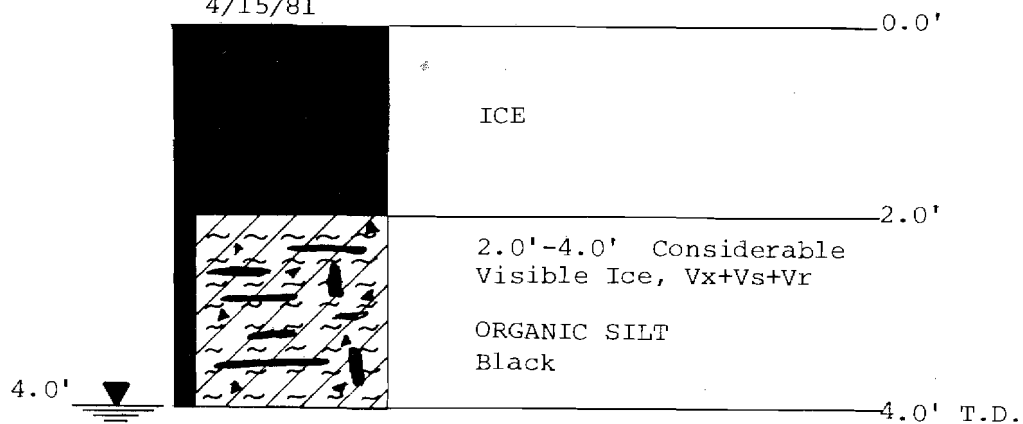
BORROW AREA E
TEST PIT TP-E6



Scale: 1"=

TP-E7
4/15/81

Elevation: 1450.7'



PREPARED BY:

PREPARED FOR:



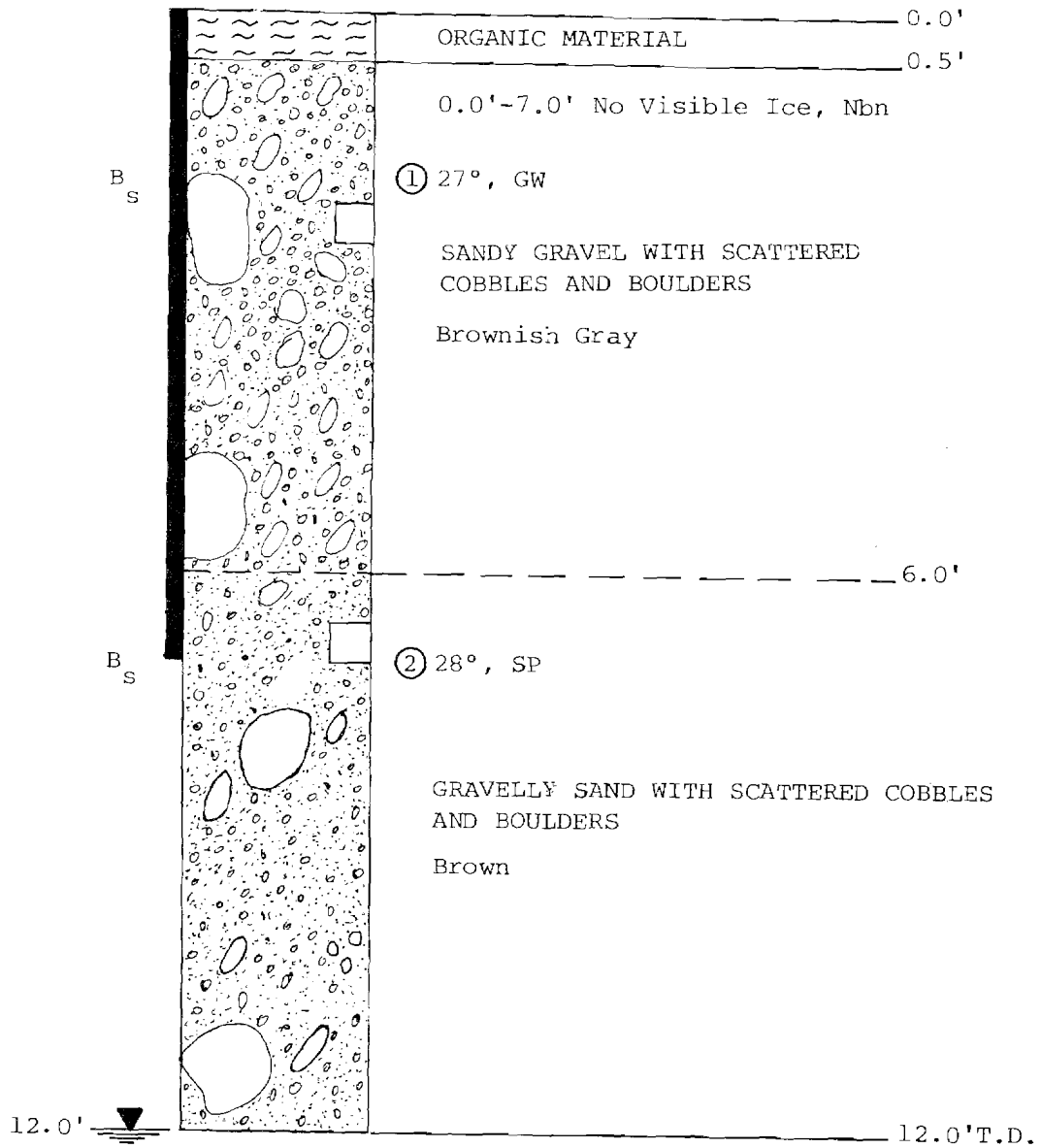
BORROW AREA E
TEST PIT TP-E7

Scale: 1"=2'



TP-E8
4/20/81

Elevation: 1450.2'



PREPARED BY:

PREPARED FOR:



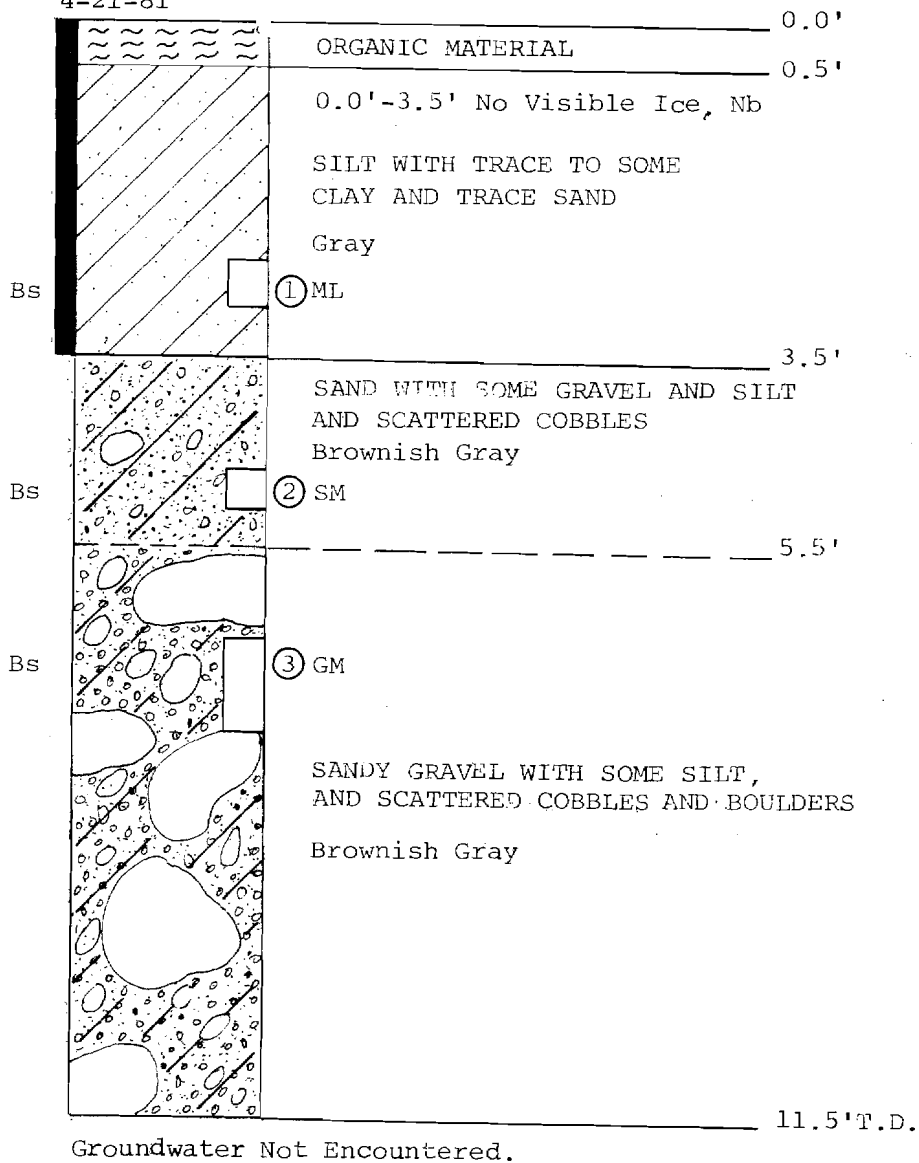
BORROW AREA E
TEST PIT TP-E8

Scale: 1"=2'



TP-E9
4-21-81

Elevation: 1476.7'



PREPARED BY:

PREPARED FOR:



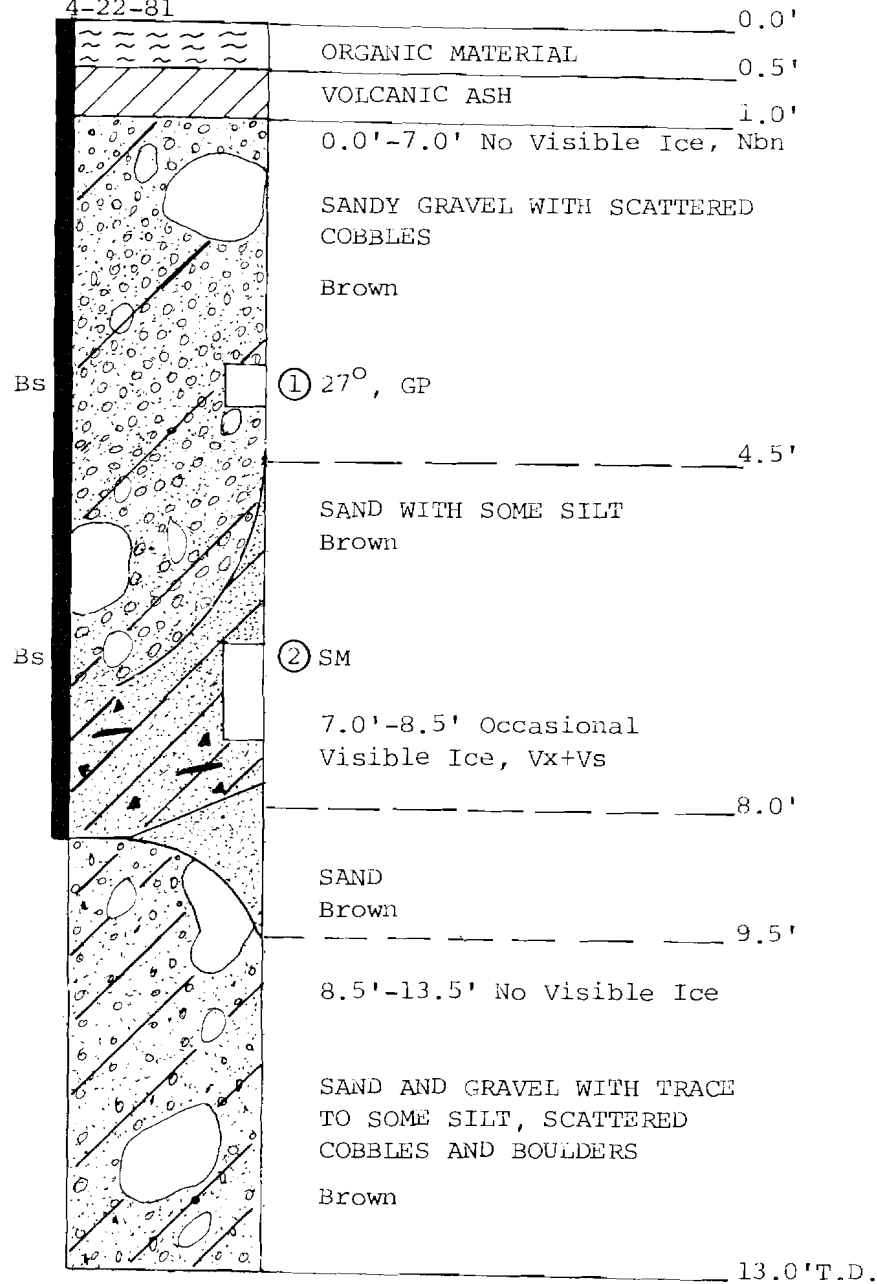
BORROW AREA E
TEST PIT TP-E9



Scale: 1"=2'

TP-E10A
4-22-81

Elevation: 1500.7'



Groundwater Not Encountered.

PREPARED BY:

PREPARED FOR:



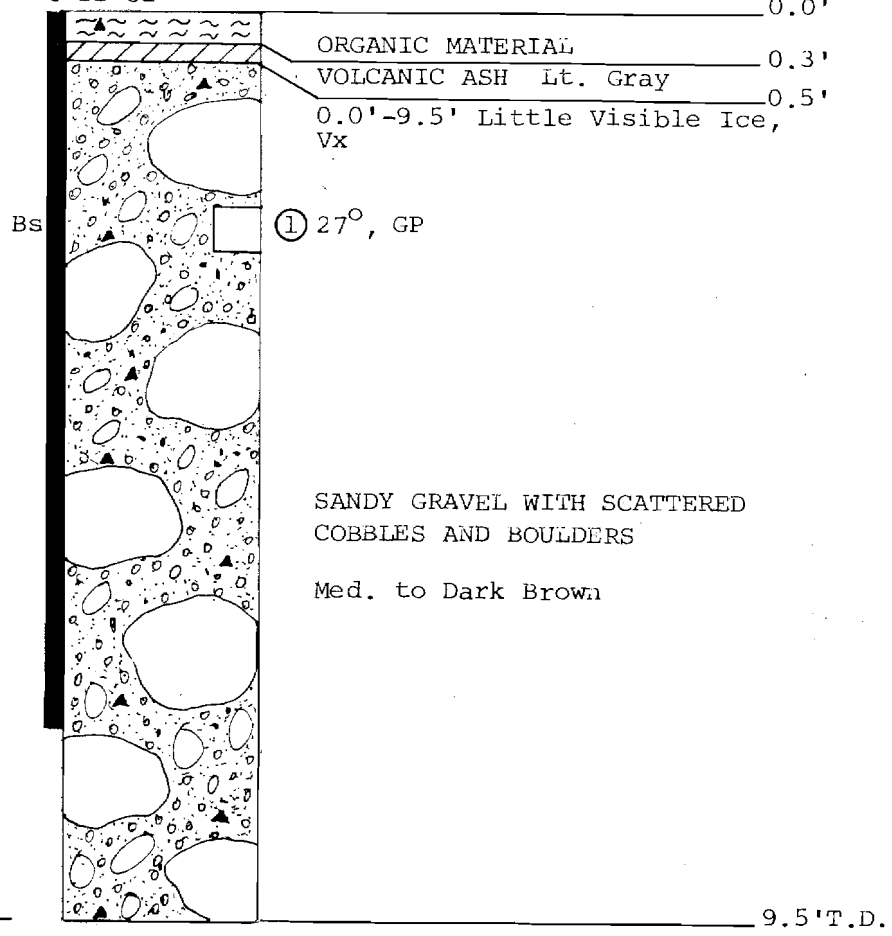
BORROW AREA E
TEST PIT TP-E10A



Scale: 1"=2'

TP-E10B
4-22-81

Elevation: 1493.7'

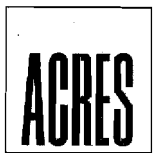


PREPARED BY:

PREPARED FOR:



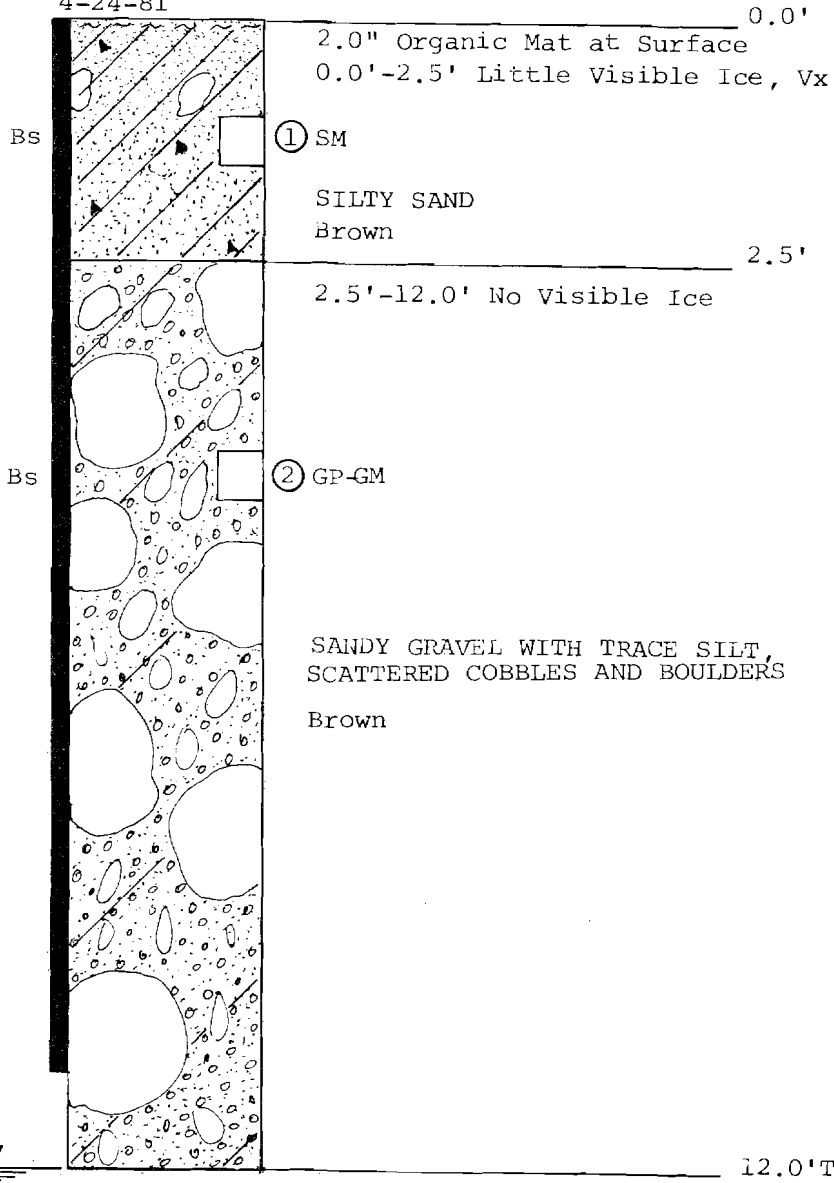
BORROW AREA E
TEST PIT TP-E10B



Scale: 1"=2'

TP-E11
4-24-81

Elevation: 1512.7'



PREPARED BY:

PREPARED FOR:



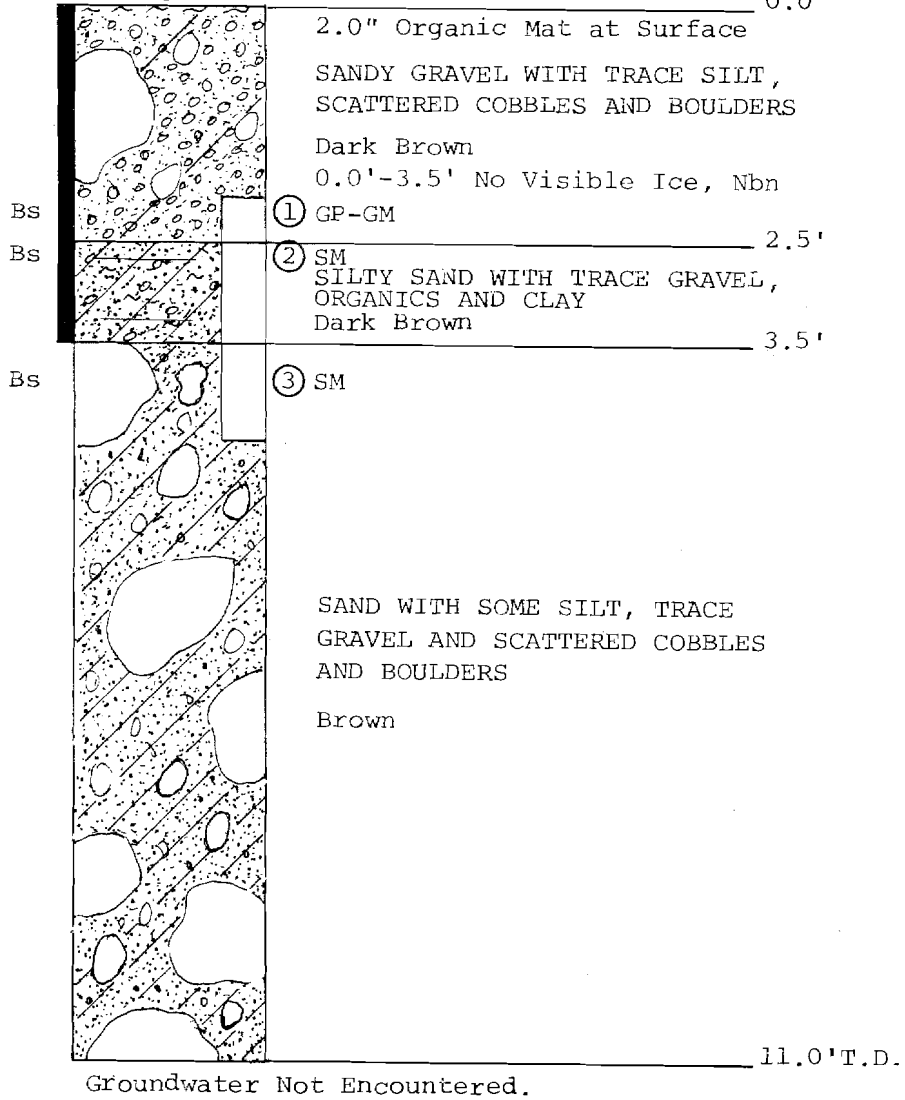
BORROW AREA E
TEST PIT TP-E11



Scale: 1"=2'

TP-E12
4-25-81

Elevation: 1534.9'
0.0'



PREPARED BY:



BORROW AREA E
TEST PIT TP-E12

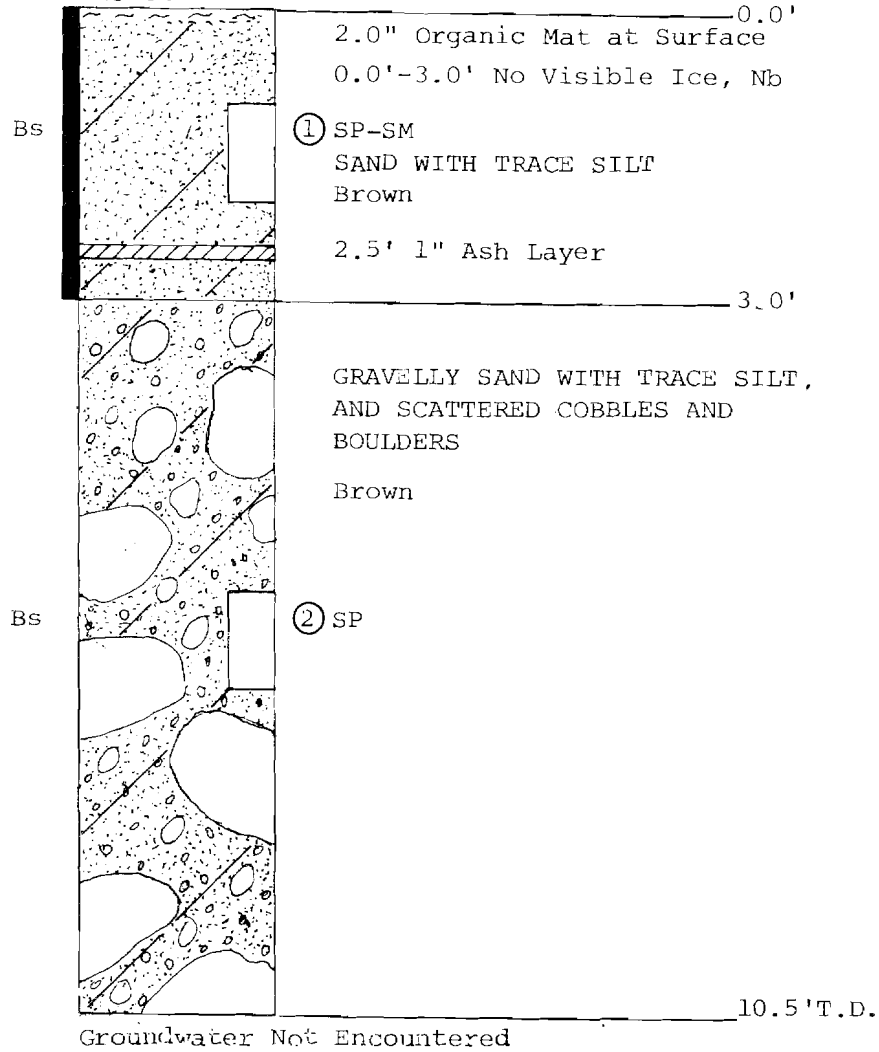
PREPARED FOR:



Scale: 1"=2'

TP-E14
4-26-81

Elevation: 1503.0'



PREPARED BY:



BORROW AREA E
TEST PIT TP-E14

PREPARED FOR:



Scale: 1"=2'

TP-E15

Elevation: 1468.3'

4-28-81

0.0'



2.0" Organic Mat at Surface

0.0'-11.5' No Visible Ice, Nf

BS

① 28°, GW

GRAVEL WITH SOME SAND,
SCATTERED COBBLES AND
BOULDERS

Brown

11.5' T.D.

Groundwater Not Encountered.

PREPARED BY:

PREPARED FOR:



BORROW AREA E
TEST PIT TP-E15

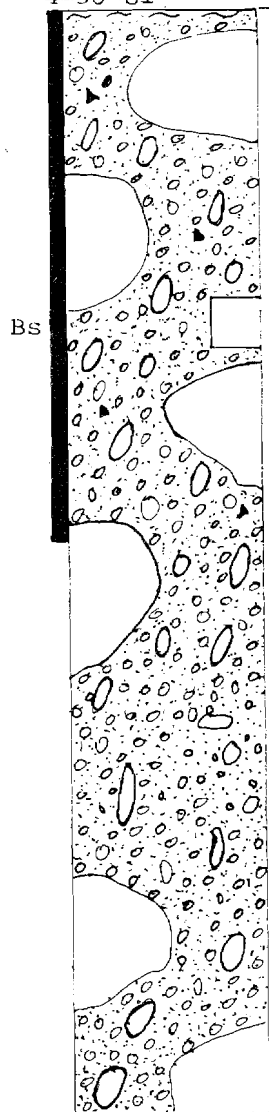


Scale: 1"=2'

TP-E16
4-30-81

Elevation: 1463.8'

0.0'



1.0" Organic Mat at Surface
1.0" Clayey Silt Beneath
Organic Mat

0.0'-5.5' Little to No
Visible Ice, Vx and Nbn

① SP

GRAVELLY SAND WITH
SCATTERED COBBLES AND
BOULDERS

Brown

11.5' T.D.

Groundwater Not Encountered.

PREPARED BY:

PREPARED FOR:



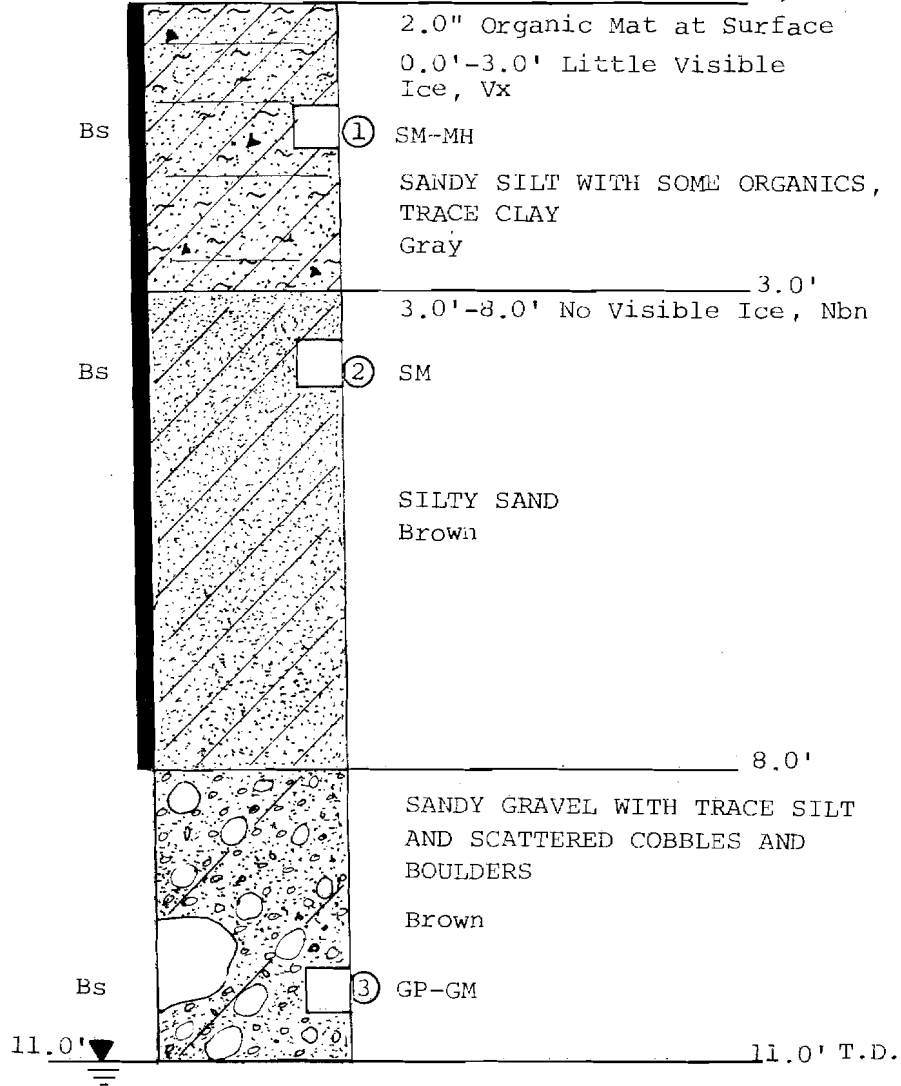
BORROW AREA E
TEST PIT TP-E16



Scale: 1"-2'

TP-E17
5-01-81

Elevation: 1441.7'
0.0'



PREPARED BY:



PREPARED FOR:

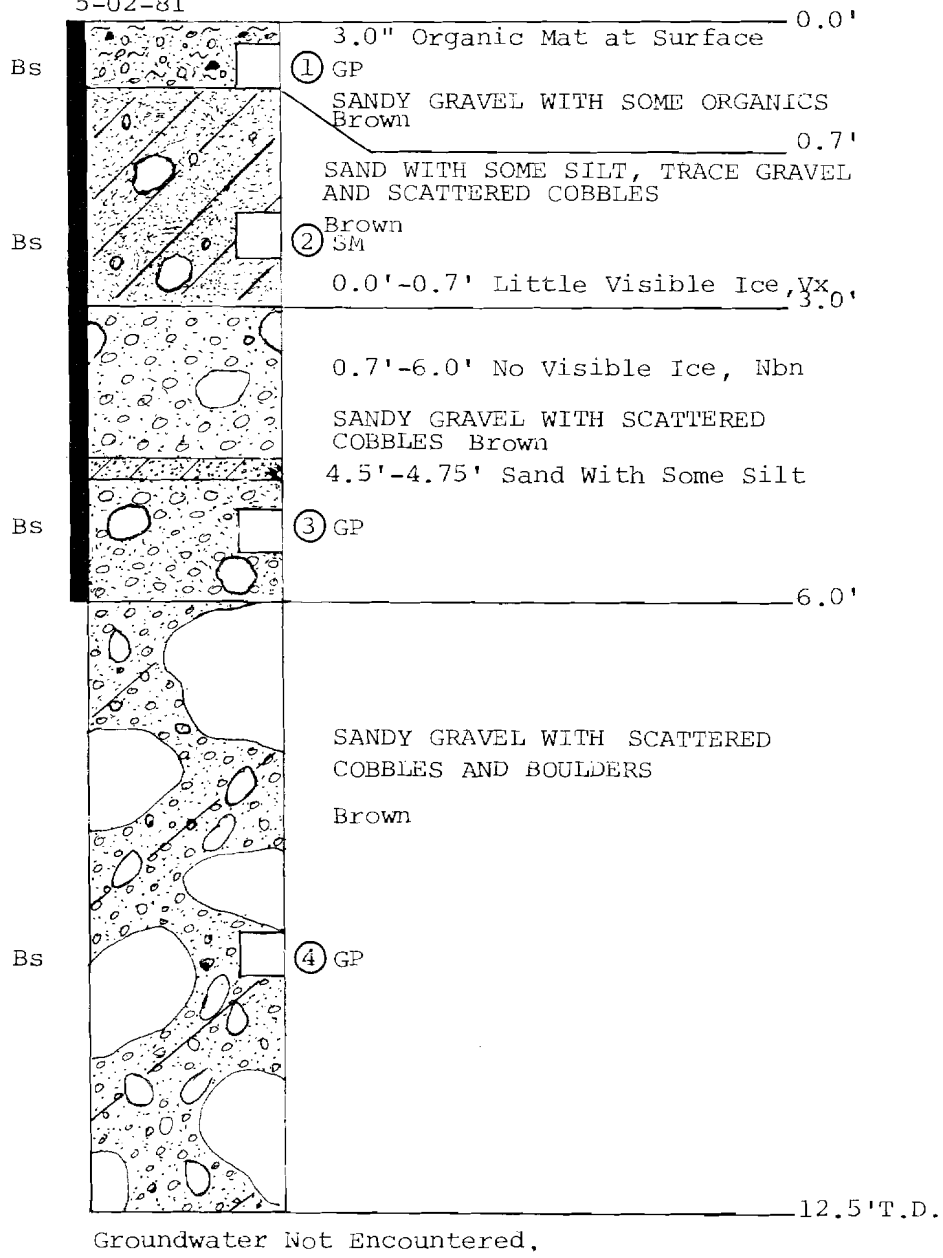
BORROW AREA E
TEST PIT TP-E17



Scale: 1"-2'

TP-E18
5-02-81

Elevation: 1455.1'



PREPARED BY:

PREPARED FOR:



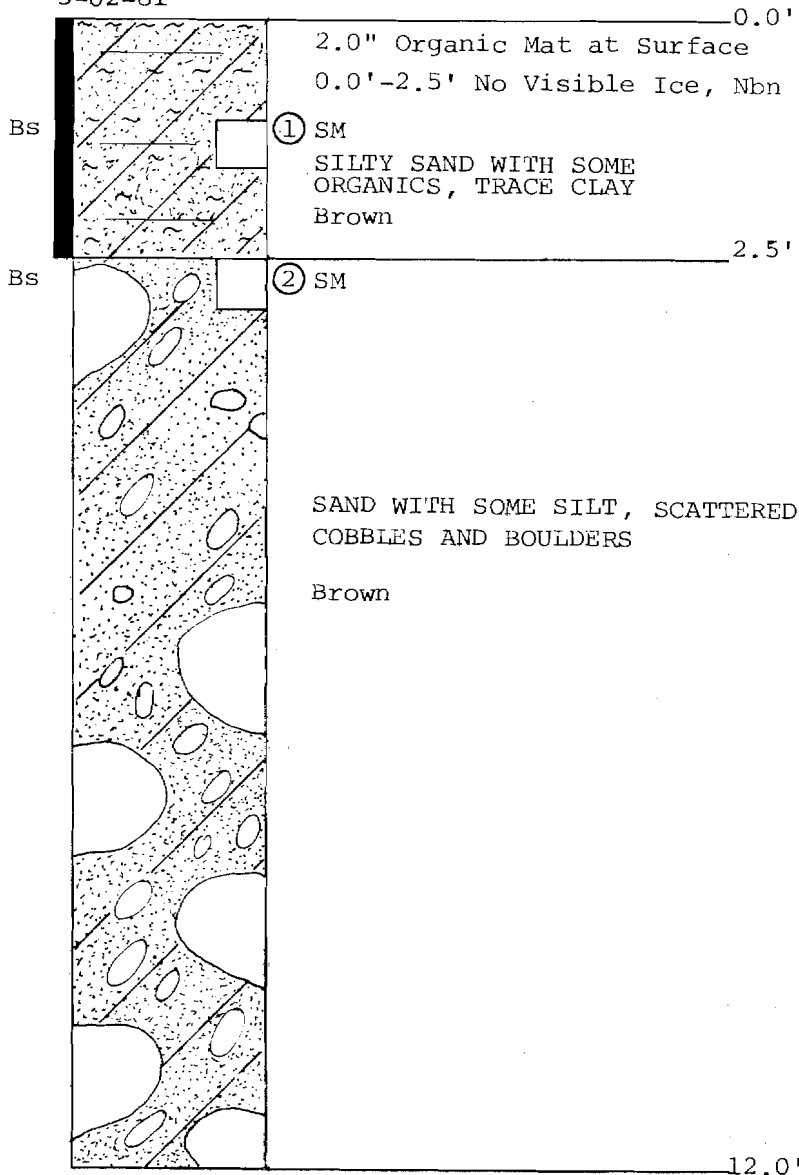
BORROW AREA E
TEST PIT TP-E18



Scale: 1"=2'

TP-E19
5-02-81

Elevation: 1464.7'



Groundwater Not Encountered.

PREPARED BY:

PREPARED FOR:



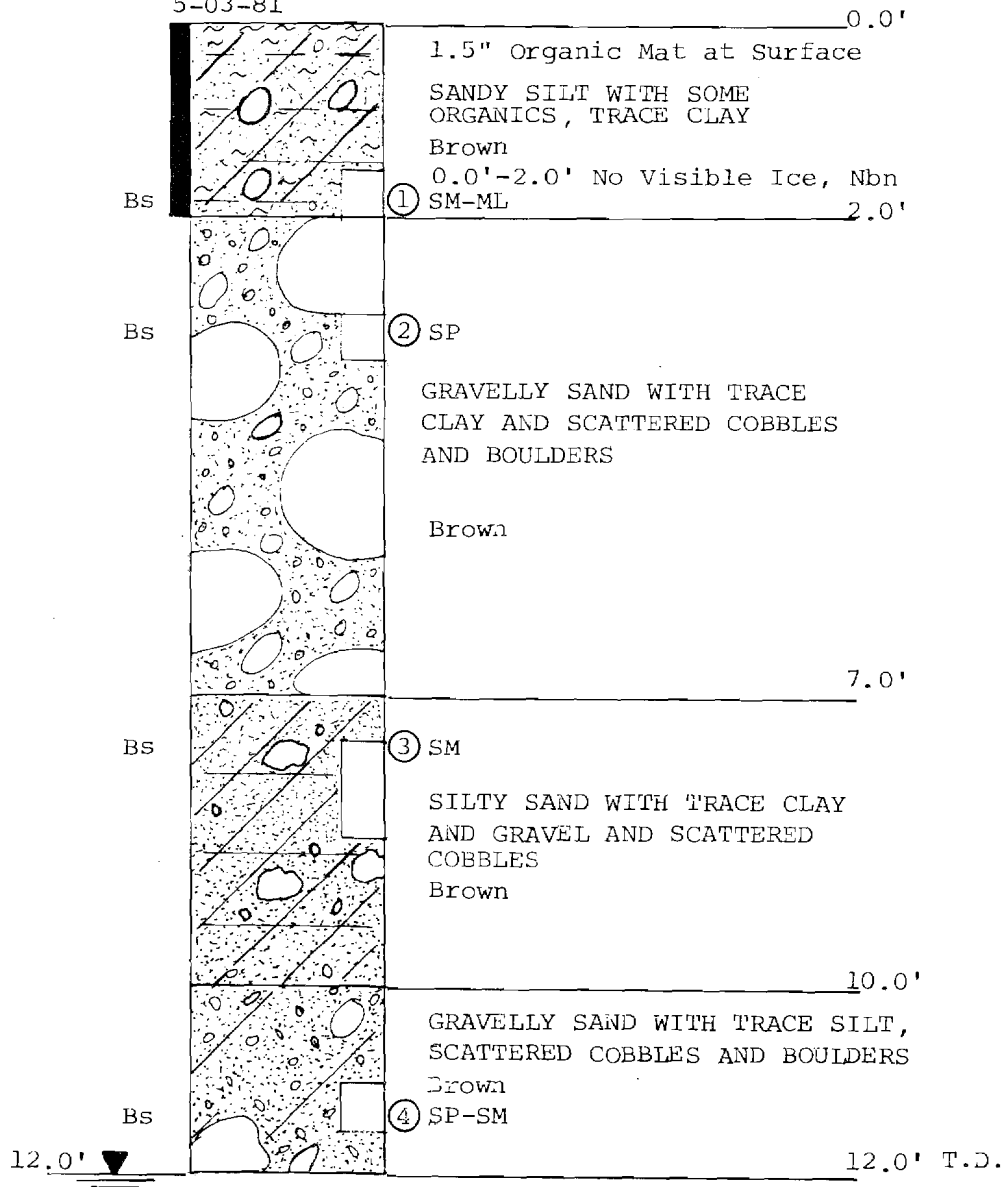
BORROW AREA E
TEST PIT TP-E19



Scale: 1"=2'

TP-E20
5-03-81

Elevation: 1435.0'



PREPARED BY:

PREPARED FOR:



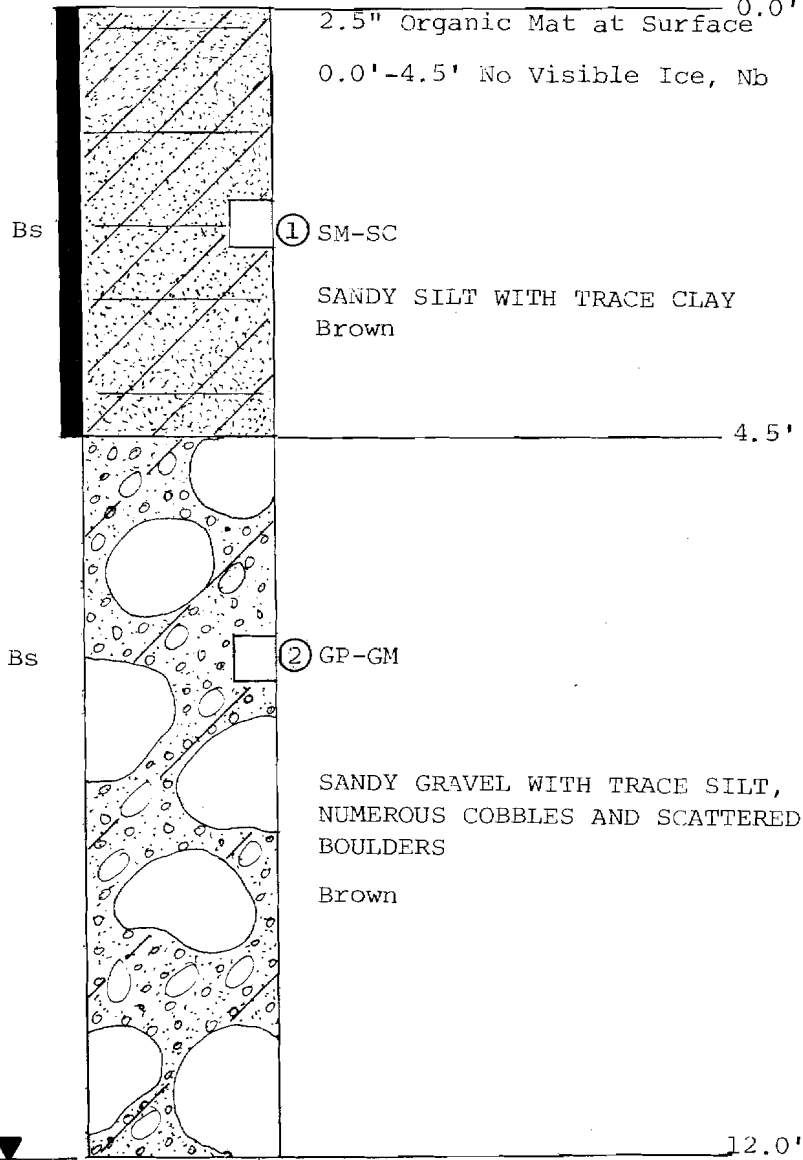
BORROW AREA E
TEST PIT TP-E20



Scale: 1"=2'

TP-E21
5-03-81

Elevation: 1425.4'



PREPARED BY:

PREPARED FOR:

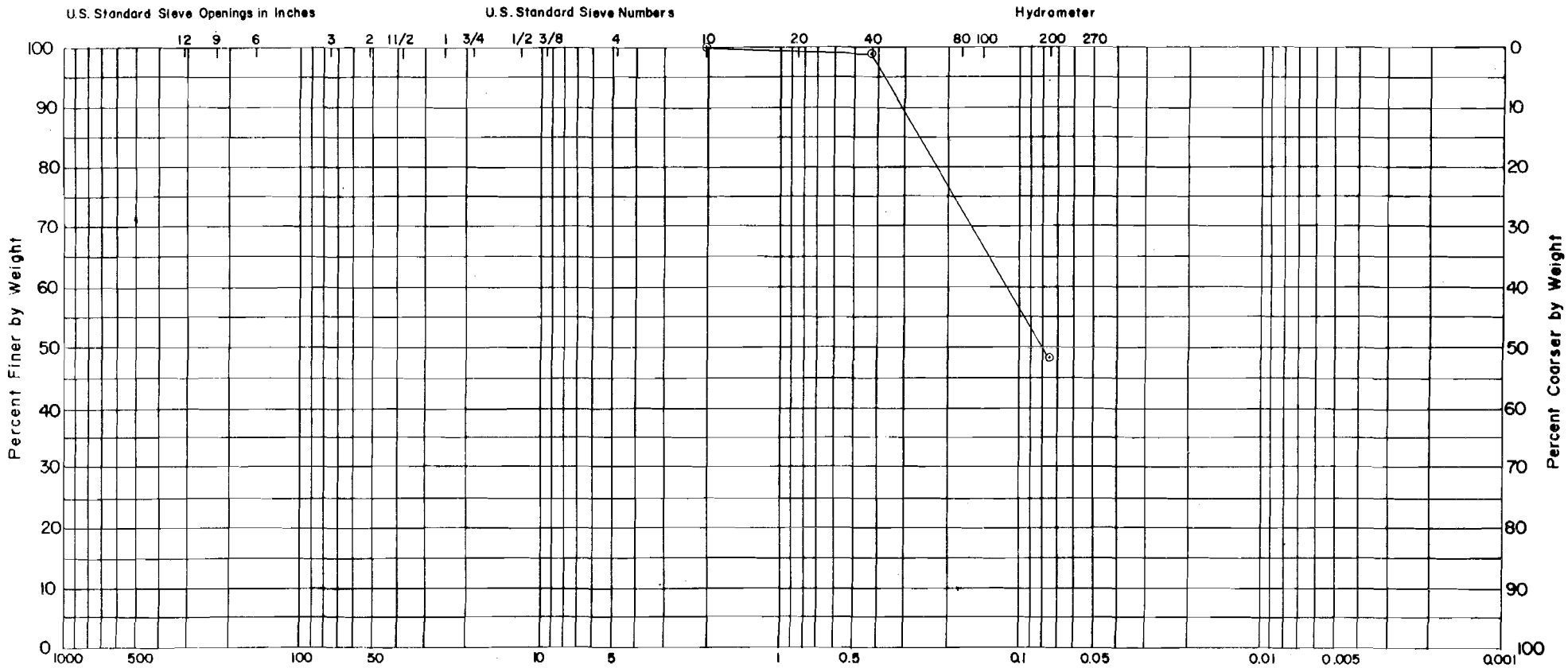


BORROW AREA E
TEST PIT TP-E21



Scale: 1"=2'

LABORATORY TEST DATA



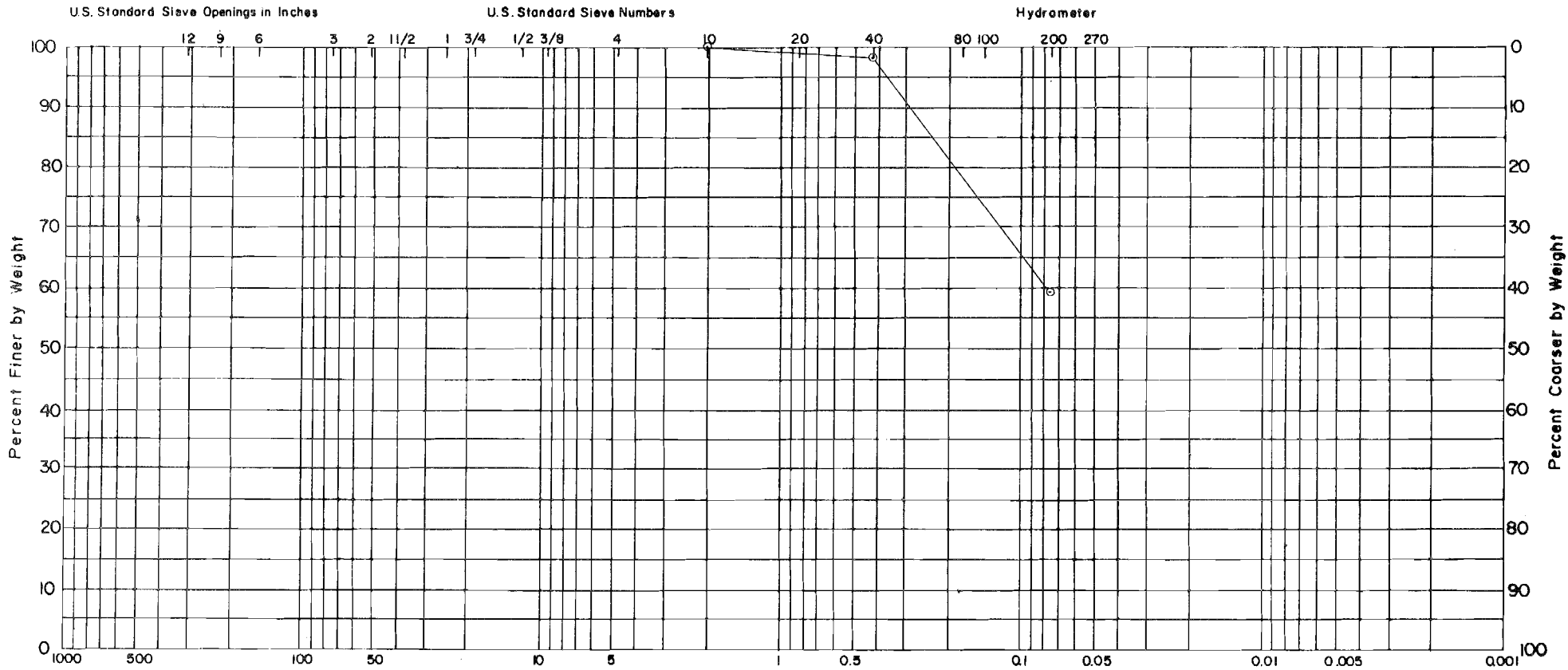
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-E1-3 (1.0-1.5')	19.6%				SM SILTY SAND



BORROW AREA E

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



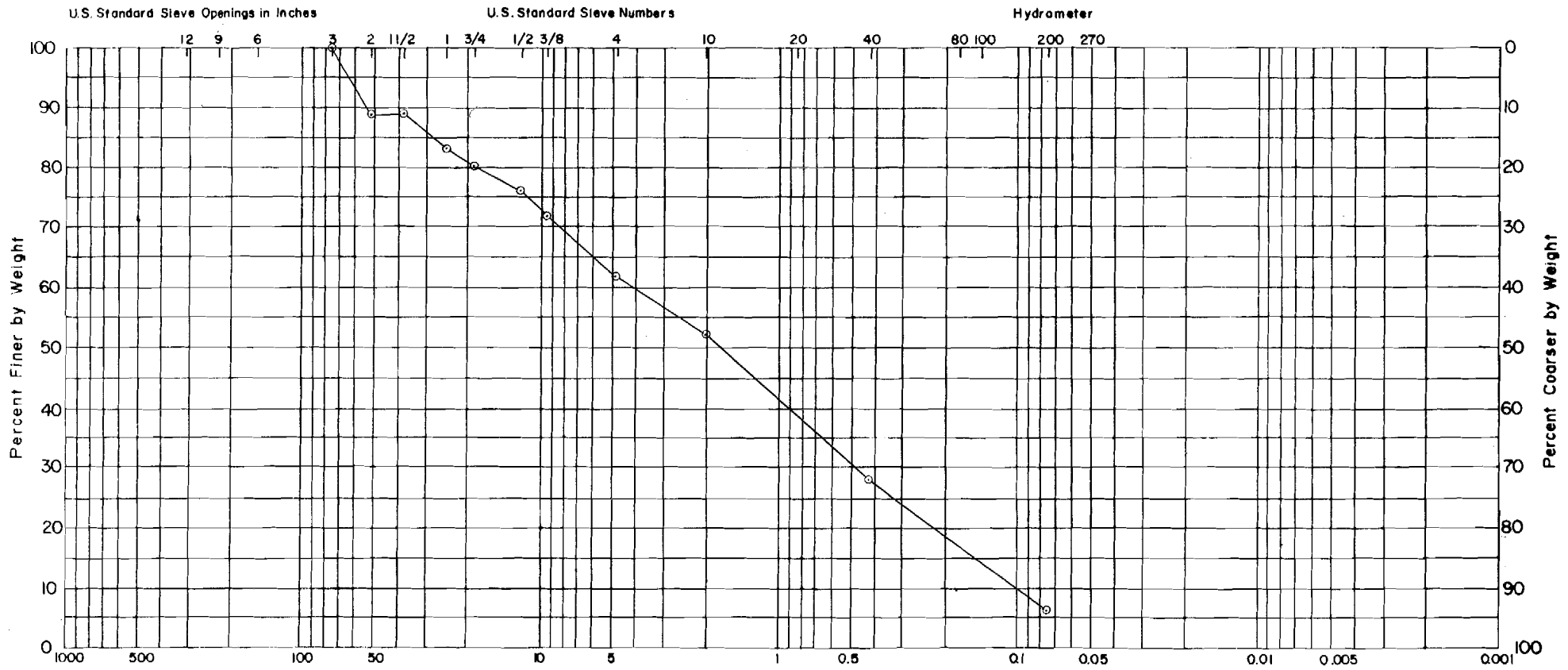
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E1-4 (2.0-3.5')	27.3%				ML	SANDY SILT



BORROW AREA E

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



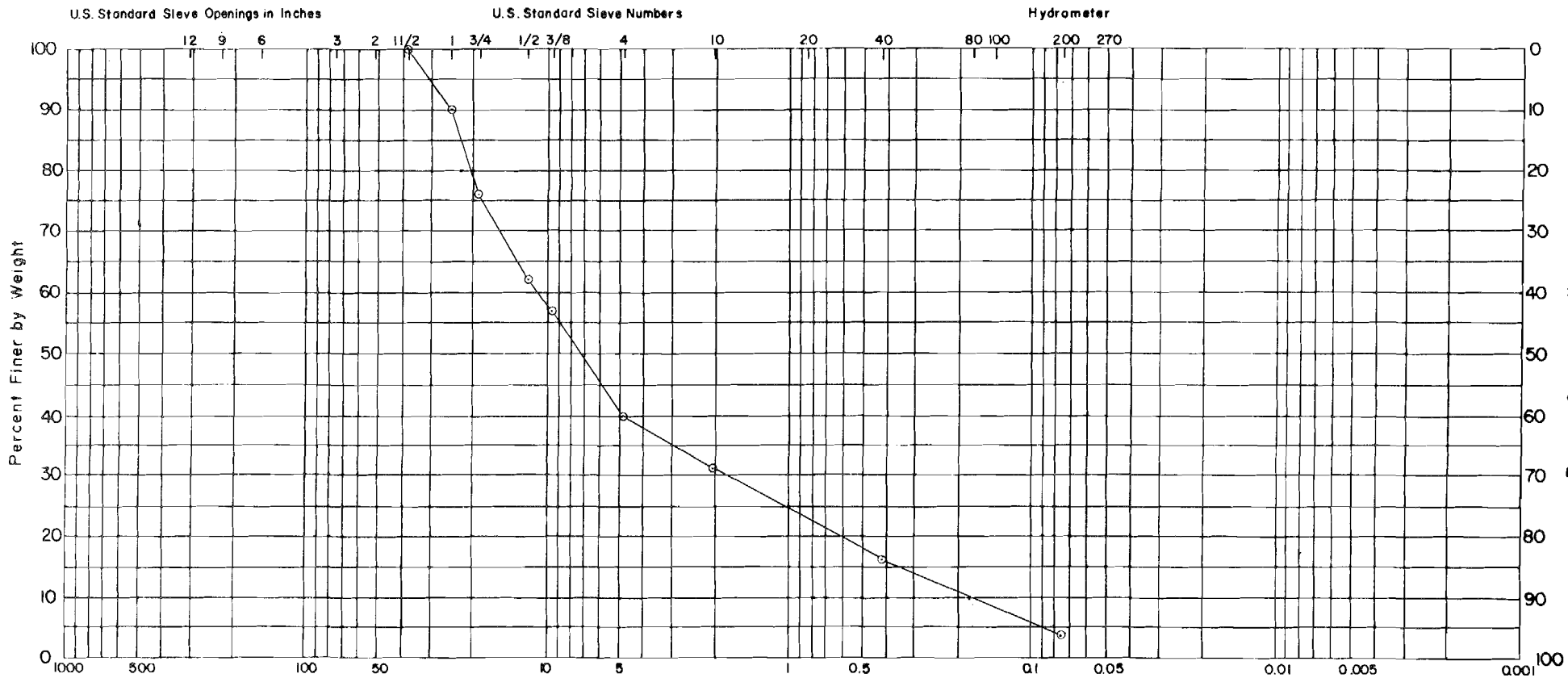
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-E3-6 (4.5-6.0')	4.4%				SP-SM GRAVELLY SAND Poorly Graded



BORROW AREA E

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



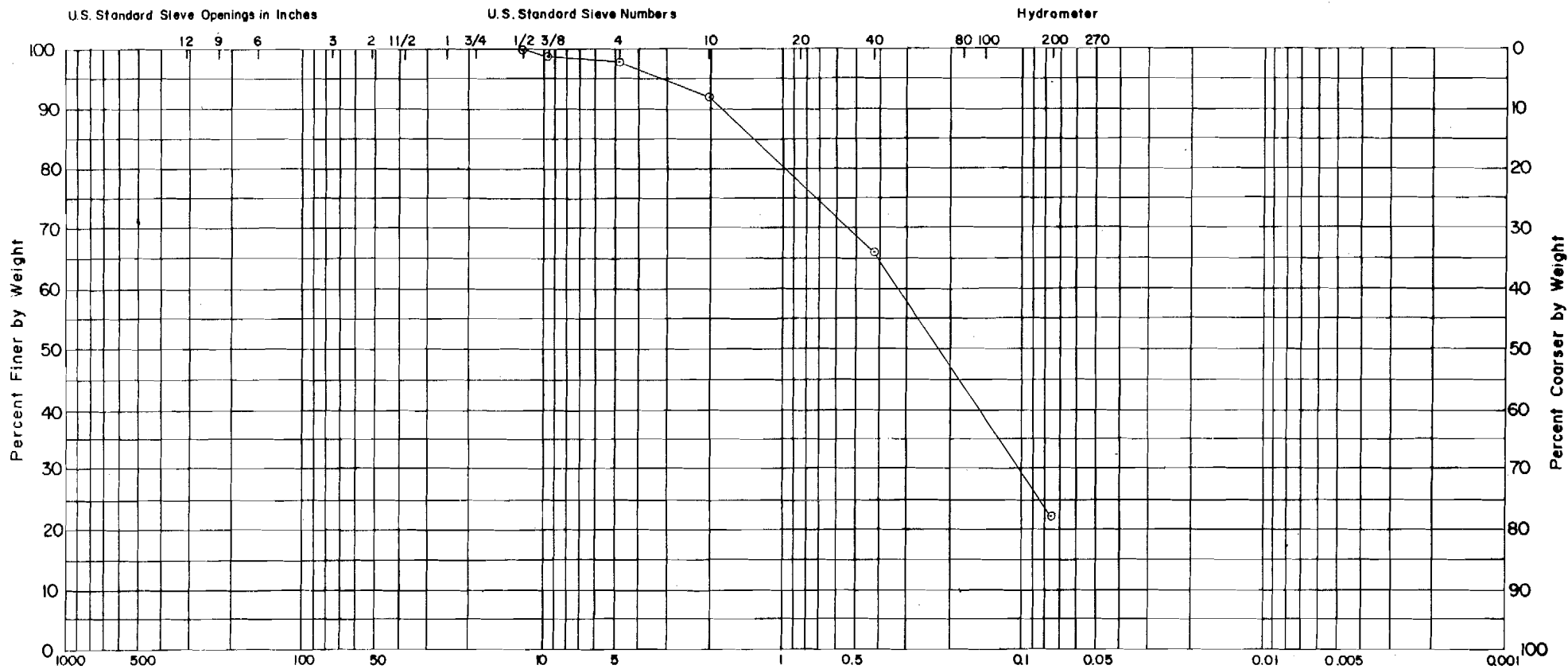
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E3-7 (6.5-8.0')	0.7%				GW	SANDY GRAVEL Well Graded



BORROW AREA E

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



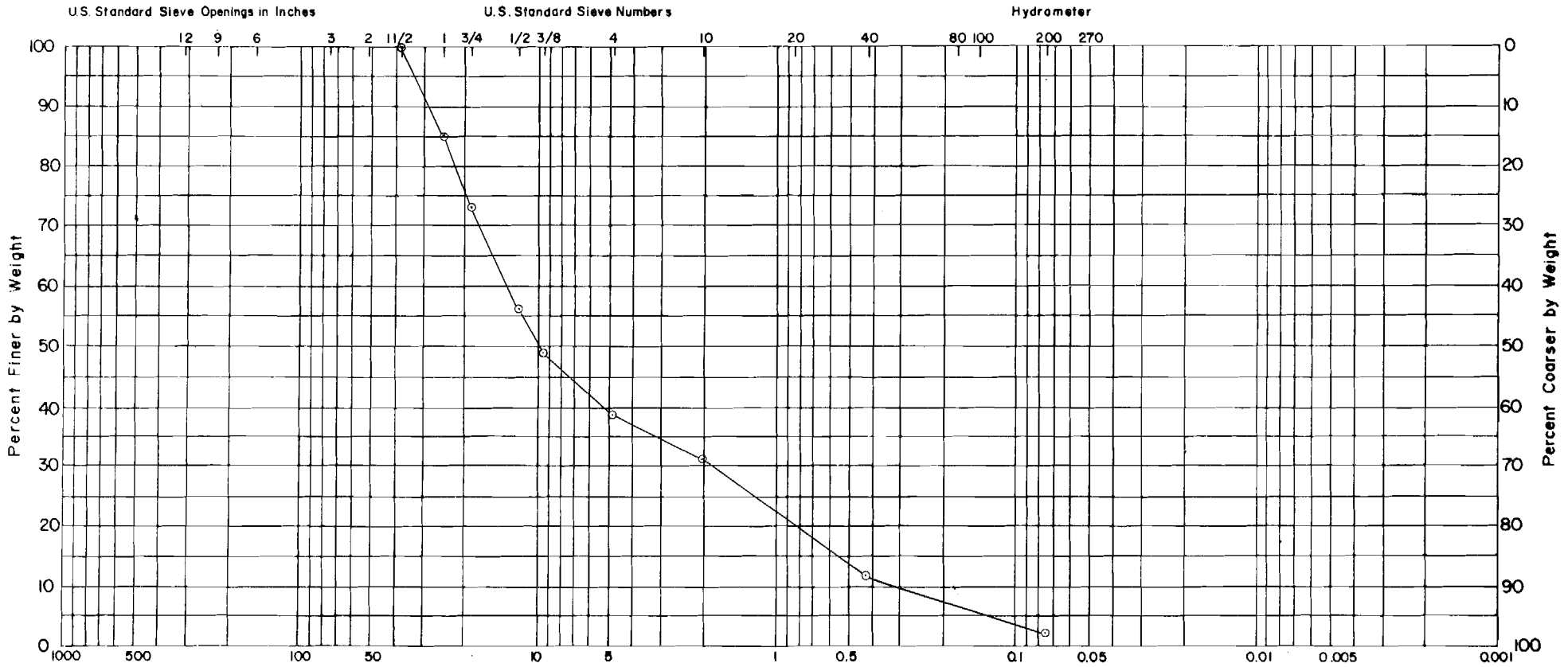
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-E4-6 (5.0-6.5')	17.6%				SM SILTY SAND WITH TRACE GRAVEL



BORROW AREA E

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



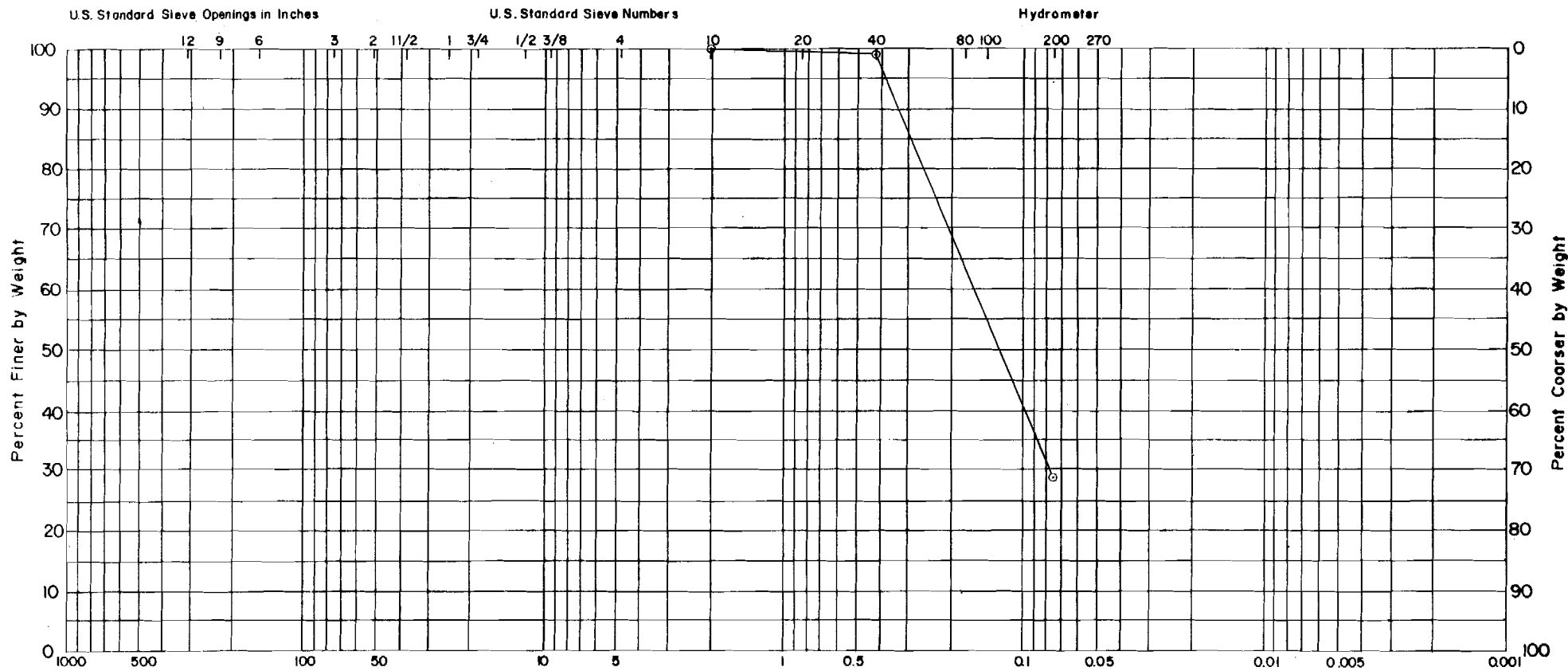
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-E7-3 (2.0-3.0")	2.3%				GP SANDY GRAVEL WITH TRACE SILT



BORROW AREA E

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



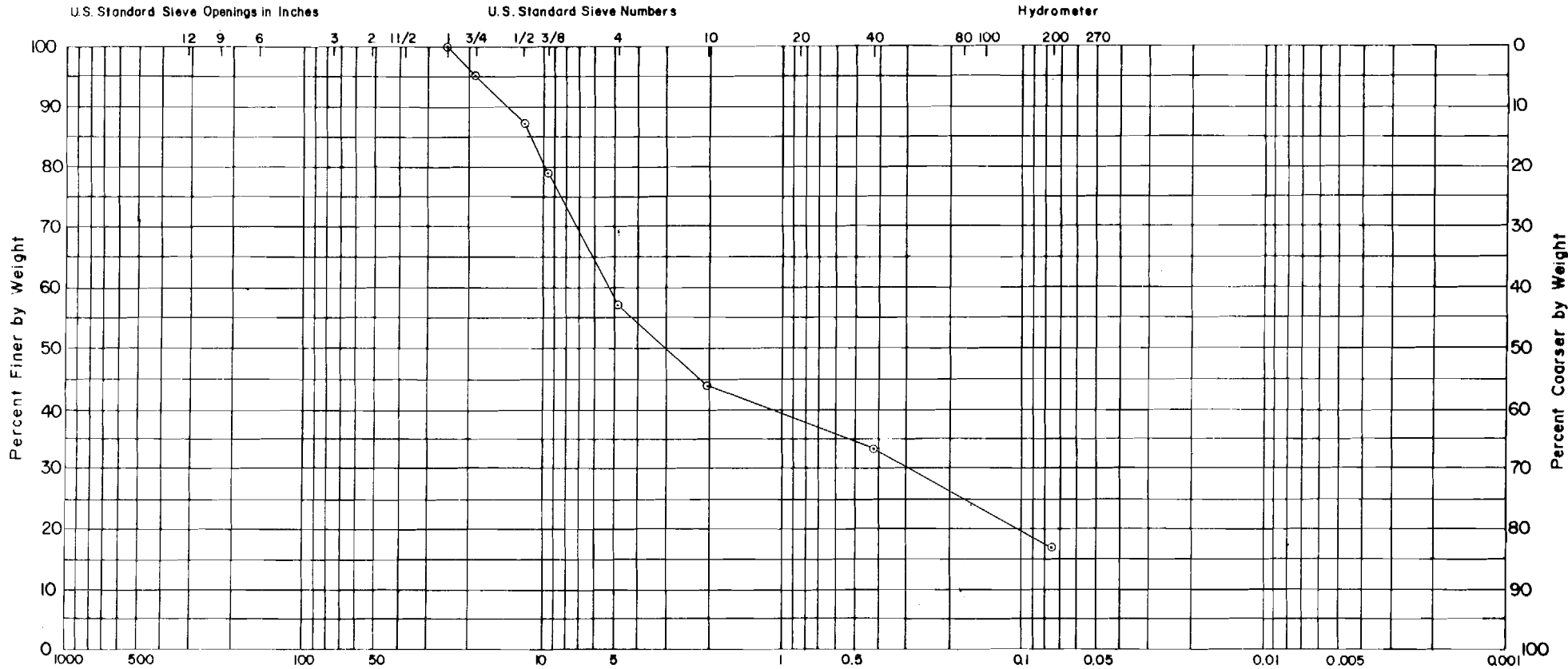
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-E9-2 (1.5-3.0')	15.7%				SM SILTY SAND Poorly Graded



BORPOW AREA E

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

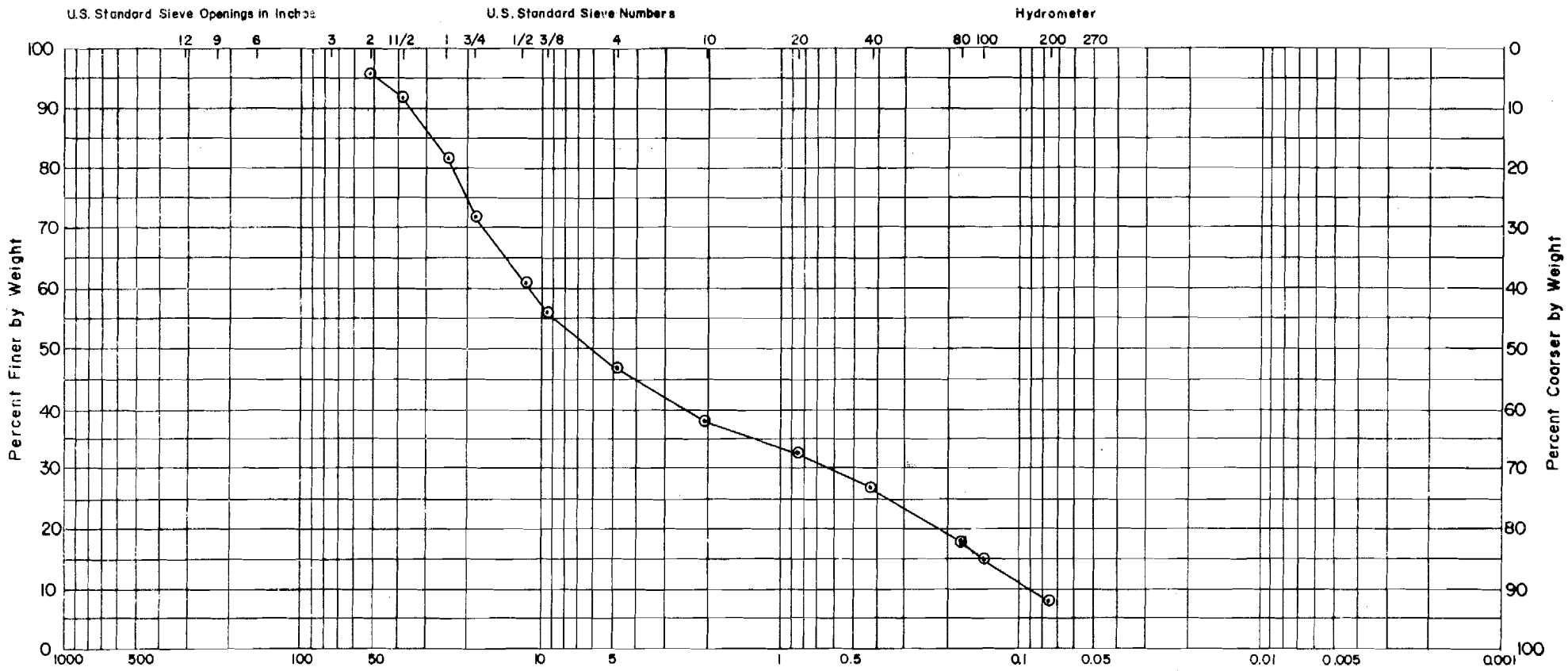
SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-E9-6 (6.5-8.0')	4.4%				GM	SANDY GRAVEL WITH SOME SILT



R&M CONSULTANTS INC.

BORROW AREA E

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



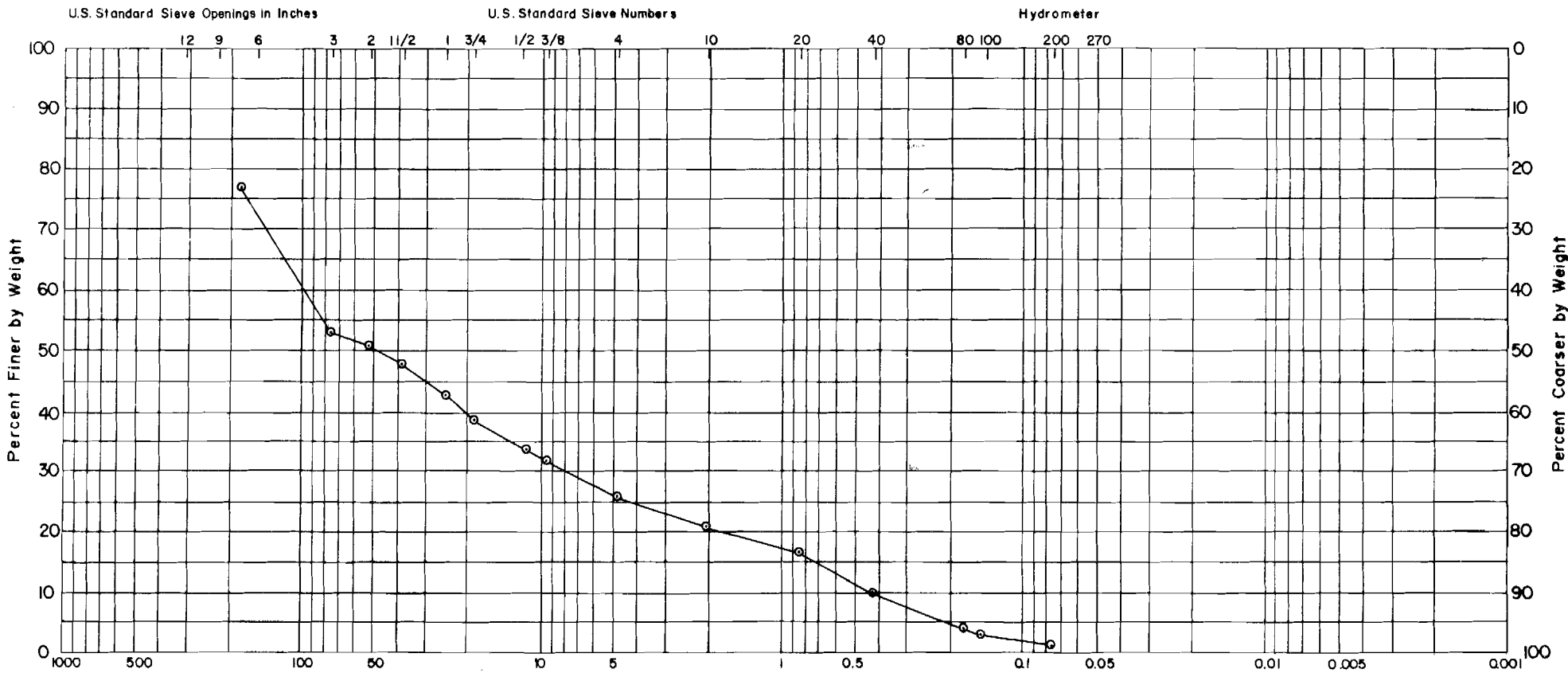
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E1 #1					GP-GM	SANDY GRAVEL WITH TRACE SILT



Borrow Area E
Test Pit TP-E1

DRAWN BY: J.M.
 APPROVED BY: T.I.
 DATE: Dec. 1981
 PROJECT NO. 052506



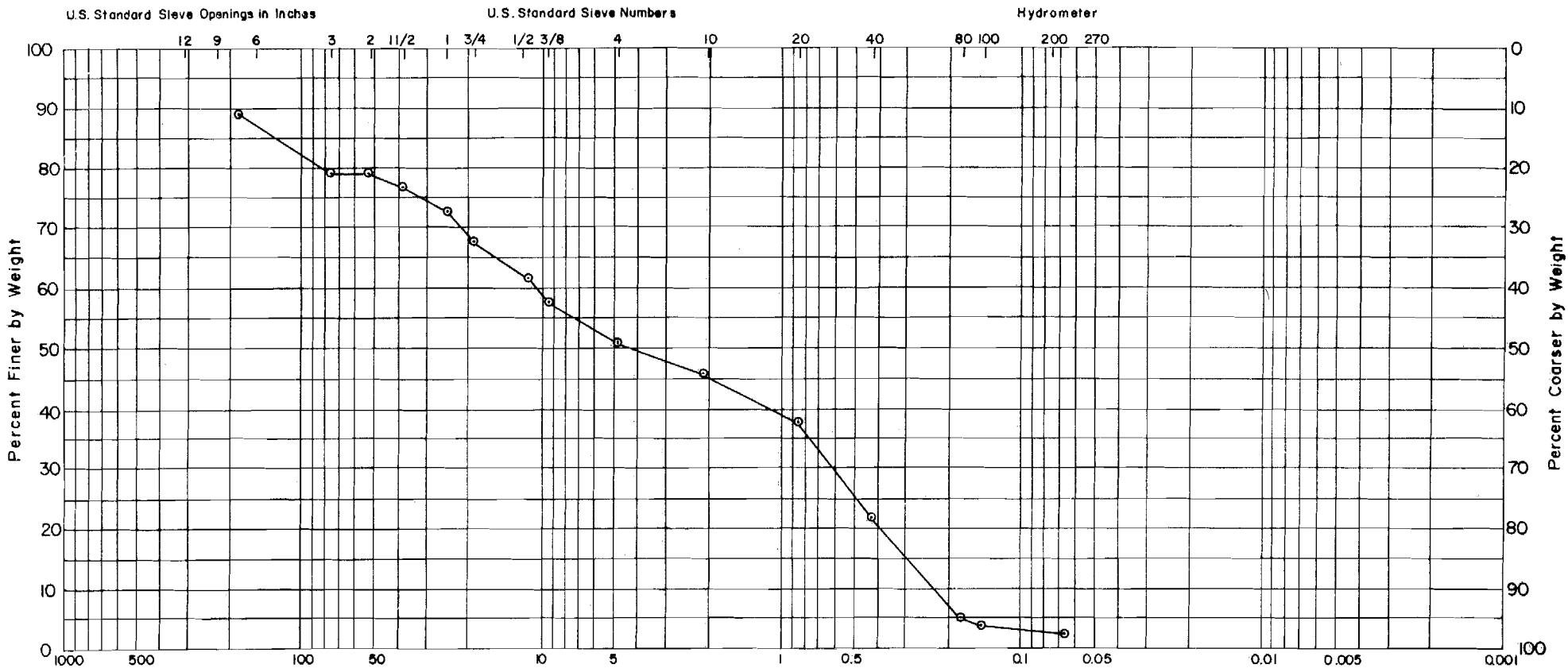
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E1 #2					GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS



BORROW AREA E
TEST PIT TP-E1

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



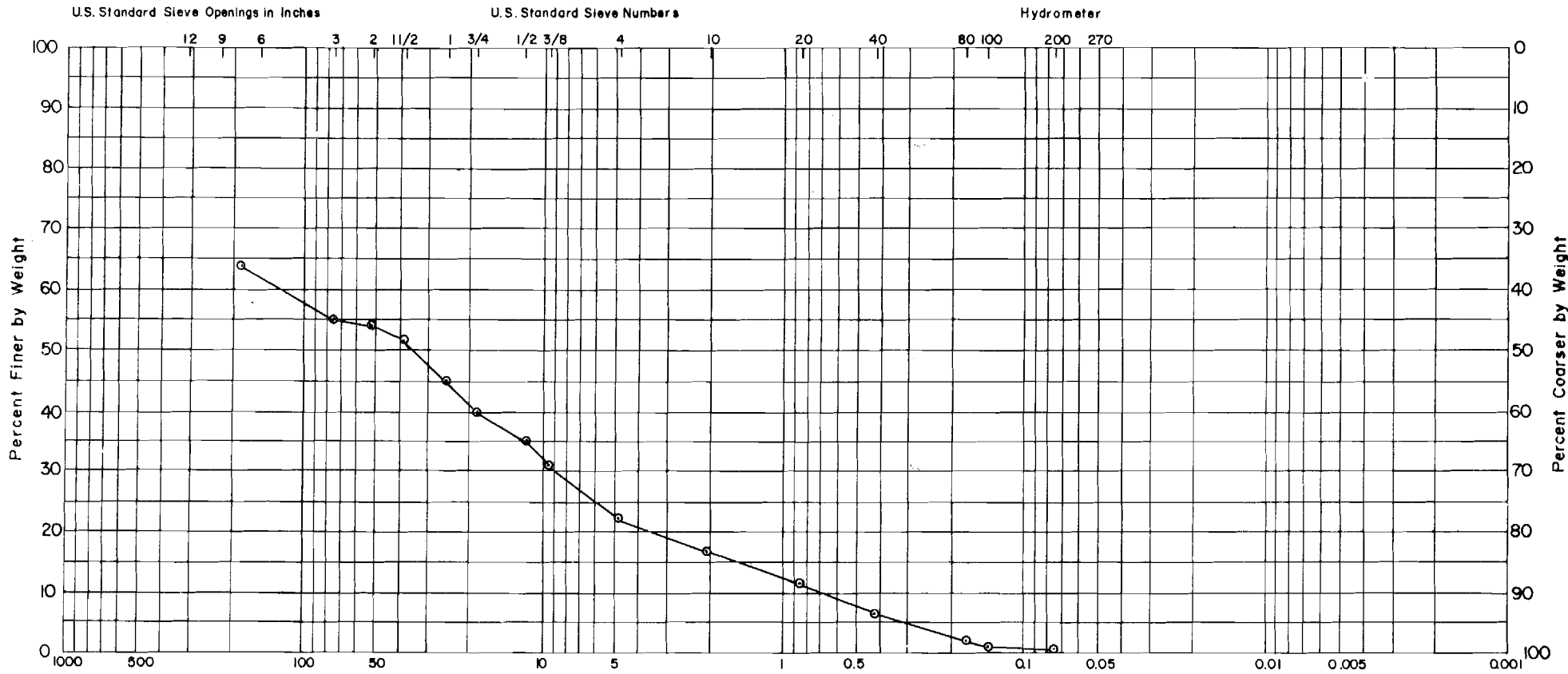
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E2 #1					SP	GRAVELLY SAND WITH SCATTERED COBBLES



BORROW AREA E
TEST PIT TP-E2

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



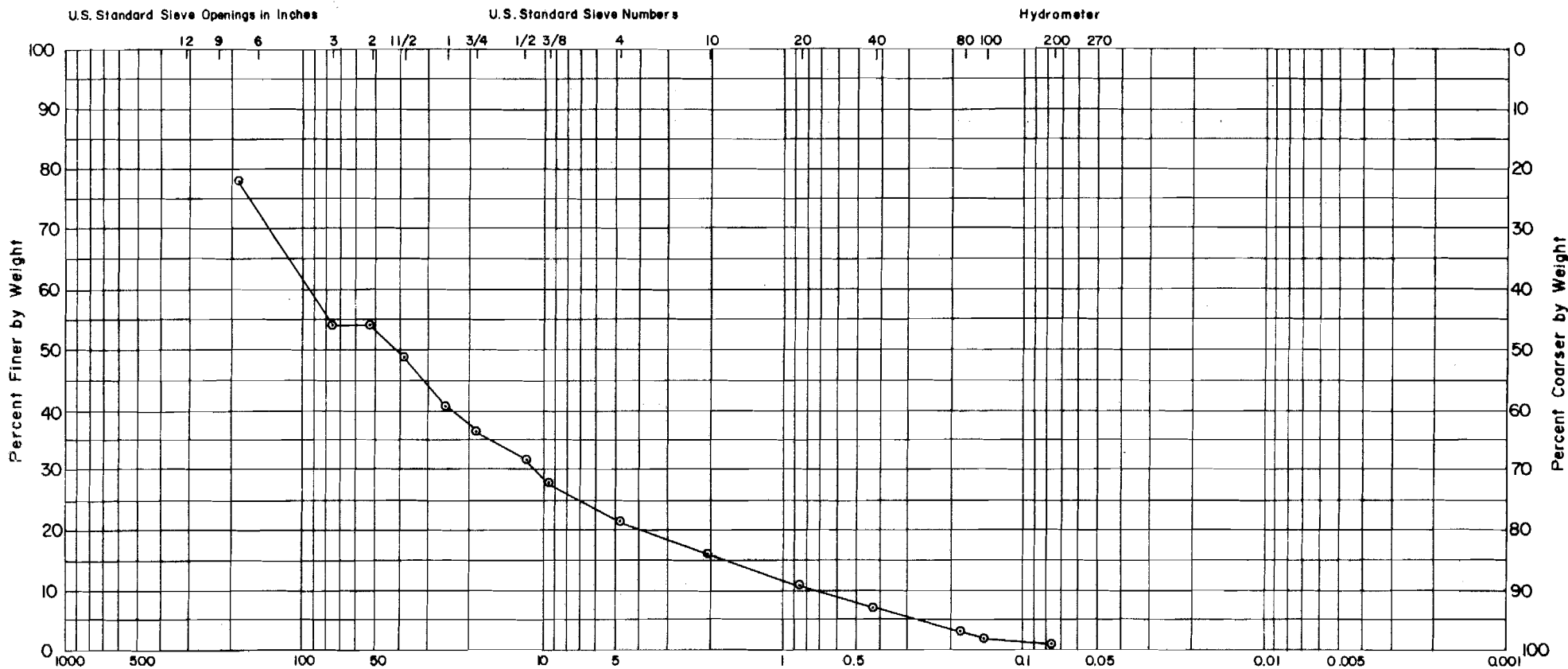
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E2 #2					GW	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS



BORROW AREA E
TEST PIT TP-E2

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



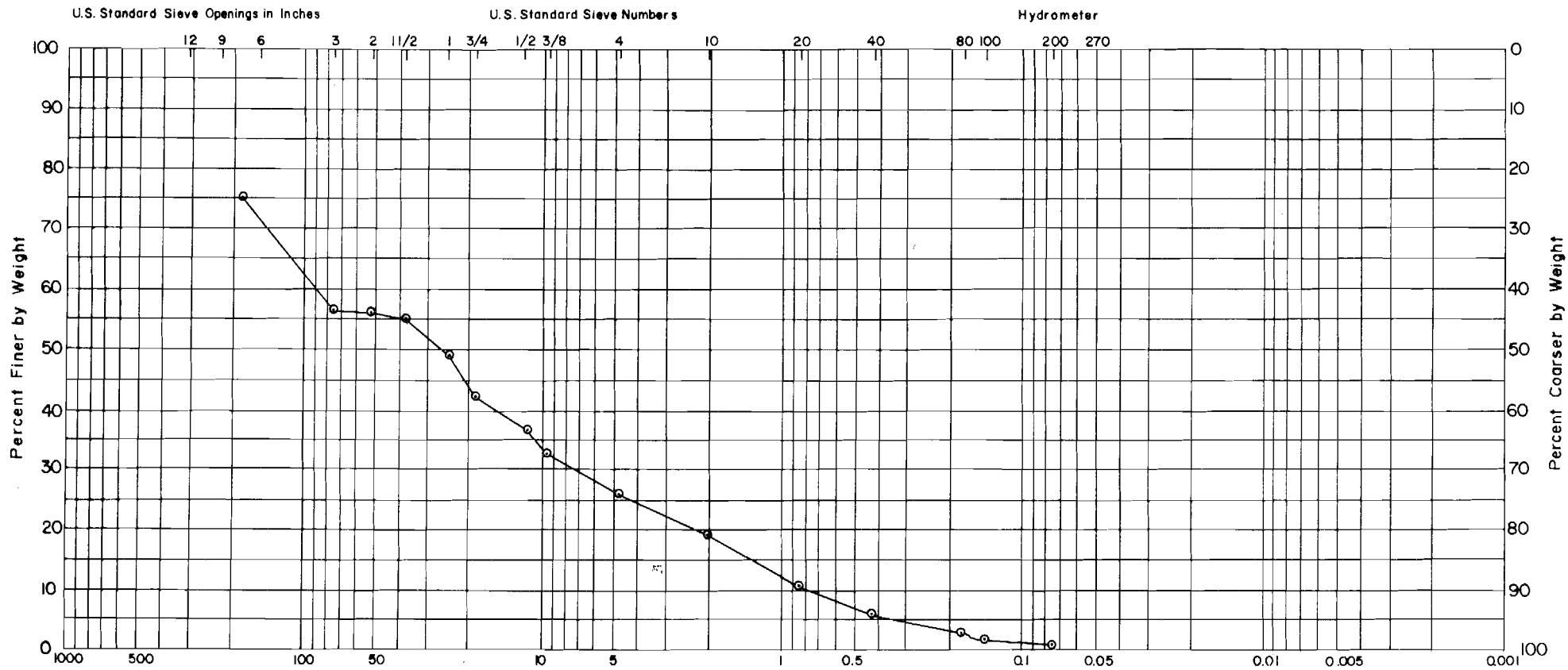
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E3 #1					GW	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS



BORROW AREA E
TEST PIT TP-E3

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



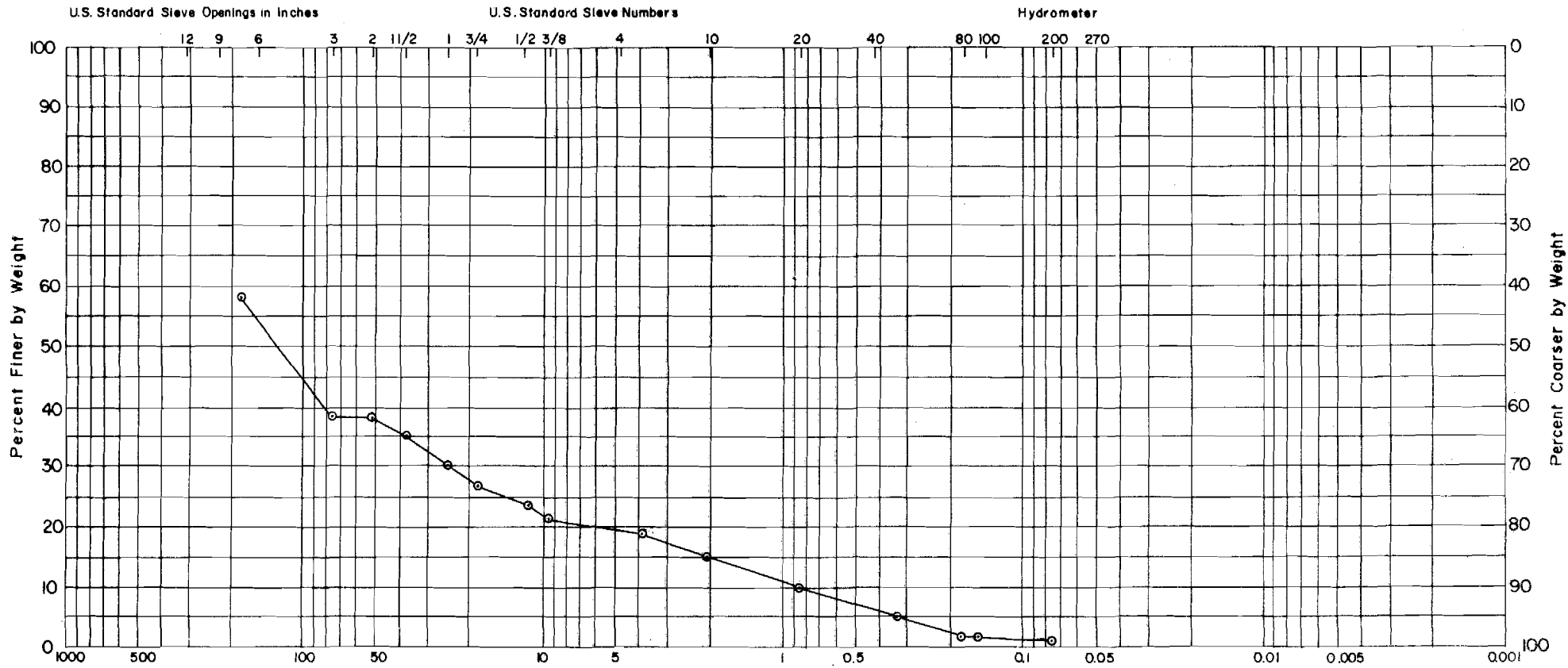
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E3 #2					GW-GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS



BORROW AREA E
TEST PIT TP-E3

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



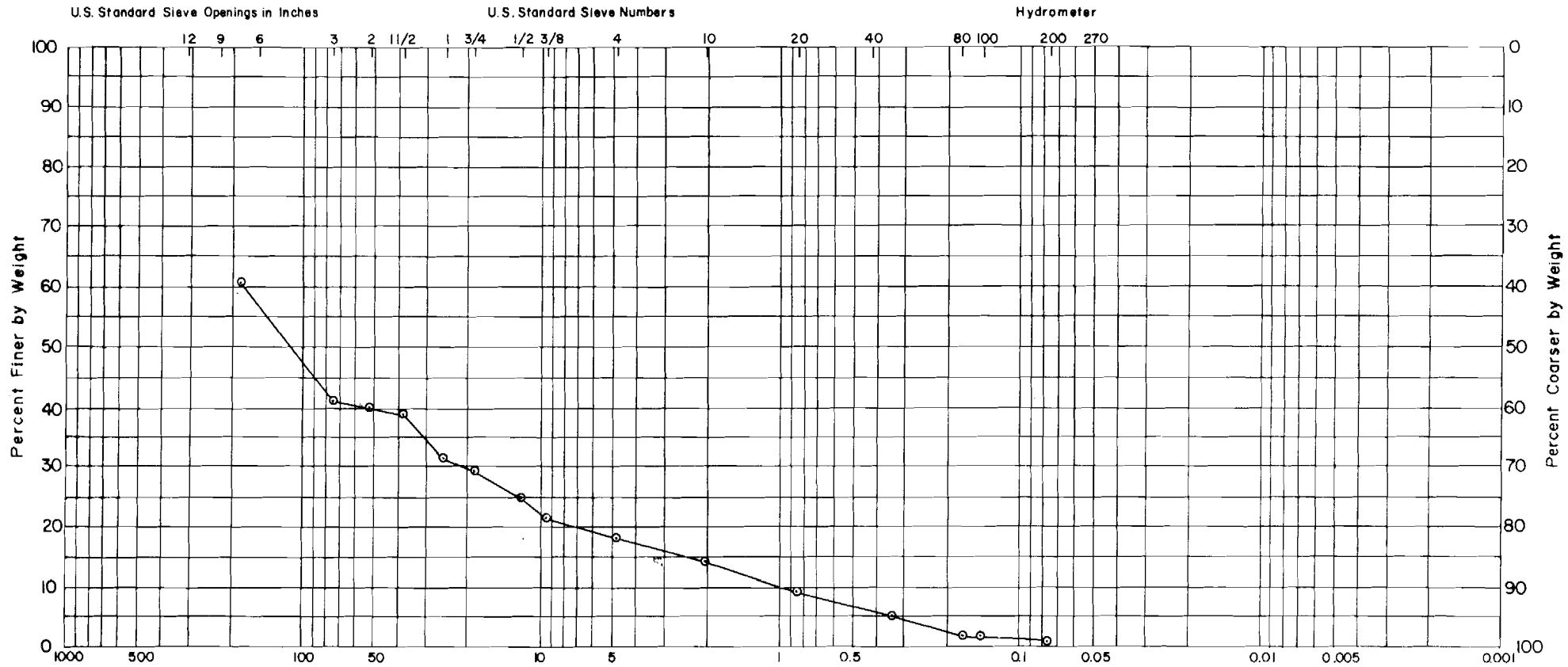
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E4 #1					GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS



BORROW AREA E
TEST PIT TR-E4

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



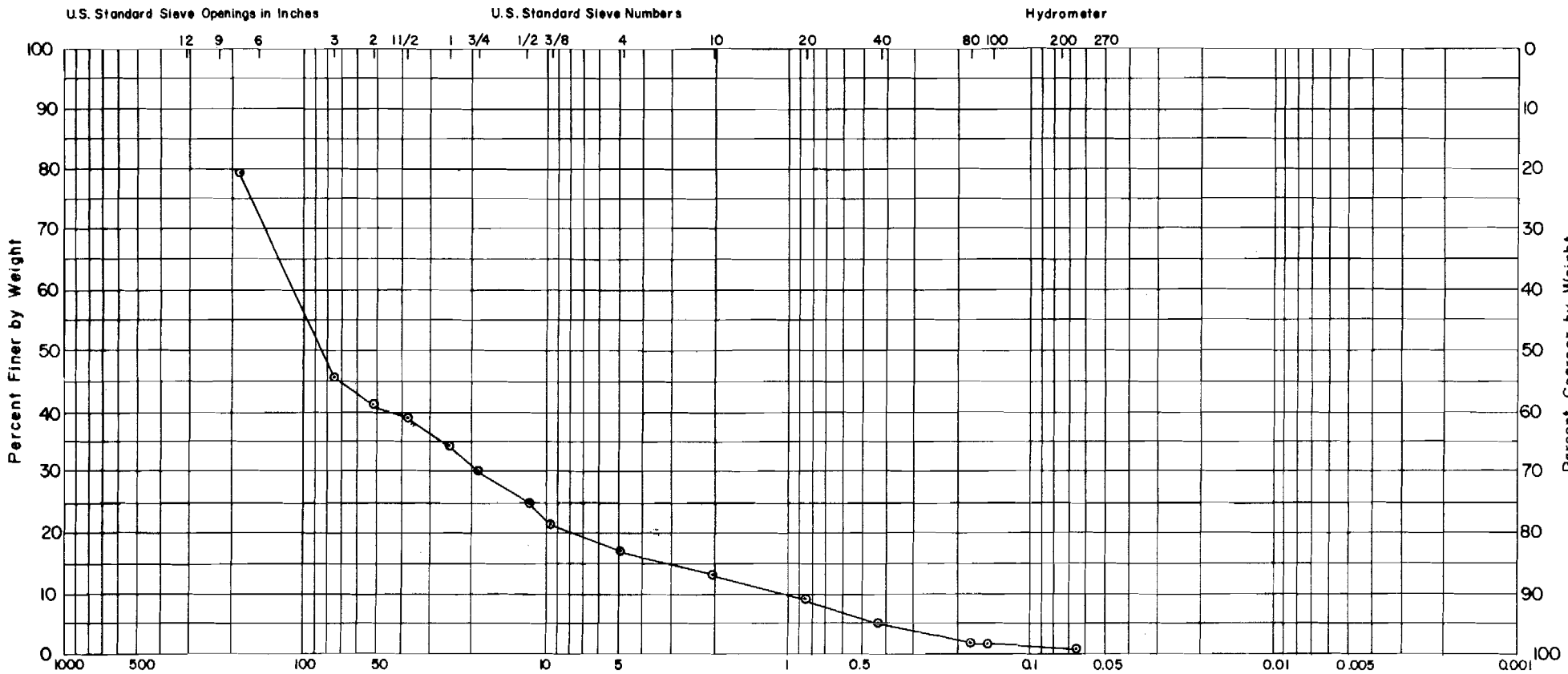
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E4 #2					GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS



BORROW AREA E
TEST PIT TP-E4

DRAWN BY: J.M.
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DATE: Dec. 1981
PROJECT NO. 052506



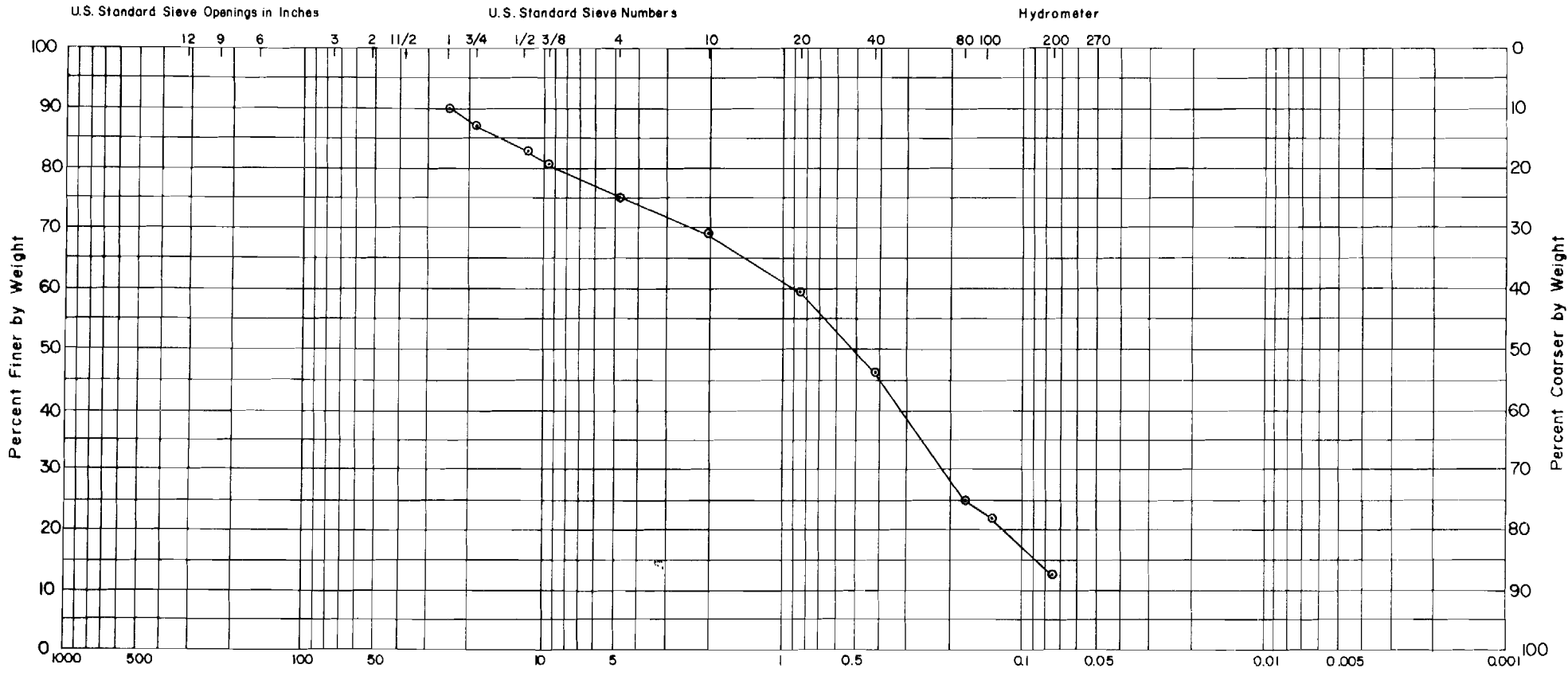
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E5 #1					GW-GP	SANDY GRAVEL WITH NUMEROUS COBBLES AND SCATTERED BOULDERS



BORROW AREA E
TEST PIT TP-E5

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 DATE: Dec. 1981
 PROJECT NO. 052506



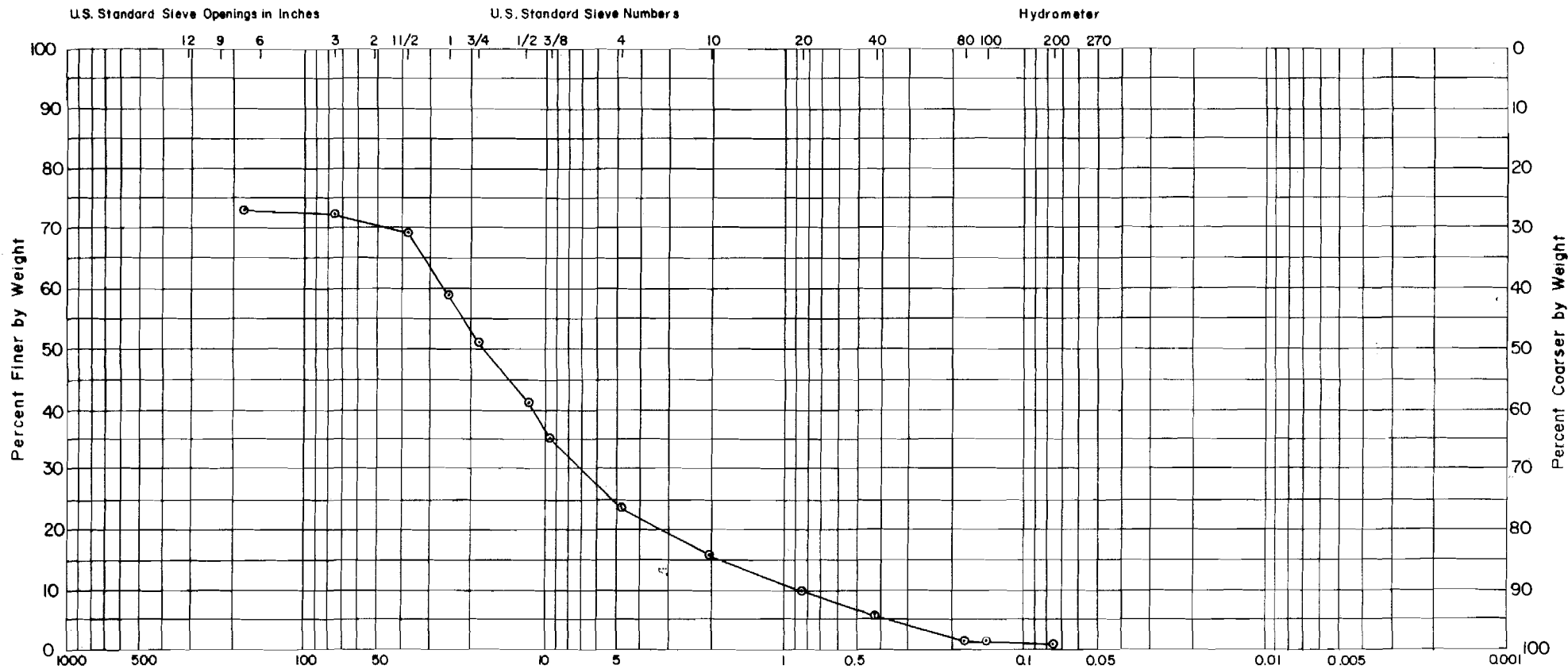
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E6 #1					SM	SAND WITH SOME GRAVEL AND SILT



BORROW AREA E
TEST PIT TP-E6

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DATE: Dec. 1981
PROJECT NO. 052506



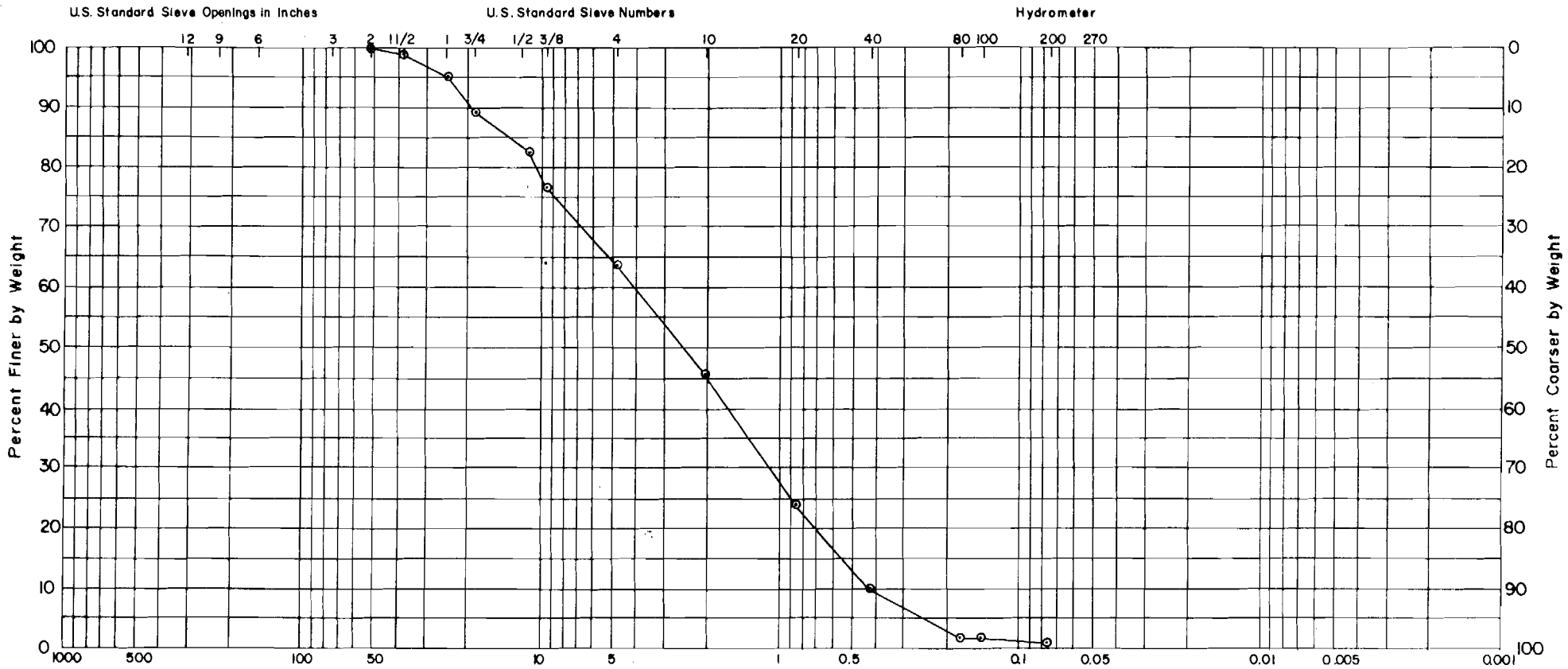
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E8 #1					GW	SANDY GRAVEL WITH SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E8

DRAWN BY: J.M.
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DATE: Dec. 1981
PROJECT NO. 052506



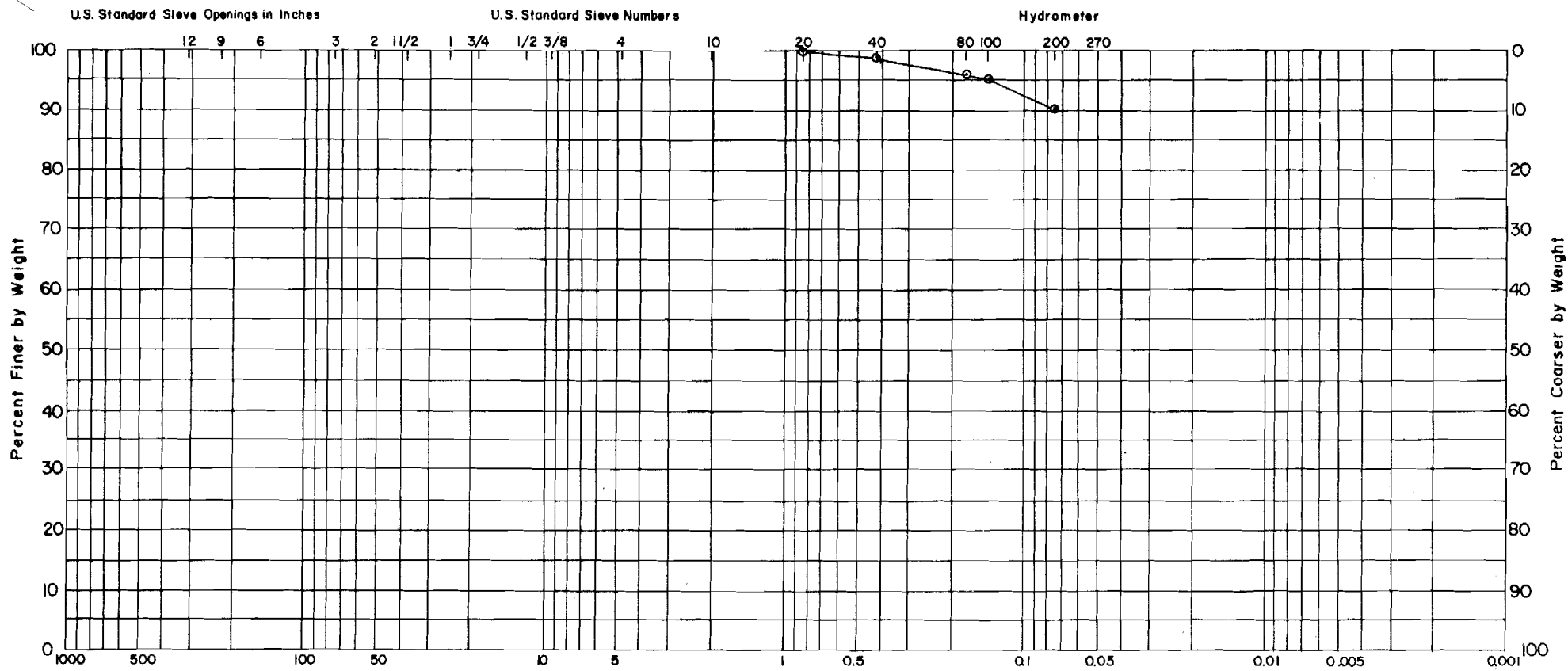
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E8 #2					SP	GRAVELLY SAND



BORROW AREA E
TEST PIT TP-E8

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DATE: Dec. 1981
PROJECT NO. 052506



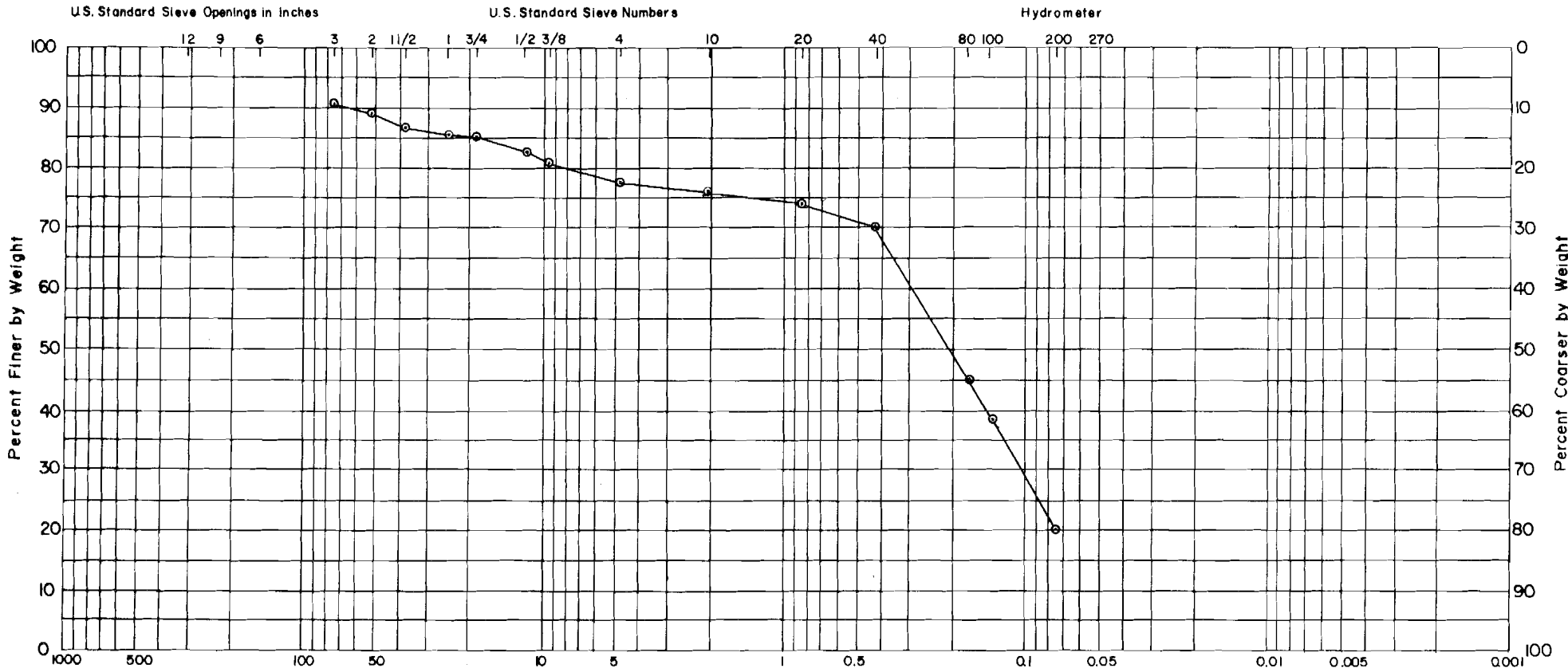
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E9 #1					ML	SILT WITH SOME TO TRACE CLAY AND TRACE SAND



BORROW AREA E
TEST PIT TP-E9

DRAWN BY: J.M.
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DATE: Dec. 1981
PROJECT NO. 052506



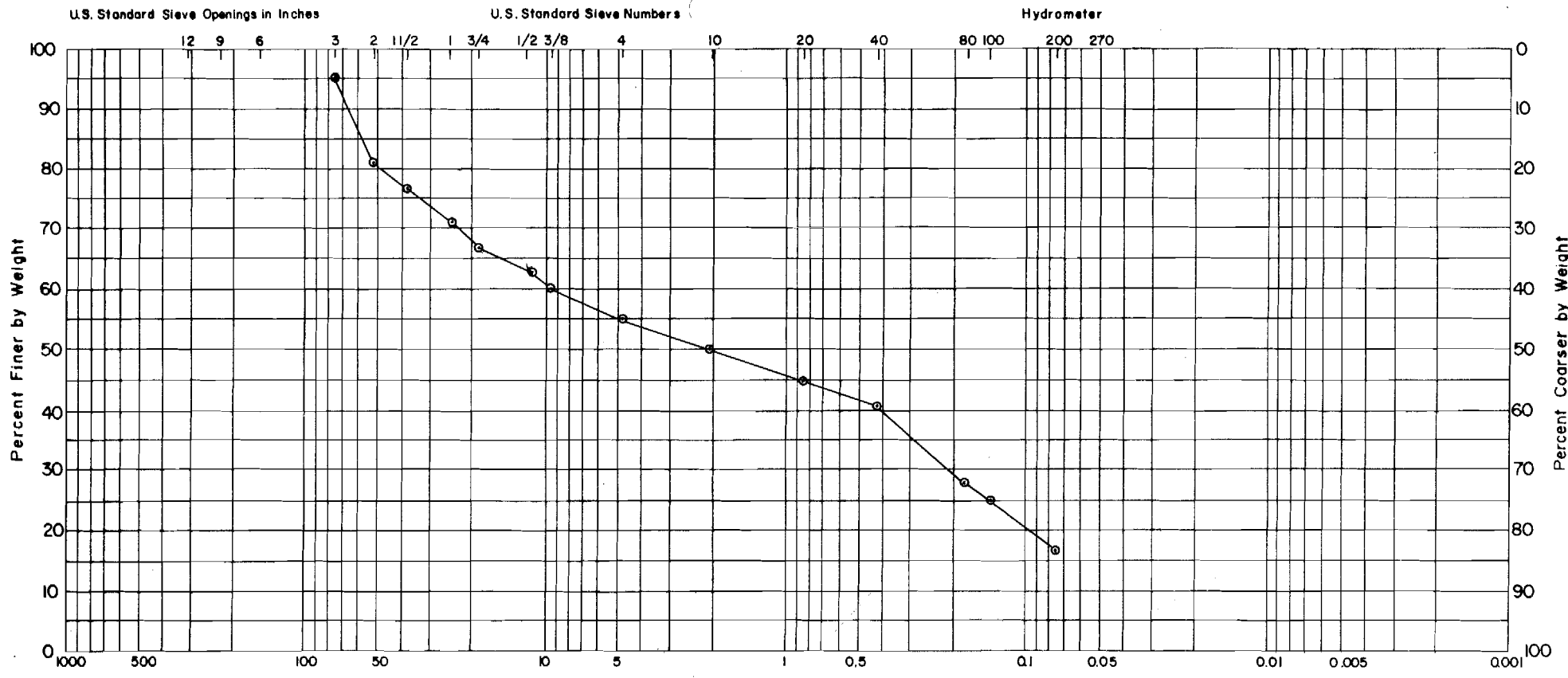
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E9 #2					SM	SAND WITH SOME GRAVEL AND SILT AND SCATTERED COBBLES



BORROW AREA E
TEST PIT TP-E9

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APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



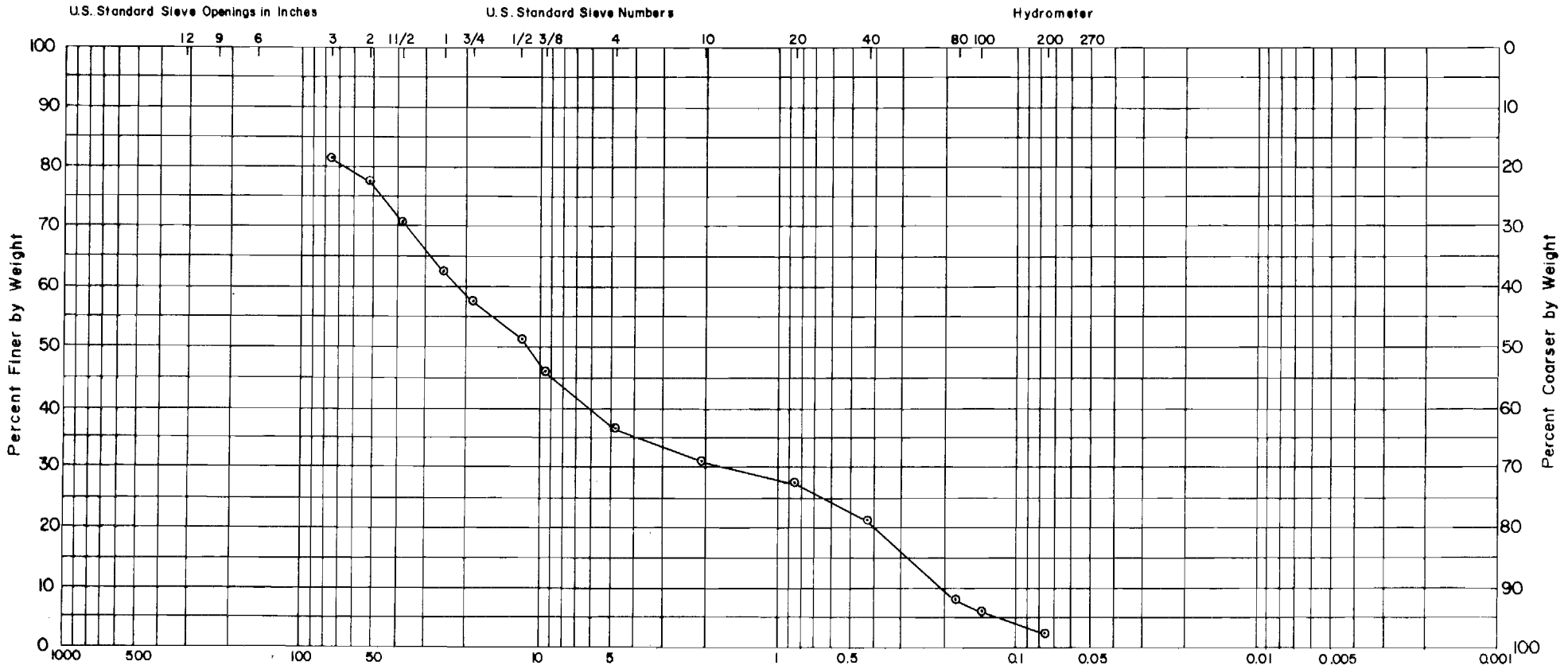
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E9 #3					GM	SANDY GRAVEL WITH SOME SILT AND SCATTERED COBBLES.



BORROW AREA E
TEST PIT TP-E9

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



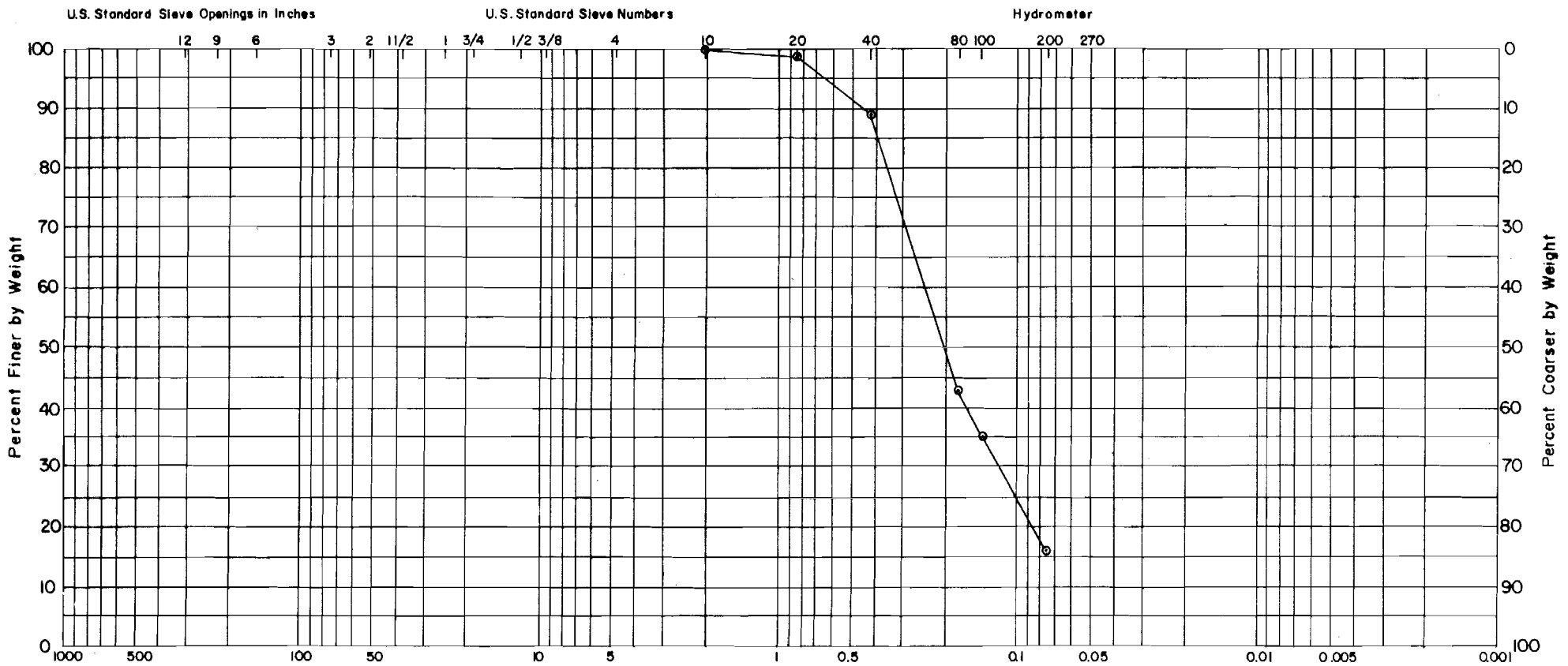
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E10A #1					GP	SANDY GRAVEL WITH SCATTERED COBBLES



BORROW AREA E
TEST PIT TP-E10A

DRAWN BY: J.M.
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DATE: Dec. 1981
PROJECT NO. 052506



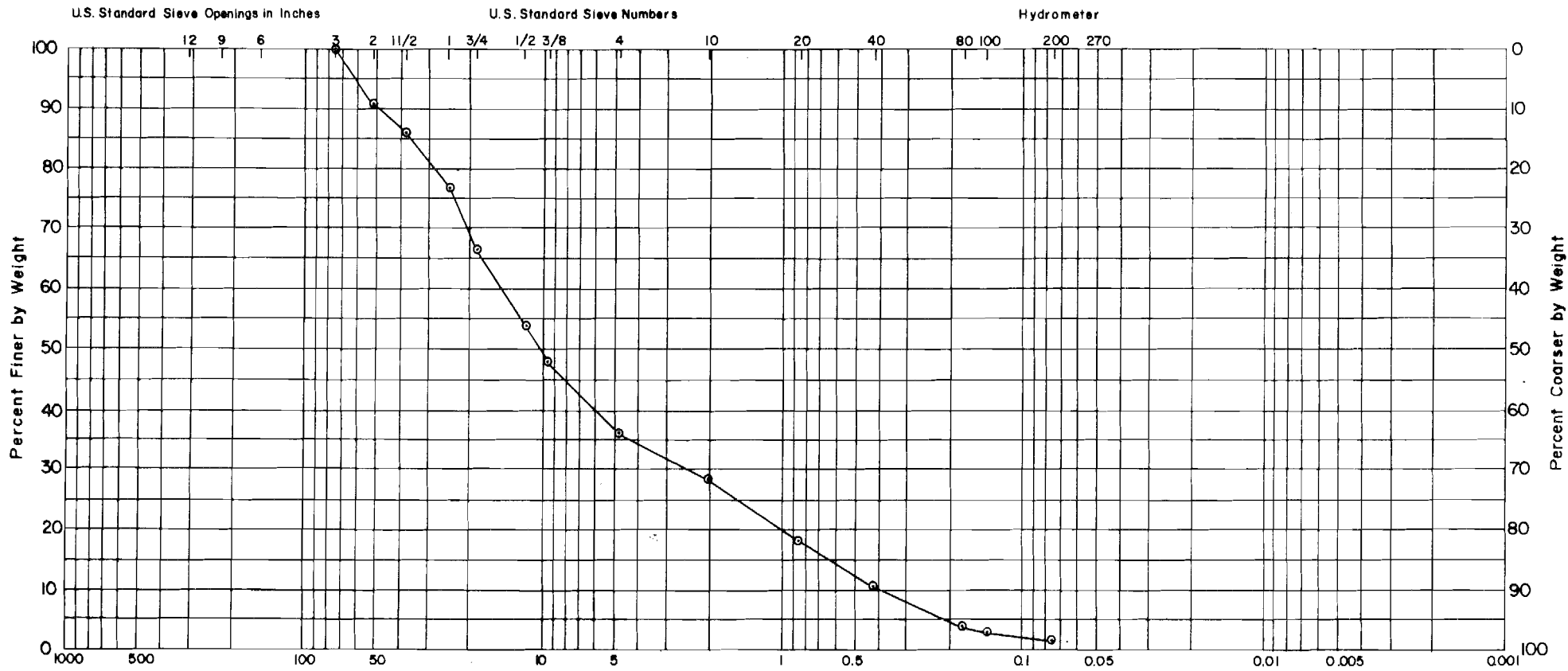
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E10A #2					SM	SAND WITH SOME SILT



BORROW AREA E
TEST PIT TP-E10A

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DATE: Dec. 1981
PROJECT NO. 052506



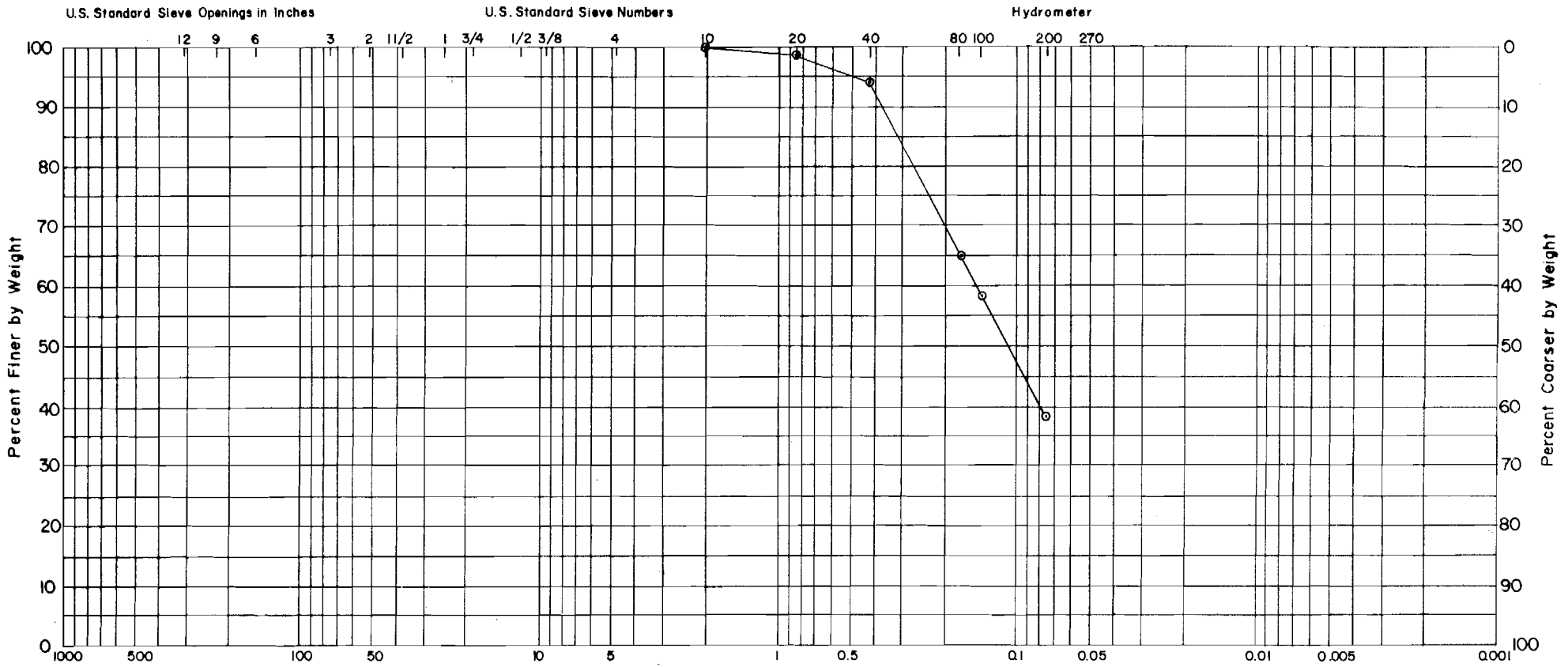
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E10B #1					GP	SANDY GRAVEL



BORROW AREA E
TEST PIT TP-#10B

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APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



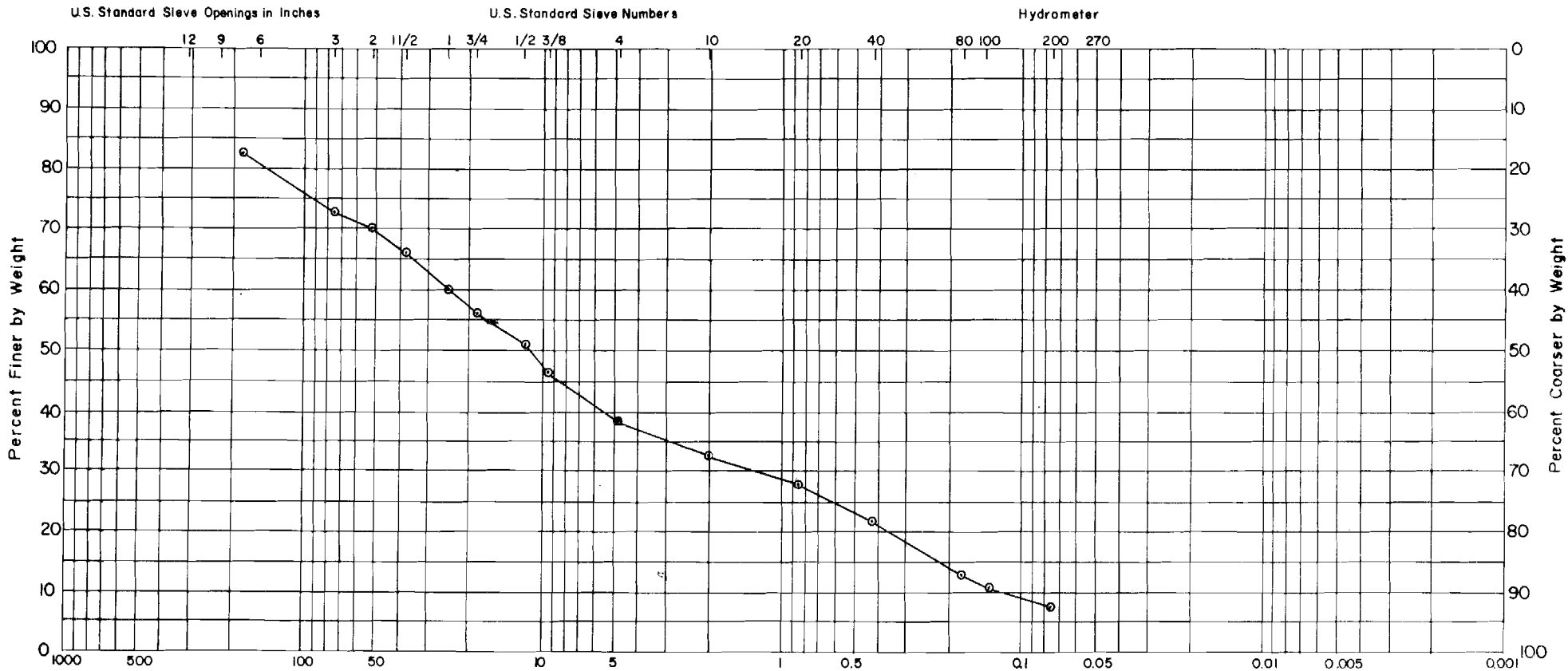
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E11 #1					SM	SILTY SAND



BORROW AREA E
TEST PIT TP-E11

DRAWN BY: J.M.
 APPROVED BY: T.I.
 DATE: Dec. 1981
 PROJECT NO. 052506



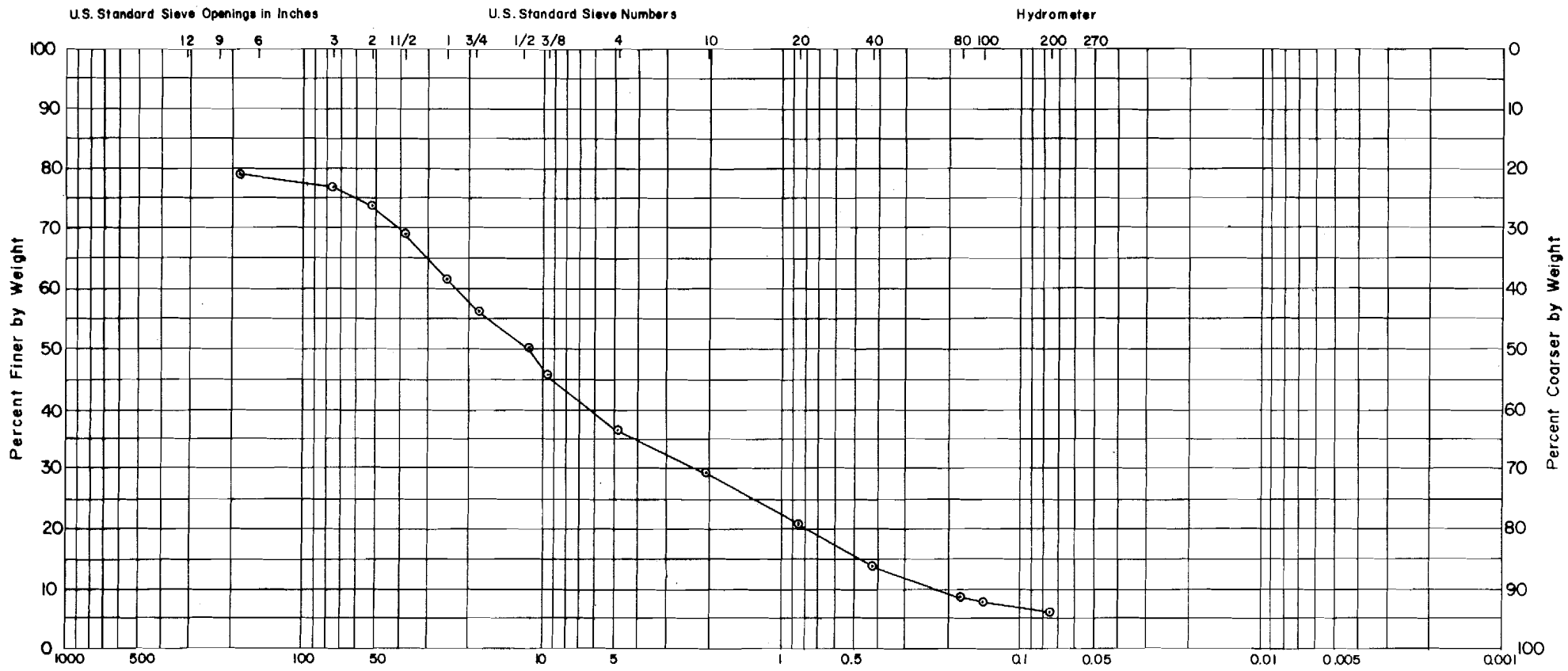
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E11 #2					GP-GM	SANDY GRAVEL WITH TRACE SILT AND SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E11

DRAWN BY: J.M.
 APPROVED BY: T.I.
 DATE: Dec. 1981
 PROJECT NO. 052506



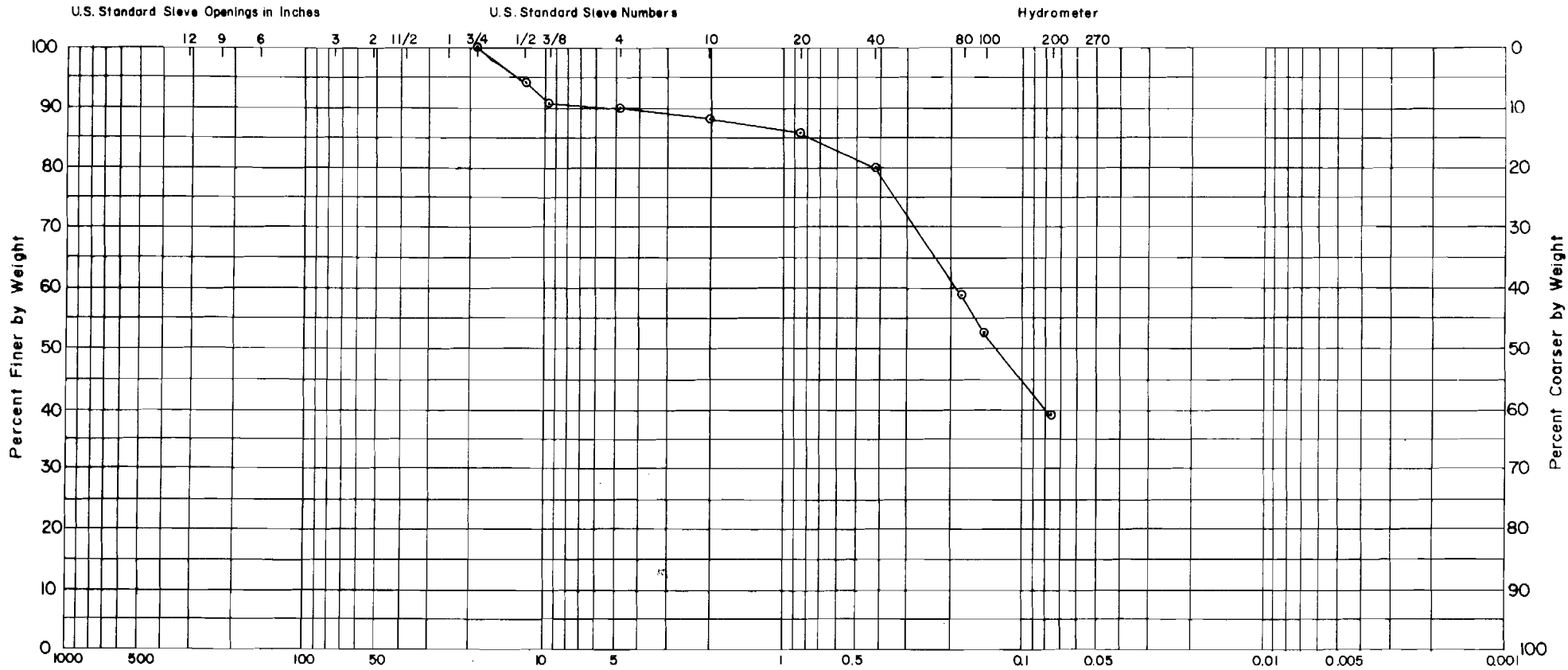
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E12 #1					GP-GM	SANDY GRAVEL WITH TRACE SILT AND SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E12

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



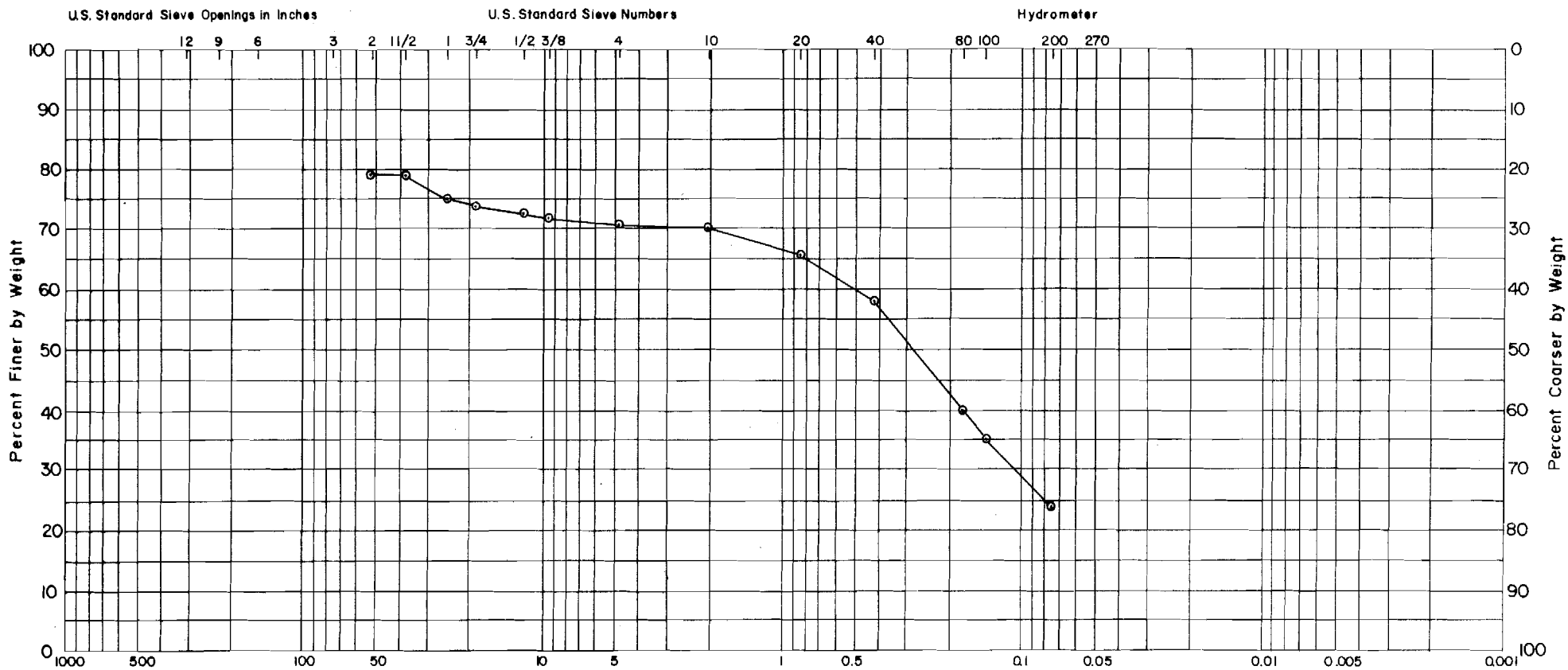
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E12 #2					SM	SILTY SAND WITH TRACE GRAVEL AND CLAY (FIELD GEOLOGIST NOTES TRACE ORGANICS)



BORROW AREA E
TEST PIT TP-E12

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



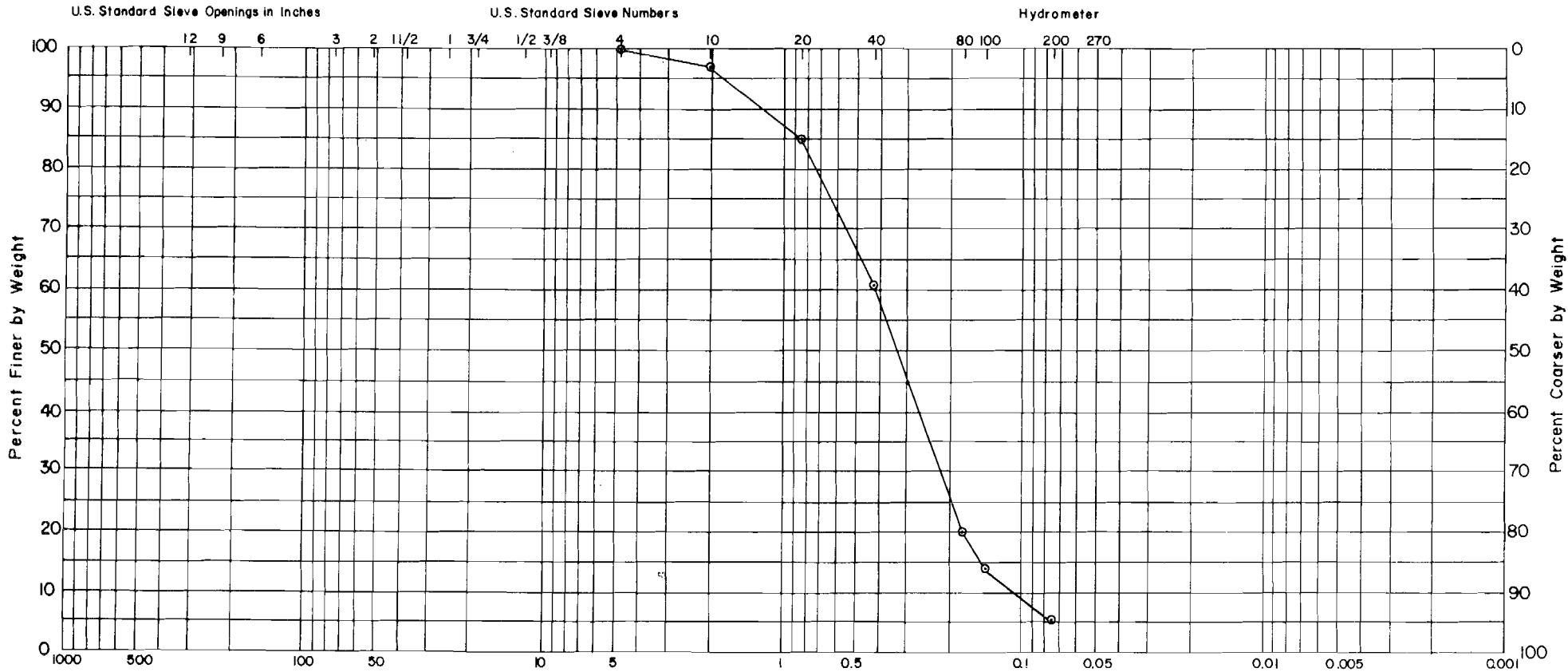
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E12 #3					SM	SAND WITH SOME SILT, TRACE GRAVEL AND SCATTERED COBBLES



BORROW AREA E
TEST PIT TP-E12

DRAWN BY: J.M.
 APPROVED BY: T.I.
 DATE: Dec. 1981
 PROJECT NO. 052506



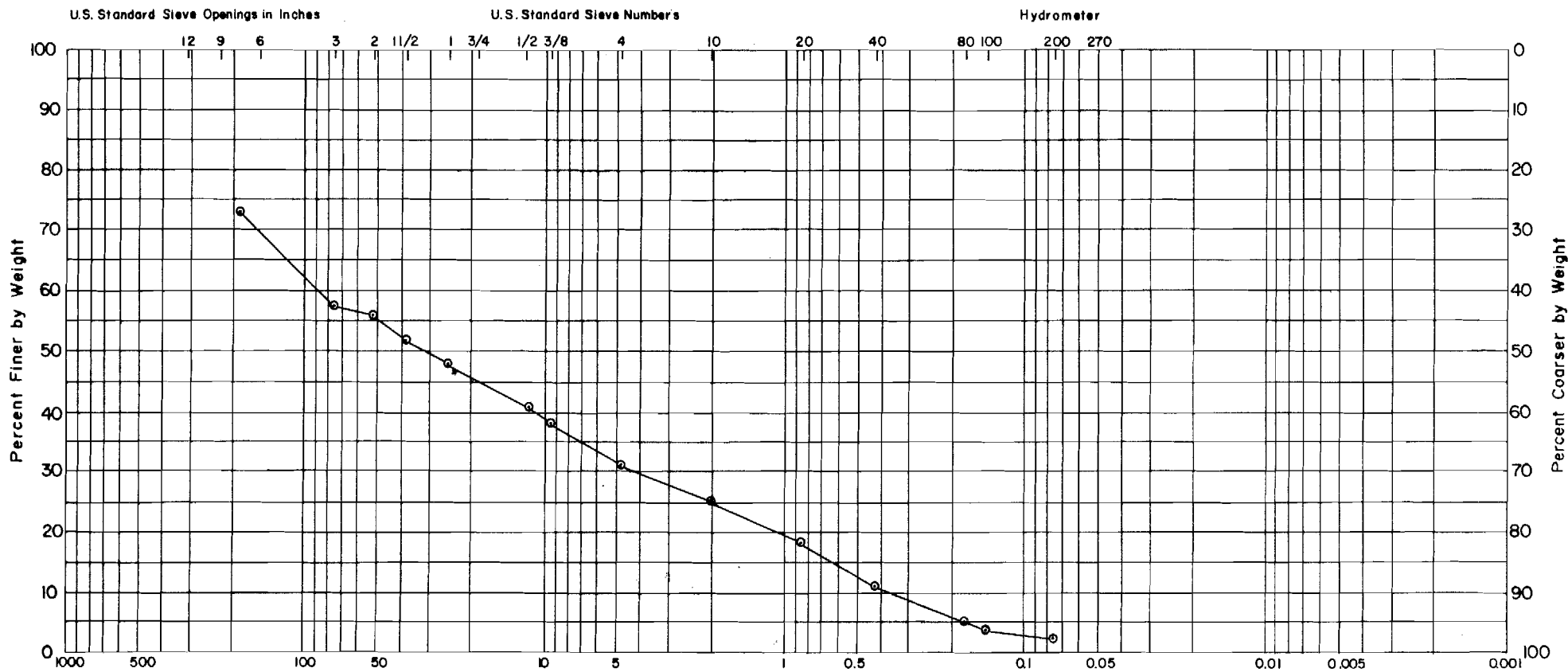
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E14 #1					SP-SM	SAND WITH TRACE SILT



BORROW AREA E
TEST PIT TP-E14

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



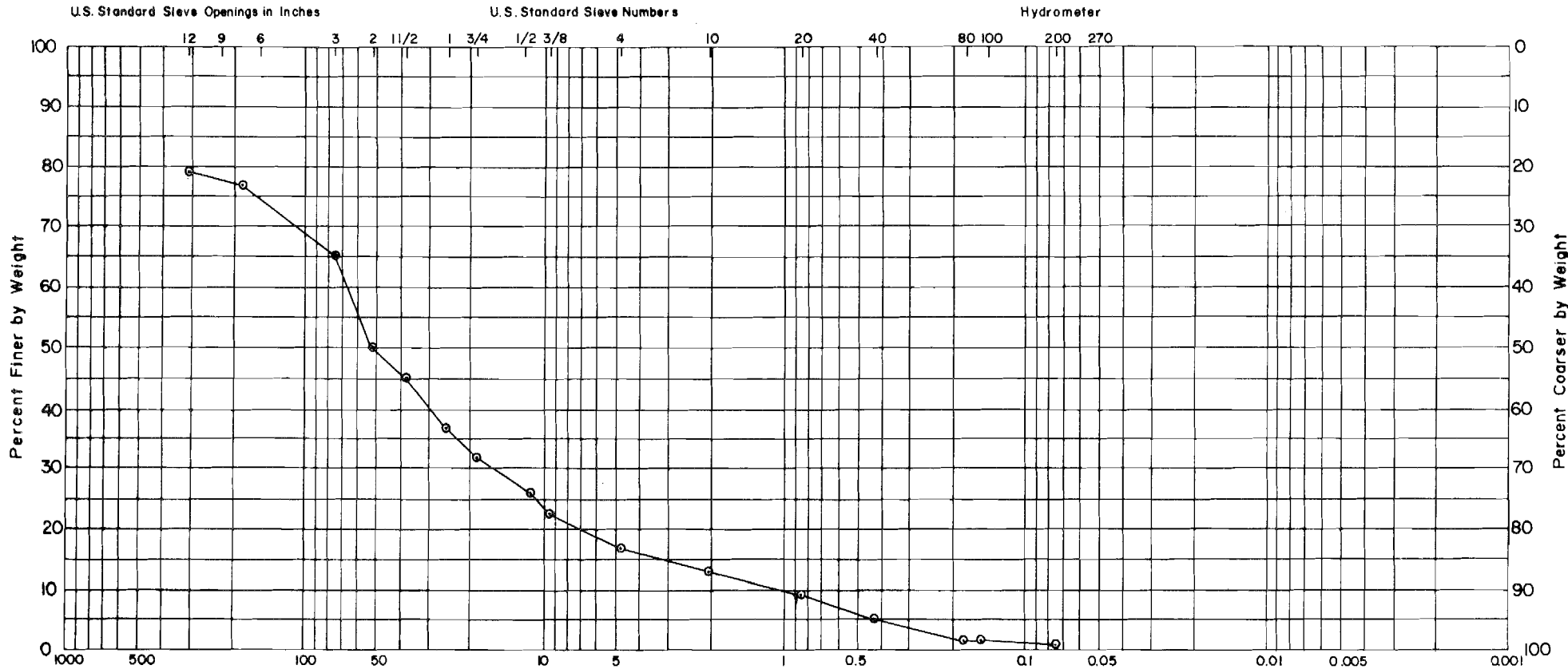
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E14 #2					SP	GRAVELLY SAND W/TRACE SILT, AND SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E14

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 APPROVED BY: T.I.
 DATE: Dec. 1981
 PROJECT NO. 052506



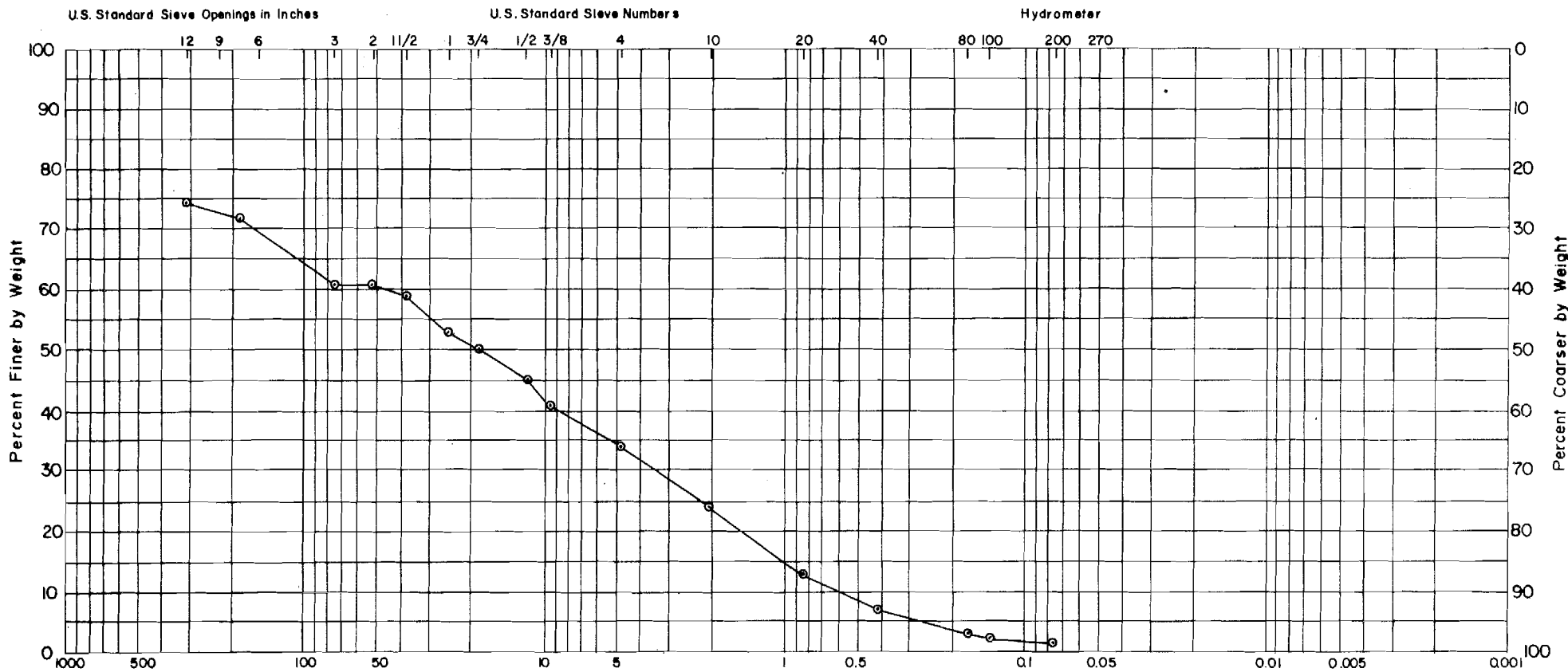
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E15 #1					GW	GRAVEL WITH SOME SAND AND SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E15

DRAWN BY: J.M.
 APPROVED BY: T.I.
 DATE: Dec. 1981
 PROJECT NO. 052506



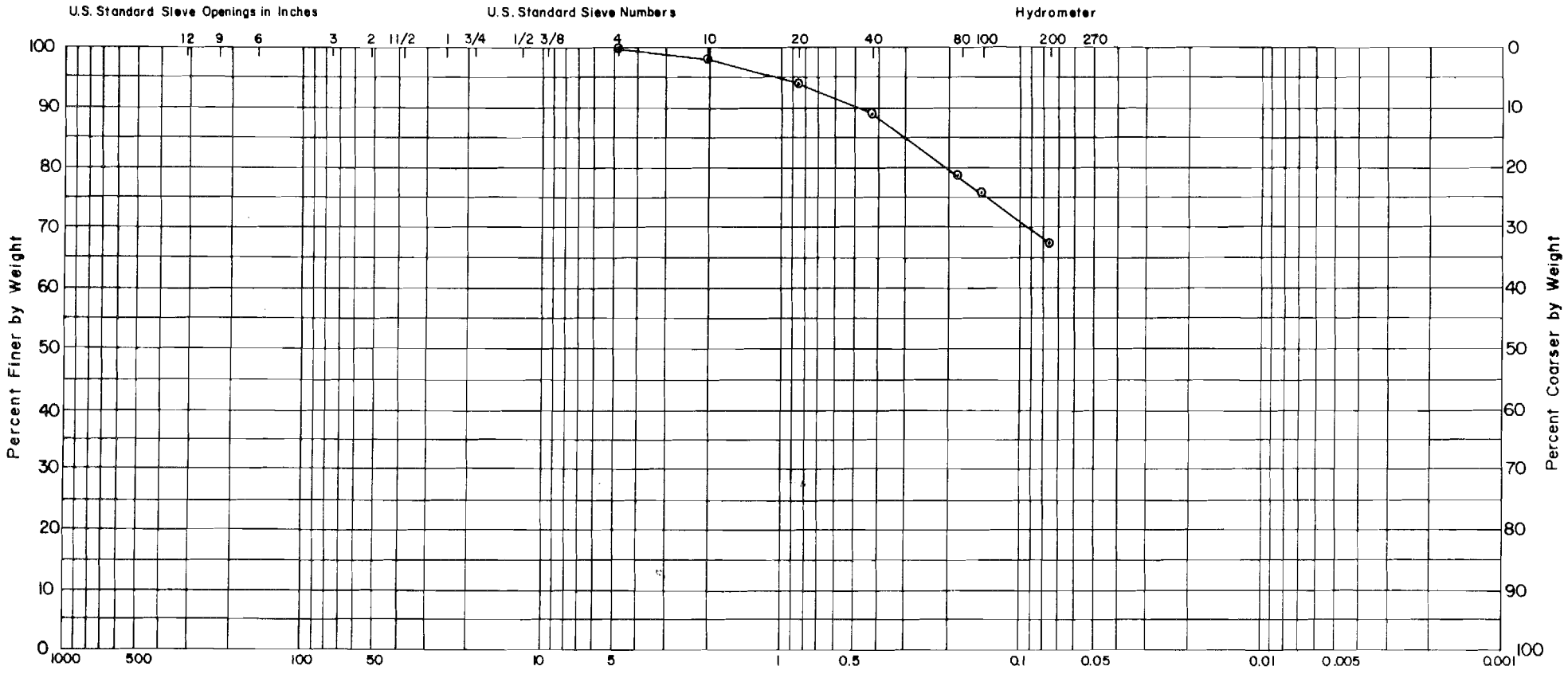
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E16 #1					SP	GRAVELLY SAND WITH SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E16

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



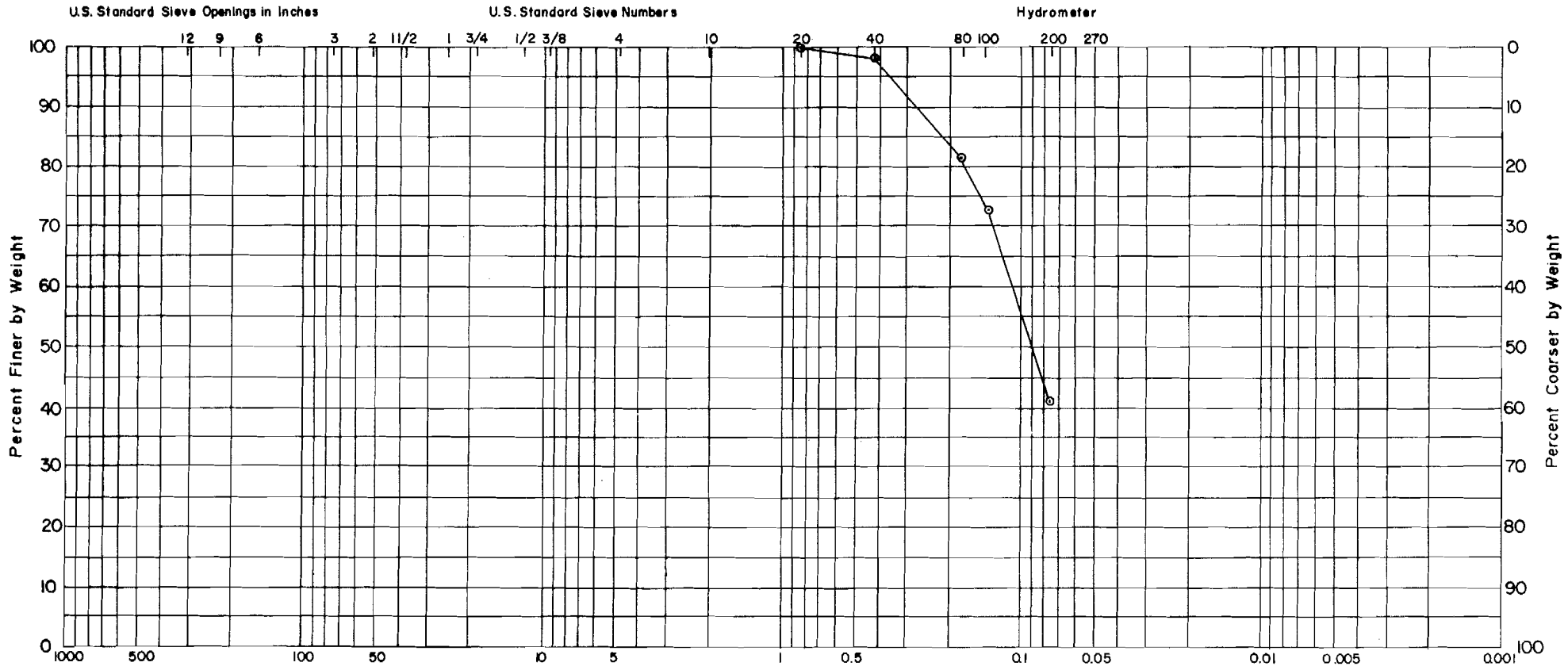
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E17 #1					SM-MH	SANDY SILT WITH SOME TO TRACE CLAY (FIELD GEOLOGIST NOTES SOME TO TRACE ORGANICS)



BORROW AREA E
TEST PIT TP-E17

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



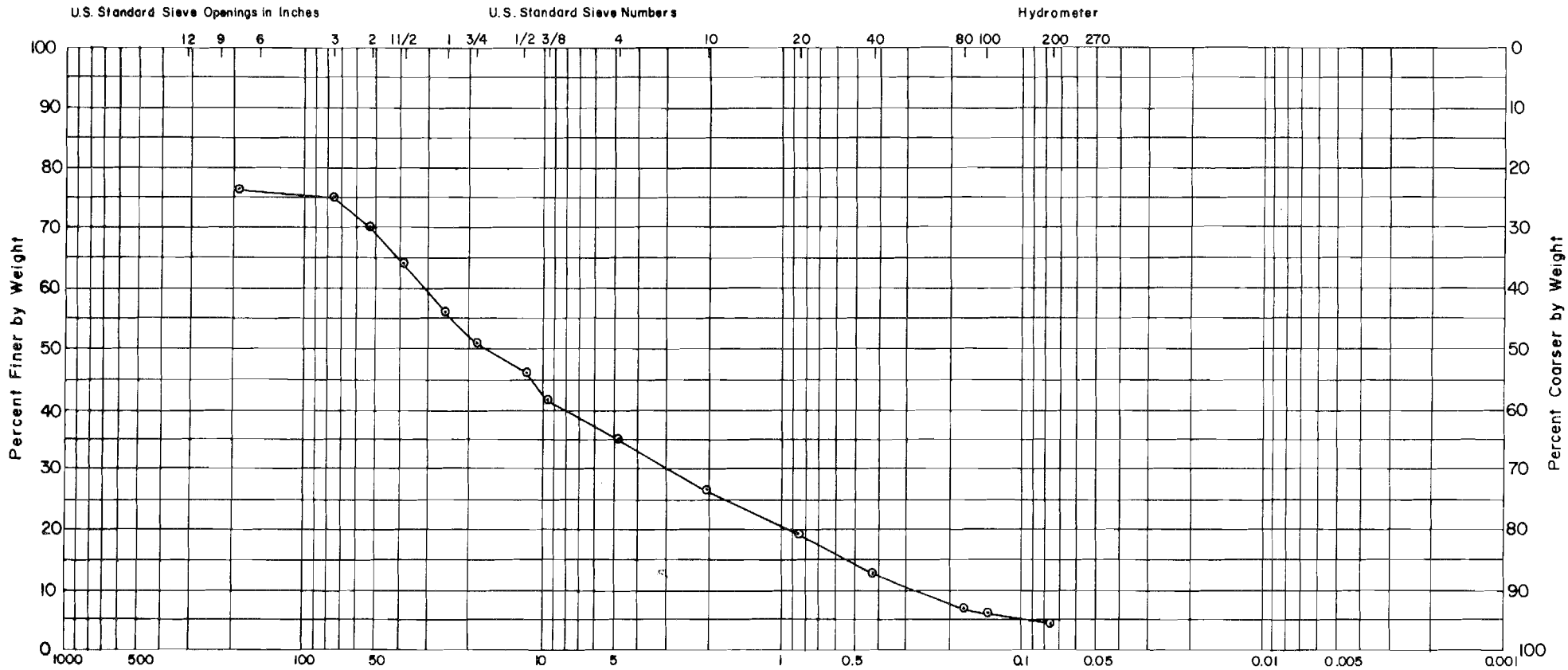
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E17 #2					SM	SILTY SAND



BORROW AREA E
TEST PIT TP-E17

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



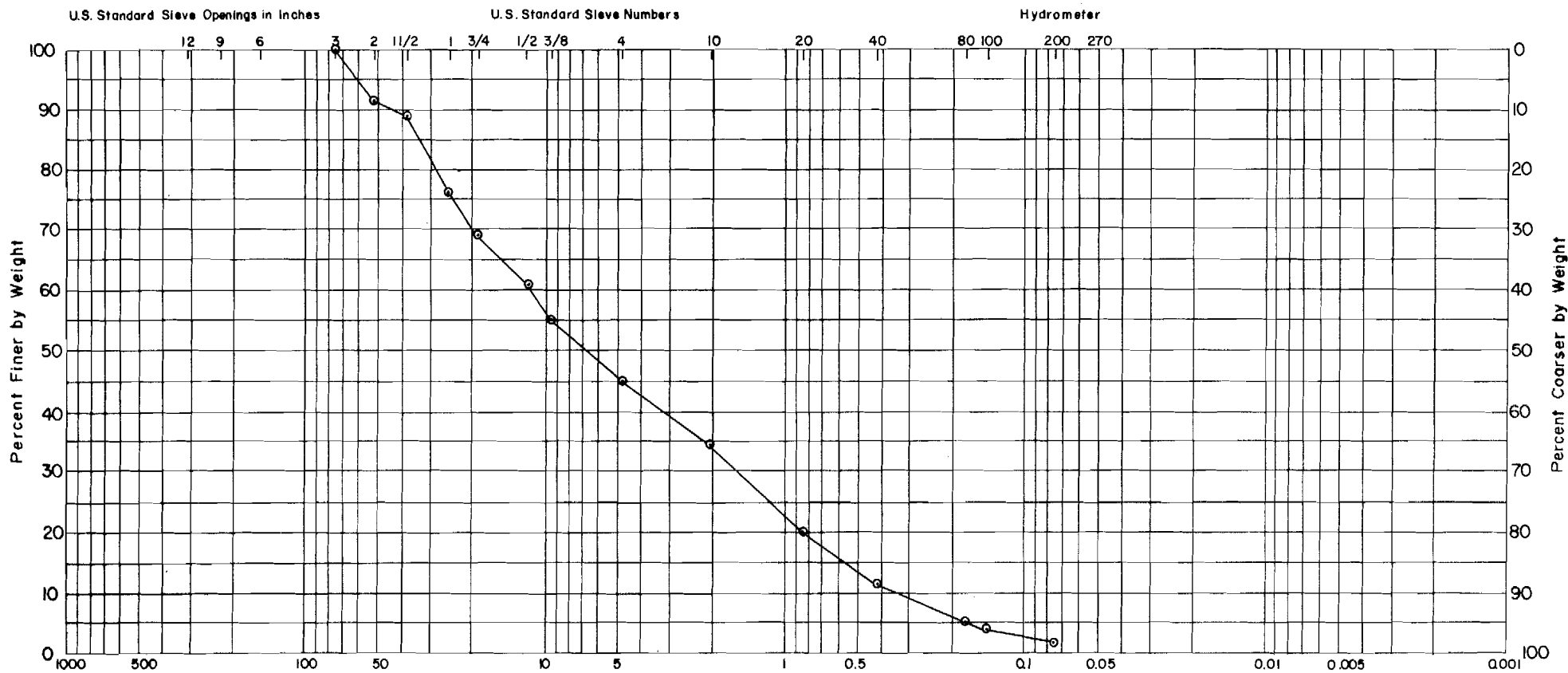
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E17 #3					GP-GM	SANDY GRAVEL WITH TRACE SILT, SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E17

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



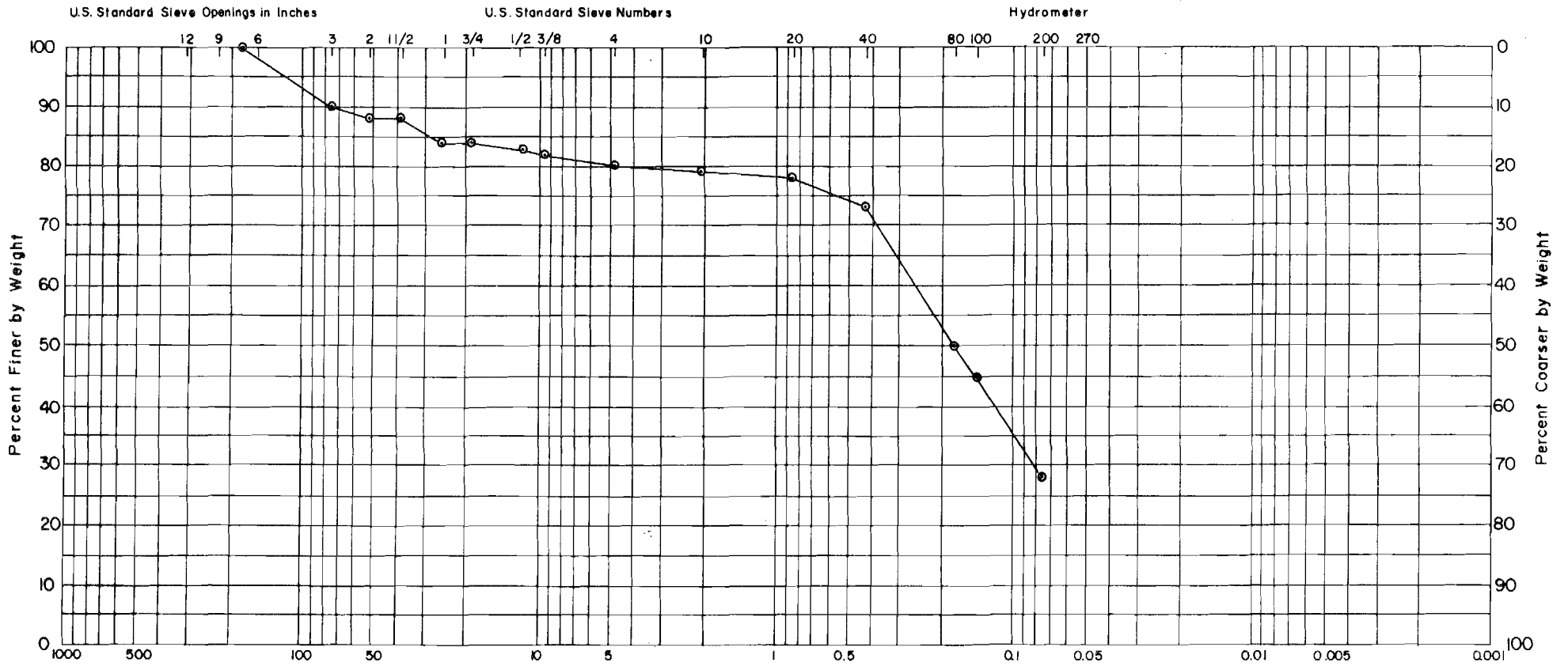
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E18 #1					GP	SANDY GRAVEL (FIELD GEOLOGIST NOTES SOME ORGANICS)



BORROW AREA E
TEST PIT TP-E18

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



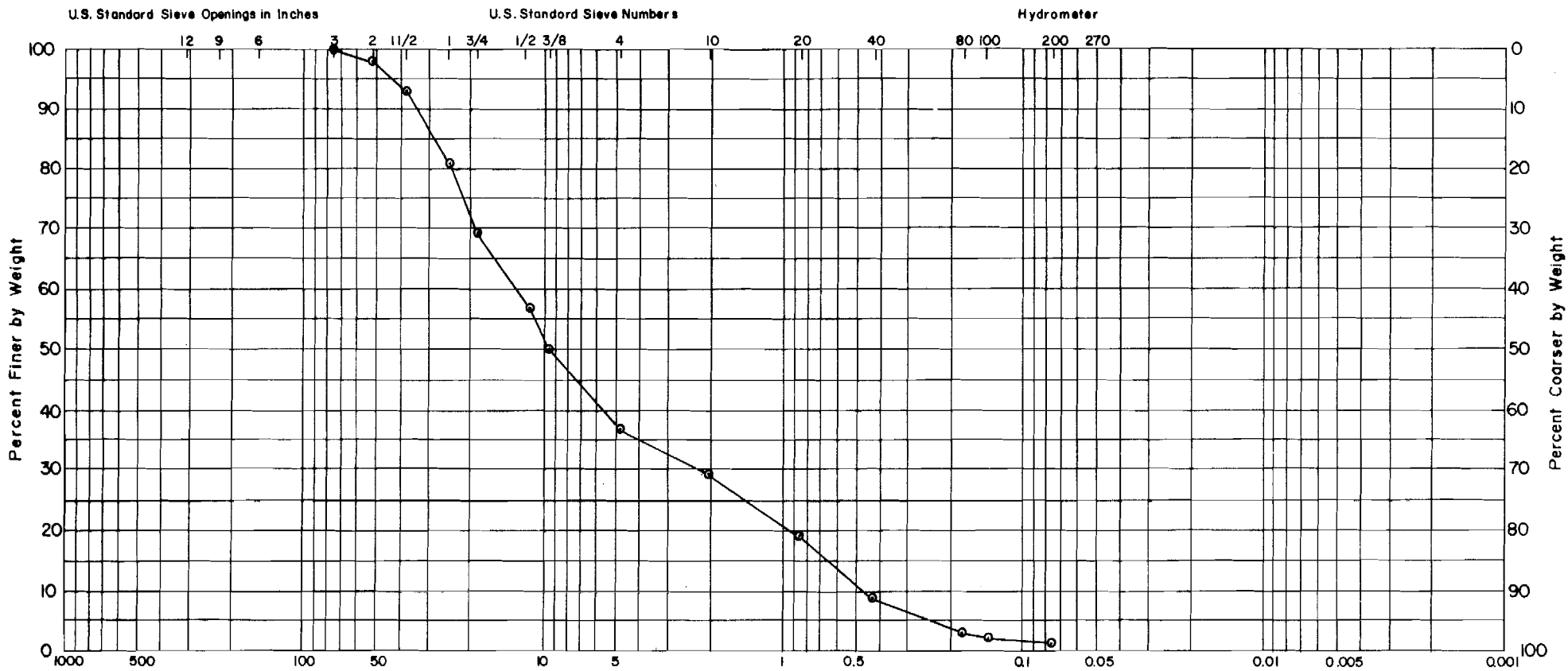
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E18 #2					SM	SAND WITH SOME SILT, TRACE GRAVEL AND SCATTERED COBBLES



BORROW AREA E
TEST PIT TP-E18

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



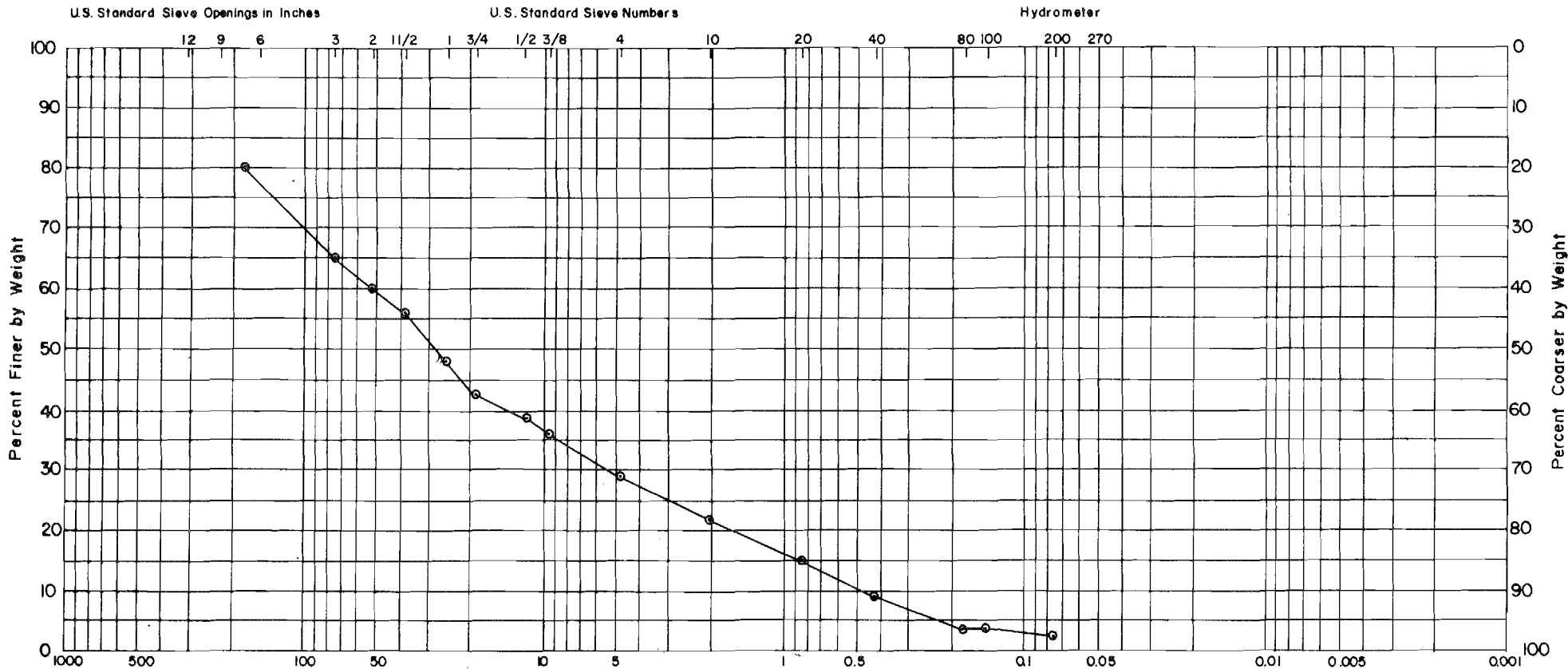
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E18 #3					GP	SANDY GRAVEL



BORROW AREA E
TEST PIT TP-E18

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



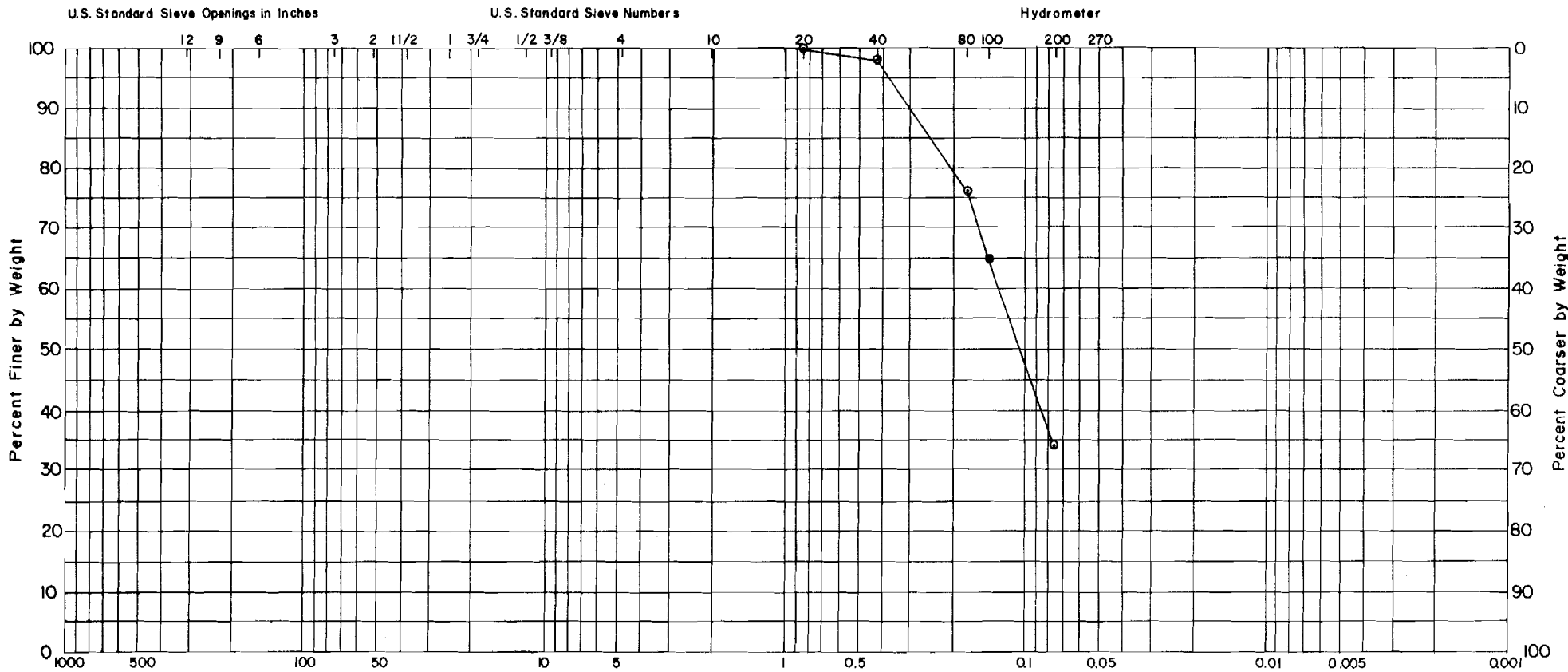
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E18 #4					GP	SANDY GRAVEL WITH SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E18

DRAWN BY: J.M.
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PROJECT NO. 052506



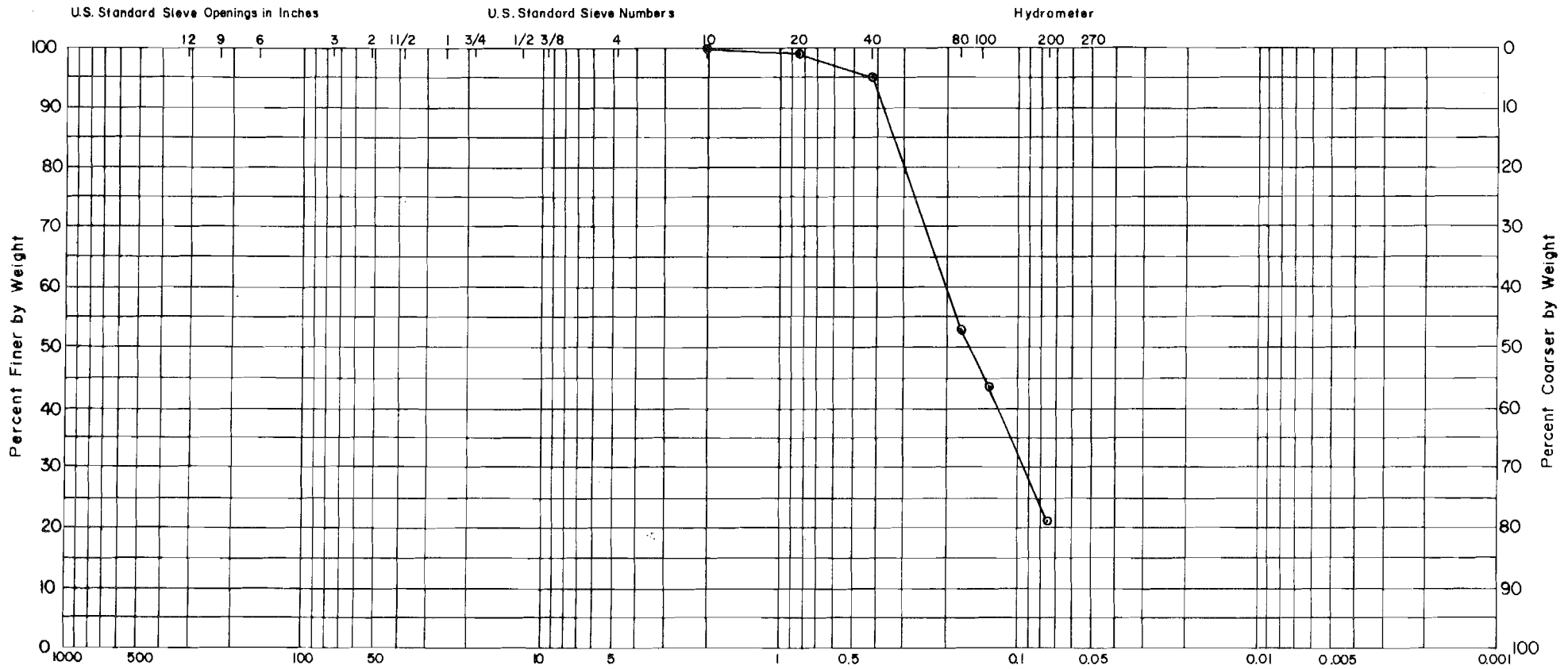
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E19 #1					SM	SILTY SAND WITH TRACE CLAY. (FIELD GEOLOGIST NOTES TRACE ORGANICS)



BORROW AREA E
TEST PIT TP-E19

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



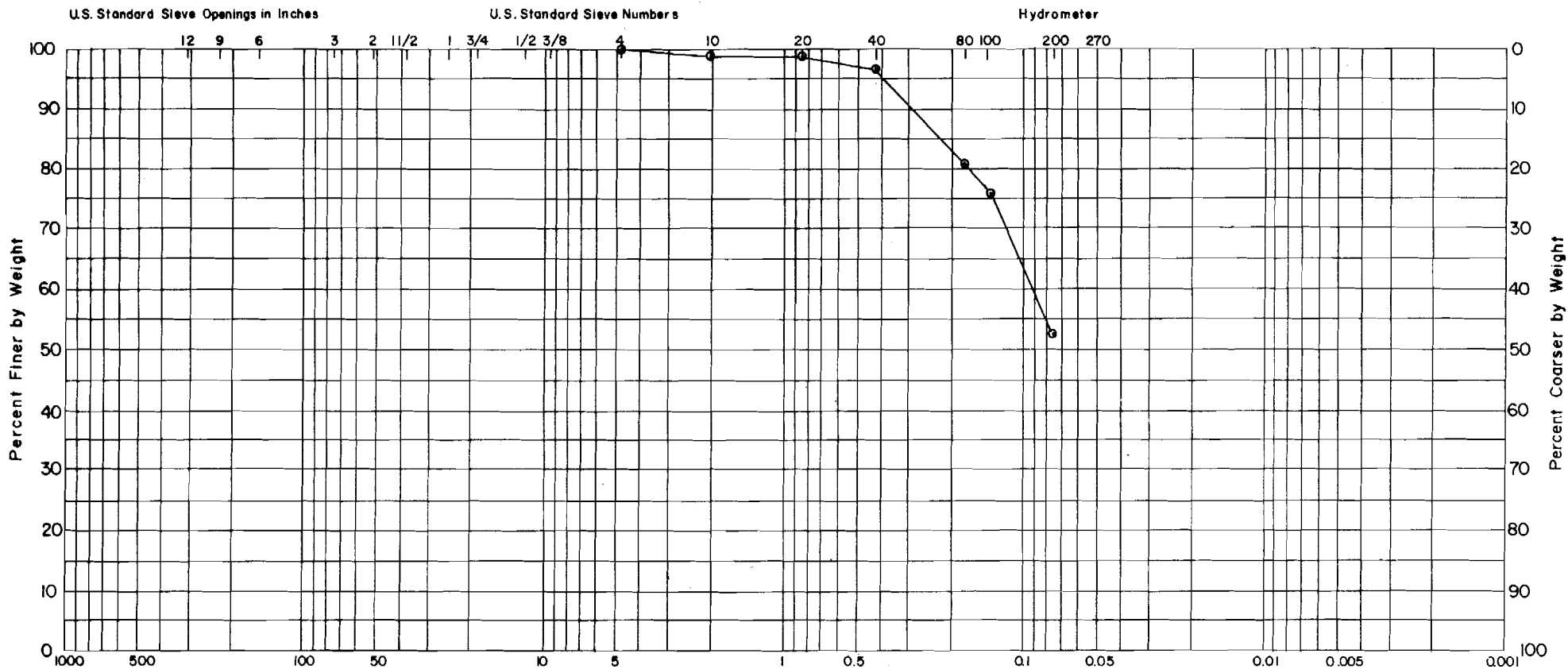
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E19 #2					SM	SAND WITH SOME SILT,



BORROW AREA E
TEST PIT TP-19

DRAWN BY: J.M.
 APPROVED BY: T.I.
 DATE: Dec. 1981
 PROJECT NO. 052506



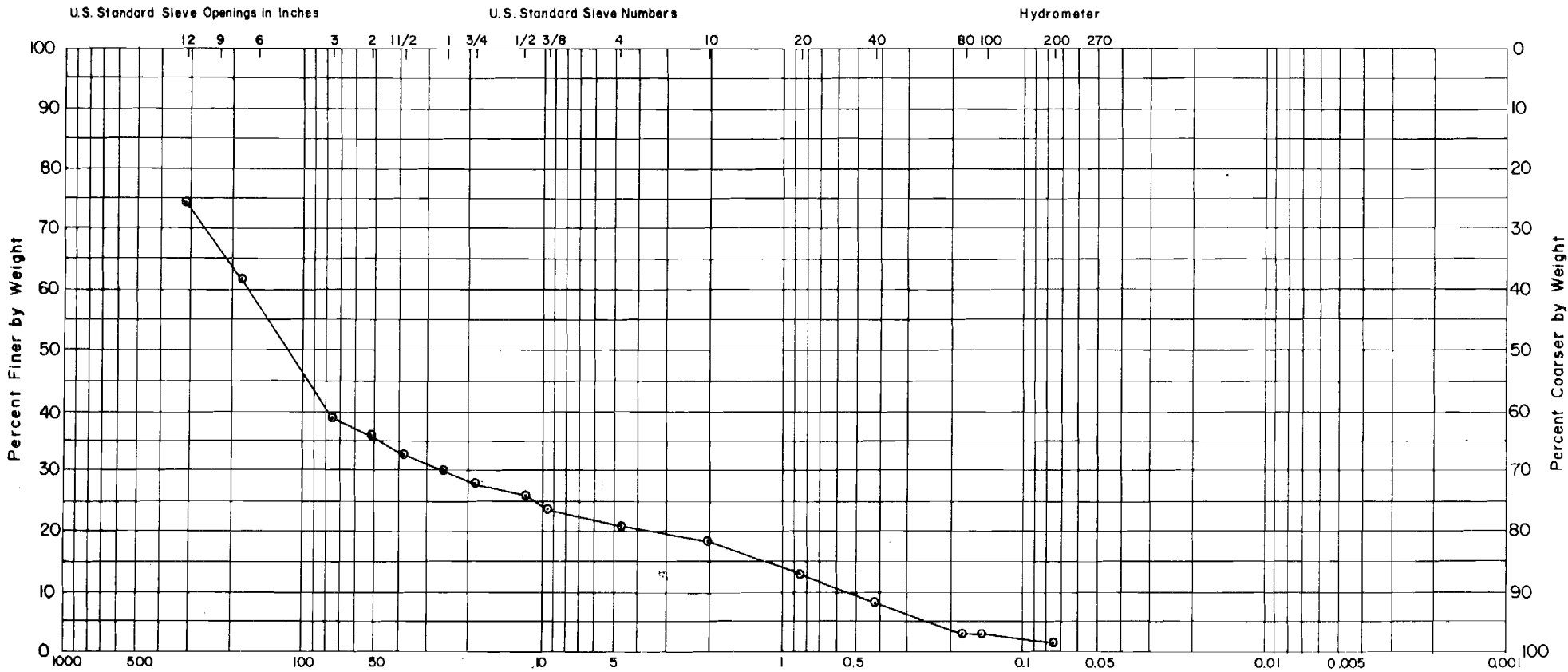
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E20 #1					SM-ML	SANDY SILT WITH TRACE CLAY (FIELD GEOLOGIST NOTES TRACE ORGANICS)



BORROW AREA E
TEST PIT TP-E20

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



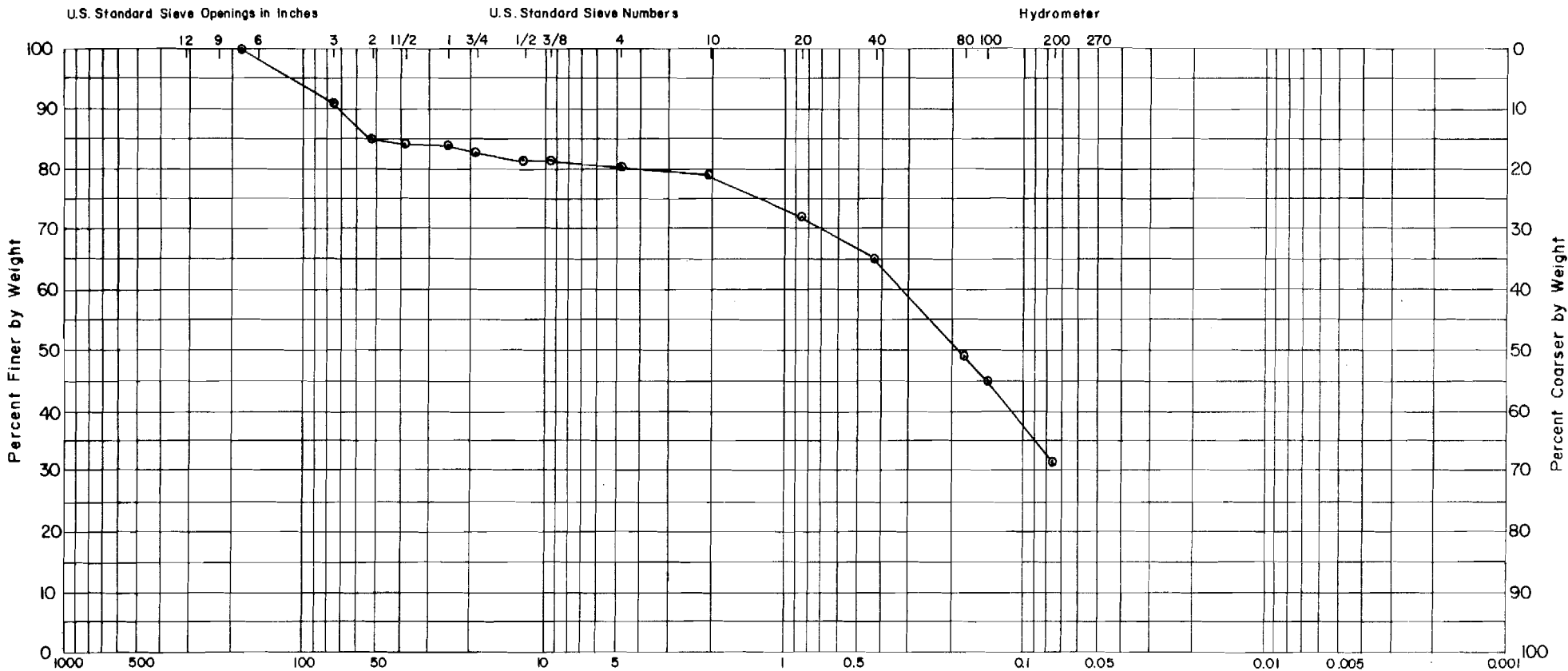
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E20 #2					SP	GRAVELLY SAND WITH TRACE CLAY AND SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E20

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



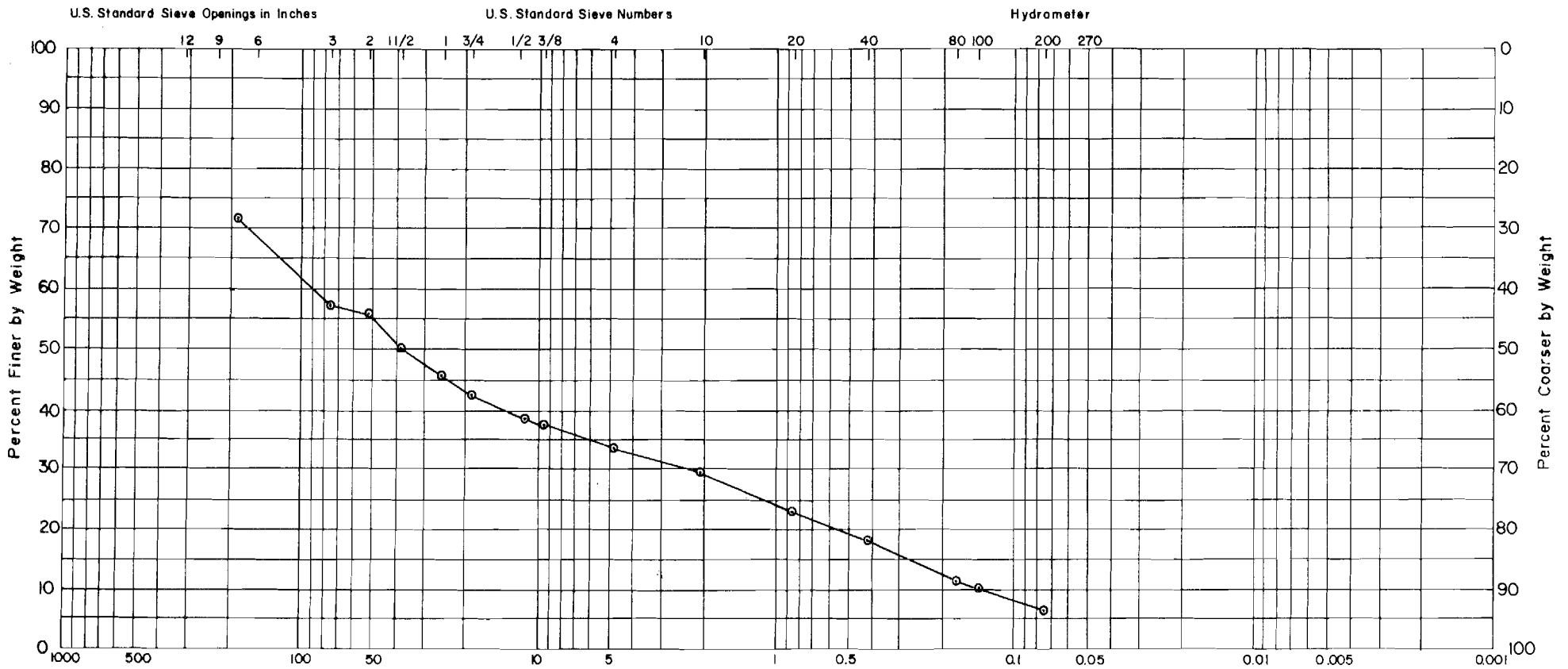
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E20 #3					SM	SILTY SAND WITH TRACE CLAY AND GRAVEL AND SCATTERED COBBLES



BORROW AREA E
TEST PIT TP-E20

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



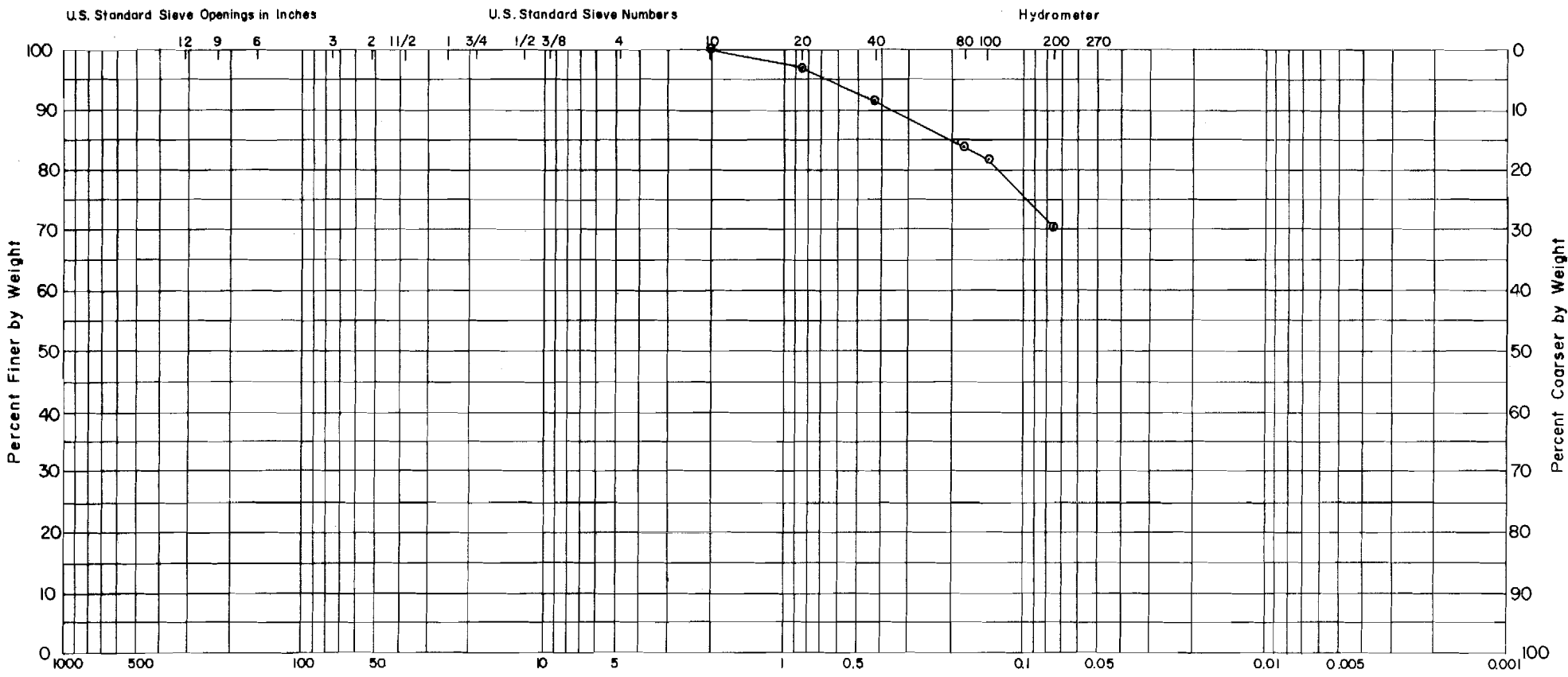
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E20 #4					SP-SM	GRAVELLY SAND WITH TRACE SILT SCATTERED COBBLES AND BOULDERS



BORROW AREA E
TEST PIT TP-E20

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



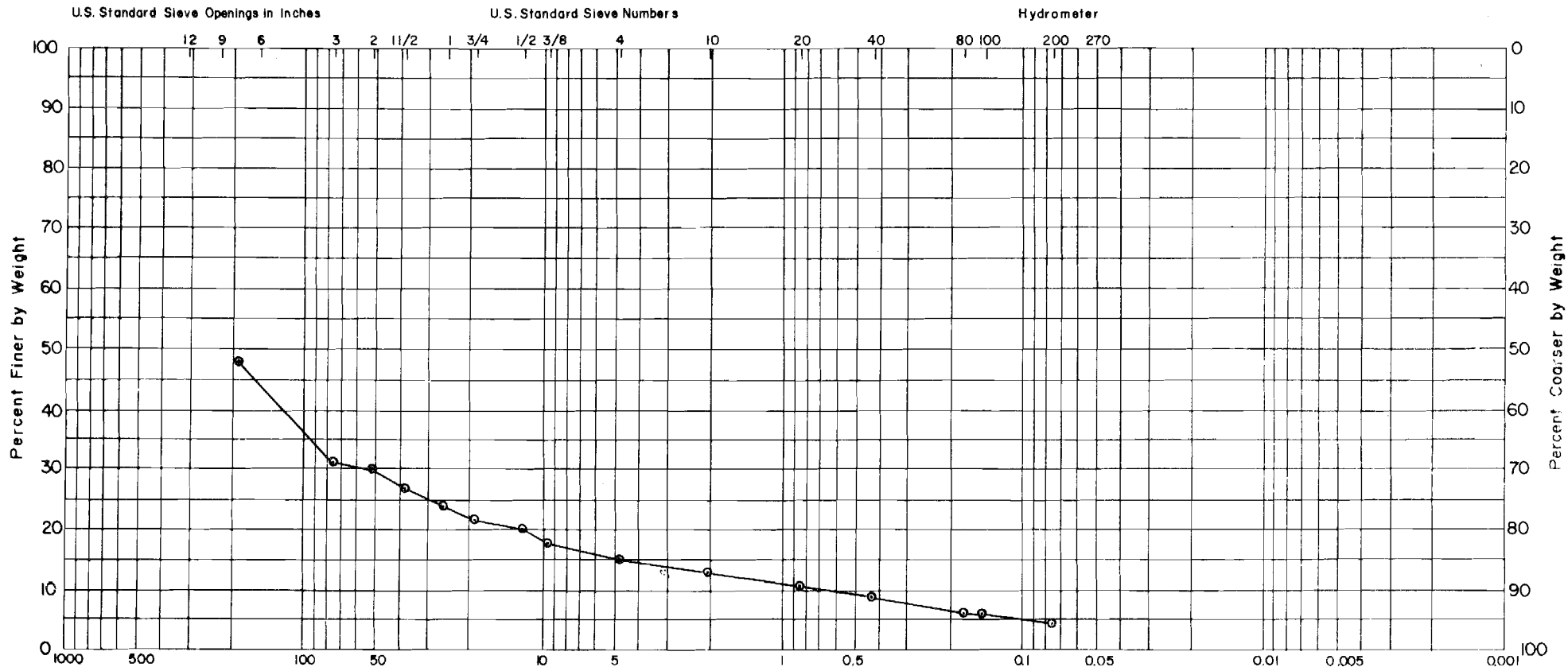
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E21 #1					SM-SC	SANDY SILT WITH TRACE CLAY



BORROW AREA E
TEST PIT TP-E21

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASS	CLASSIFICATION & DESCRIPTION
TP-E21 #2					GP-GM	SANDY GRAVEL WITH TRACE SILT, NUMEROUS COBBLES AND SCATTERED BOULDERS




BORROW AREA E
TEST PIT TP-E21

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: Dec. 1981
PROJECT NO. 052506

F.3 BORROW SITE H

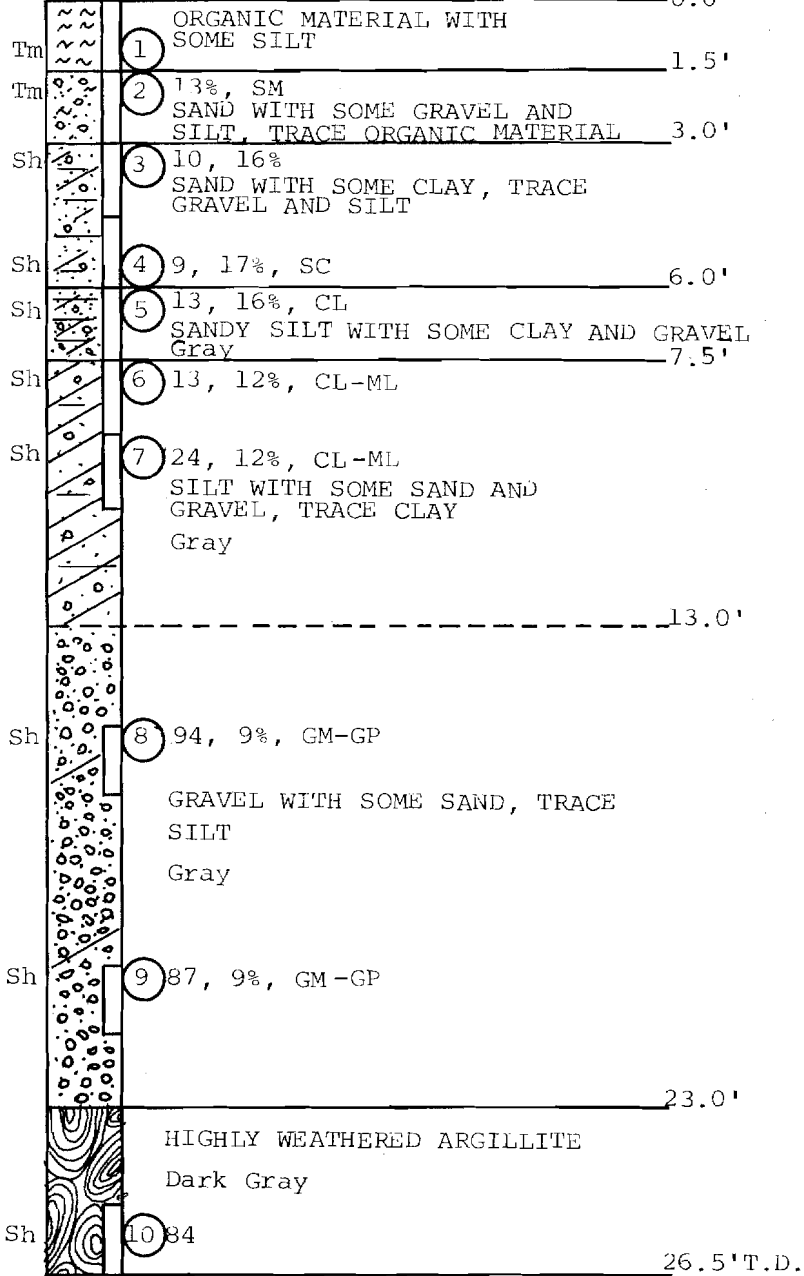
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AUGER HOLE LOGS

0.0'
A.B. 

AH-H1
7-16-81

Elevation 2127.5'



PREPARED BY:

PREPARED FOR:



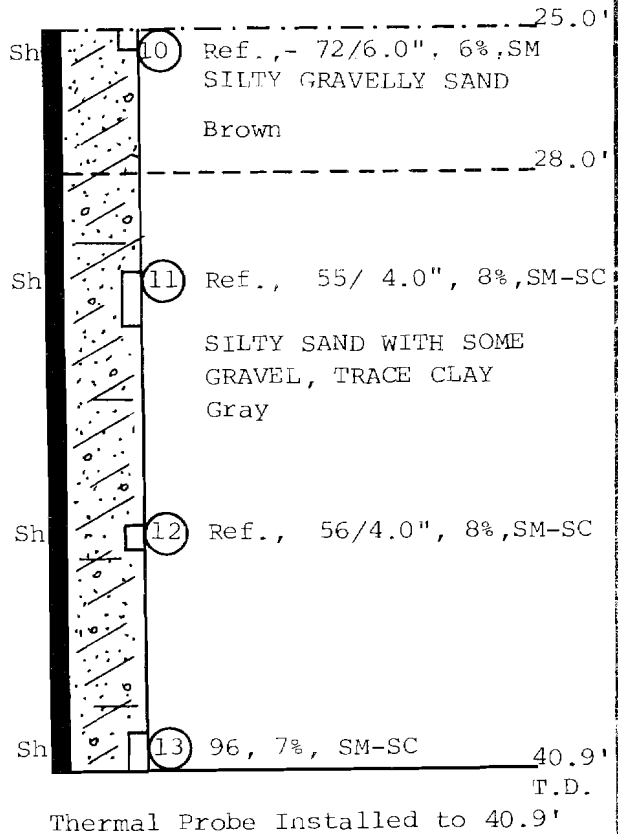
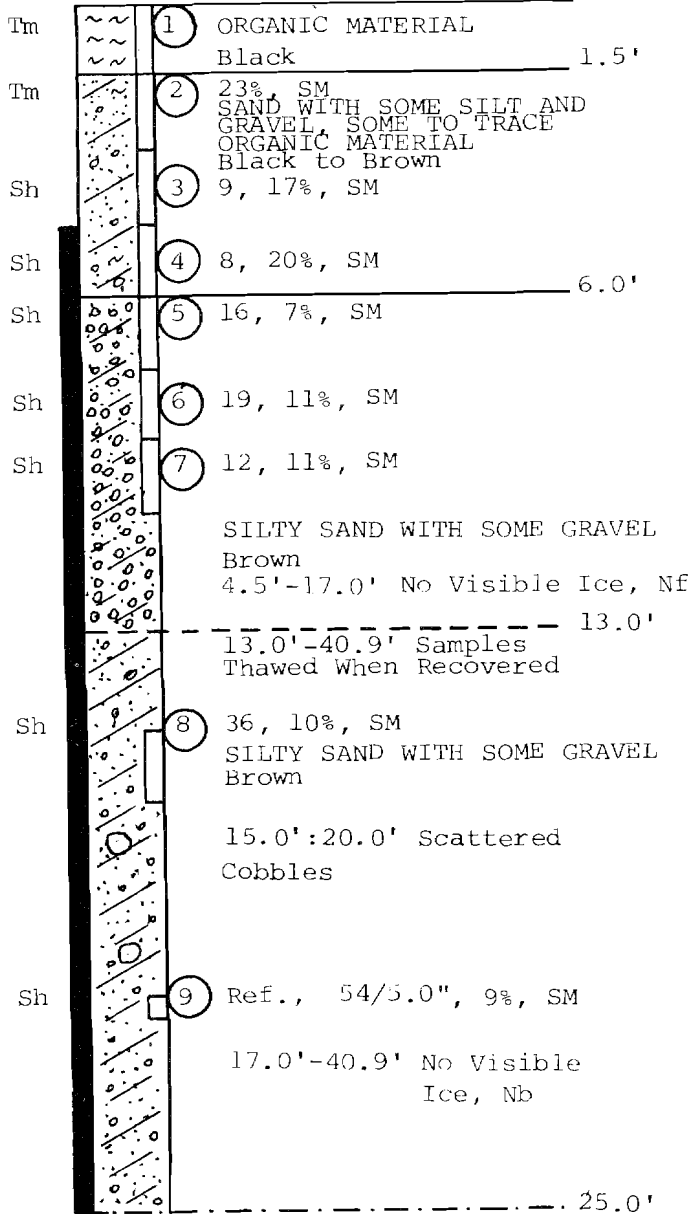
BORROW AREA H
AUGER HOLE AH-H1



Scale: 1"=4'

0.0'
A.B.

AH-H2 Elevation 1970.9'
7-19-81 0.0'



PREPARED BY:

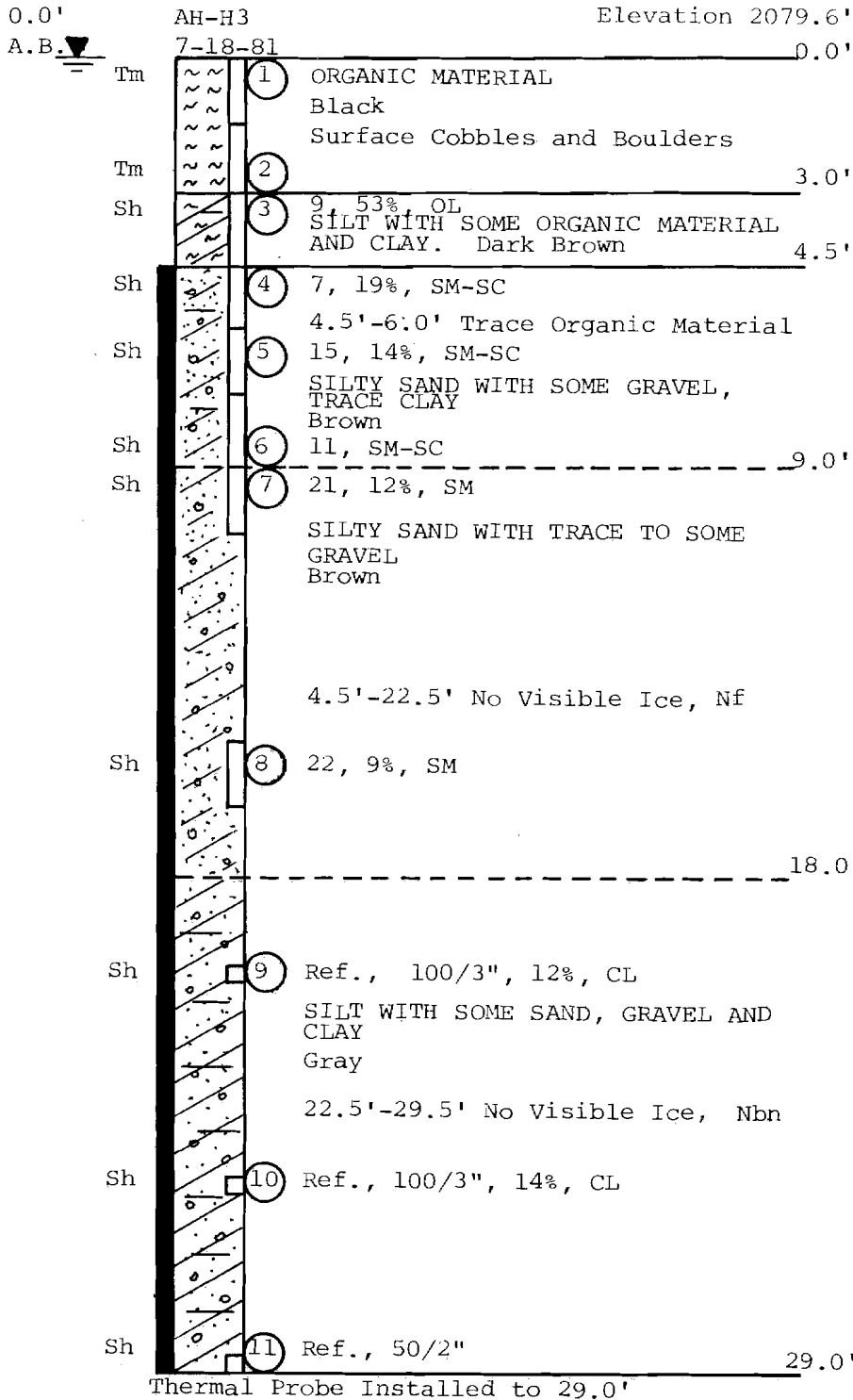


BORROW AREA H
AUGER HOLE AH-H2

PREPARED FOR:



Scale: 1"=4'



PREPARED BY:



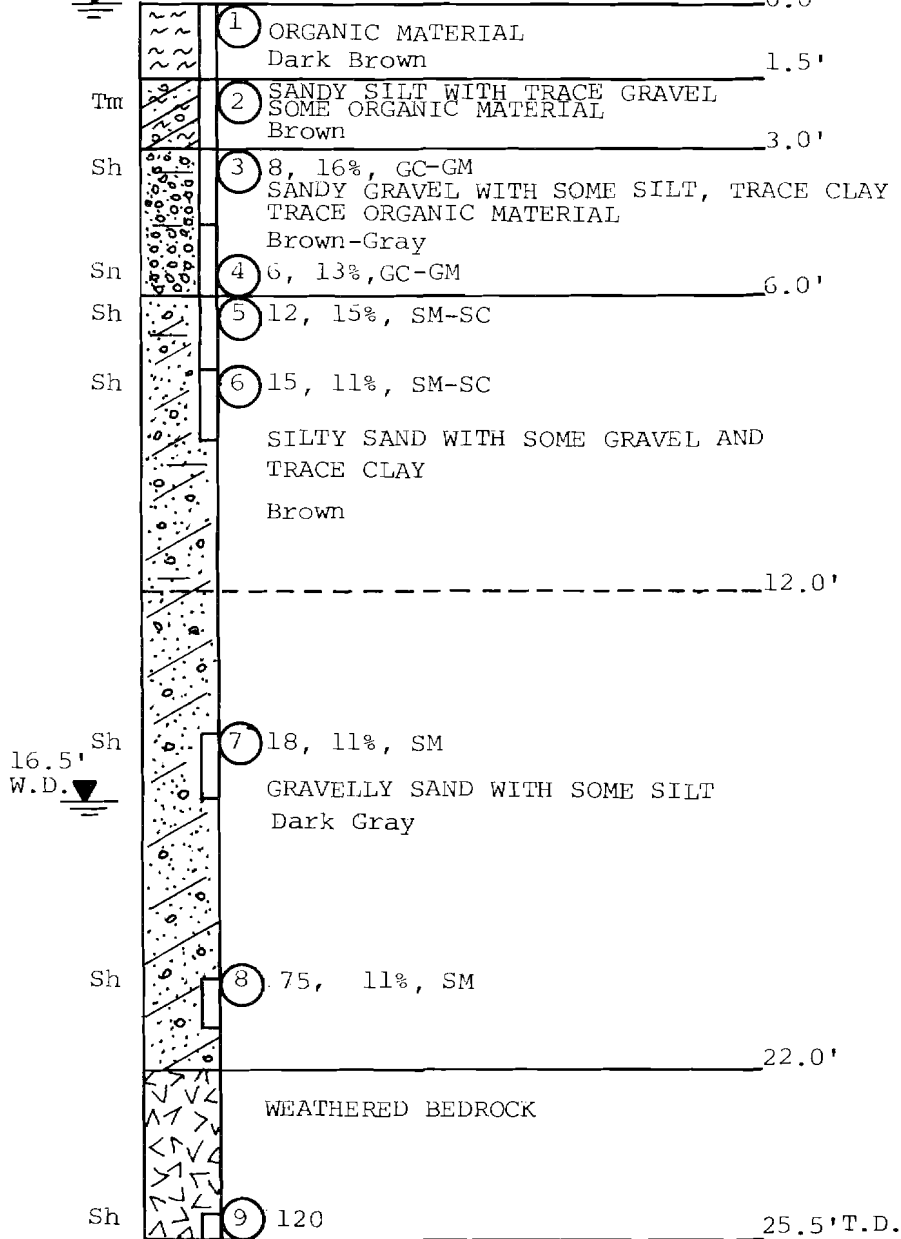
BORROW AREA H
AUGER HOLE AH-H3

PREPARED FOR:



Scale: 1"=4'

0.0' AH-H4 Elevation 2064.5'
 A.B. 7-14-81



Thermal Probe Installed to 25.0'

PREPARED BY:

PREPARED FOR:



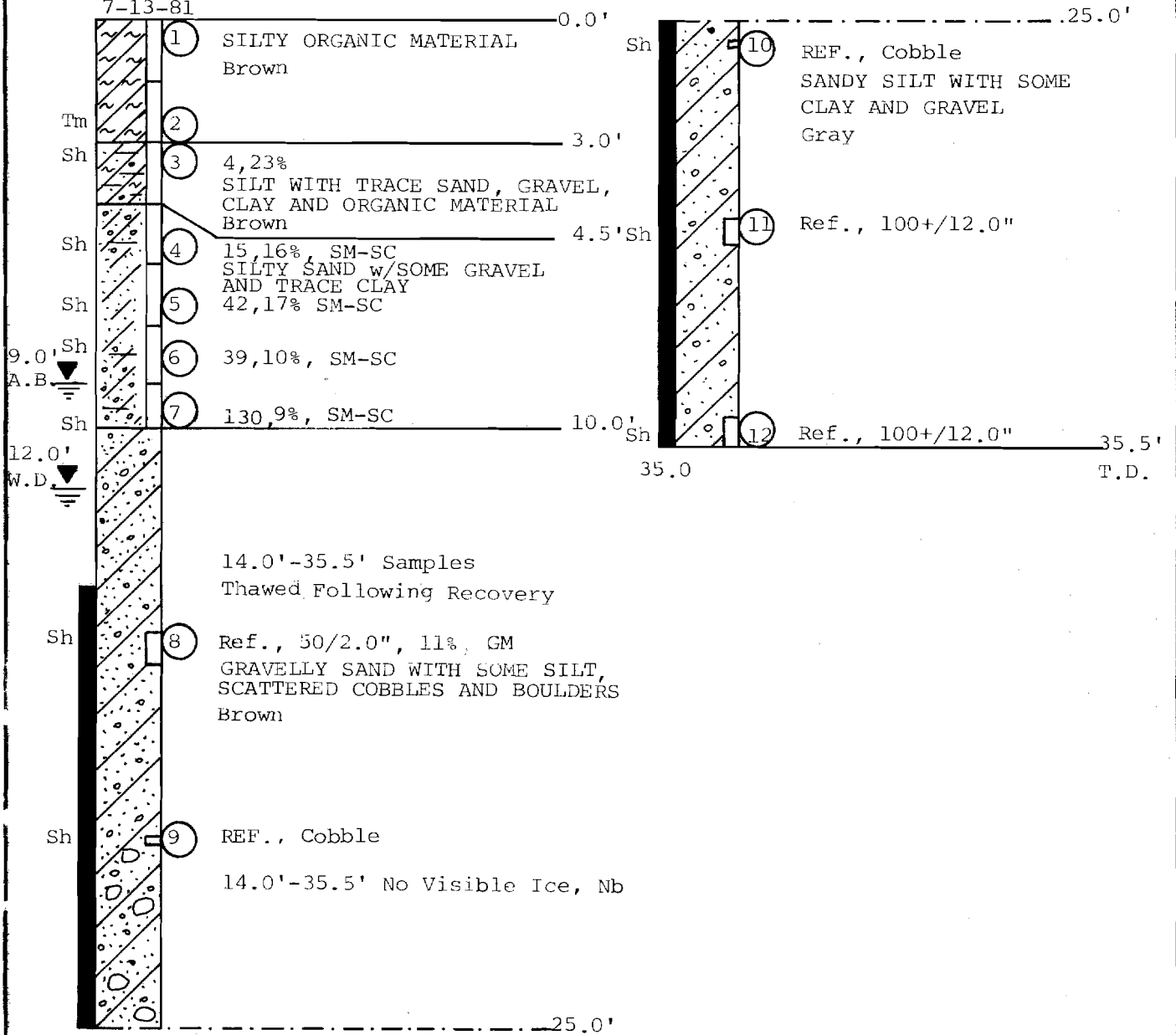
BORROW AREA H
 AUGER HOLE AH-H4



Scale: 1"-4'

AH-H5
7-13-81

Elevation 2186.2'



PREPARED BY:

PREPARED FOR:

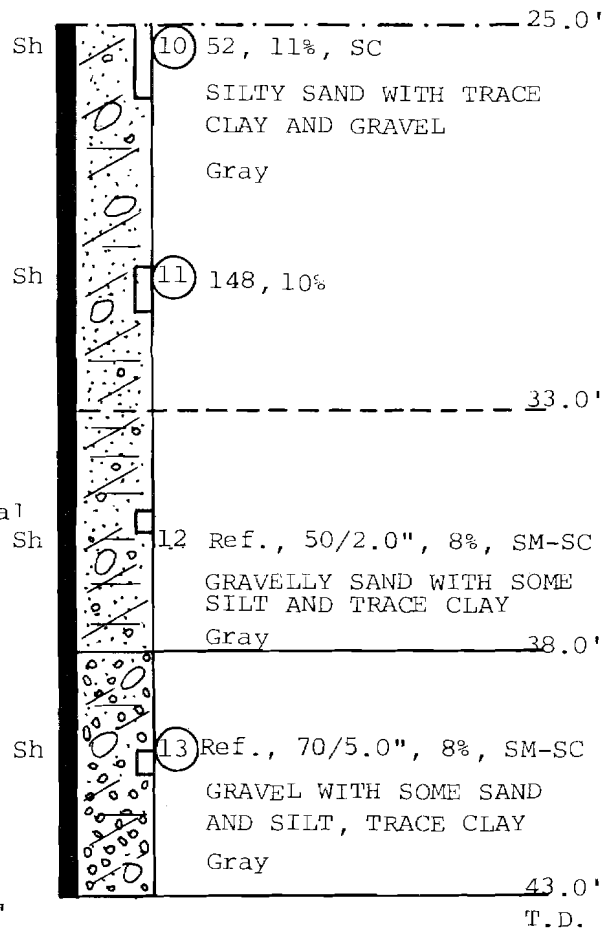
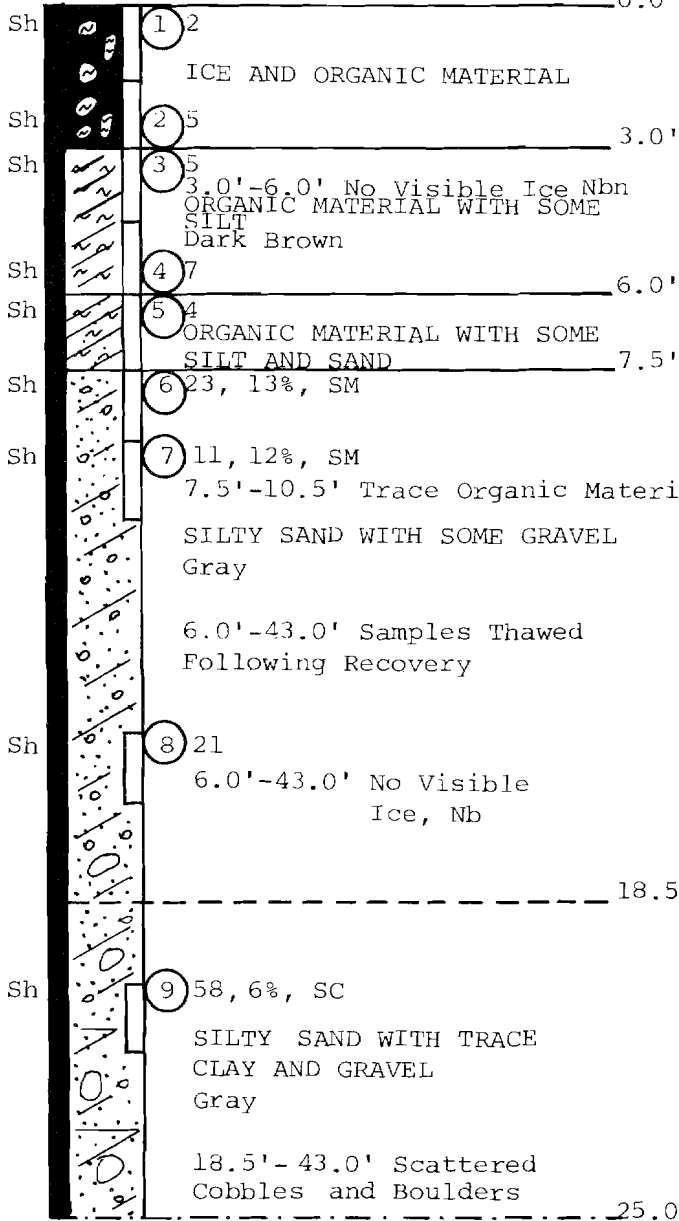


BORROW AREA H
AUGER HOLE AH-H5



Scale: 1"=4'

0.0' Elevation 2181.0'
 A.B. AH-H6
 7-12-81



Thermal Probe Installed to 43.0'

PREPARED BY:


PREPARED FOR:



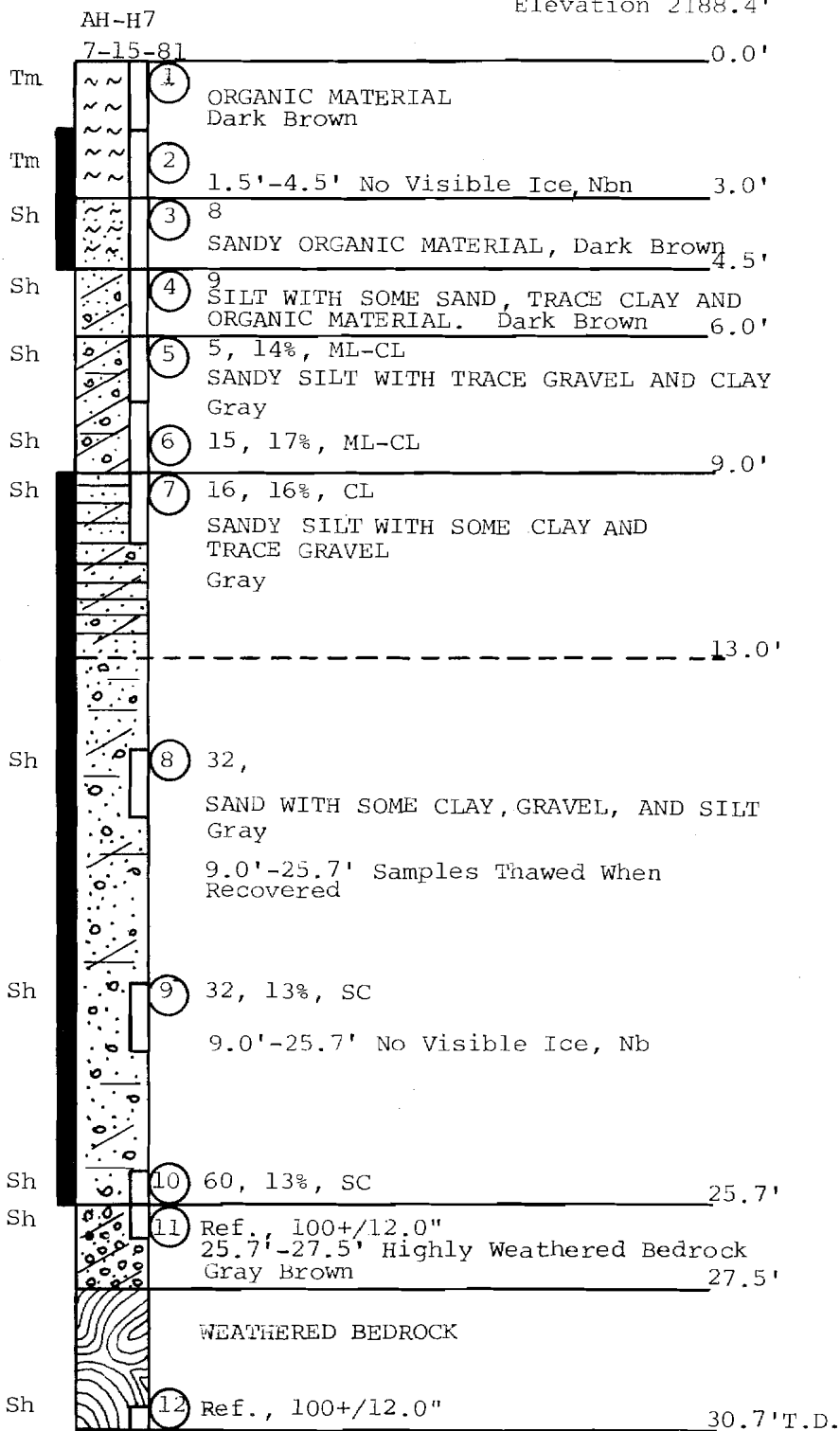
BORROW AREA H
 AUGER HOLE AH-H6



Scale: 1"=4'

0.0'
A.B. 

Elevation 2188.4'



Thermal Probe Installed to 30.7'

PREPARED BY:

PREPARED FOR:

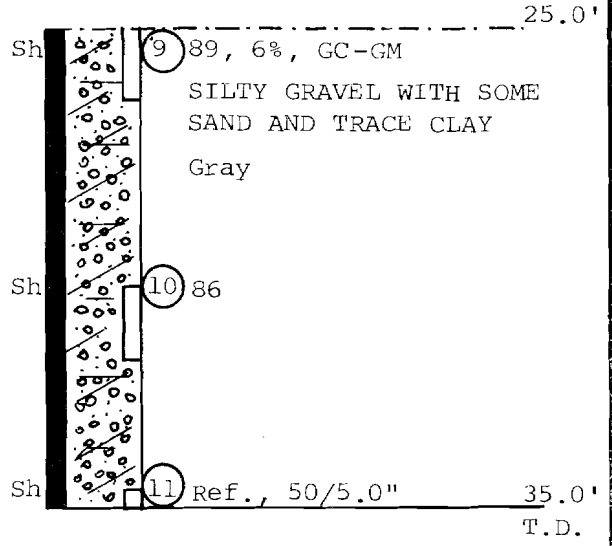
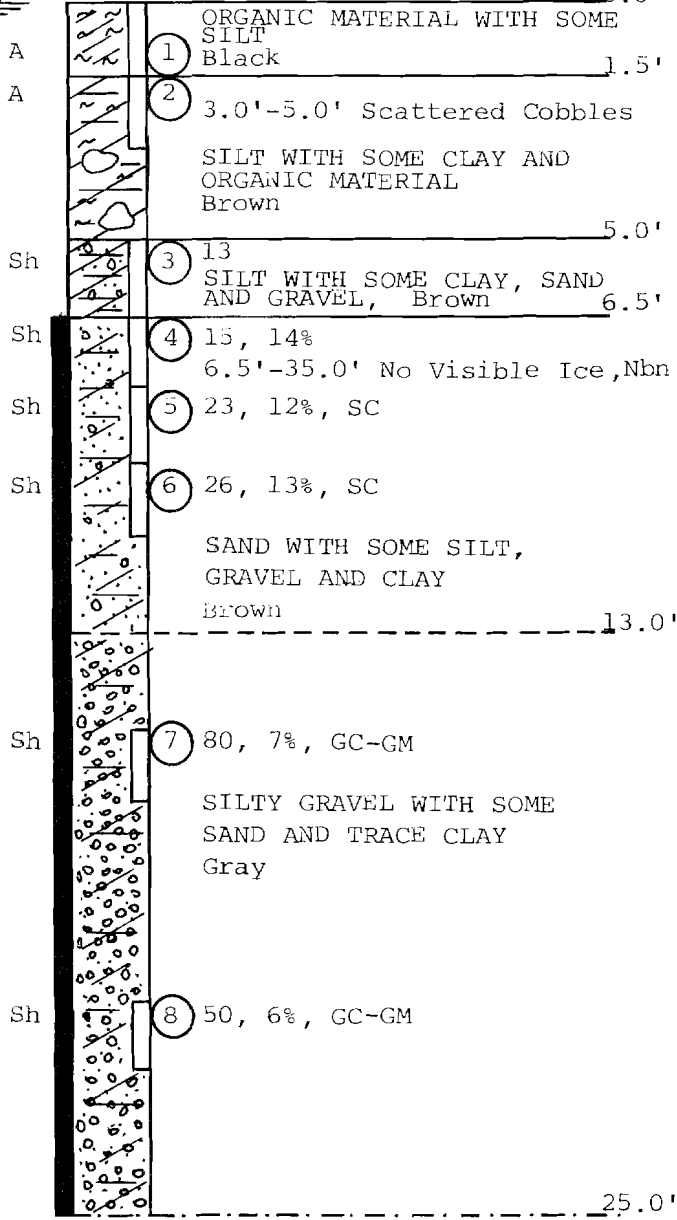


BORROW AREA H
AUGER HOLE AH-H7.



Scale: 1"=4'

0.0' AH-H8 Elevation 2093.5'
 A.B. 7-17-81 0.0'



Thermal Probe Installed to 35.0'

PREPARED BY:

PREPARED FOR:



BORROW AREA H
 AUGER HOLE AH-H8



Scale: 1"-4'

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LABORATORY TEST DATA

PROJECT NO. 052504

CLIENT: Acres American, Inc.

PROJECT NAME Susitna Hydroelectric
(Watana Dam Site)

R & M CONSULTANTS, INC.

DATE October 17, 1980

PARTY NO. _____ PAGE NO. C-01

SUMMARY OF LABORATORY TEST DATA

DESCRIPTION			4"	3"	2"	1½"	1"	¾"	½"	¾"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.	
BORROW	H	W-80-256			100	95	88	84	81	78	71	64	53	38.2	24.3	13.6	8.6	10.9	21.7	9.2	GC-SC	
		(Grab Sample)																			GM-SM	
BORROW	H	W-80-257			100	97	92	89	84	81	73	66	54	36.0	19.6	8.9	5.2	12.3	17.1	2.5	GM-SM	
		(Grab Sample)																				

REMARKS: _____

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
 CLIENT: Acres American
 PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE October 5, 1981

SUMMARY OF LABORATORY TEST DATA

PARTY NO. _____ PAGE NO. 1

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	3"	2"	1½"	1"	¾"	½"	3/8"	4	10	40	200	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	H1	2	1.5'- 3.0'			100	92	89	85	82	74	59	46	24.8						13	SM
	H1	3	3.0'- 4.0'																	16	
	H1	4	4.5'- 6.0'			100	96	96	94	92	88	79	60	21.4		32	17			17	SC
	H1	5	6.0'- 7.5'					100	93	90	86	77	66	51.7		34	21			16	CL
	H1	6,7	7.5'-10.5'*			100	98	94	88	85	82	74	64	55.1		25	7			12,12	CL-ML
	H1	8,9	15.0'-21.5'*		100	69	57	50	45	41	34	28	20	12.1		21	NP			9	GM-GP
	H2	2-4	1.5'- 6.0'*					100	95	91	85	69	48	22.9		NV	NP			23,17,20	SM
	H2	5-7	6.0'-10.5'*		100	88	83	82	78	74	67	61	50	35.0		18	NP			7,11,11	SM
	H2	8	15.0'-16.5'				100	90	85	80	76	65	51	32.7						10	SM
	H2	9,10	20.0'-25.5'*				100	93	84	78	73	62	48	31.5		17	NP			9,6	SM
	H2	11-13	30.0'-40.8'*				100	95	89	87	82	71	61	39.7		18	5			8,8,7	SM-SC
	H3	3	3.0'- 4.5'																	53	
	H3	4,5	4.5'- 7.5'*					100	94	91	86	74	59	42.0		18	5			19,14	SM-SC
	H3	7	9.0'-10.5'					100	99	97	93	82	63	40.6		NV	NP			12	SM
	H3	8	15.0'-16.5'					100	93	88	83	67	51	29.9		14	NP			9	SM
	H3	9	20.0'-20.3'																	12	
	H3	10	25.0'-25.2'																	14	

NOTE: SIEVE ANALYSIS = PERCENT PASSING

REMARKS: * Samples Combined for Gradation and Atterberg Limits
 NV = Non-Viscous, NP = Non-Plastic

PROJECT NO. 052506
 CLIENT: Acres American
 PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE October 1981

PARTY NO. _____ PAGE NO. 2

SUMMARY OF LABORATORY TEST DATA

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	3"	2"	1½"	1"	¾"	½"	3/8"	4	10	40	200	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	H4	3,4	3.0'-6.0'*		100	82	82	73	66	61	55	49	37	20.4		23	7			16,13	GM-GC
	H4	5,6	6.0'-9.0'*		100	89	87	86	85	81	74	67	55	39.5		20	4			15,11	SM-SC
	H4	7,8	15.0'-21.5'*		100	92	90	83	78	74	64	55	41	27.2		22	NP			11	SM
	H5	3	3.0'-4.5'																	23	
	H5	4	4.5'-6.0'			100	95	93	89	86	78	72	62	41.0		23	6			16	SM-SC
	H5	5	6.0'-7.5'*								100	89	73	45.2		22	6			17	SM-SC
	H5	6,7	7.5'-10.0'		100	81	76	76	76	76	76	61	49	33.3		21	4			10,9	SM-SC
	H5	8	15.0'-15.7'																	11	
	H6	6,7	7.5'-10.5'*			100	97	93	91	88	78	69	53	32.5		NV	NP			13,12	SM
	H6	9	20.0'-21.5'																	6	
	H6	10	25.0'-26.5'					100	95	93	90	79	63	45.5		23	9			11	SC
	H6	11	30.0'-31.0'																	10	
	H6	12	35.0'-35.6'			100	82	82	73	71	66	47	34	19.2		21	6			8	SM-SC
	H6	13	40.0'-40.4'																	8	

REMARKS: * Samples Combined for Gradation and Atterberg Limits
 NV = Non-Viscous, NP = Non-Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
 CLIENT: Acres American
 PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE October 1981

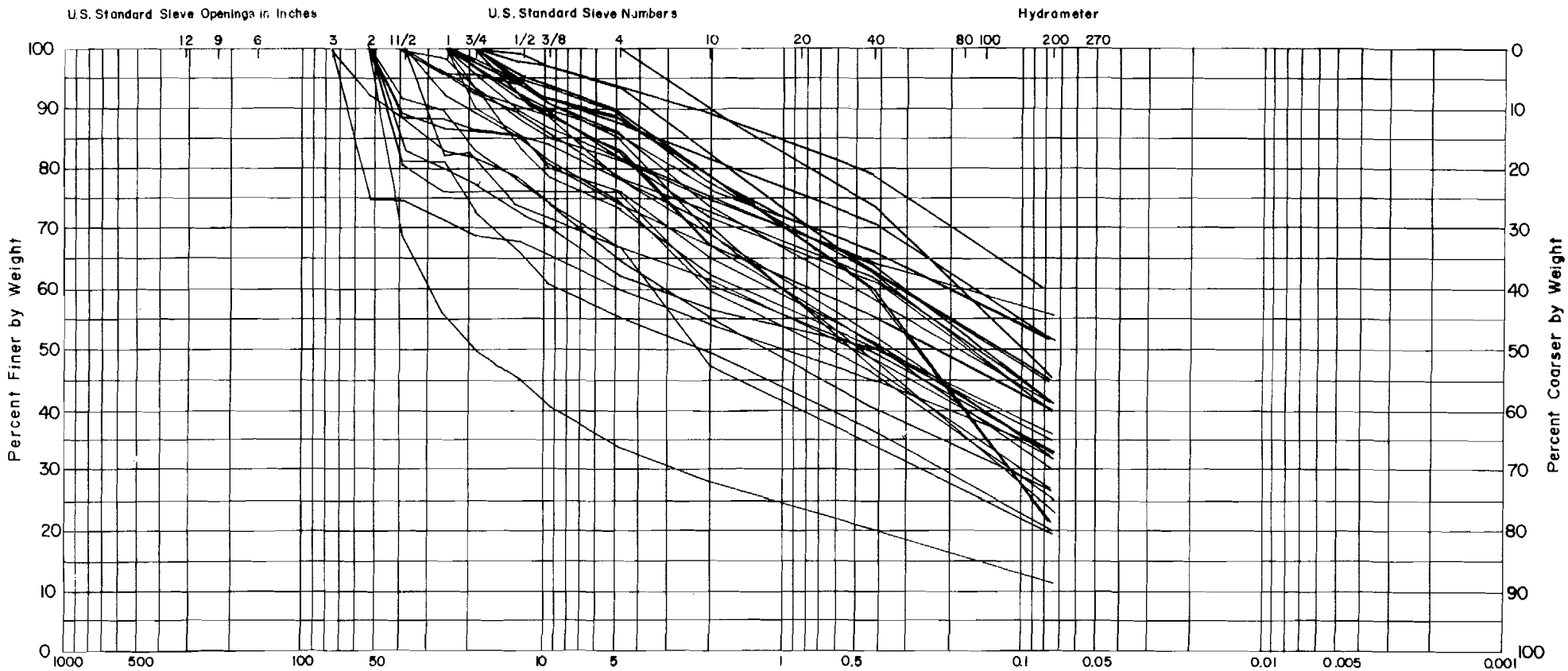
PARTY NO. _____ PAGE NO. 3

SUMMARY OF LABORATORY TEST DATA

LAB NO.	BORING NO.	SAMPLE NO.	DEPTH	3"	2"	1½"	1"	¾"	½"	3/8"	4	10	40	200	FINE SPG	L.L.	P.I.	WET DENSITY	DRY DENSITY	MOISTURE CONTENT	CLASS
	H7	5,6	6.0'-9.0'*				100	98	94	92	88	82	71	51.5		17	4			14,17	ML-CL
	H7	7	9.0'-10.5'					100	98	97	93	89	79	58.7		29	14			16	CL
	H7	9,10	20.0'-25.7'*	100	92	88	88	87	86	84	78	71	48	27.4		33	19			13,13	SC
	H8	4	6.5'-8.0'													NV	NP			14	
	H8	5,6	8.0'-11.0'*				100	97	92	89	82	75	64	42.4		25	11			12,13	SC
	H8	7	15.0'-16.5'		100	83	79	77	72	70	62	56	50	36.3		21	7			7	GC-GM
	H8	8,9	20.0'-26.5'*	100	75	75	72	69	68	66	60	54	45	32.9		21	7			6,6	GC-GM
	BORROW H					100	95	92	87	79	57	51	44	30.5		23	6				
	<u>Bulk Sample</u>																				

REMARKS: * Samples Combined for Gradation and Atterberg Limits
 NV = Non-Viscous, NP = Non-Plastic

NOTE: SIEVE ANALYSIS = PERCENT PASSING



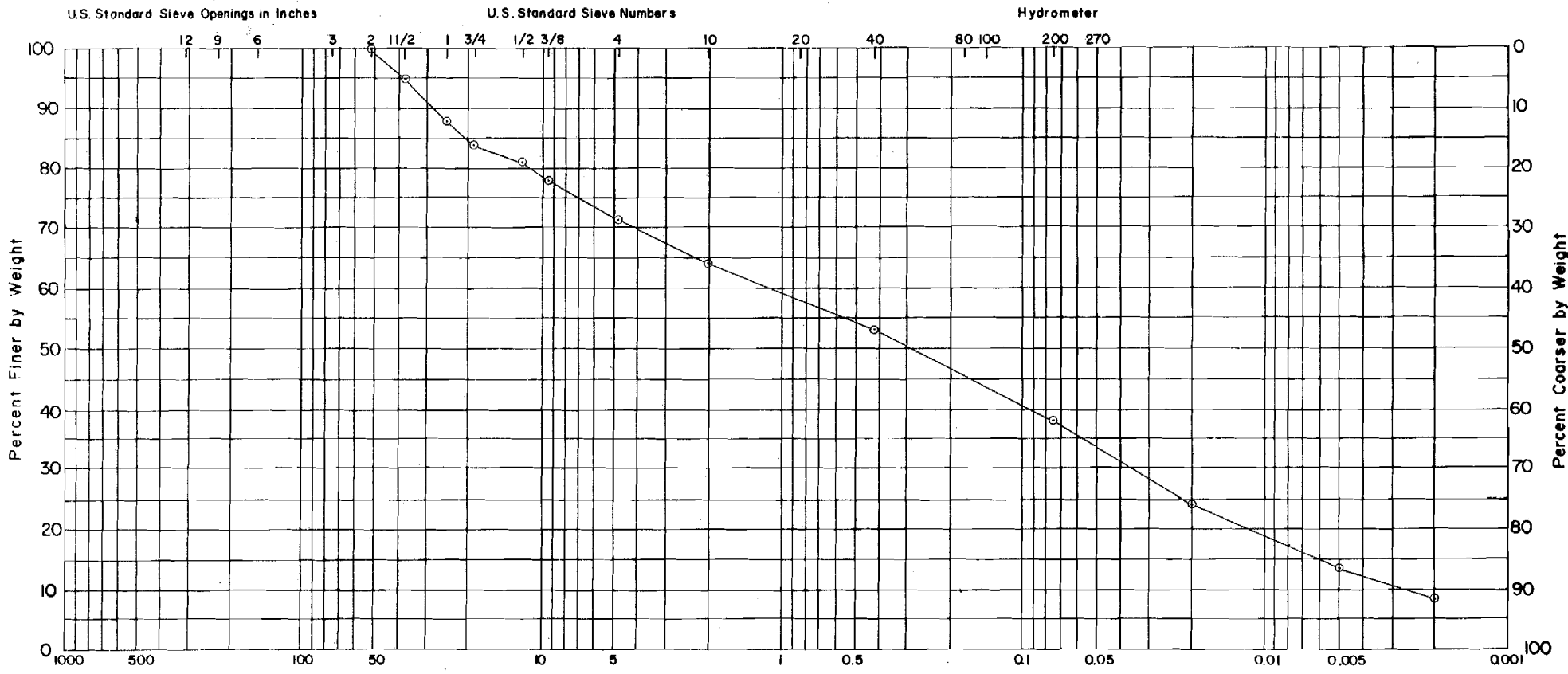
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION



BORROW AREA H
COMPOSITE GRADATION CURVE

DRAWN BY:
APPROVED BY:
DATE:
PROJECT NO.



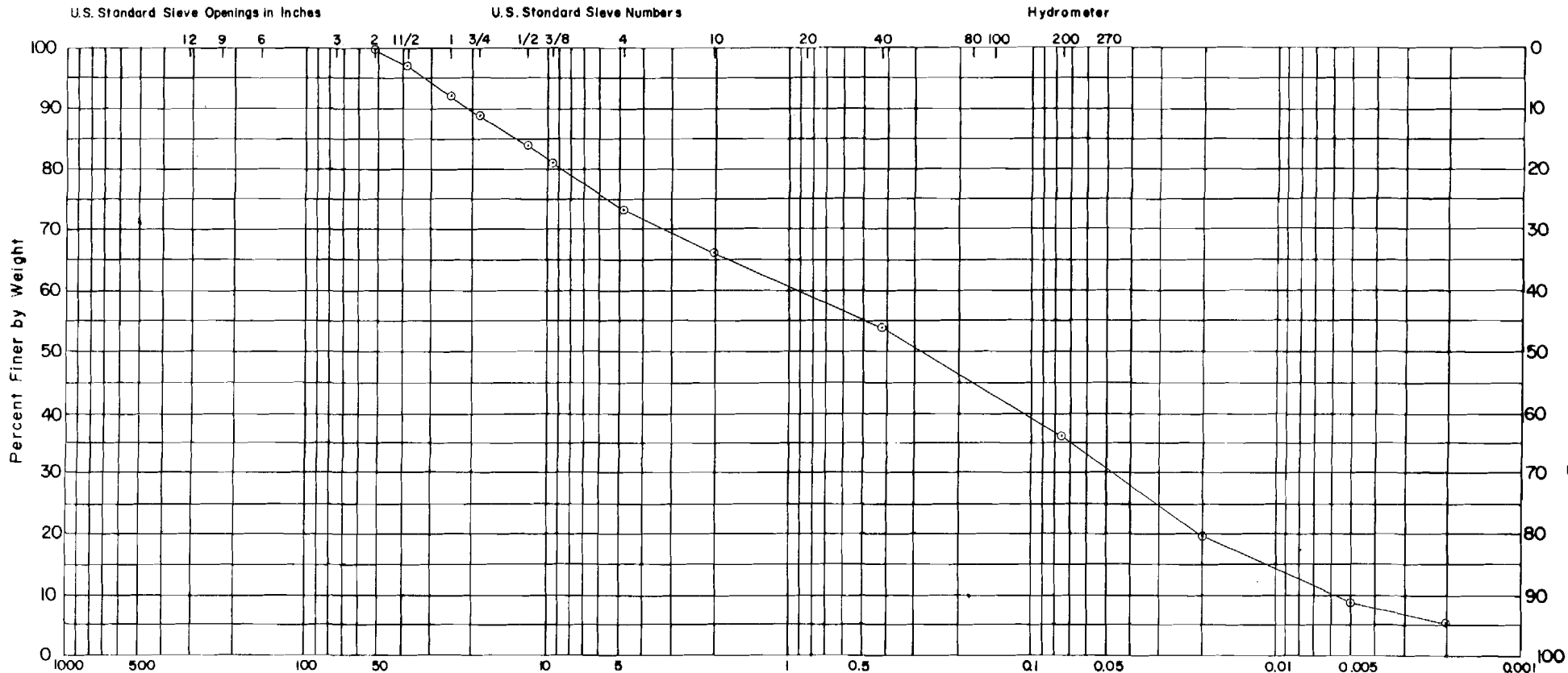
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
W-80-256 (Grab Sample)	10.9%		21.7	9.2	GC-SC	Poorly graded 'Till' with low Plasticity SILTY GRAVEL AND SAND WITH TRACE CLAY



BORROW AREA H

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



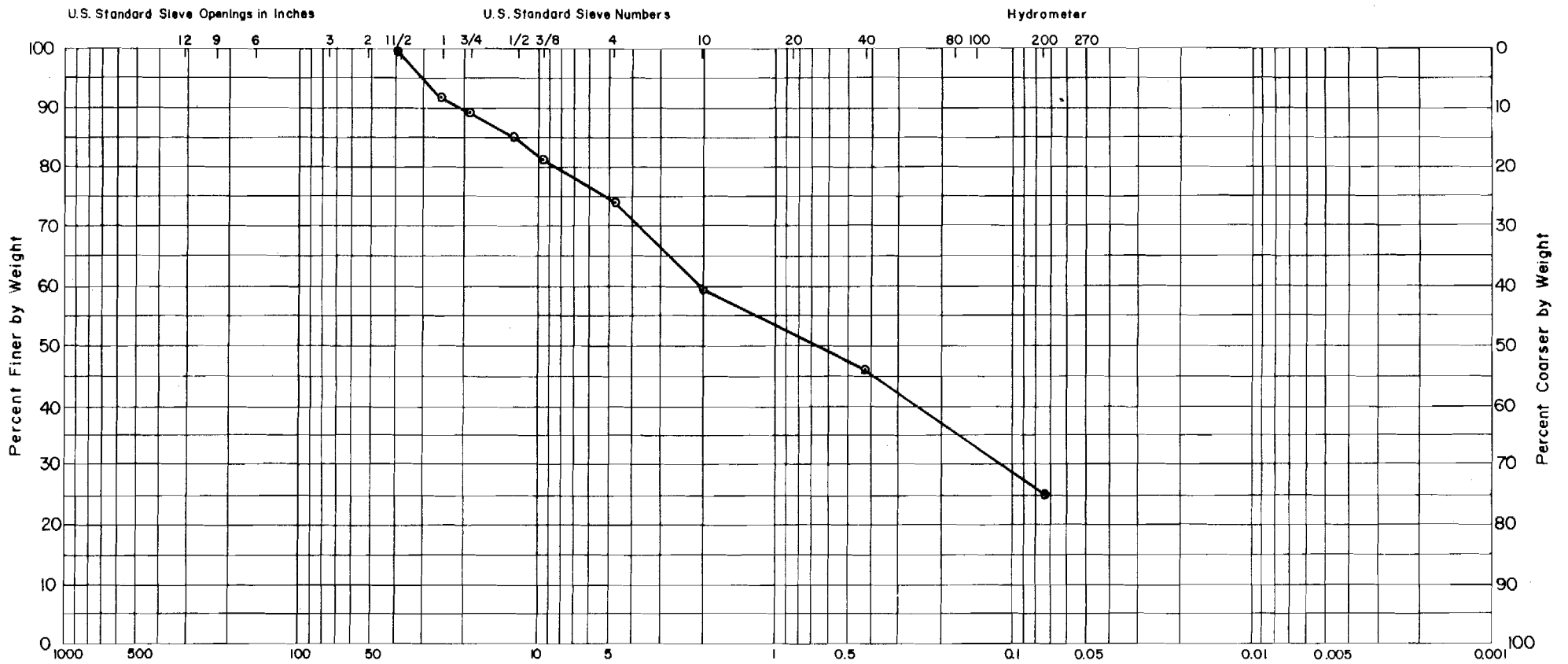
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
W-80-257	12.3%		17.1	2.5	GM-SM	Poorly graded 'Till' with Non-Plastic Fines
(Grab Sample)						SILTY GRAVEL AND SAND WITH TRACE CLAY



BORPOW APEA H

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. G525C4



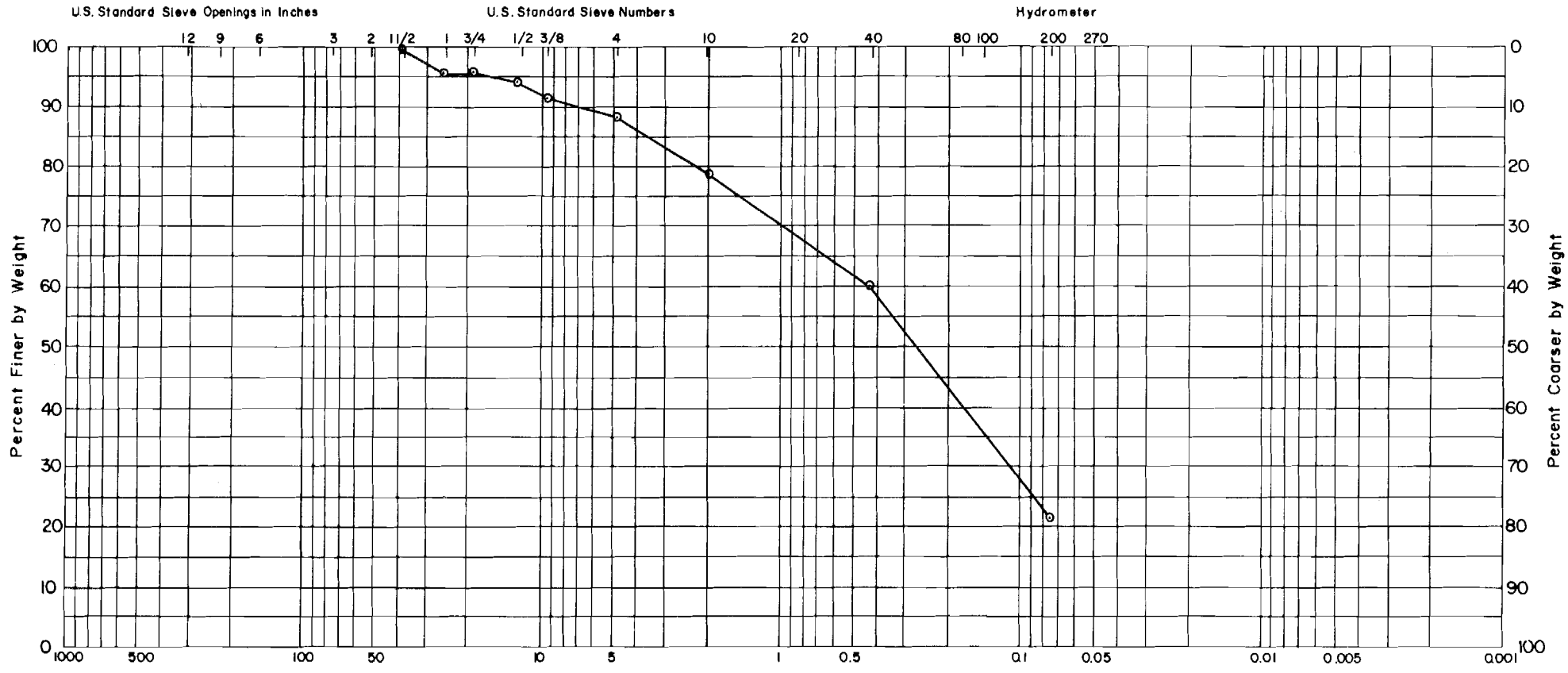
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H1 #2	13			SM	SAND WITH SOME GRAVEL AND SILT, TRACE ORGANIC MATERIAL



BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:
APPROVED BY: MCH
DATE: Oct, 1981
PROJECT NO. 052506



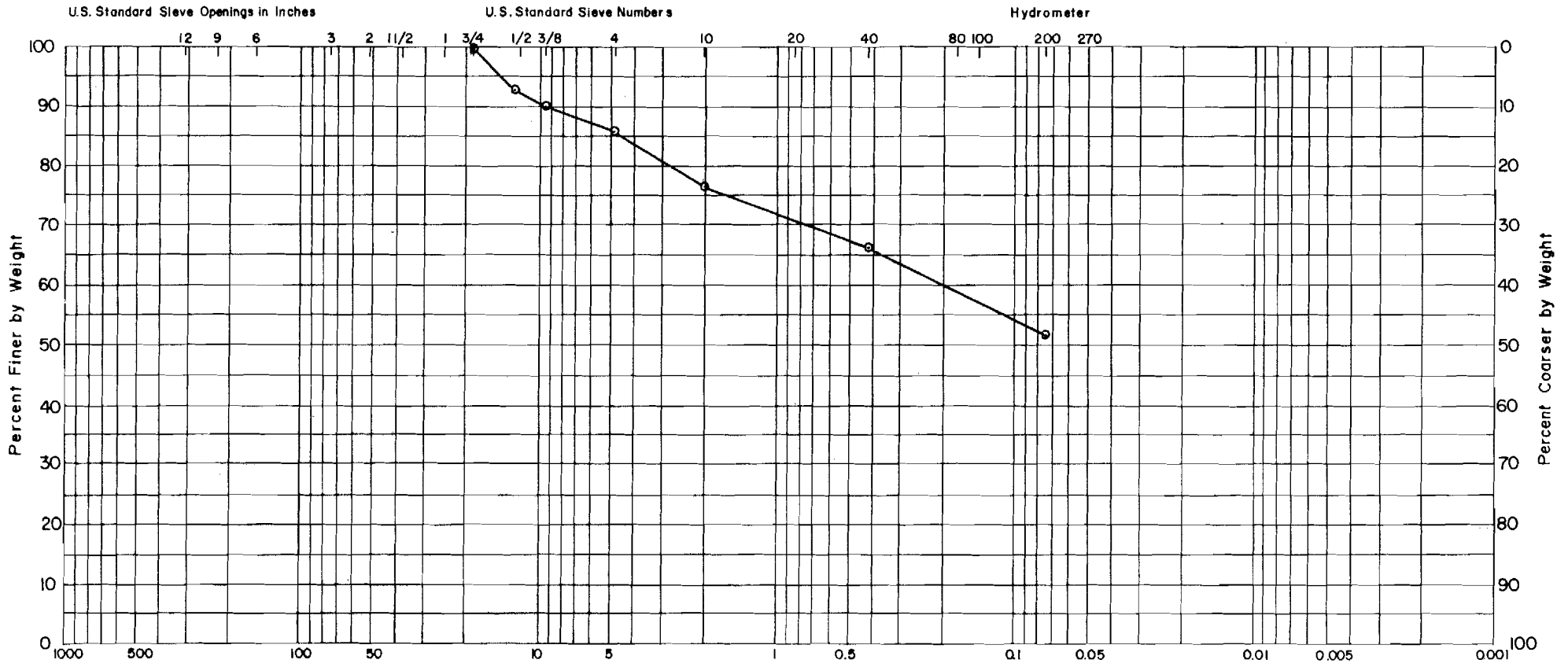
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H1 #4	17		32	17	SC	SAND WITH SOME CLAY, TRACE GRAVEL AND SILT



BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



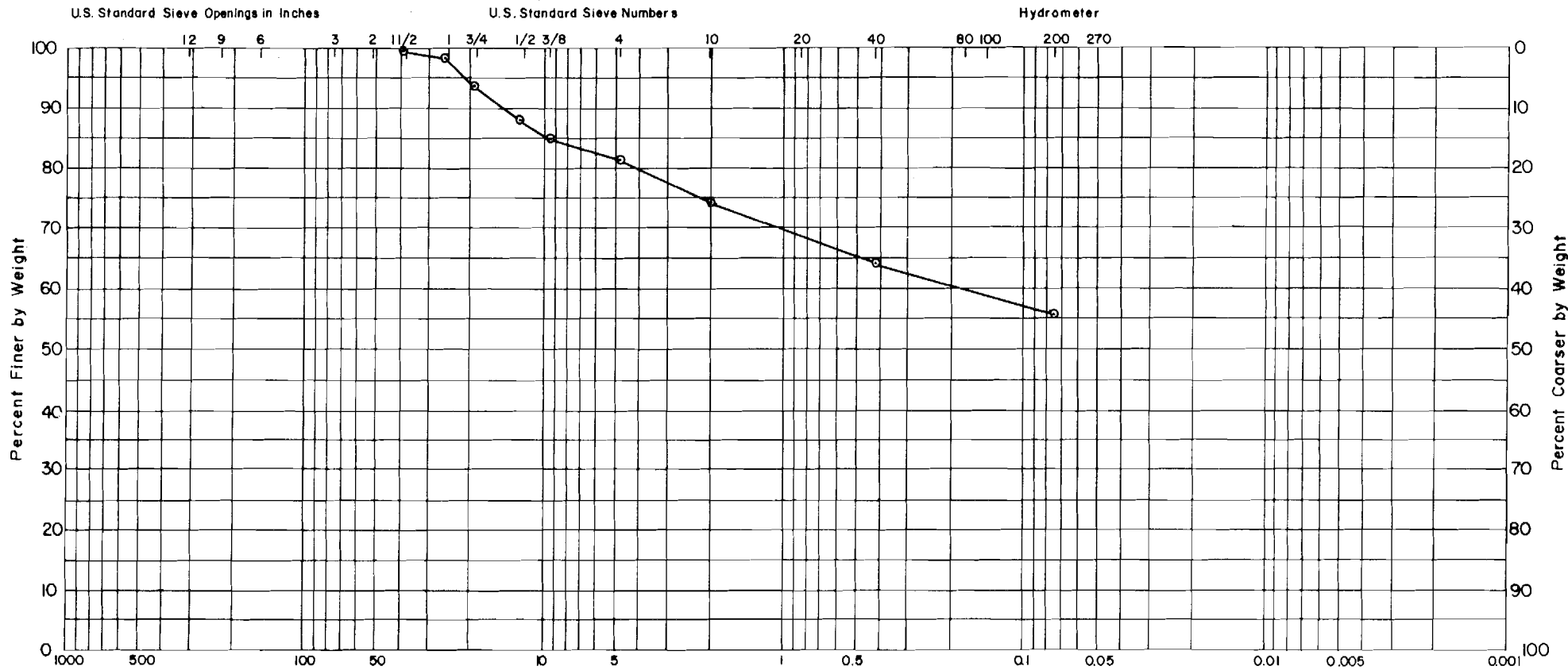
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY,	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H1 #5	16		34	21	CL SANDY SILT WITH SOME CLAY AND GRAVEL



BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



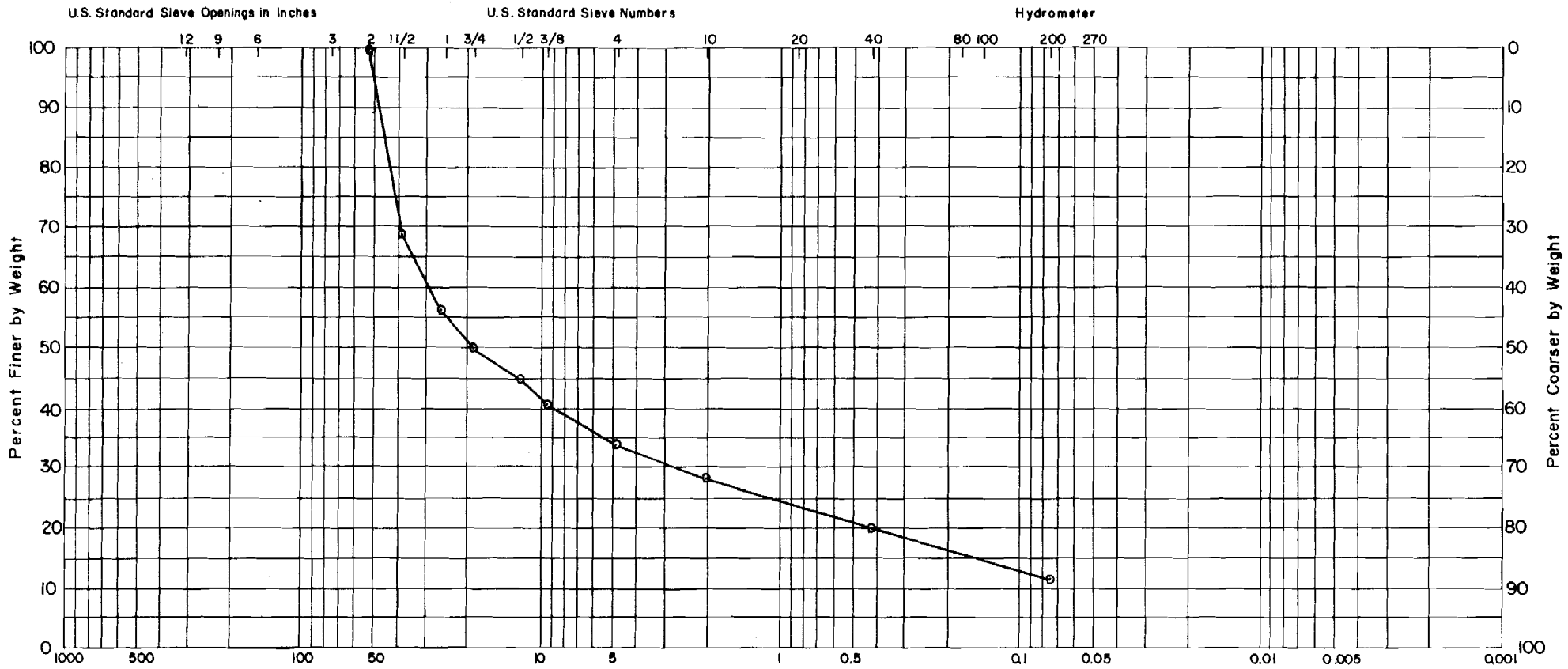
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H1 #6,7	12,12		25	7	CL-ML SILT WITH SOME SAND AND GRAVEL, TRACE CLAY



BORROW AREA H
 AUGER HOLE AH-H1

DRAWN BY:
 APPROVED BY: MCH
 DATE: Oct. 1981
 PROJECT NO. 052506



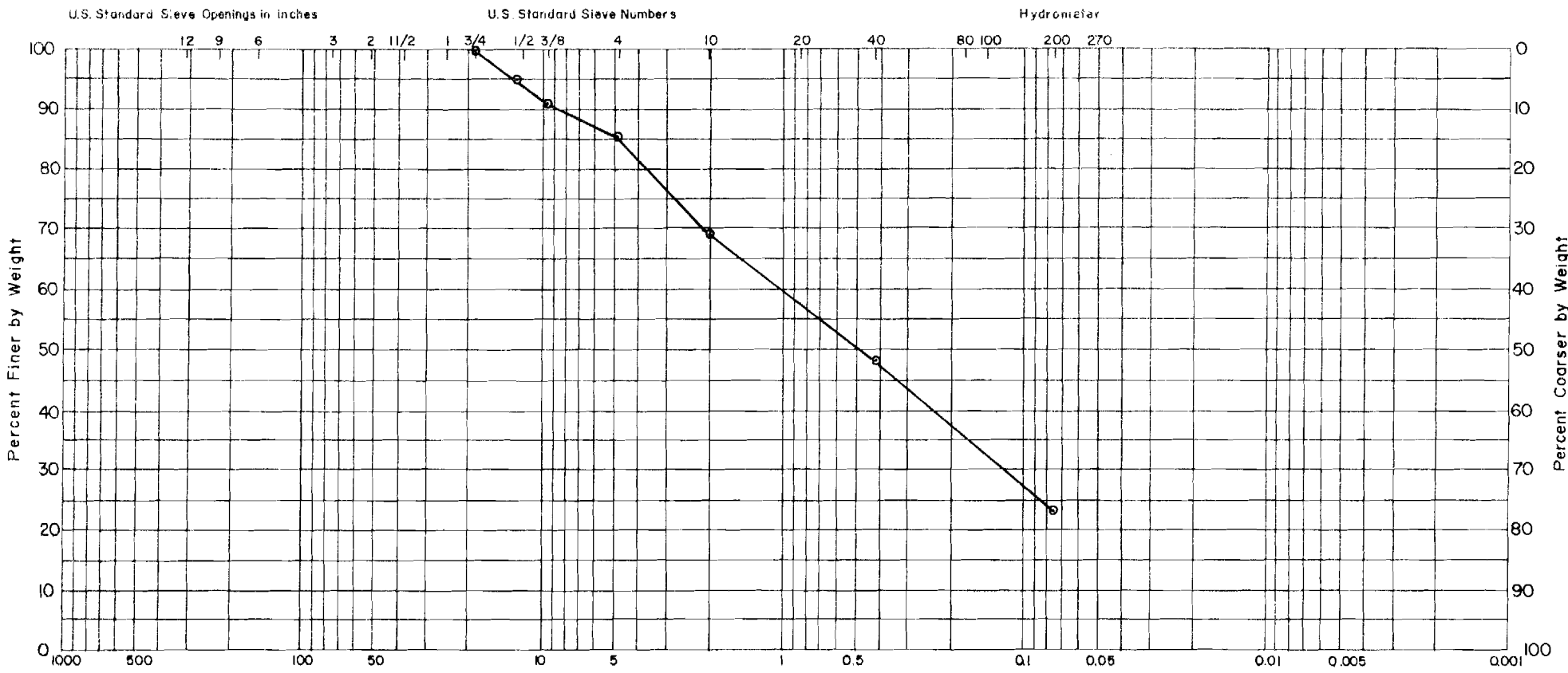
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H1 #8,9	9		21	NP	GP-GM GRAVEL WITH SOME SAND, TRACE SILT



BORROW AREA H
AUGER HOLE AH-H1

DRAWN BY:
APPROVED BY: MCh
DATE: Oct. 1981
PROJECT NO. 052506



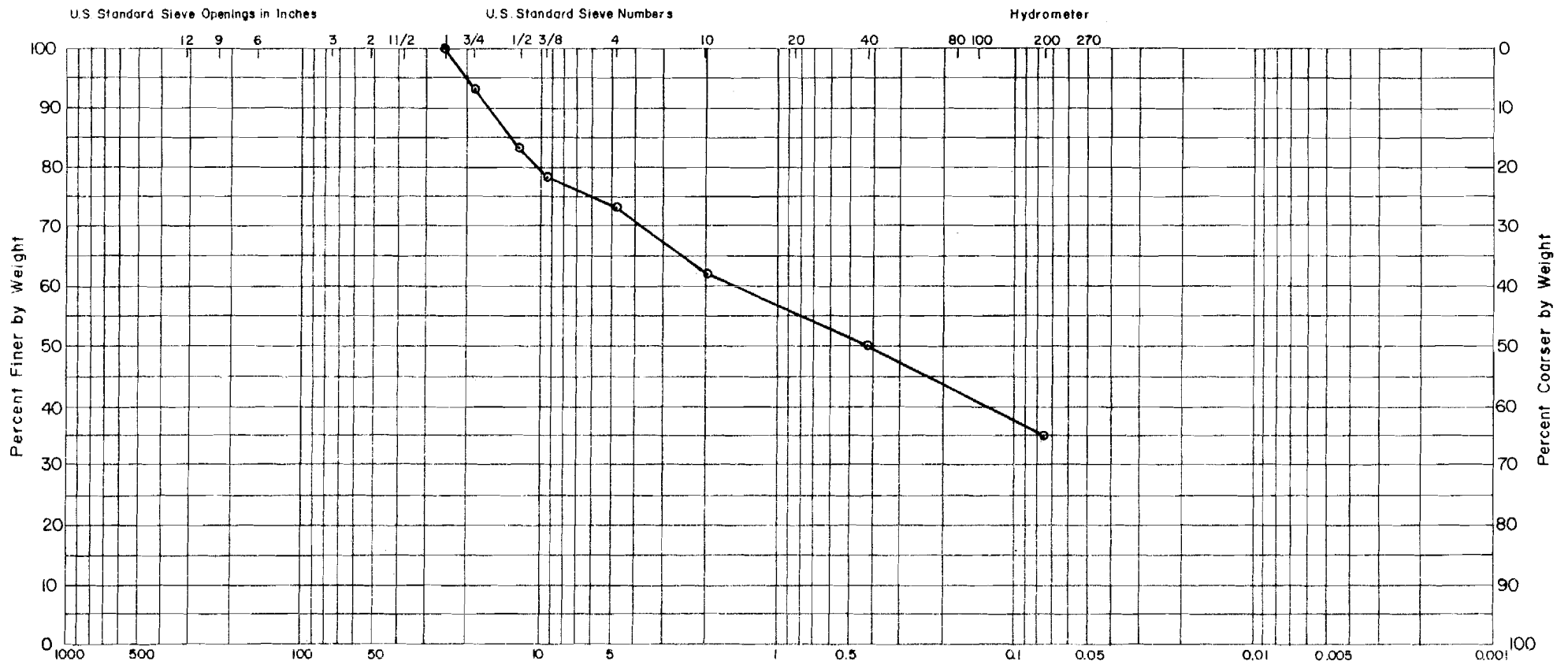
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H2 #2, 3, 4	23, 17, 20		NV	NP	SM	SAND WITH SOME SILT AND GRAVEL



BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCI
DATE: Oct. 1931
PROJECT NO. 052506



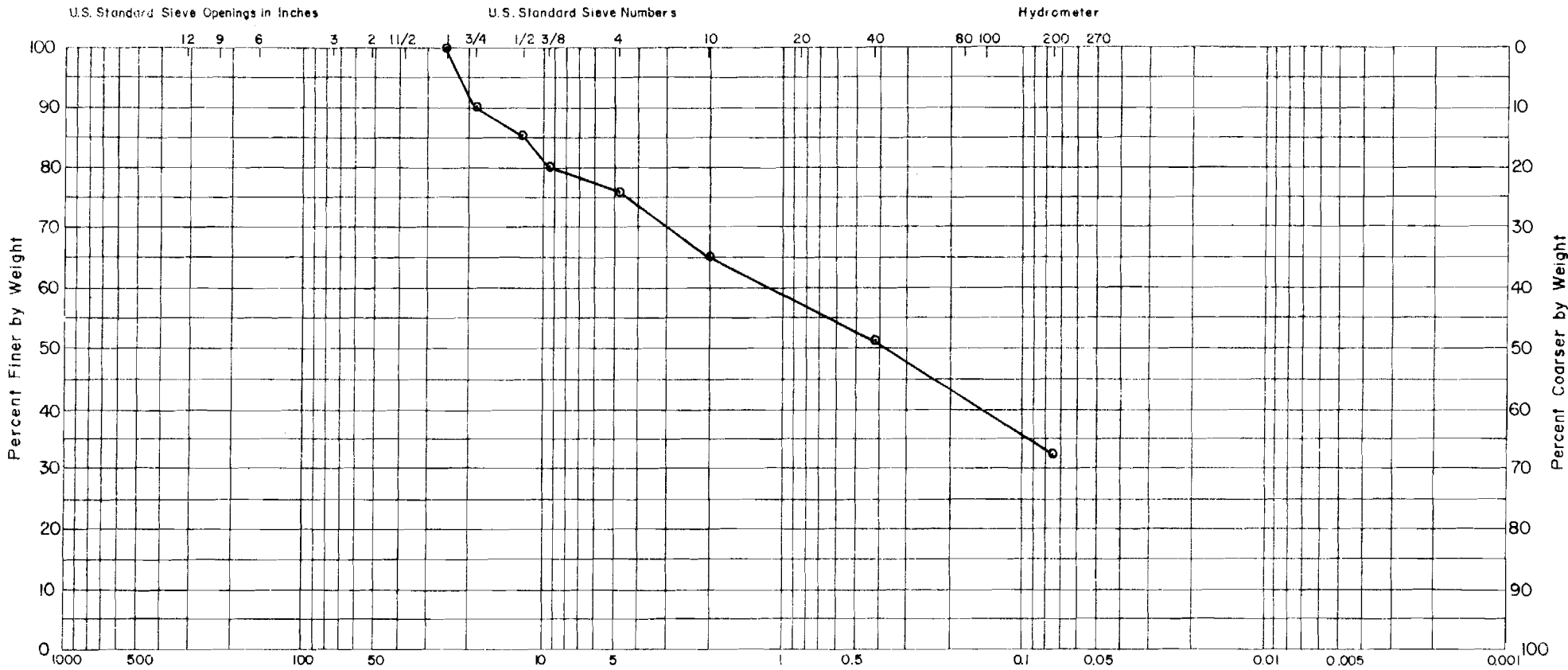
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H2 #5,6,7	7,11,11		18	NP	SM SILTY SAND WITH SOME GRAVEL



BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCI
DATE: Oct. 1981
PROJECT NO. 052506



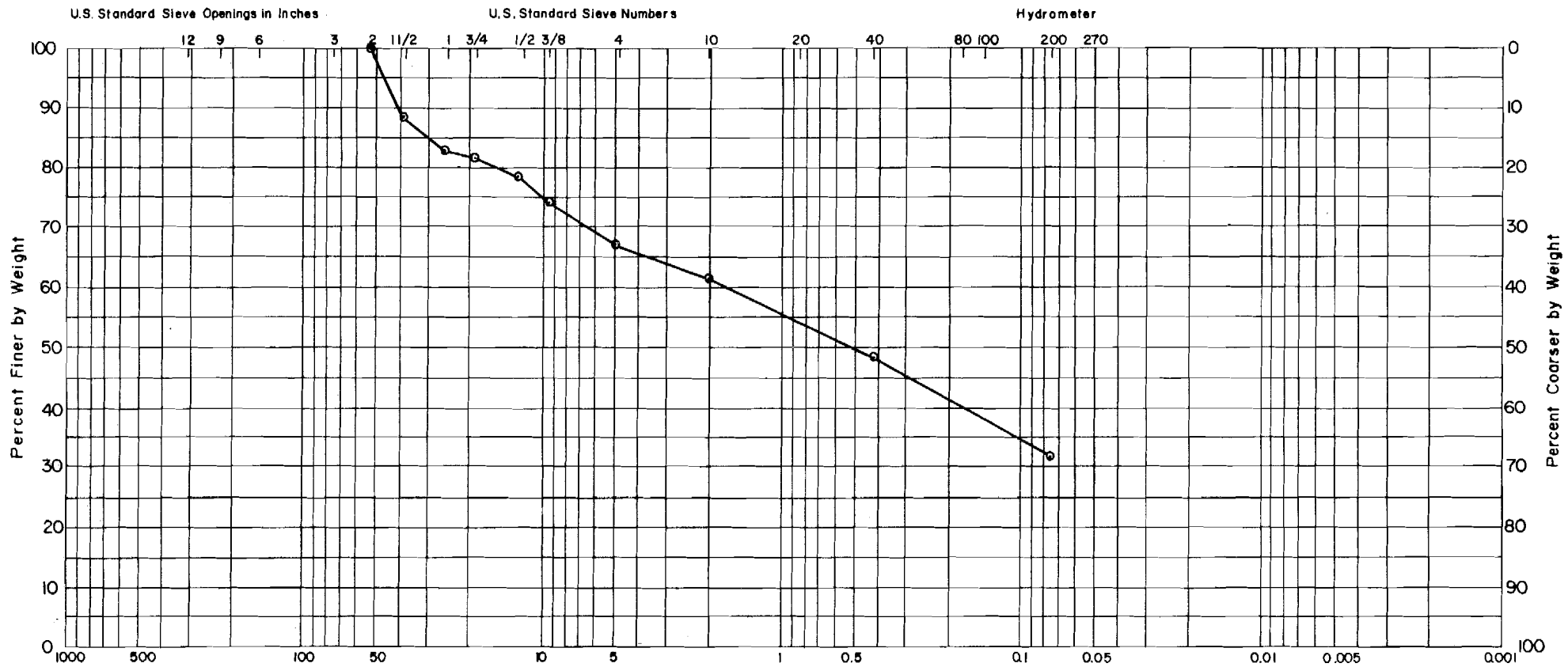
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H2 #8	10			SM	SILTY SAND WITH SOME GRAVEL



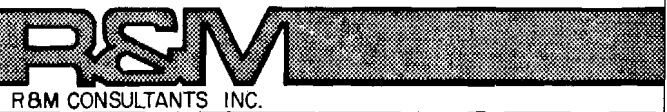
BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCl
DATE: Oct. 1981
PROJECT NO. 052506



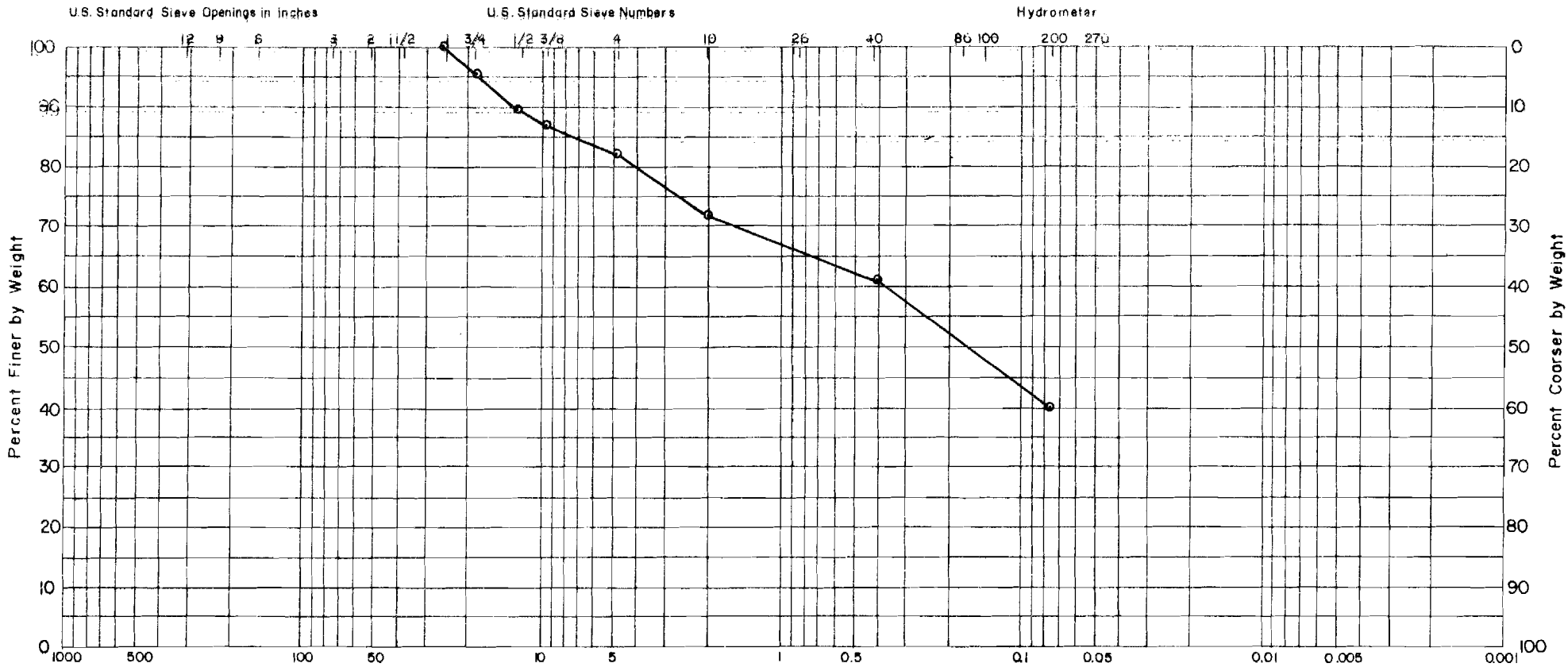
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H2 #9,10	9,6		17	NP	SM SILTY, GRAVELLY SAND



BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



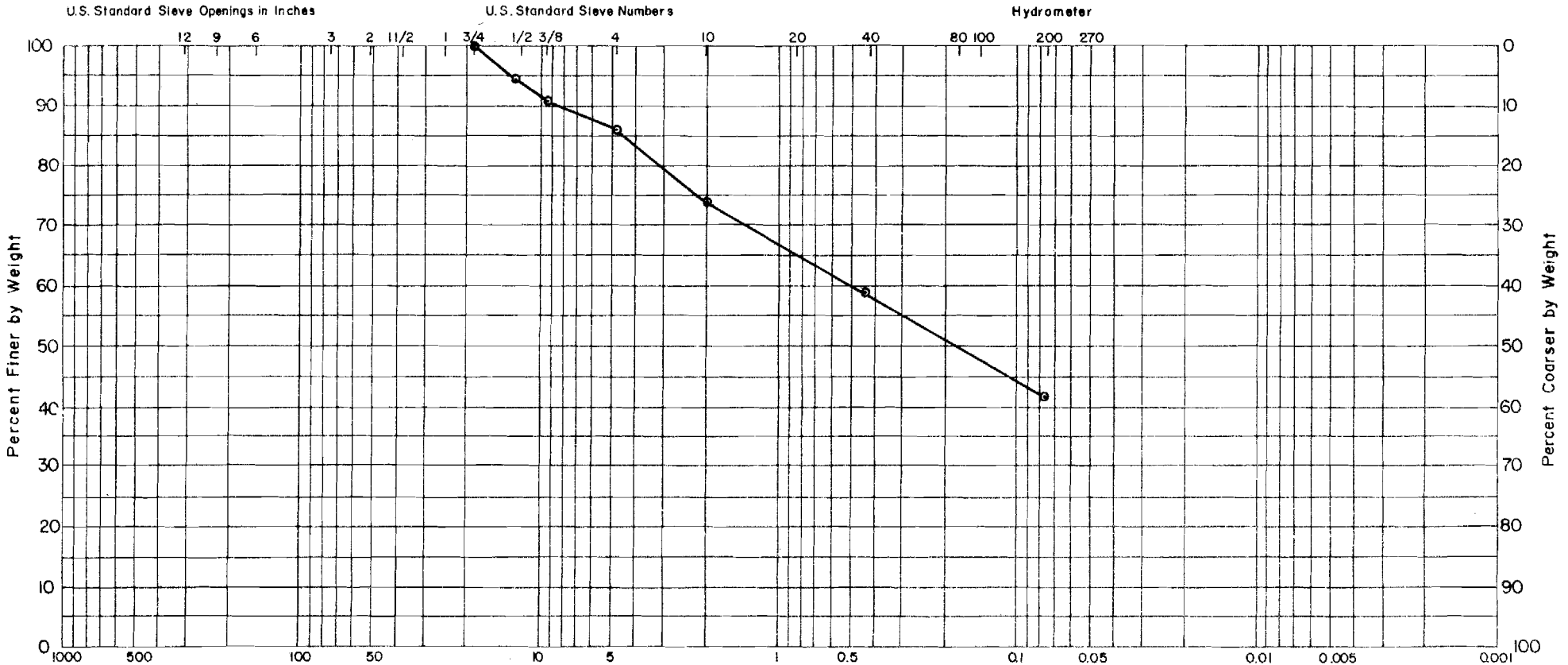
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H2 #11,12,13	8, 8, 7		18	5	SM-SC SILTY SAND WITH SOME GRAVEL, TRACE CLAY



BORROW AREA H
AUGER HOLE AH-H2

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



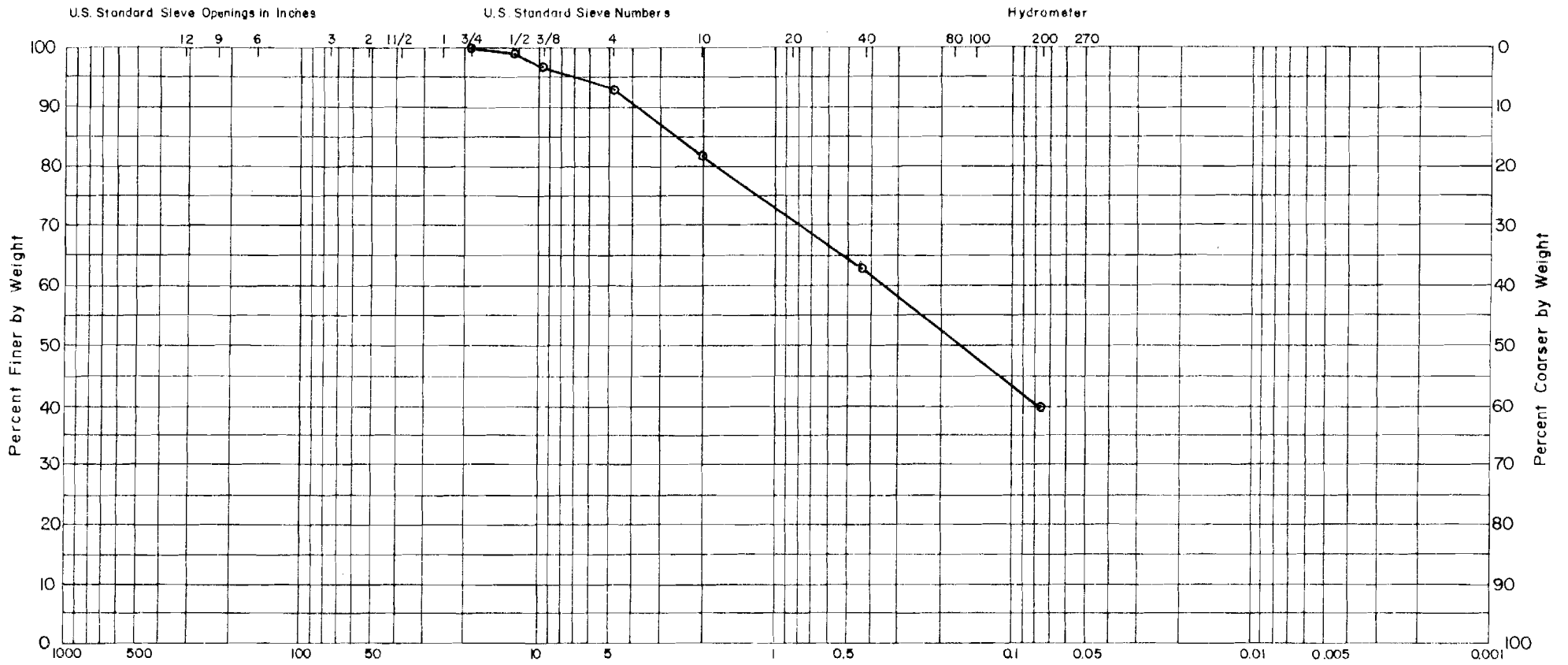
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOTISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H3 #4, 5	19, 14		18	5	SM-SC SILTY SAND WITH SOME GRAVEL, TRACE CLAY



BORROW AREA H
 AUGER HOLE AH-H3

DRAWN BY:
 APPROVED BY: MCH
 DATE: Oct. 1981
 PROJECT NO. 052506



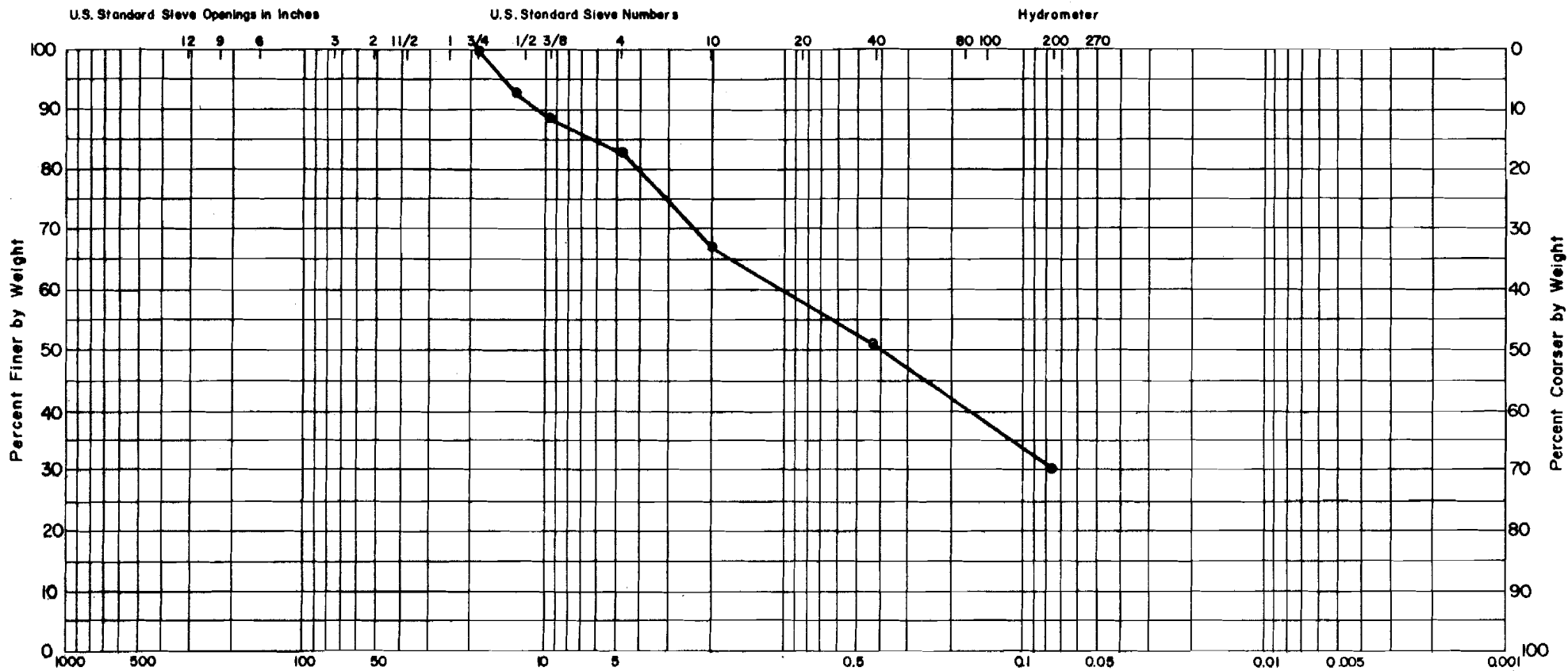
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H3 #7	12		NV	NP	SM SILTY SAND WITH TRACE GRAVEL



BORROW AREA H
AUGER HOLE AH-H3

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



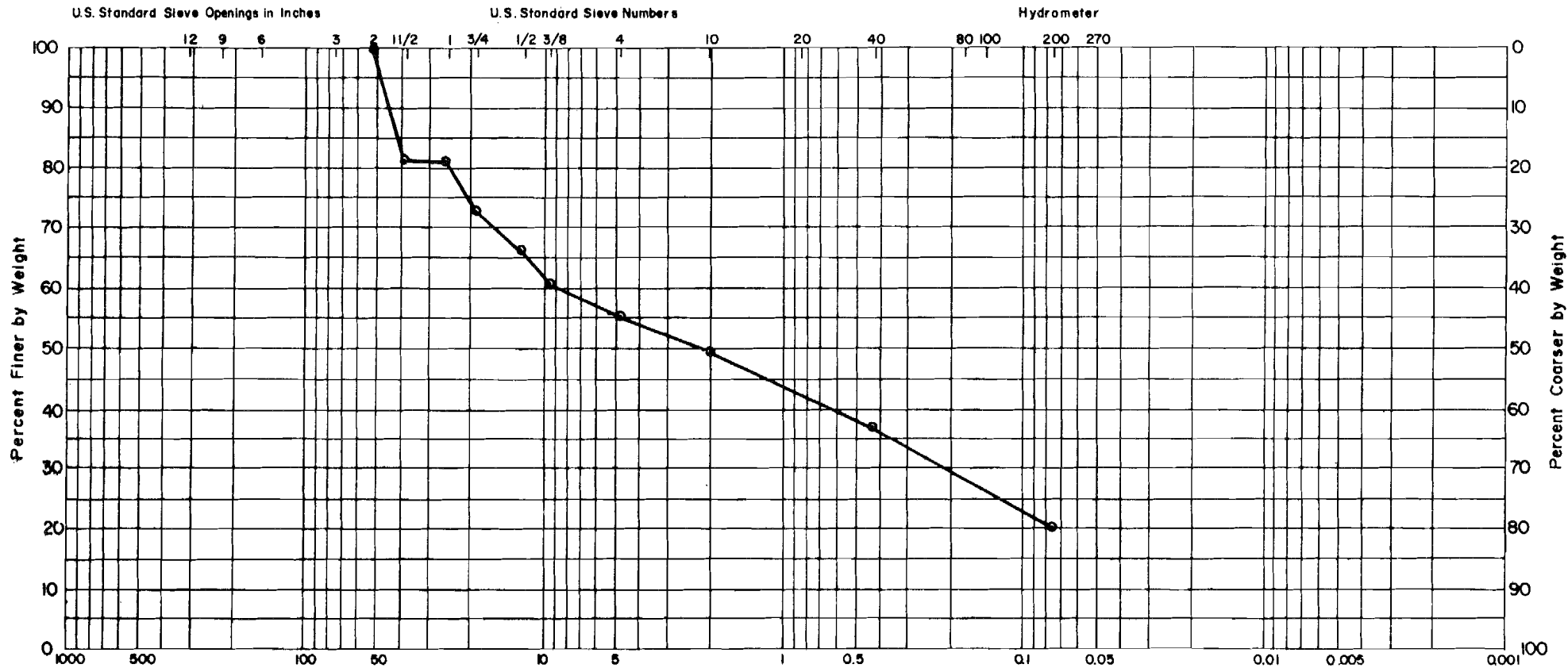
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H3 #8	9		14	NP	SM	SILTY SAND WITH SOME GRAVEL



BORROW AREA H
AUGER HOLE AH-H3

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



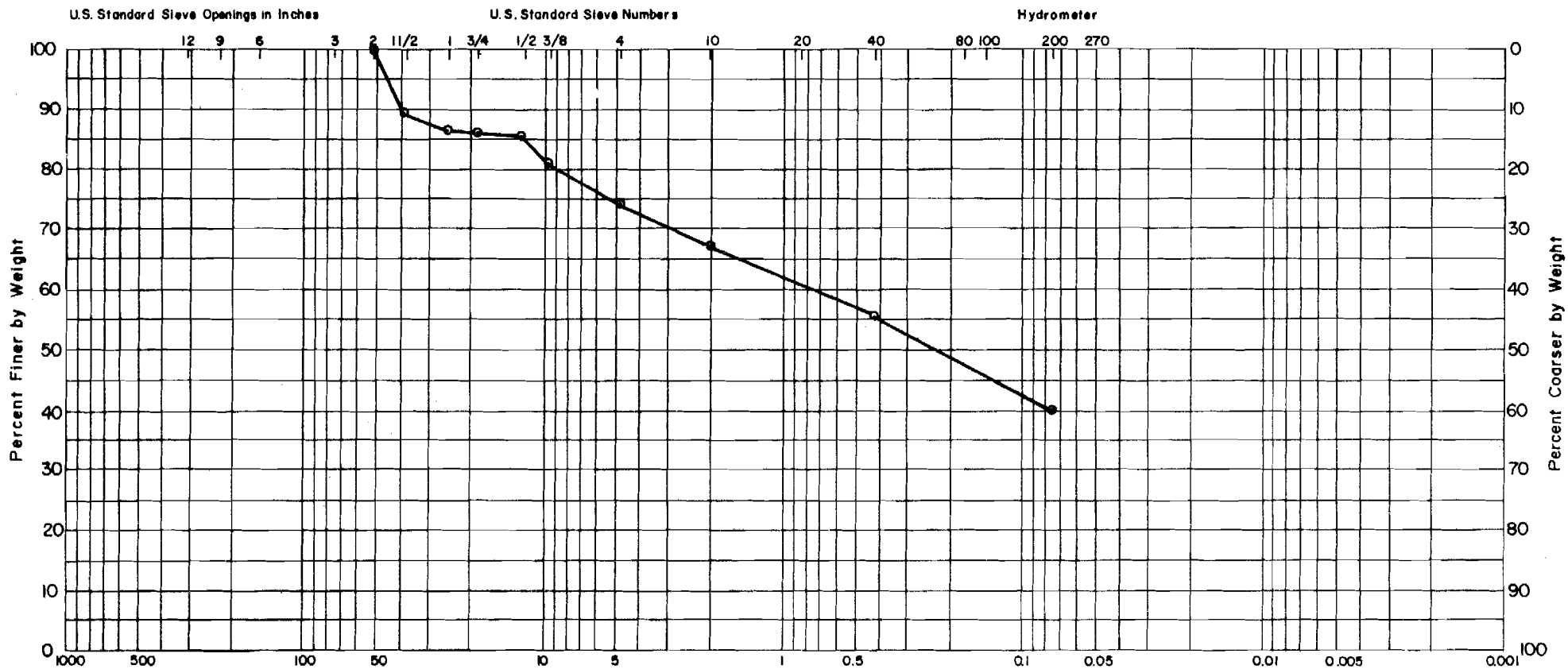
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H4 #3,4	16,13		23	7	GC-GM	SANDY GRAVEL WITH SOME SILT AND TRACE CLAY



BORROW AREA H
AUGER HOLE AH-H4

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



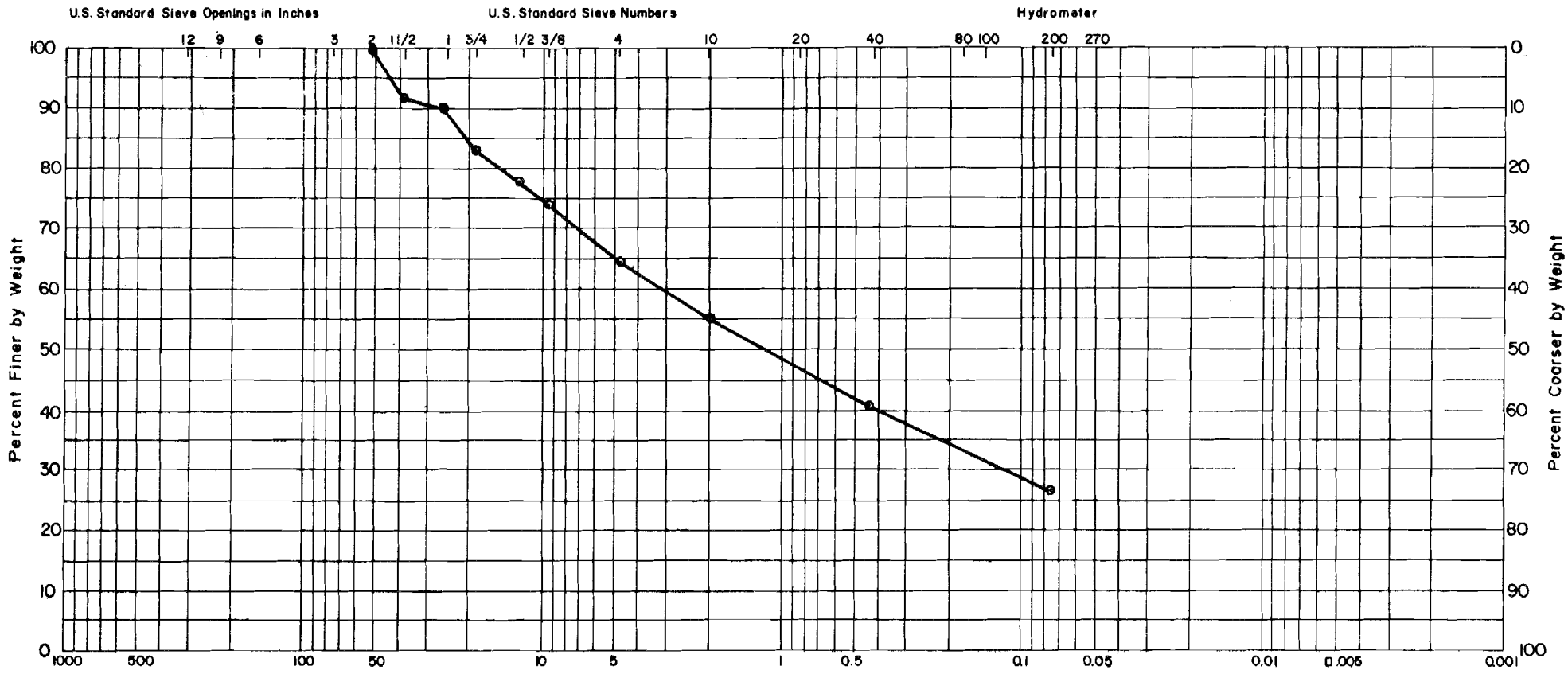
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H4 #5,6	15, 11		20	4	SM-SC SILTY SAND WITH SOME GRAVEL, AND TRACE CLAY



BORROW AREA H
AUGER HOLE AH-H4

DRAWN BY:
APPROVED BY: MCH
DATE: Oct, 1981
PROJECT NO. 052506



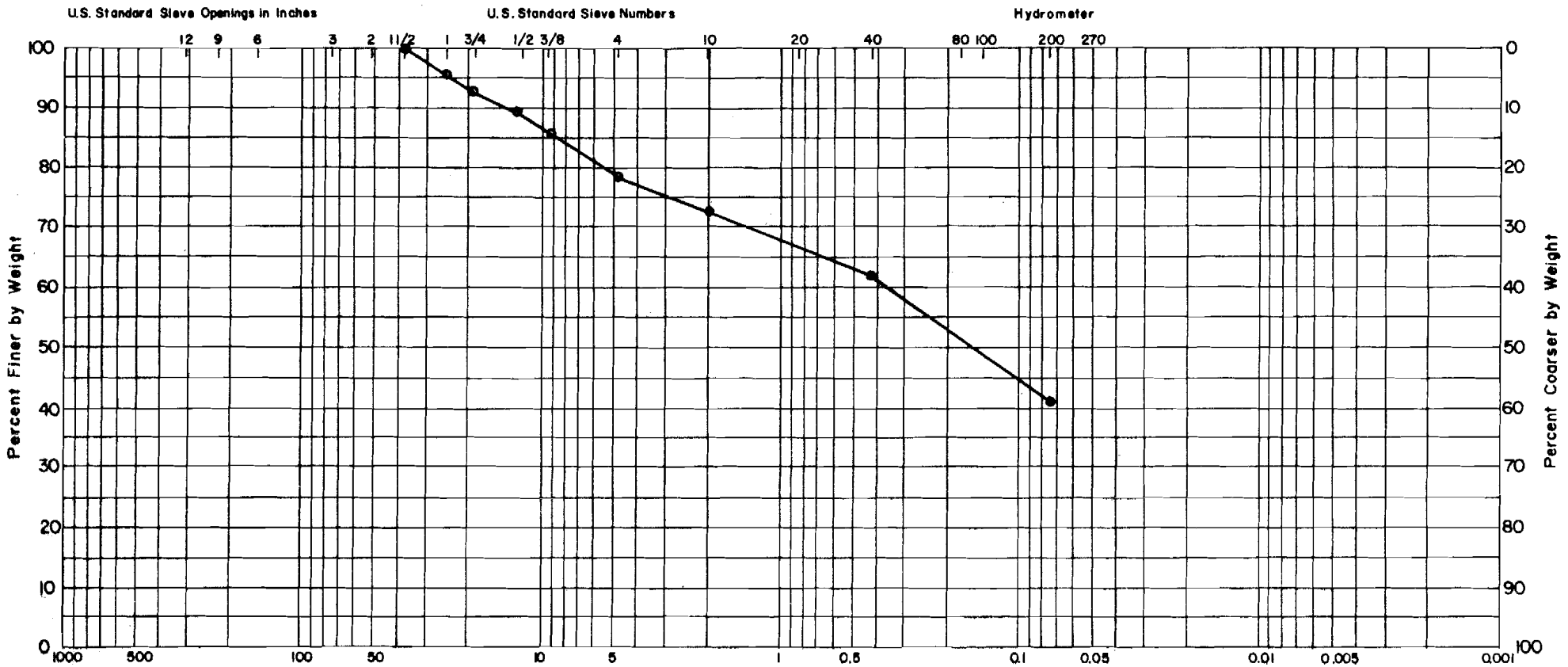
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H4 #7,8	11		22	NP	SM GRAVELLY SAND WITH SOME SILT



BORROW AREA H
AUGER HOLE AH-H4

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



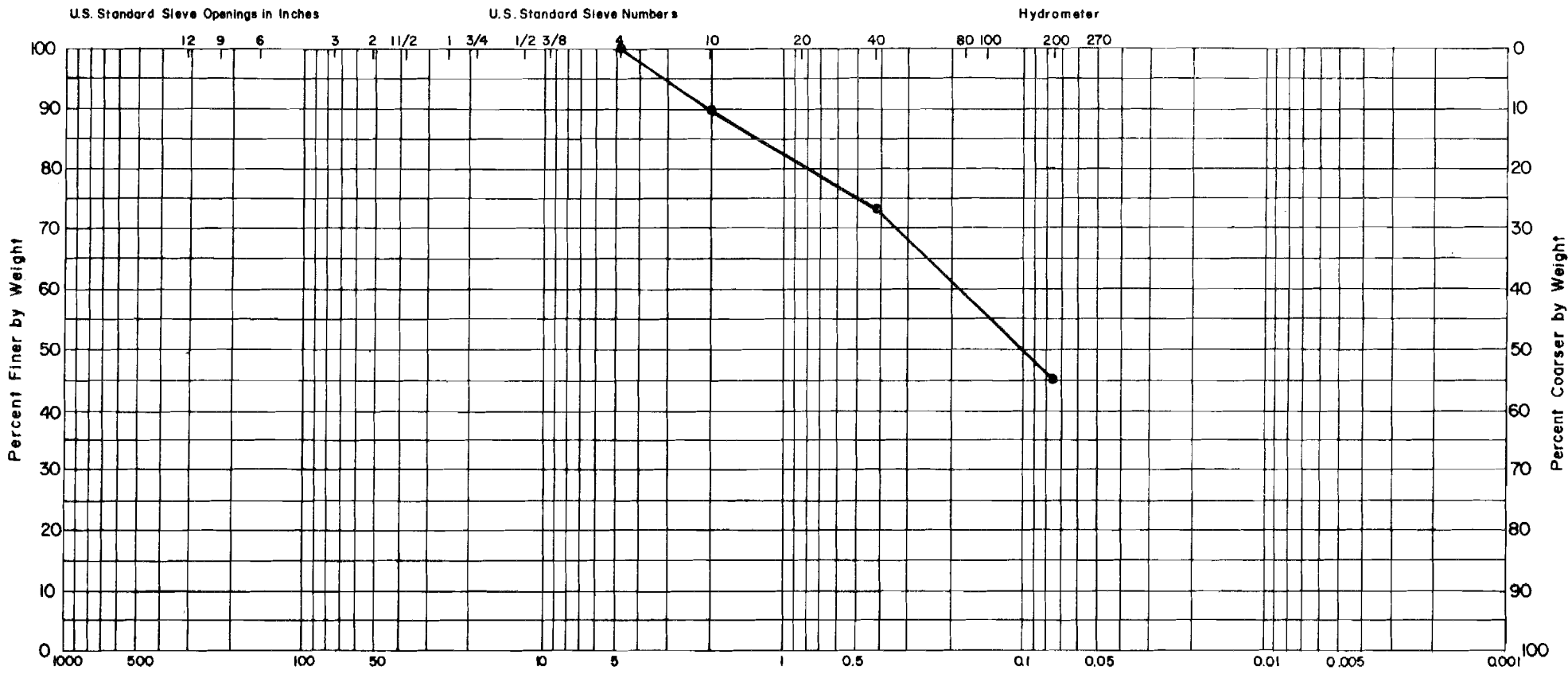
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H5 #4	16		23	6	SM-SC	SILTY SAND WITH SOME GRAVEL AND TRACE CLAY



BORROW AREA H.
AUGER HOLE AH-H5

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



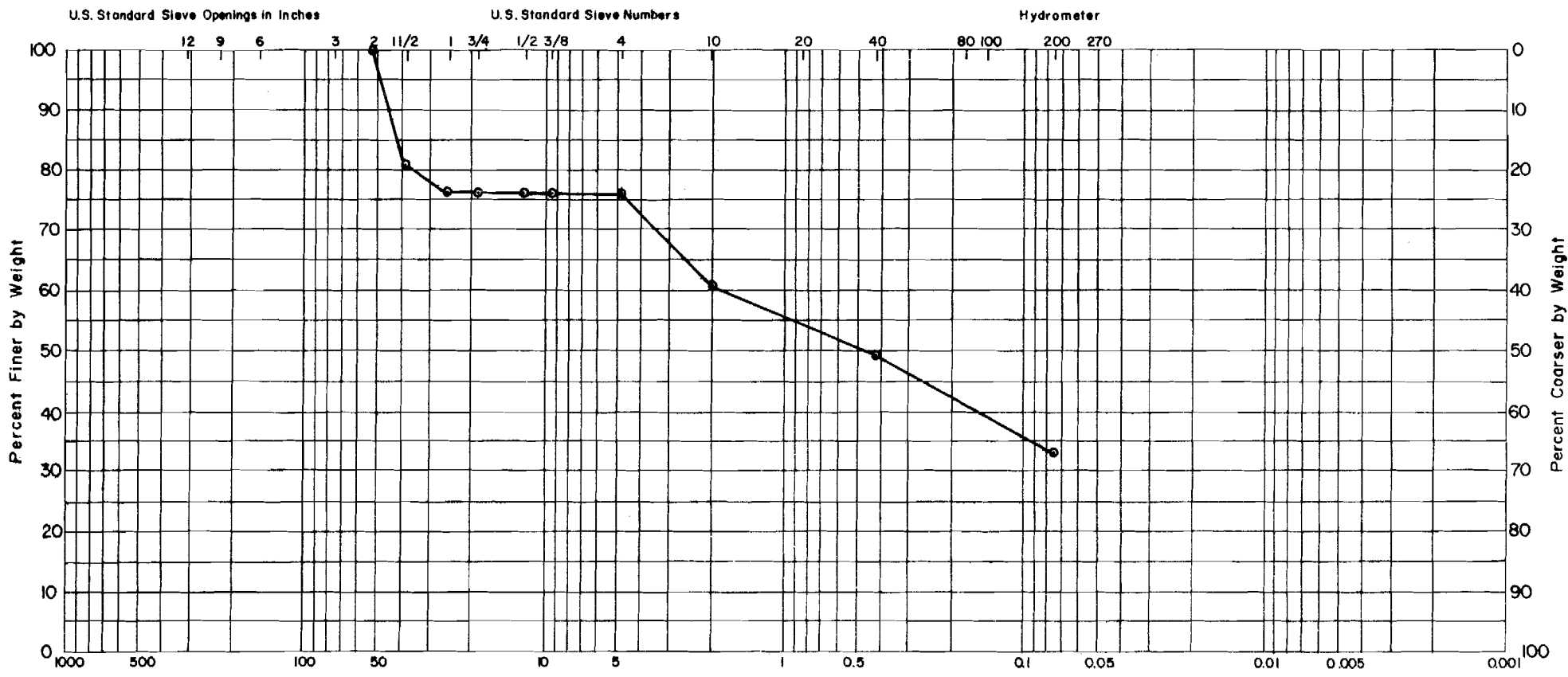
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H5 #5	17		22	6	SM-SC	SILTY SAND WITH TRACE CLAY



BORROW AREA H
AUGER HOLE AH-H5

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



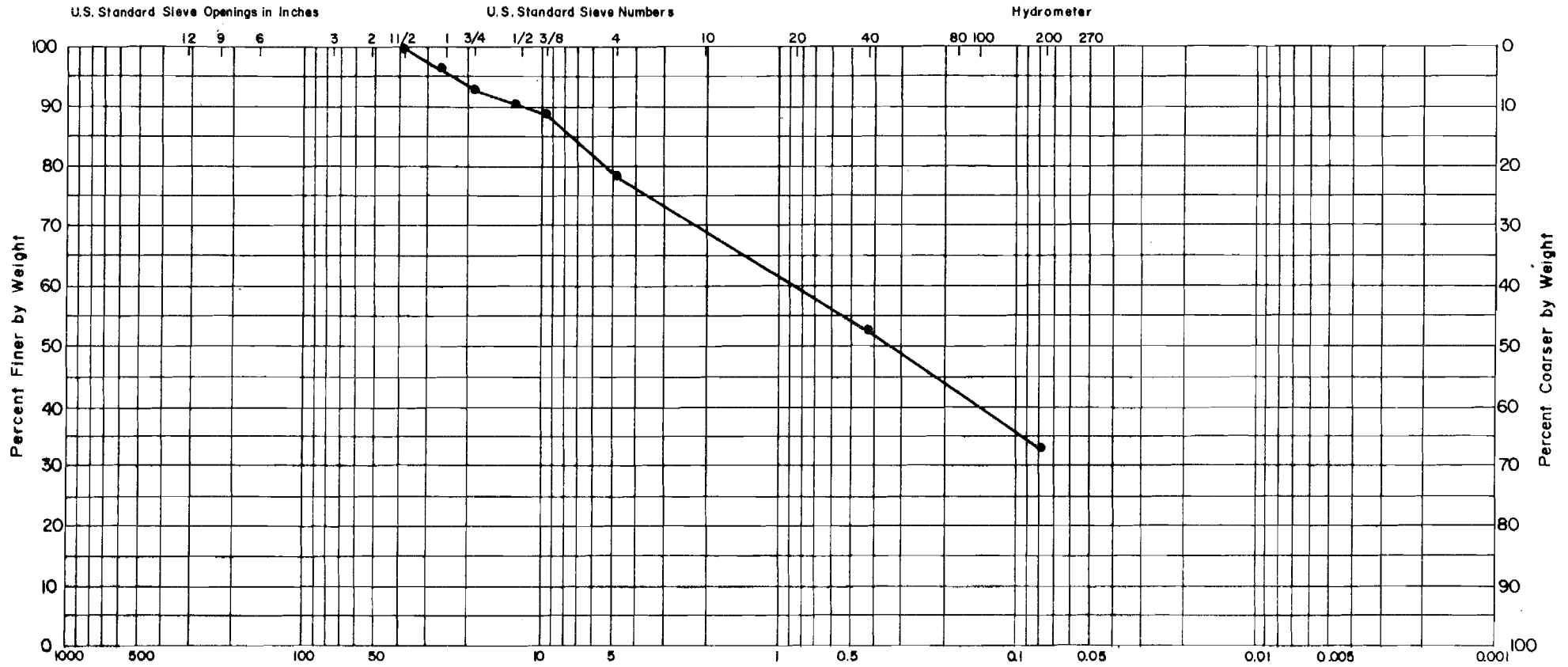
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H5 #6,7	10.9		21	4	SM-SC SILTY SAND WITH SOME GRAVEL AND TRACE CLAY



BORROW AREA H
AUGER HOLE AH-H5

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



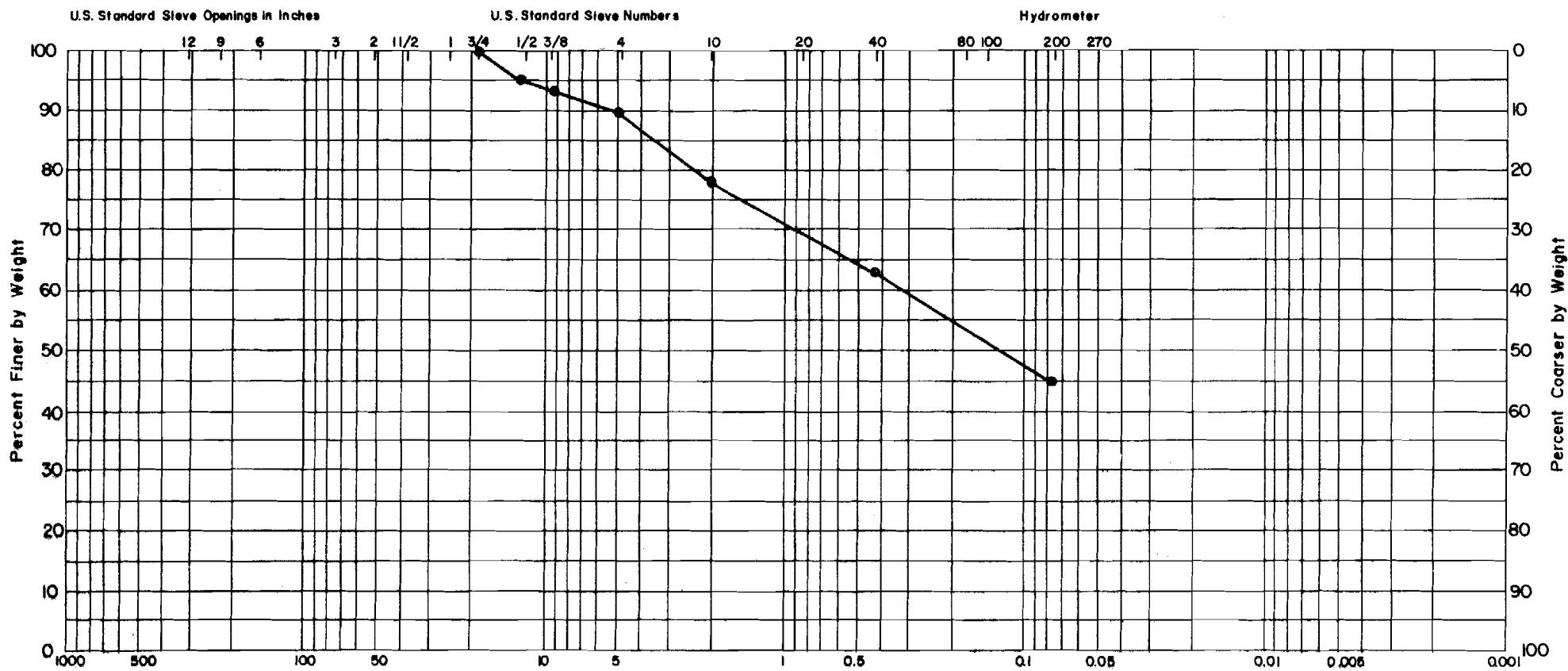
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H6 #6,7	13, 12		NV	NP	SM
					SILTY SAND WITH SOME GRAVEL



BORROW AREA H
AUGER HOLE AH-H6

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



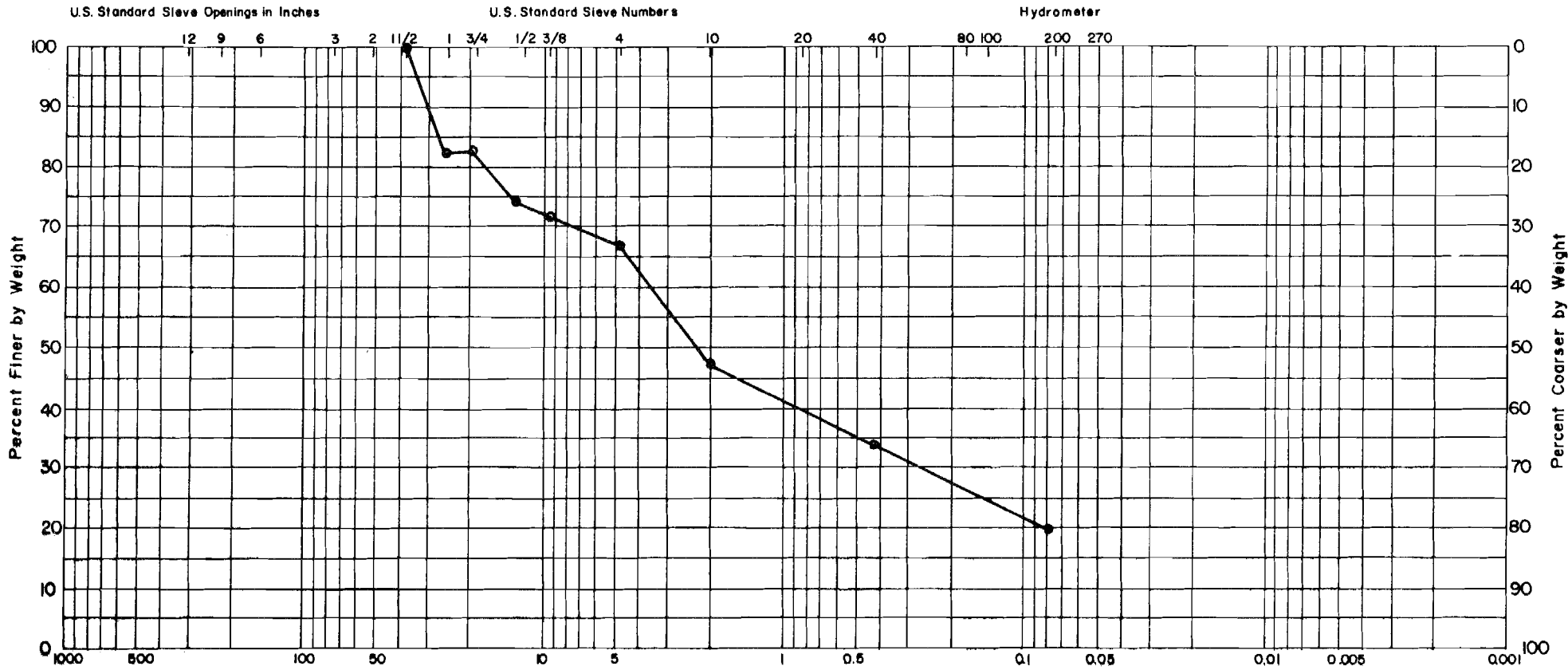
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H6 #10	11		23	9	SC	SILTY SAND WITH TRACE GRAVEL AND CLAY



BORROW AREA H
AUGER HOLE AH-H6

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



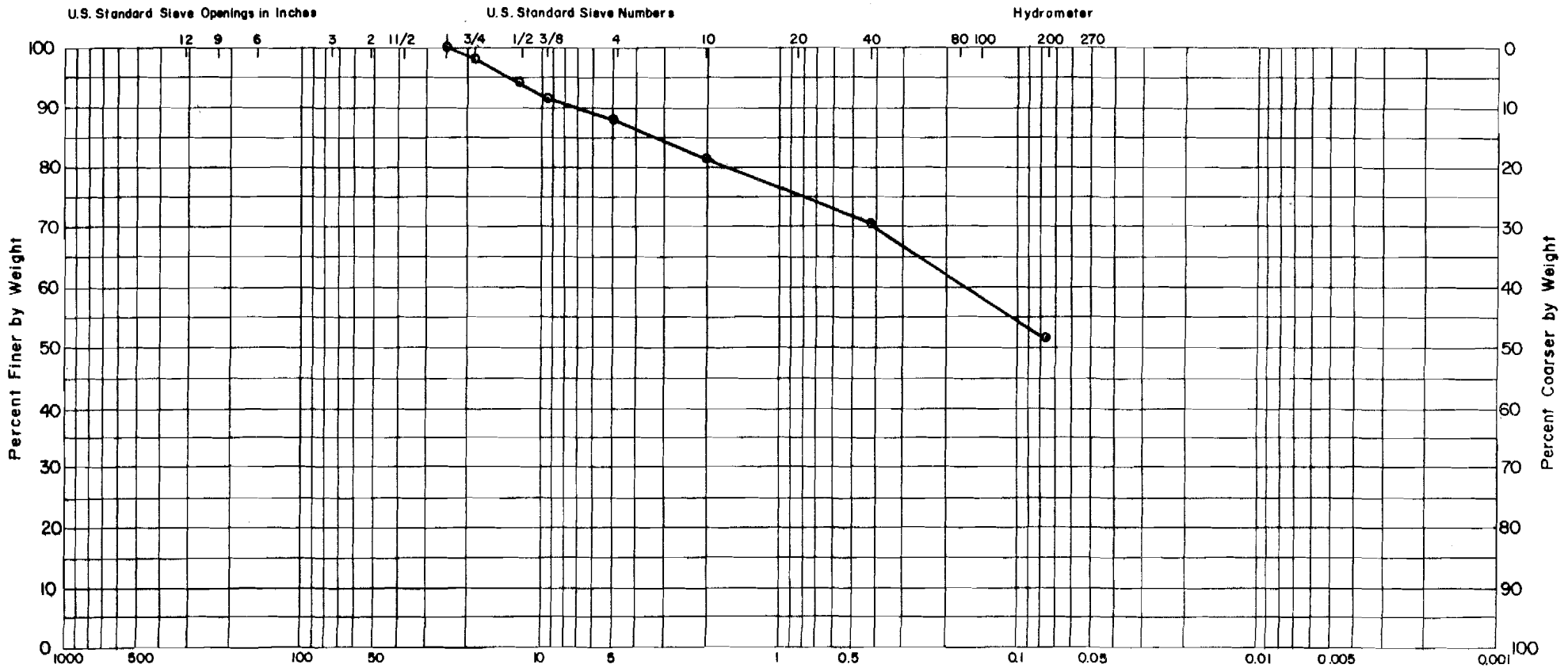
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H6 #12	8		21	6	SM-SC GRAVELLY SAND WITH SOME SILT, TRACE CLAY



BORROW AREA H
 AUGER HOLE AH-H6

DRAWN BY:
 APPROVED BY: MCH
 DATE: Oct, 1981
 PROJECT NO. 052506



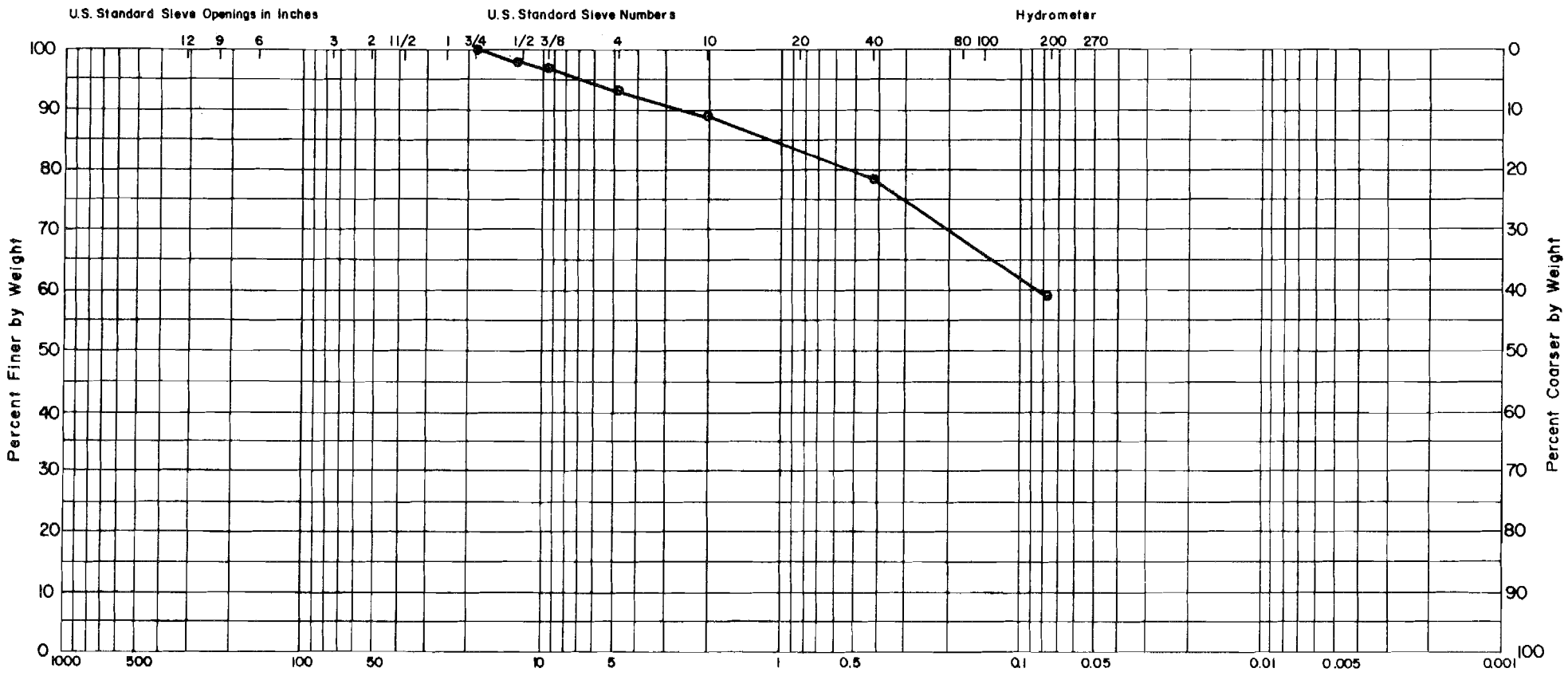
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H7 #5,6	14,17		17	4	ML-CL	SANDY SILT WITH TRACE GRAVEL AND CLAY



BORROW AREA H
 AUGER HOLE AH-H7

DRAWN BY:
 APPROVED BY: MCH
 DATE: Oct. 1981
 PROJECT NO. 052506



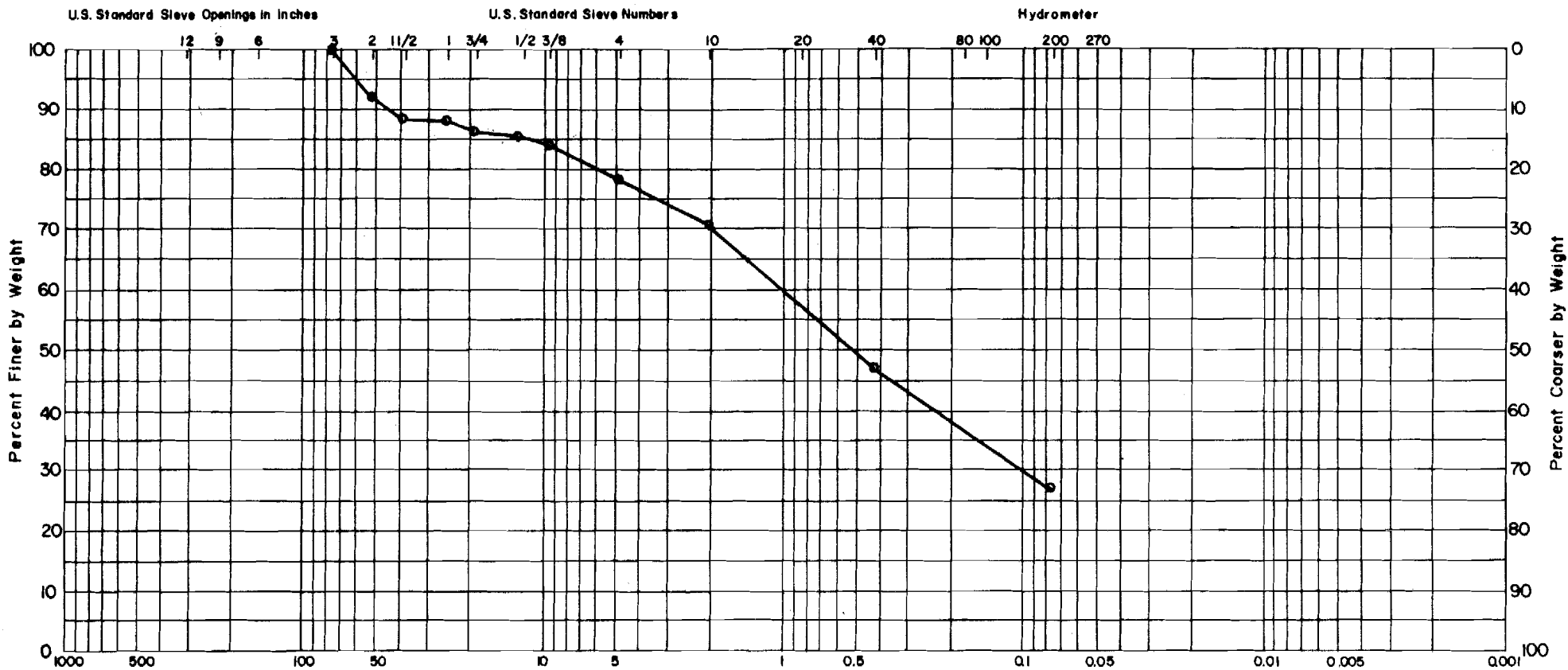
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H7 #7	16		29	14	CL SANDY SILT WITH SOME CLAY AND TRACE GRAVEL



BORROW AREA H
AUGER HOLE AH-H7

DRAWN BY:
APPROVED BY: MCH
DATE: Oct. 1981
PROJECT NO. 052506



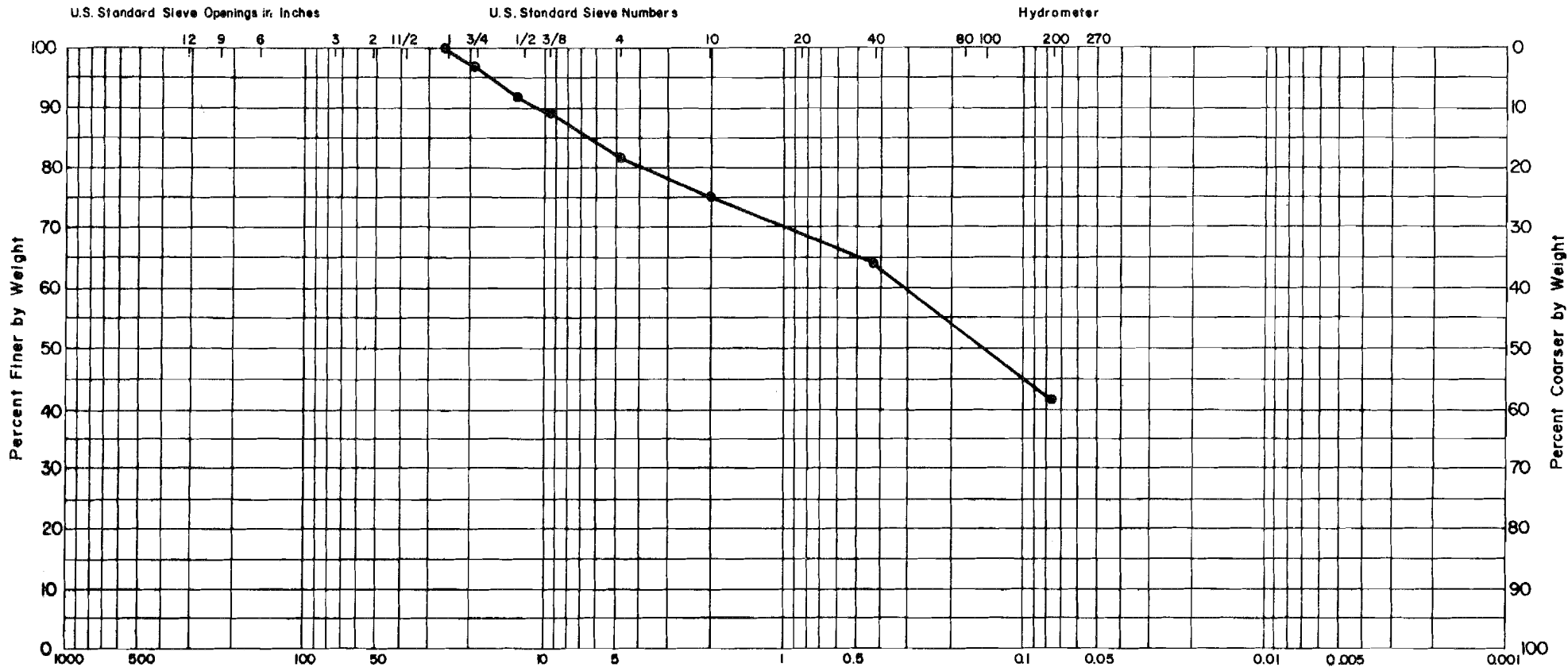
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H7 #9,10	13, 13		33	19	SC SAND WITH SOME CLAY, GRAVEL, AND SILT



BORROW AREA H
 AUGER HOLE AH-H7

DRAWN BY:
 APPROVED BY: MCl
 DATE: Oct. 1981
 PROJECT NO. 052506



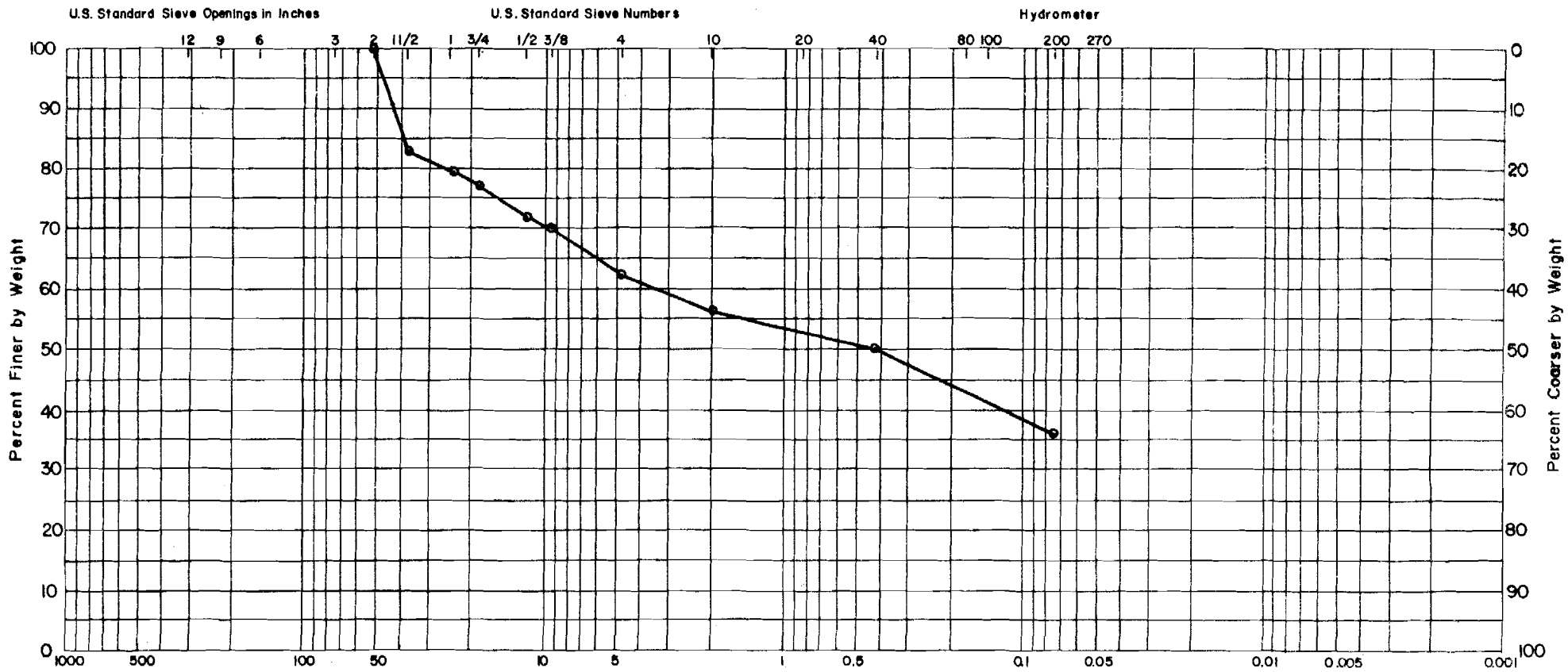
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H8 #5,6	12,13		25	11	SC SAND WITH SOME SILT, GRAVEL, AND CLAY



BORROW AREA H
 AUGER HOLE -AH-H8

DRAWN BY:
 APPROVED BY: MCH
 DATE: Oct. 1981
 PROJECT NO. 052506



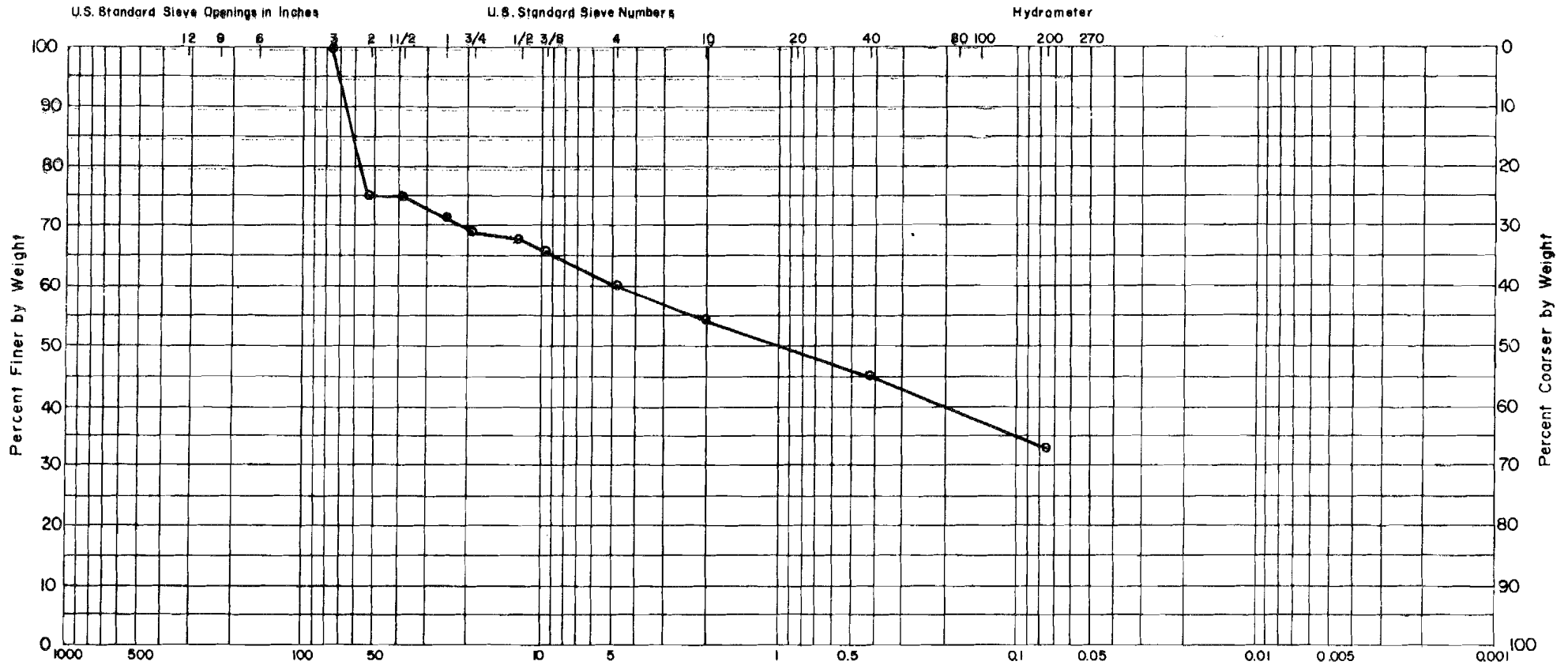
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
AH-H8 #7	7		21	7	GC-GM SILTY GRAVEL WITH SOME SAND, TRACE CLAY



BORROW AREA H
AUGER HOLE AH-H8

DRAWN BY:
APPROVED BY: MCH
DATE: oct. 1981
PROJECT NO. 052506



BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
AH-H8 #8,9	6,6		21	7	GC-GM	GRAVEL WITH SOME SAND, SILT, AND TRACE CLAY



BORROW AREA H
 AUGER HOLE AH-H8

DRAWN BY:
 APPROVED BY: MCH
 DATE: Oct. 1981
 PROJECT NO. 052506

R&M Consultant Inc.
LABORATORY COMPACTION CONTROL REPORT

Job Name and Location Susitna (Watana Dam Site)

Architect or Engineer Acres American Inc.

Contractor _____

A. Description of Soil: Poorly Graded 'Till', SILTY GRAVEL AND SAND W/TRACE CLAY

Material Mark C Unified Classification GC-SC AASHO Classification _____

Source of Material Borrow Area H Sample No. W-80-256

Natural Water Content 10.9 % Natural Dry Density _____ PCF Specific Gravity _____

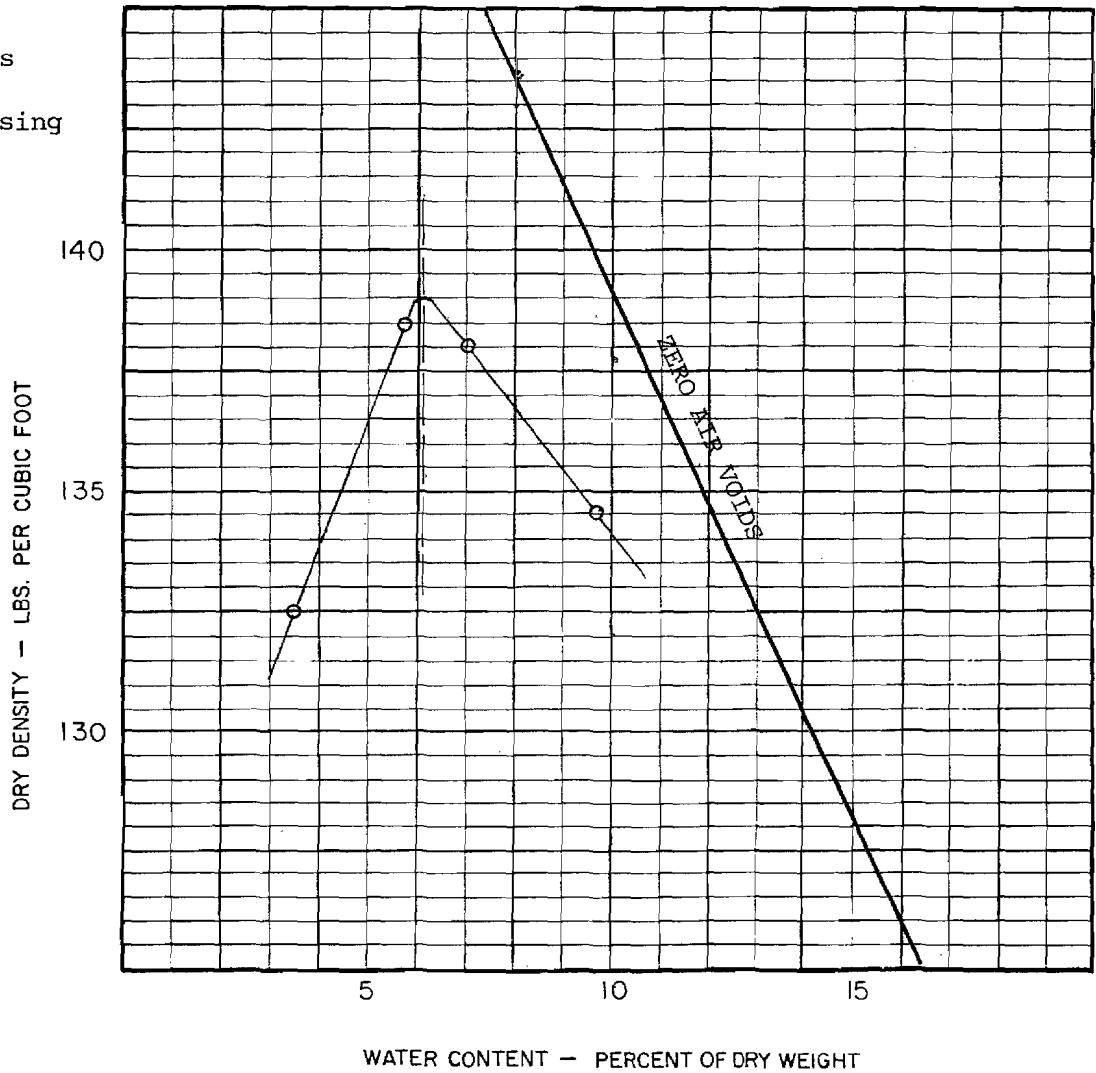
Liquid Limit 21.7 % Plastic Limit _____ % Plasticity Index 9.2

B. Test Procedure Used T-180 Method "D" - AASHTO

C. Test Results: Maximum Dry Density 139.0 PCF Optimum Water Content 6.2 %

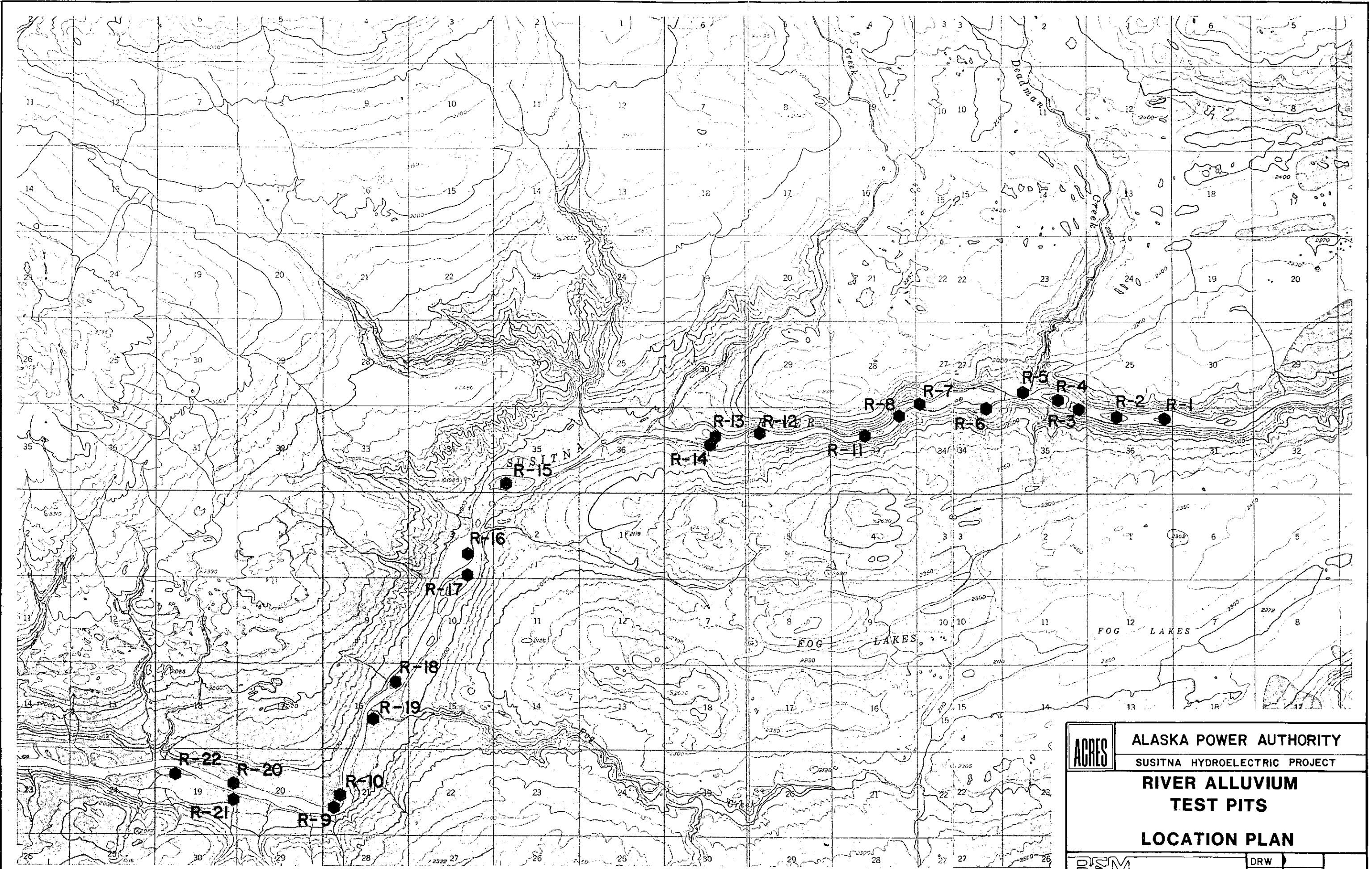
Sieve Analysis

Size	% Passing
2 "	100
1 1/2 "	95
1 "	88
3/4 "	84
1/2 "	81
3/8 "	78
# 4	71
# 10	64
# 40	53
#200	38.2
.02mm	24.3
.005	13.6
.002	8.6

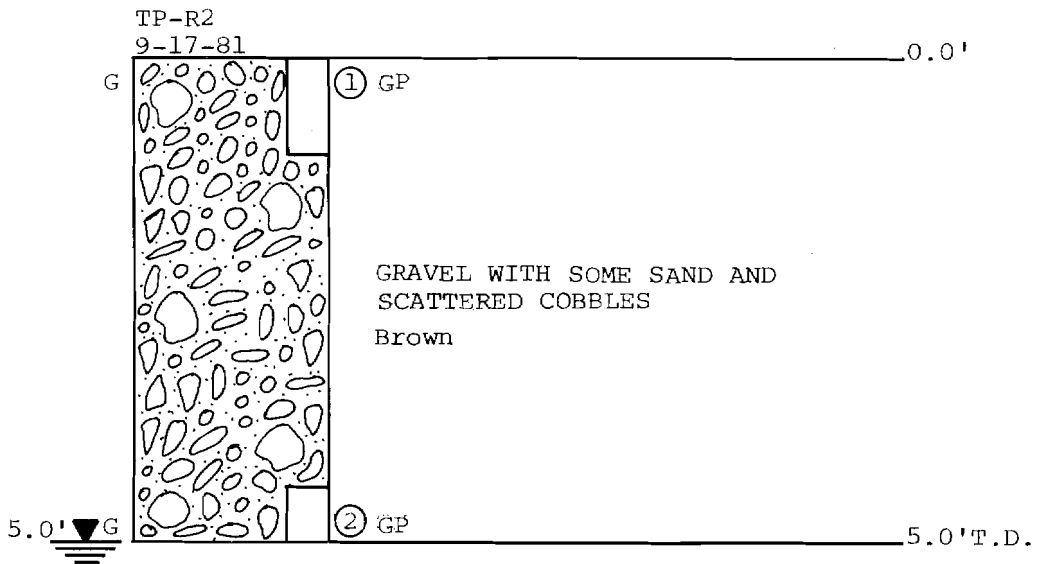
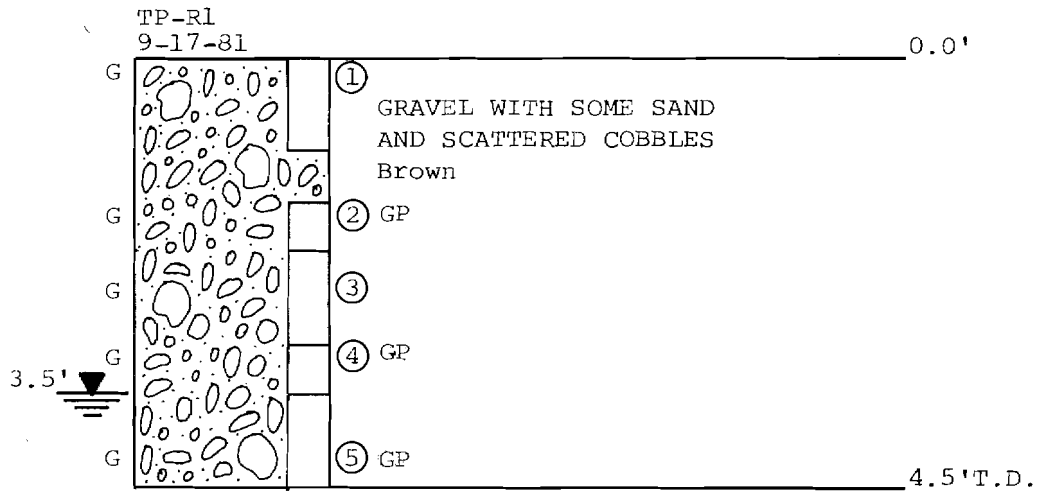


F.4 BORROW SITES I AND J

TEST PIT/TEST TRENCH LOGS



ACRES	ALASKA POWER AUTHORITY	
	SUSITNA HYDROELECTRIC PROJECT	
RIVER ALLUVIUM TEST PITS		
LOCATION PLAN		
R&M R&M CONSULTANTS, INC. ENGINEERS GEOLOGISTS PLANNERS SURVEYORS	DRW	
	CHK	
	APP'D	



ALASKA RESOURCES LIBRARY
U.S. Department of the Interior

Prepared by:

Prepared for:



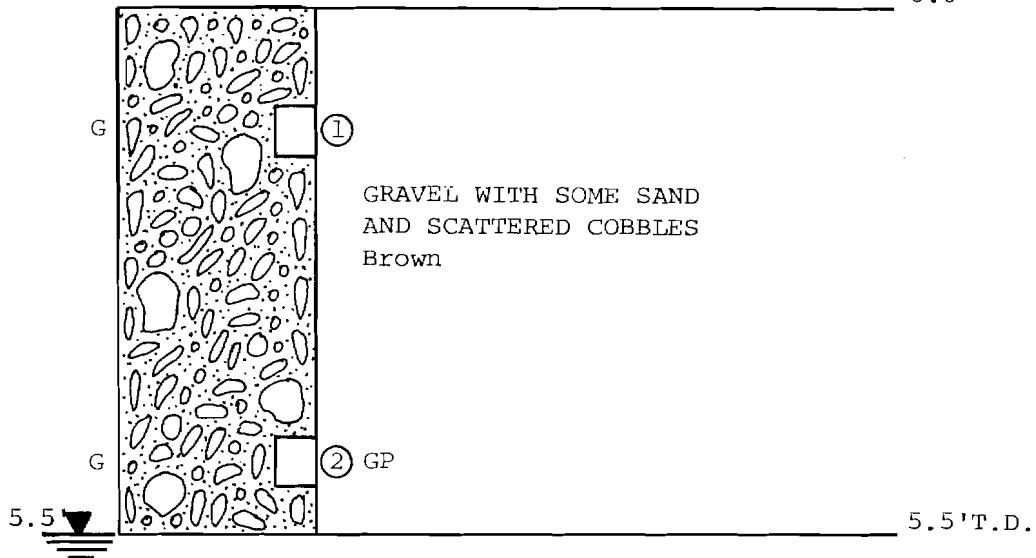
RIVER ALLUVIUM
TEST PITS
TP-R1, R2



Scale: 1"=2'

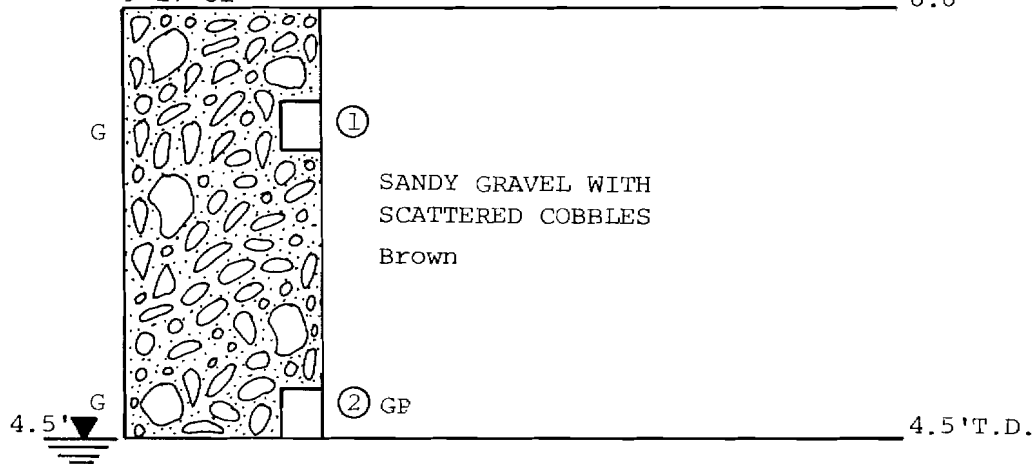
TP-R3
9-17-81

0.0'



TP-R4
9-17-81

0.0'



Prepared by:

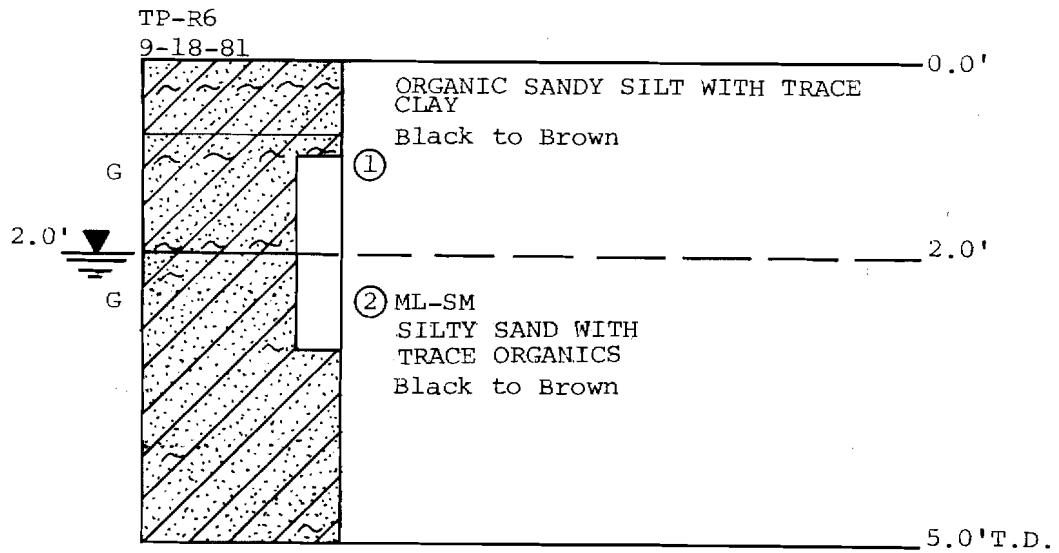
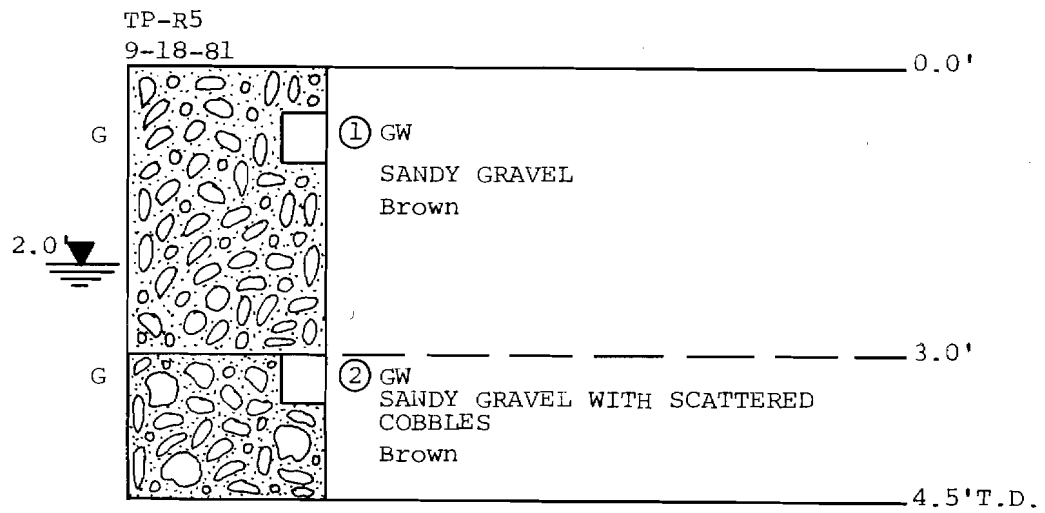
Prepared for:



RIVER ALLUVIUM
TEST PITS
TP-R3, R4



Scale: 1"=2'



Prepared by:

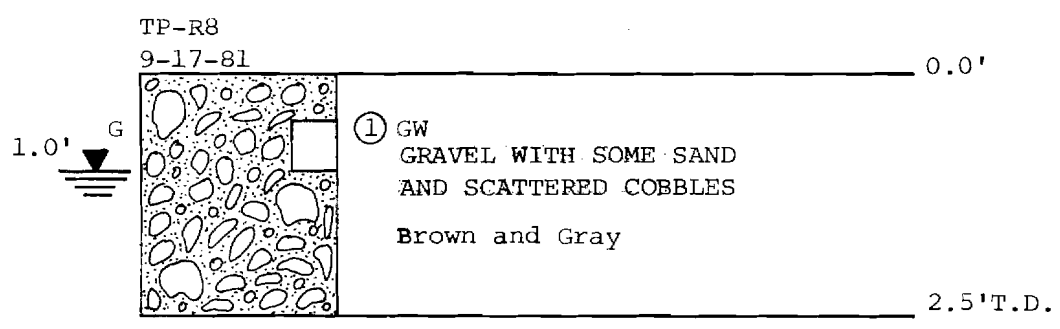
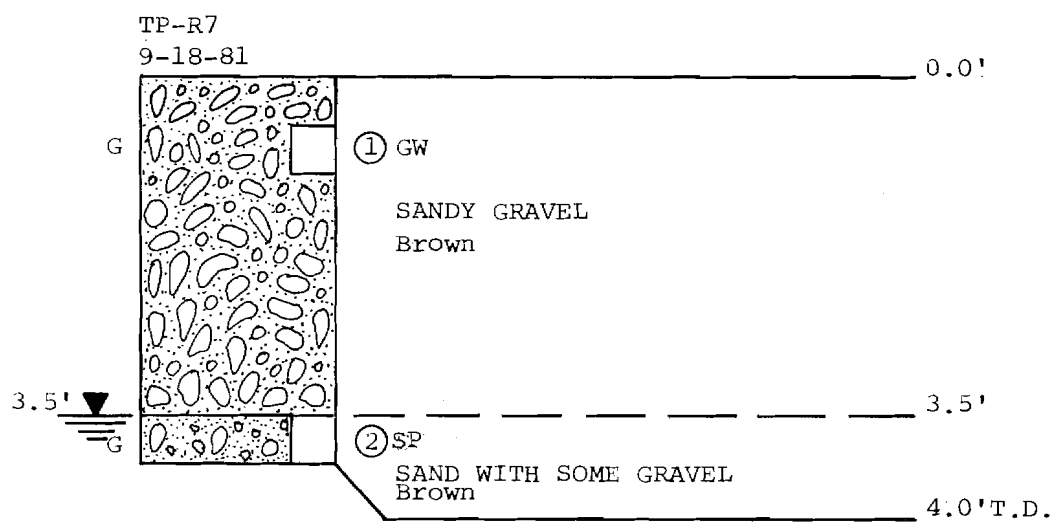
Prepared for:



RIVER ALLUVIUM
TEST PITS
TP-R5, R6



Scale: 1"=2'



Prepared by:

Prepared for:

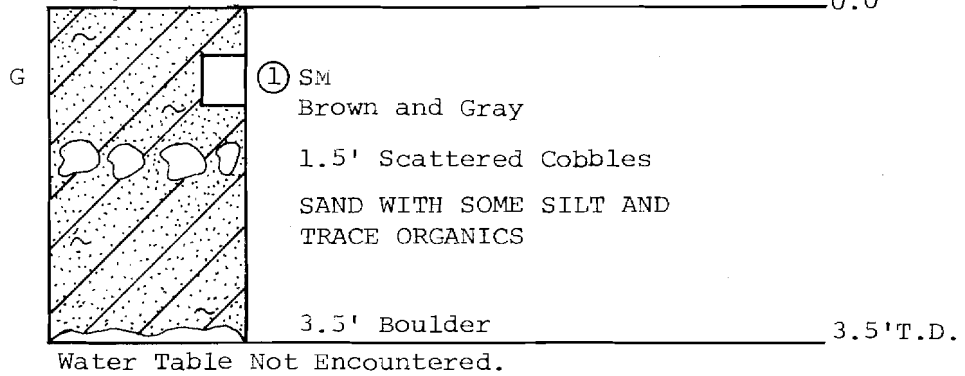


RIVER ALLUVIUM
TEST PITS
TP-R7, R8

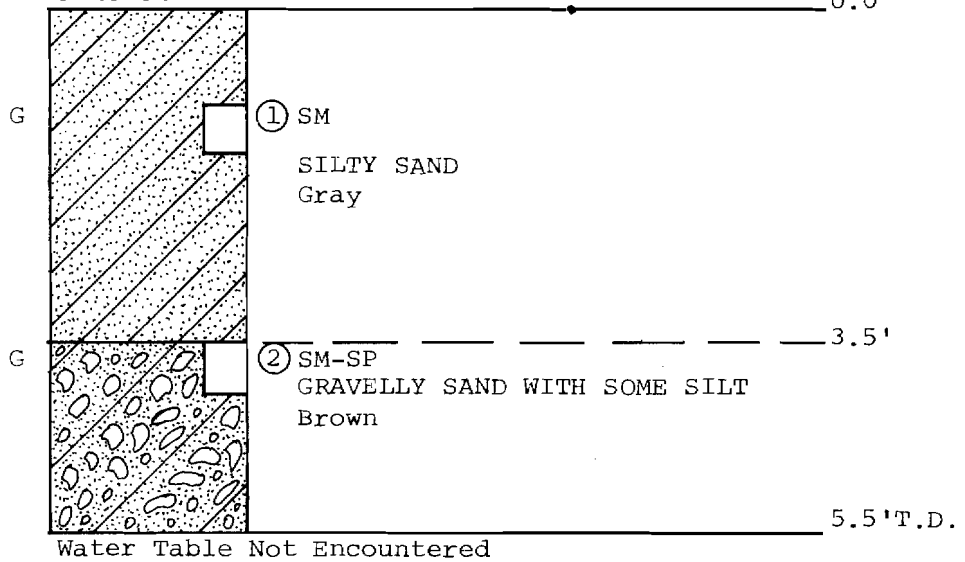


Scale: 1"=2'

TP-R9
9-18-81



TP-R10
9-18-81



Prepared by:

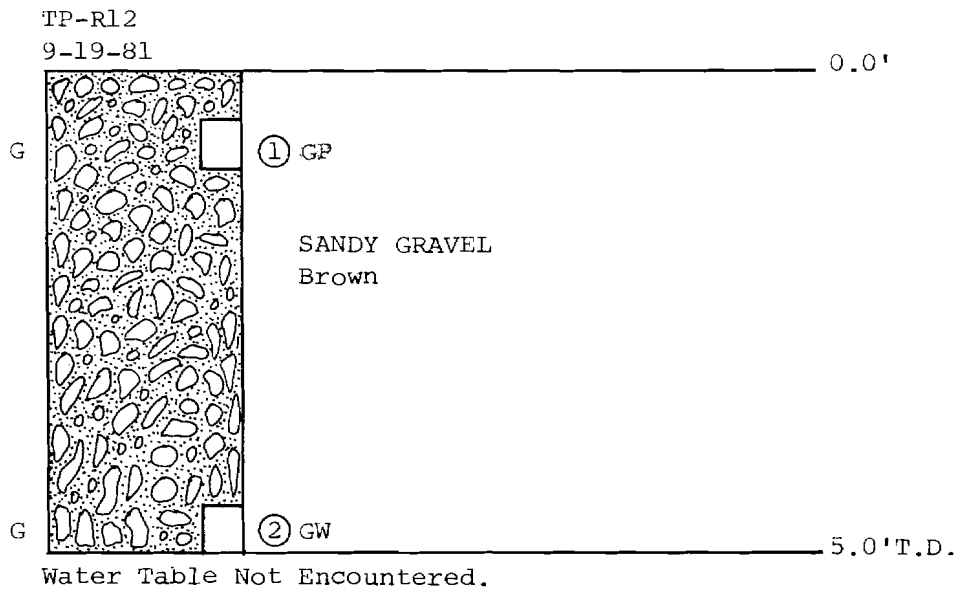
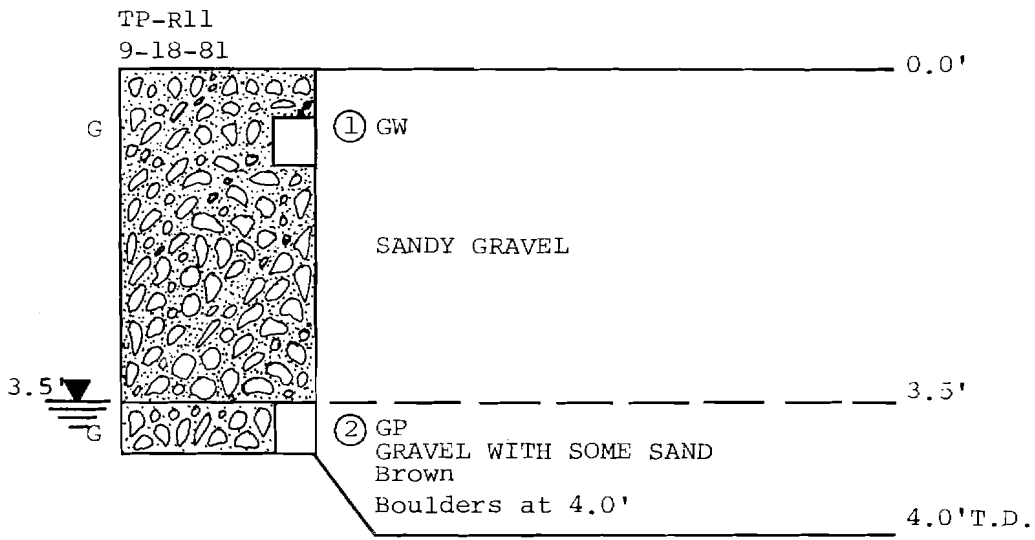
Prepared for:



RIVER ALLUVIUM
TEST PITS
TP-R9, R10



Scale: 1"=2'



Prepared by:

Prepared for:



RIVER ALLUVIUM
TEST PITS
TP-R11, R12



Scale: 1"=2'

TP-R13
9-19-81

0.0'



①

SANDY GRAVEL
Brown

② GP

6.0' T.D.

Water Table Not Encountered.

TP-R14
9-19-81

0.0'



① GW

SANDY GRAVEL
Brown

② GP

6.0' T.D.

Water Table Not Encountered

Prepared by:

Prepared for:

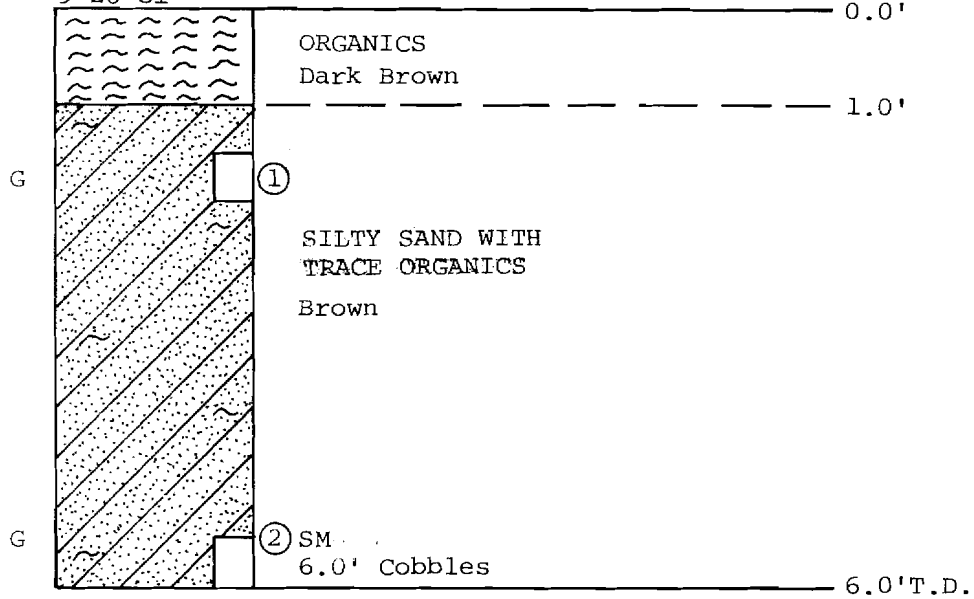


RIVER ALLUVIUM
TEST PITS
TP-R13, R14

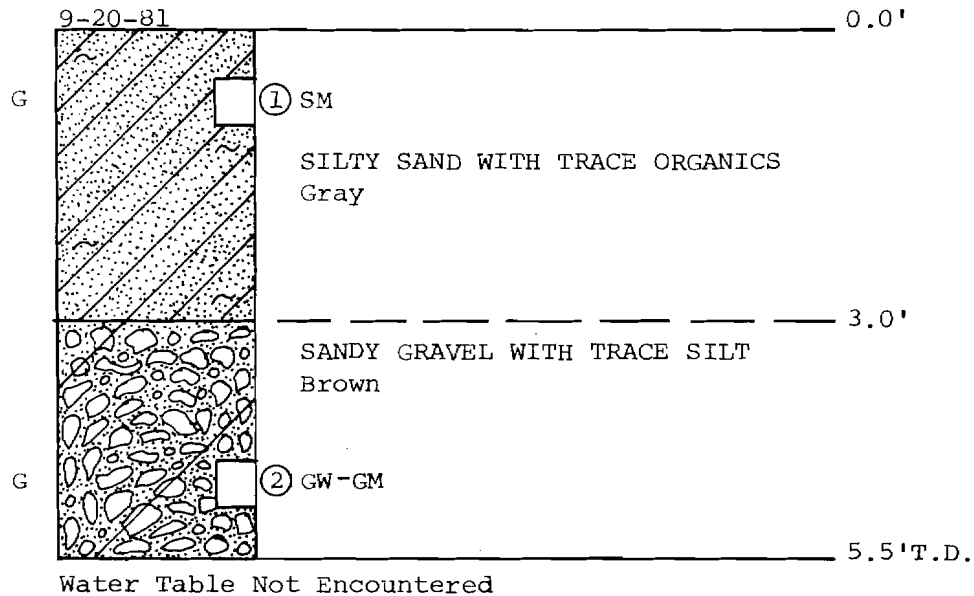


Scale: 1"=2'

TP-R15
9-20-81



TP-R16
9-20-81



Prepared by:

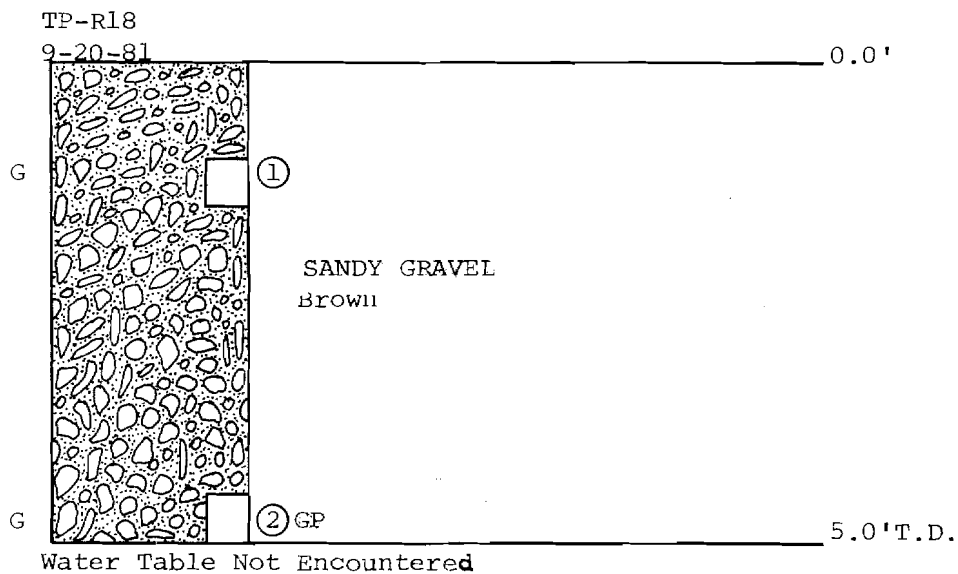
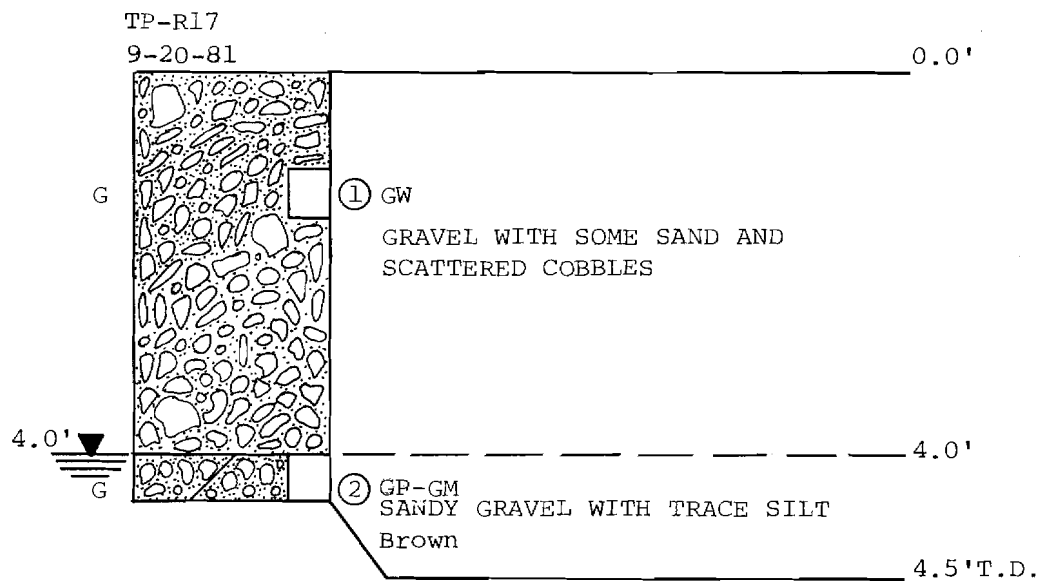
Prepared for:



RIVER ALLUVIUM
TEST PITS
TP-R15, R16



Scale: 1"=2'



Prepared by:

Prepared for:

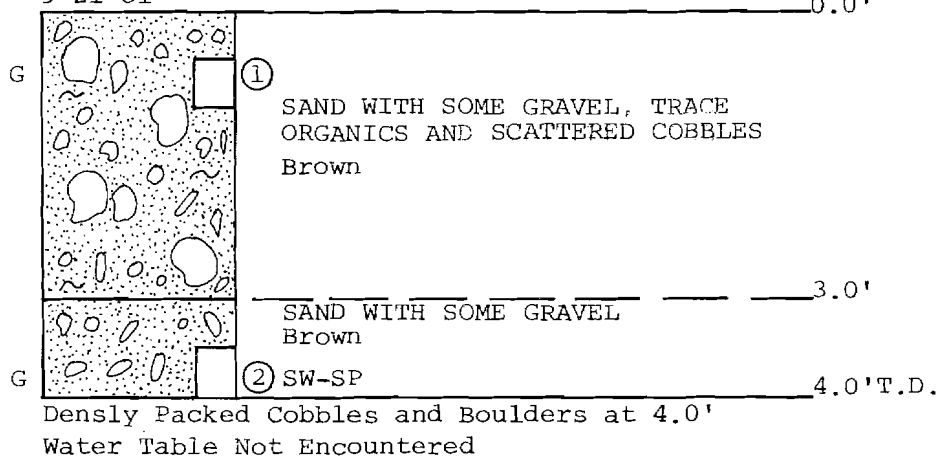


RIVER ALLUVIUM
TEST PITS
TP-R17, R18

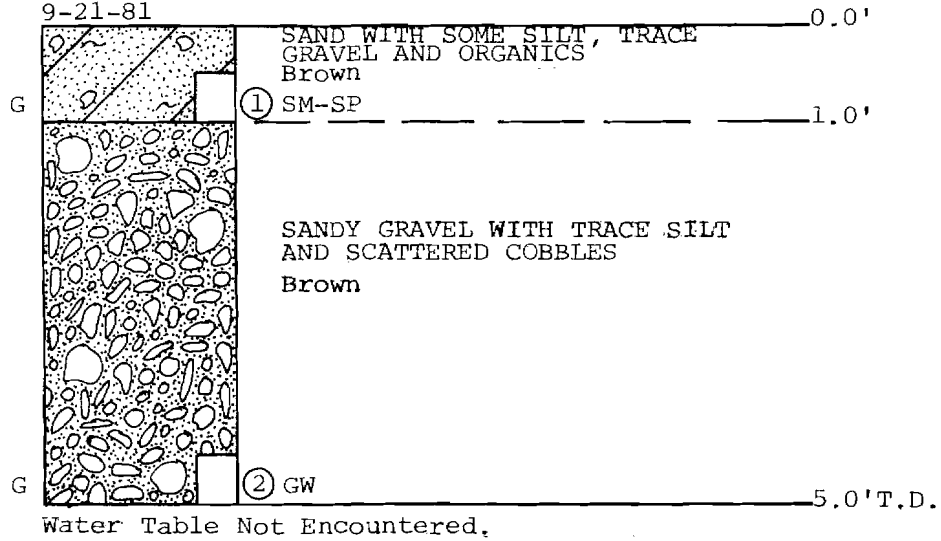


Scale: 1"=2'

TP-R19
9-21-81



TP-R20
9-21-81



Prepared by:



RIVER ALLUVIUM
TEST PITS
TP-R19, R20

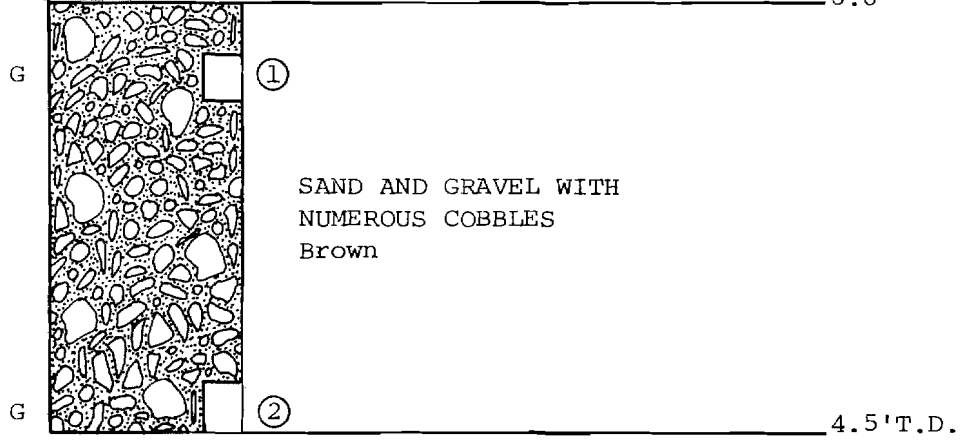
Prepared for:



Scale: 1"=2'

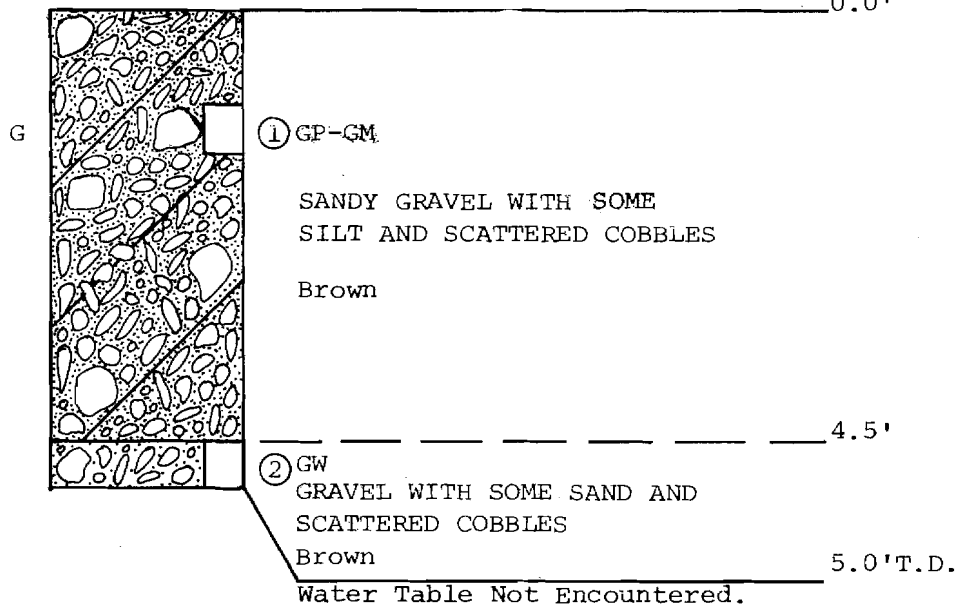
TP-R21

9-21-81



TP-R22

9-21-81



Prepared by:

Prepared for:



RIVER ALLUVIUM
TEST PITS
TP-R21, R22



Scale: 1"=2'

LABORATORY TEST DATA

PROJECT NO. 052504
 CLIENT: Acres American, Inc.
 PROJECT NAME Susitna Hydroelectric
 (Watana Dam Site)

R & M CONSULTANTS, INC.
SUMMARY OF LABORATORY TEST DATA

DATE October 17, 1980
 PARTY NO. _____ PAGE NO. _____

DESCRIPTION		4"	3"	2"	1½"	1"	¾"	½"	⅜"	#4	#10	#40	#200	.02	.005	.002	% Moist.	LL	PI	Unified Class.	
STREAM ALLUVIUM	W-80-302	100	92	90	82	69	58	45	38	27	23	14	2.6							GP	
	(Crab Sample)																				

REMARKS: _____

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
 CLIENT: Acres American, Inc.
 PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE October 29, 1981

SUMMARY OF LABORATORY TEST DATA

PARTY NO. _____ PAGE NO. 1 of 3

BORING NO.	SAMPLE NO.	DEPTH	4 1/2"	4"	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	.02	.005	.002	CLASS
TP-R1	2	1.5'-2.0'		100	95	89	78	67	59	49	43	31	22	16	13	6	4	2.2				GP
TP-R1	4	3.0'-3.5'		100	99	87	79	65	56	45	39	28	20	14	13	5	4	1.5				GP
TP-R1	5	3.5'-4.5'		100	98	94	79	67	57	46	39	29	21	17	13		4	1.5				GP
TP-R2	1	0.0'-1.0'		100	77	64	54	44	39	33	29	23	18	16	15	7	5	2.0				GP
TP-R2	2	4.5'-5.0'	100	94	89	74	63	50	42	34	30	21	14	11	11	6	5	2.0				GP
TP-R3	2	4.5'-5.0'			100	96	89	72	60	47	40	29	22	17	14	5	3	1.2				GP
TP-R4	2	4.0'-4.5'		100	97	86	77	65	58	49	43	31	25	17	11		2	0.7				GP
TP-R5	1	0.5'-1.0'			100	90	79	69	61	53	47	36	23	12	8	5	4	2.2				GW
TP-R5	2	3.0'-3.5'	100	95	90	80	75	66	60	51	44	32	21	10	8		2	1.1				GW
TP-R6	2	2.0'-3.0'									100	99	95	92	89	72	65	47.2	15.6	3.8	2.4	ML-SM
TP-R7	1	0.5'-1.0'			100	95	86	71	62	52	45	32	24	18	11	7	1	0.5				GW
TP-R7	2	3.5'-4.0'				100	91	91	87	86	84	77	75	72	47		3	1.0				SP
TP-R8	1	0.5'-1.0'		100	92	73	67	57	51	44	39	28	19	15	11	5	4	1.7				GW

REMARKS: River Alluvium Test Pits, Watana Area

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
 CLIENT: ACRES AMERICAN, INC.
 PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE October 29, 1981

SUMMARY OF LABORATORY TEST DATA

PARTY NO. _____ PAGE NO. 2 of 3

BORING NO.	SAMPLE NO.	DEPTH	4 1/2"	4"	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	.02	.005	.002	CLASS
TP-R9	1	0.5'-1.0'												100	99	62	50	24.6	4.0	1.5	1.3	SM
TP-R10	1	1.0'-1.5'												100	99	82	68	30.0				SM
TP-R10	2	3.5'-4.0'			100	92	88	81	76	71	68	64	61	59	55	38	31	14.0	2.0	.67	.63	SM-SP
TP-R11	1	0.5'-1.0'			100	90	80	66	58	48	42	33	27	24	19	7	6	2.4				GP
TP-R11	2	3.5'-4.0'			100	92	81	68	60	49	42	30	22	19	14	5	4	2.0				GP
TP-R12	1	0.5'-1.0'			100	92	77	65	58	49	43	33	26	23	21		7	3.3				GP
TP-R12	2	4.5'-5.0'			100	89	79	67	59	49	43	32	25	20	14	5	3	1.5				GP
TP-R13	2	5.5'-6.0'			100	93	85	74	65	54	49	38	31	22	12	4	3	1.7				GP
TP-R14	1	0.5'-1.0'			100	95	88	75	66	55	48	36	28	22	20	7	5	1.7				GP
TP-R14	2	5.5'-6.0'			100	93	84	69	61	52	47	36	27	19	13	5	4	1.4				GP
TP-R15	2	5.5'-6.0'												100	91	82	44.7	4.8	1.1	0.7		SM
TP-R15	1	0.5'-1.0'												100	89	78	36.8					SM
TP-R16	2	4.5'-5.0'			100	93	85	72	64	56	51	41	31	24	20	13	11	6.0	1.2	0.59	0.44	GP-GM

REMARKS: River Alluvium Test Pits, Watana Area

NOTE: SIEVE ANALYSIS = PERCENT PASSING

PROJECT NO. 052506
 CLIENT: Acres American, Inc.
 PROJECT NAME Susitna Hydroelectric

R & M CONSULTANTS, INC.

DATE October 29, 1981

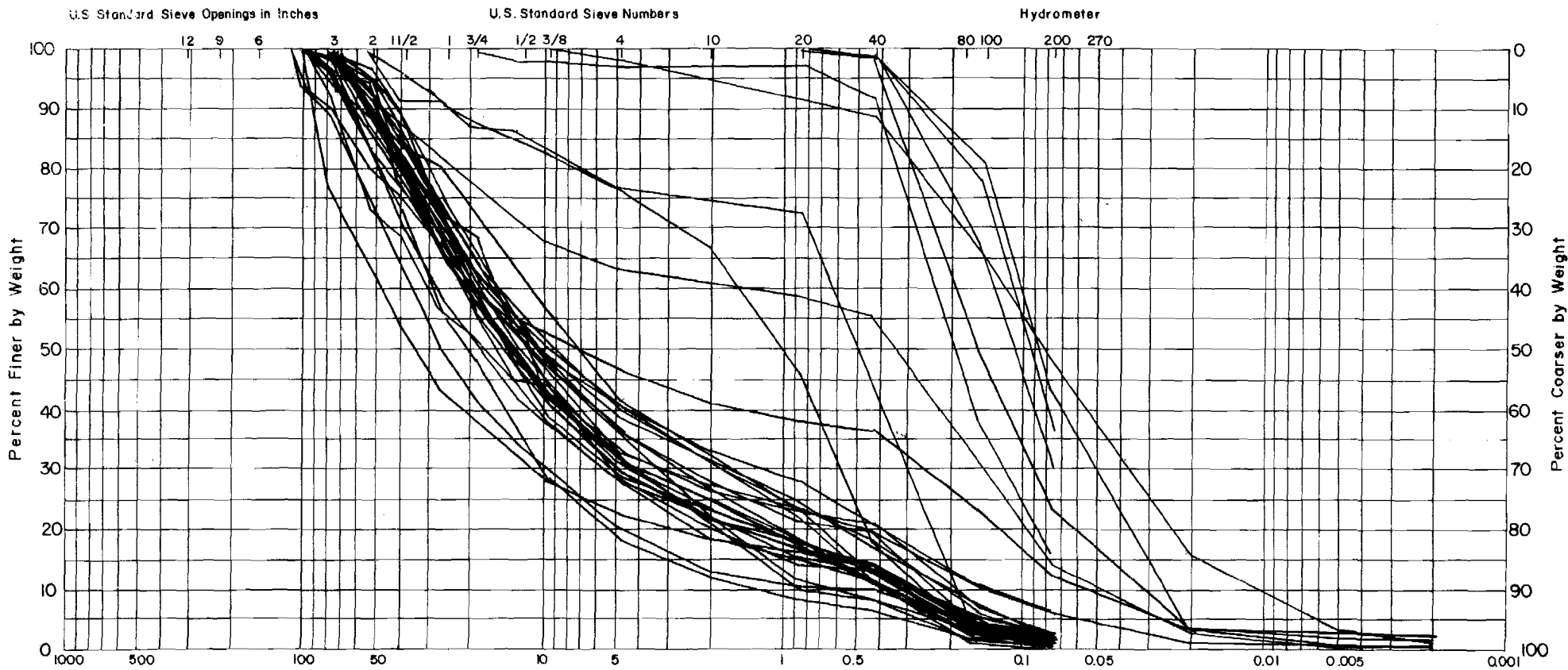
SUMMARY OF LABORATORY TEST DATA

PARTY NO. _____ PAGE NO 3 of 3

BORING NO.	SAMPLE NO.	DEPTH	4 1/2"	4"	3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#100	#200	.02	.005	.002	CLASS
TP-R17	1	1.0'-1-5'		100	98	84	70	58	50	41	36	27	21	16	11	4	3	1.6				GW
TP-R17	2	4.0'-4.5'			100	91	82	70	63	55	50	41	34	28	21	13	11	7.0				GP-GM
TP-R18	2	4.5'-5.0'			100	91	84	81	73	63	56	42	33	24	14	5	4	2.8				GP
TP-R19	2	3.5'-4.0'				100	96	92	88	85	82	76	67	46	19	5	3	2.5				SW-SP
TP-R20	1	0.5'-1.0'							100	98	98	97	97	97	91	48	39	15.2				SM-SP
TP-R20	2	4.5'-5.0'		100	93	89	81	72	63	53	48	38	32	25	17	9	7	3.6				GW
TP-R22	1	1.0'-1.5'		100	96	84	76	67	61	55	52	46	41	38	36	26	23	12.7	2.4	1.0	0.6	GP-GM
TP-R22	2	4.5'-5.0'		100	96	83	72	56	47	36	29	18	12	9	7	3	2	1.2				GW

REMARKS: River Alluvium Test Pits, Watana Area

NOTE: SIEVE ANALYSIS = PERCENT PASS IN



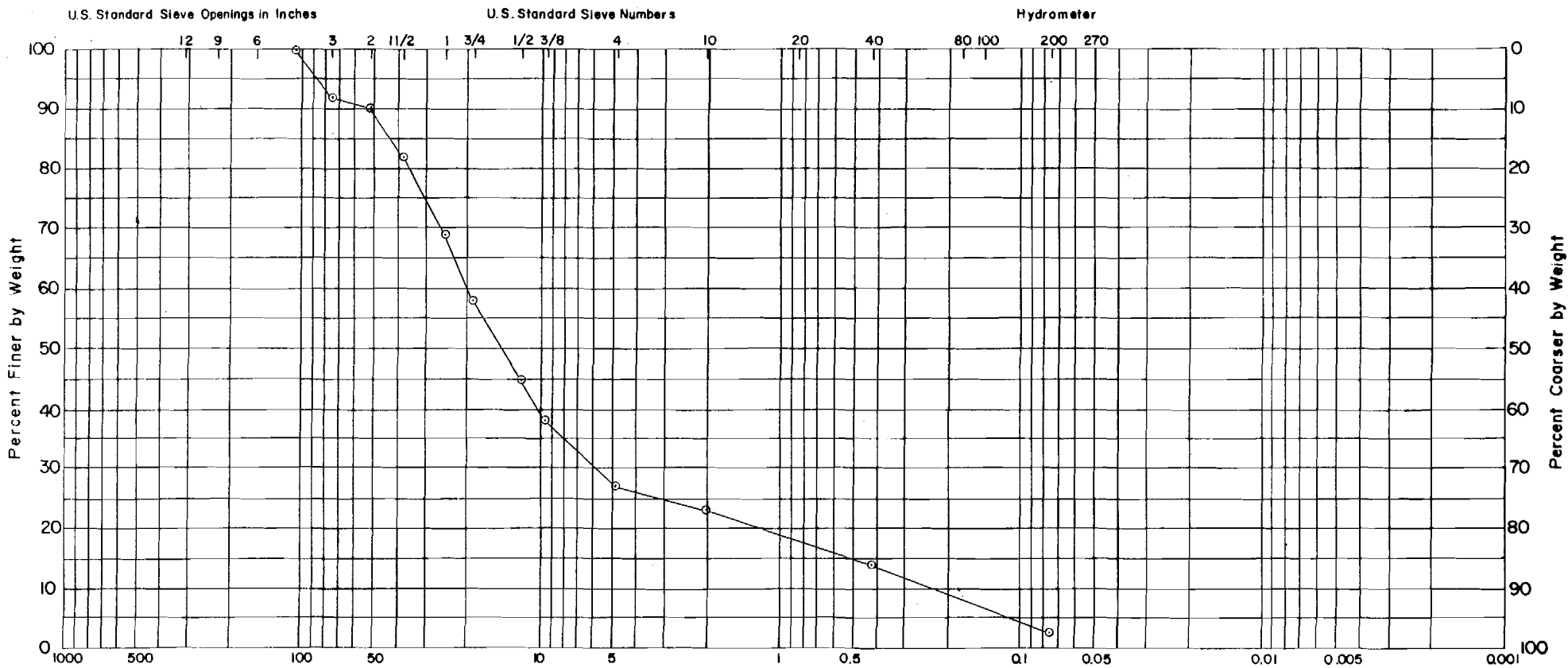
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION



RIVER ALLUVIUM
COMPOSITE GRADATION CURVE

DRAWN BY: J.M
APPROVED BY: L.J.A.
DATE: 1-82
PROJECT NO. 052506



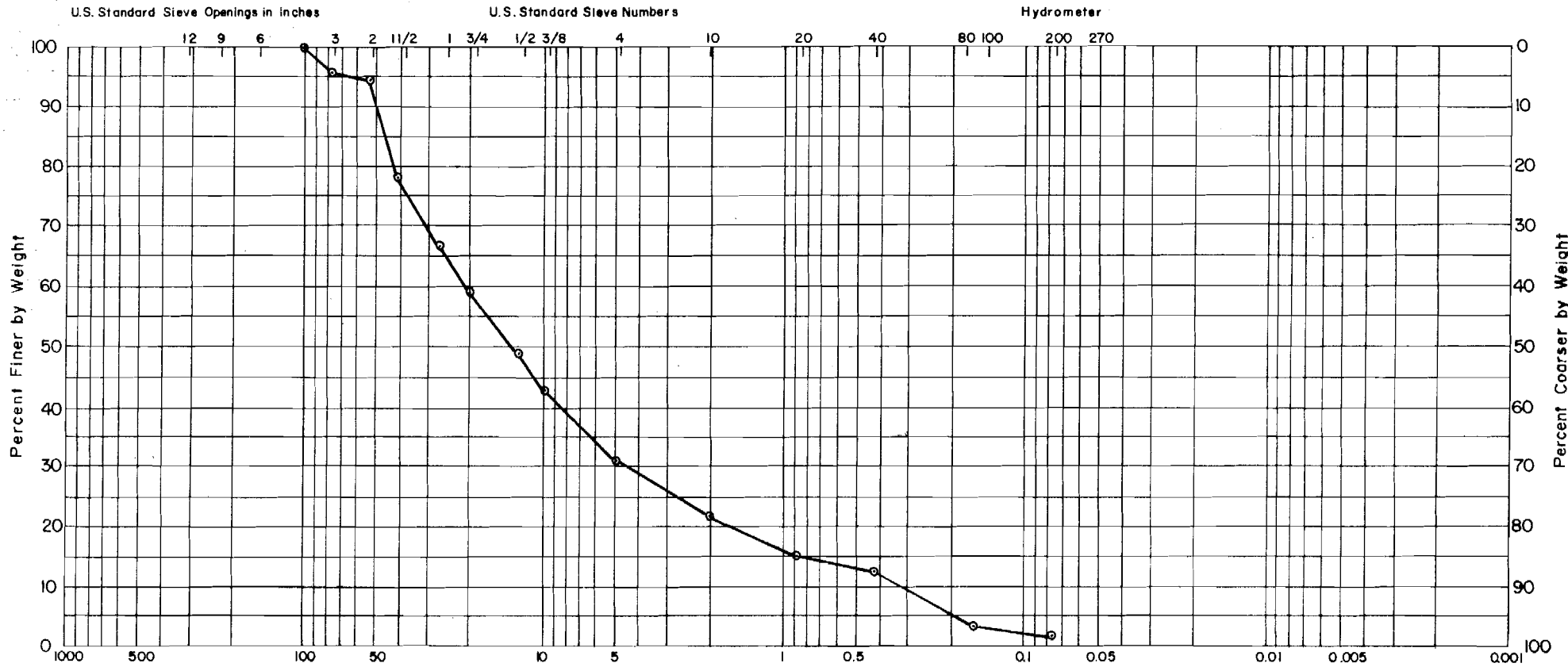
BOULDERS	COBBLES	GRAVEL			SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes	

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
W-80-302					GP	SANDY GRAVEL W/TRACE SILT
(Grab Sample)						Poorly Graded



STREAM ALUVIUM

DRAWN BY: DL
 APPROVED BY:
 DATE: December 1980
 PROJECT NO. 052504



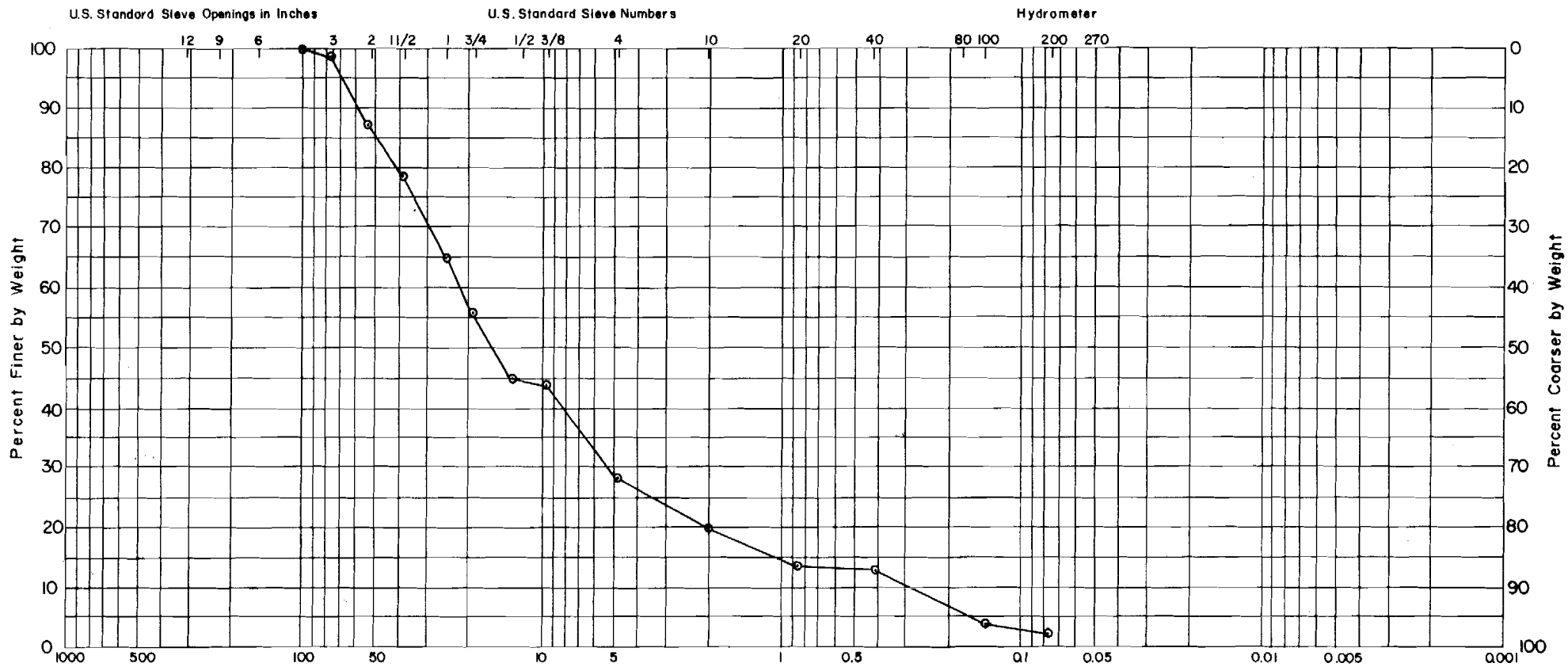
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R1 #2				GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R1

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



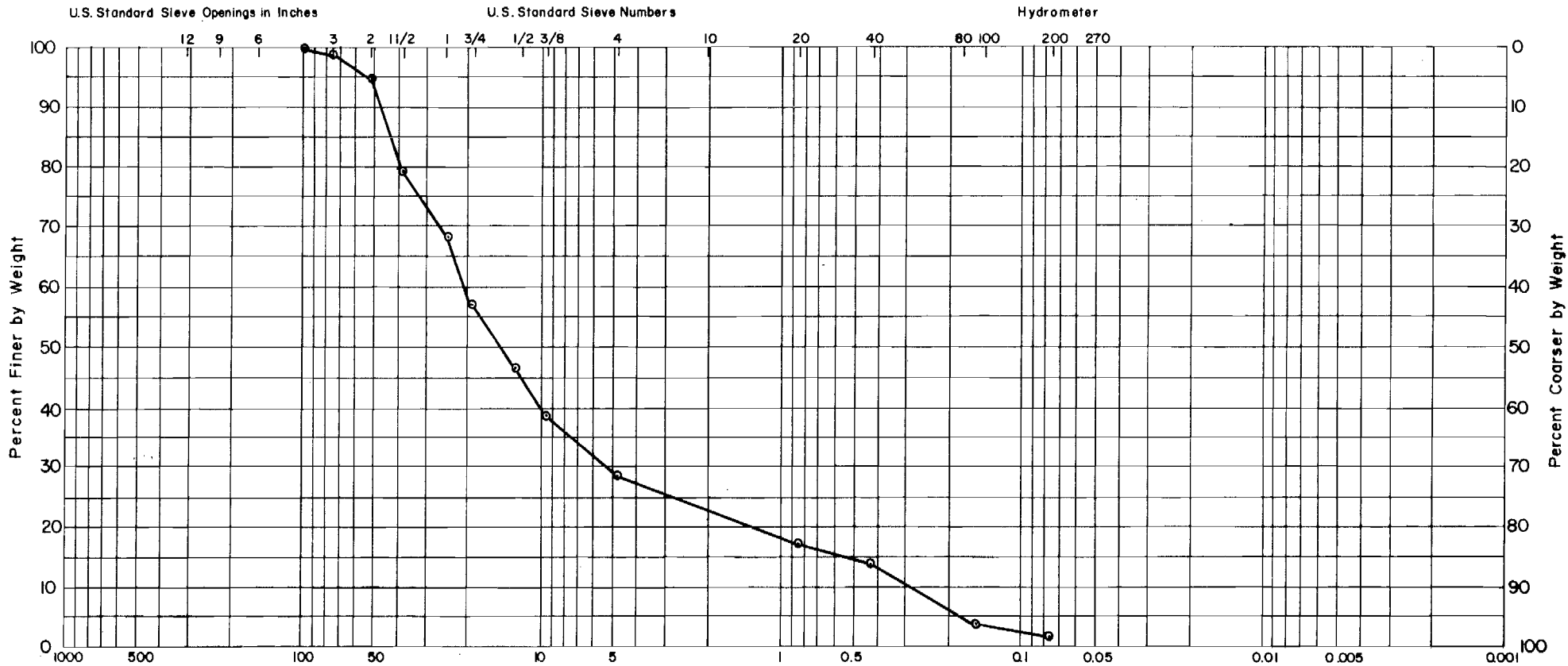
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R1 #4				GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R1

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



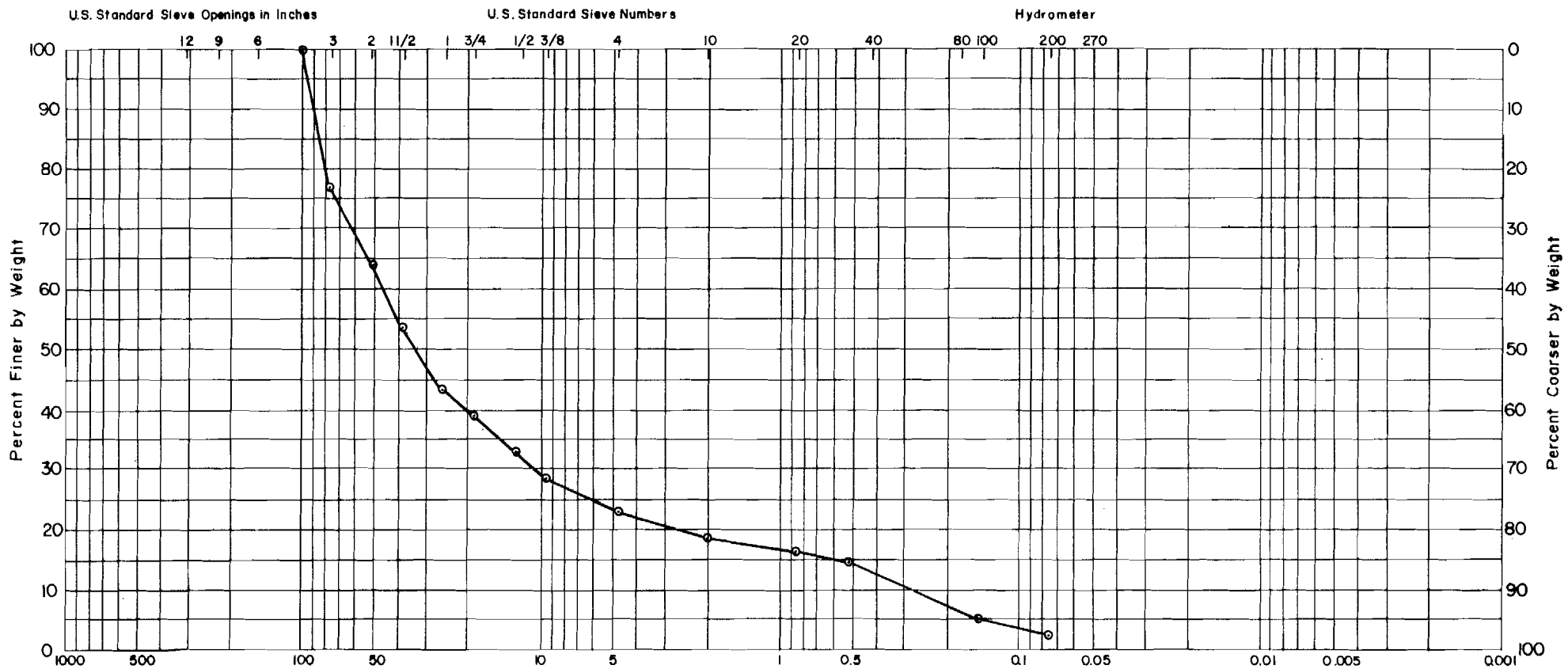
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R1 #5				GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R1

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



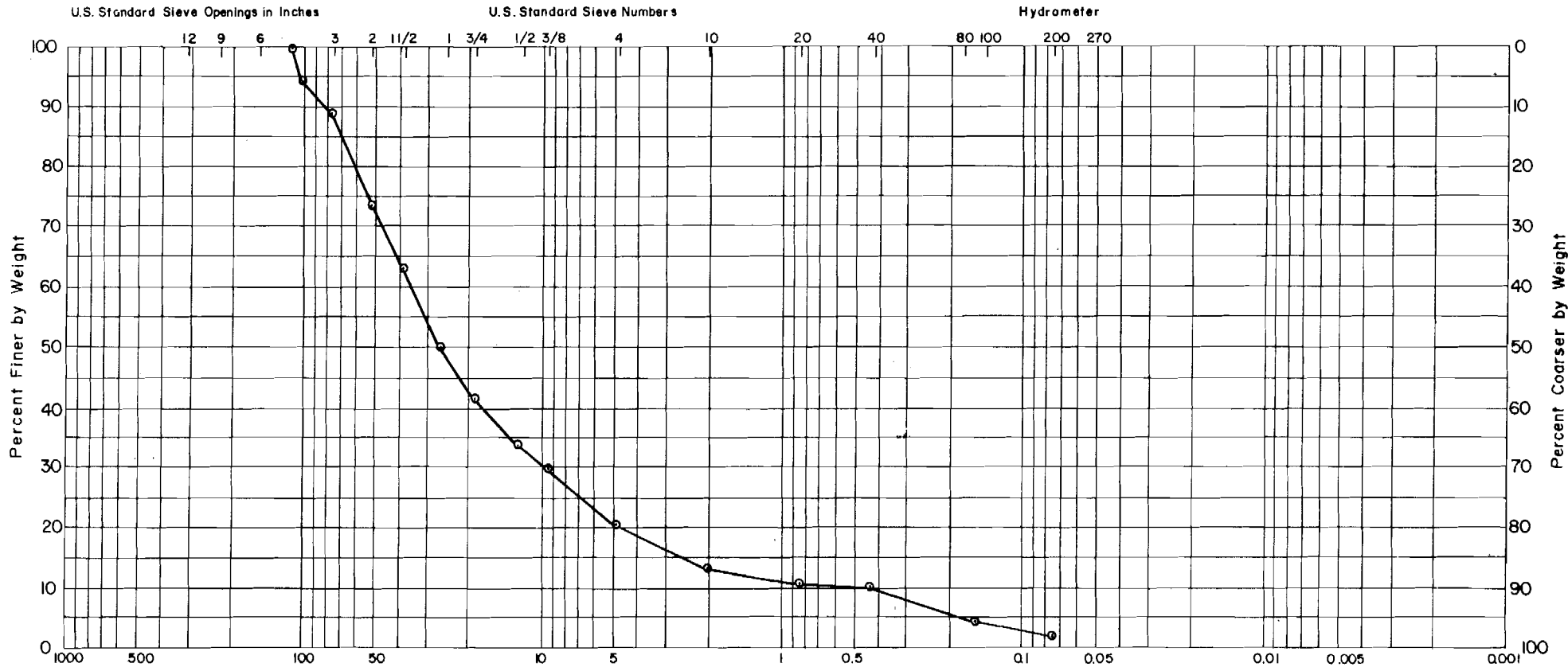
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R2 #1				GP	GRAVEL WITH SOME SAND AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R2

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



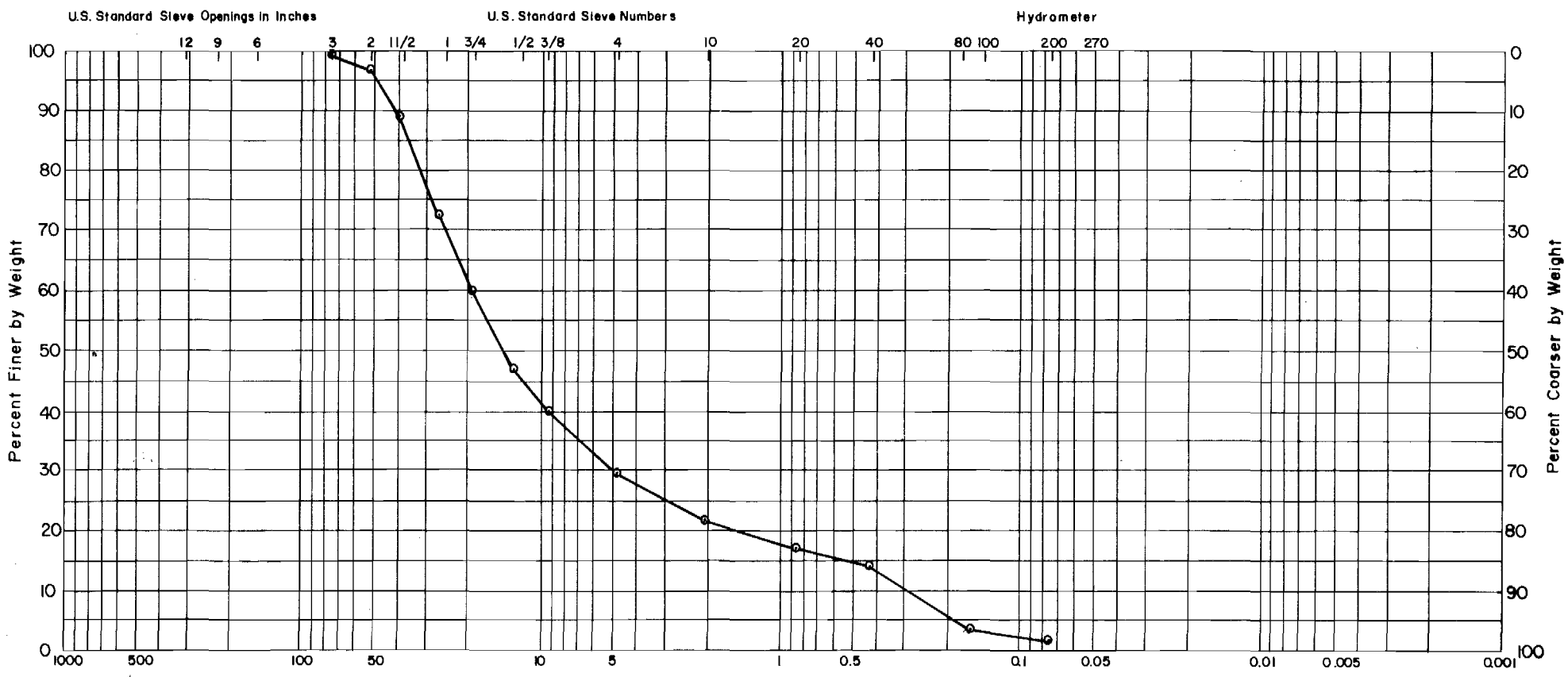
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R2. #2					GP GRAVEL WITH SOME SAND AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R2

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



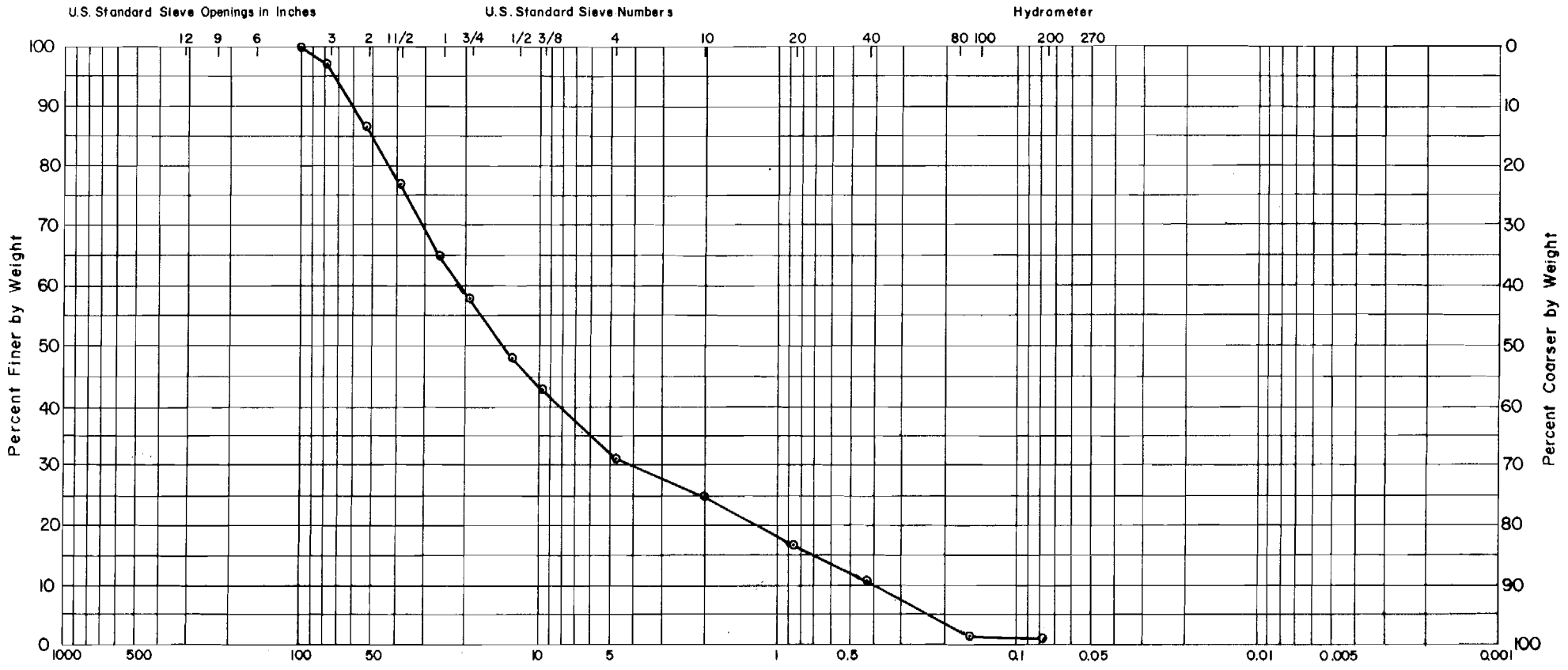
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R3 #2					GP GRAVEL WITH SOME SAND



RIVER ALLUVIUM
TEST PIT TP-R3

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



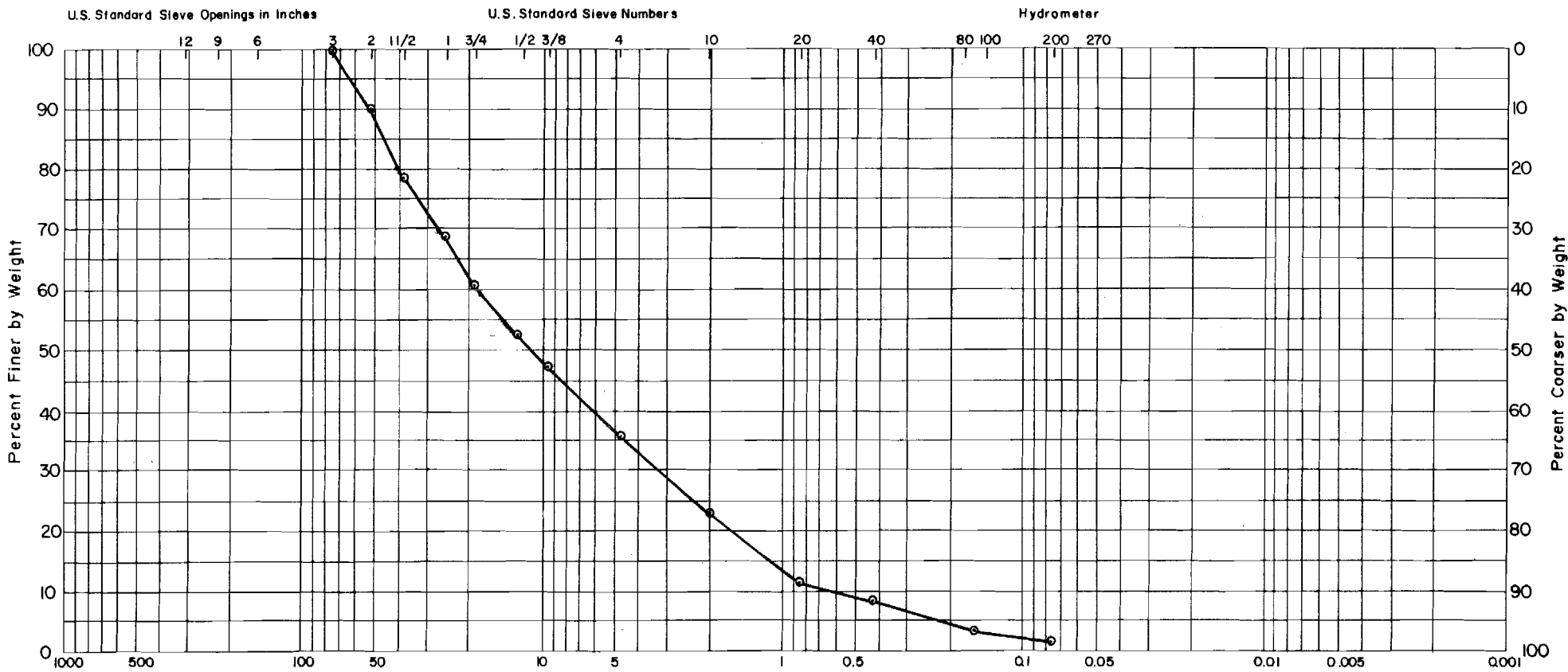
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R4 #2					GP SANDY GRAVEL WITH SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R4

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



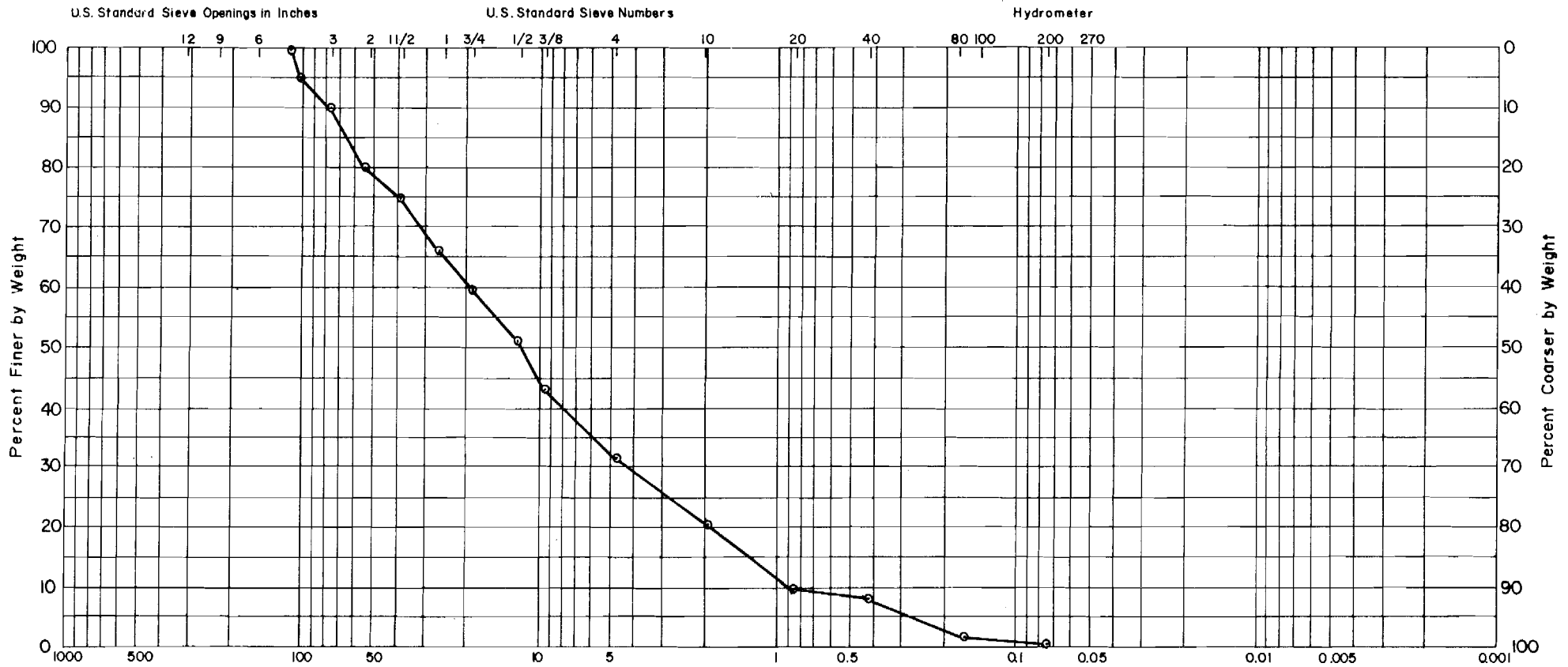
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R5 #1				GW	SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R5

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



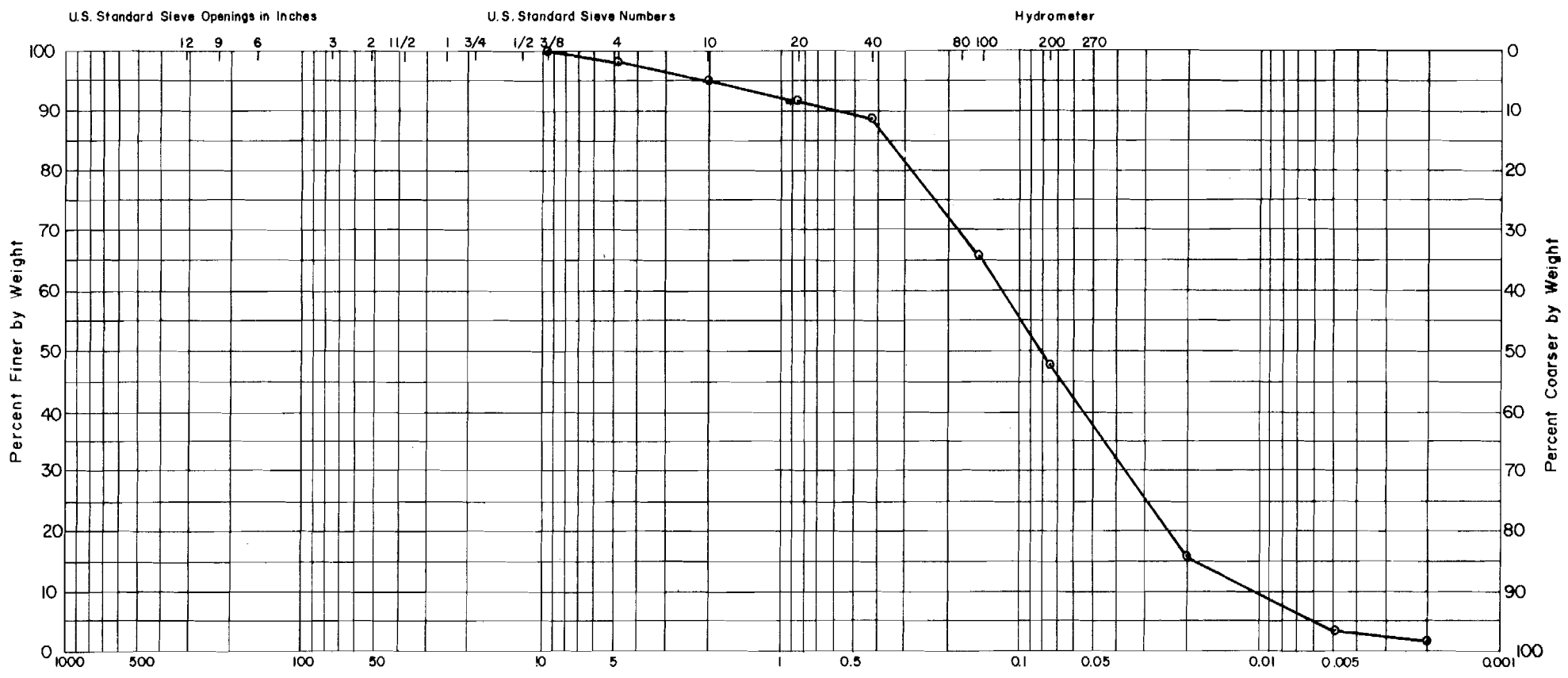
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R5 #2				GW	SANDY GRAVEL WITH SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R5

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



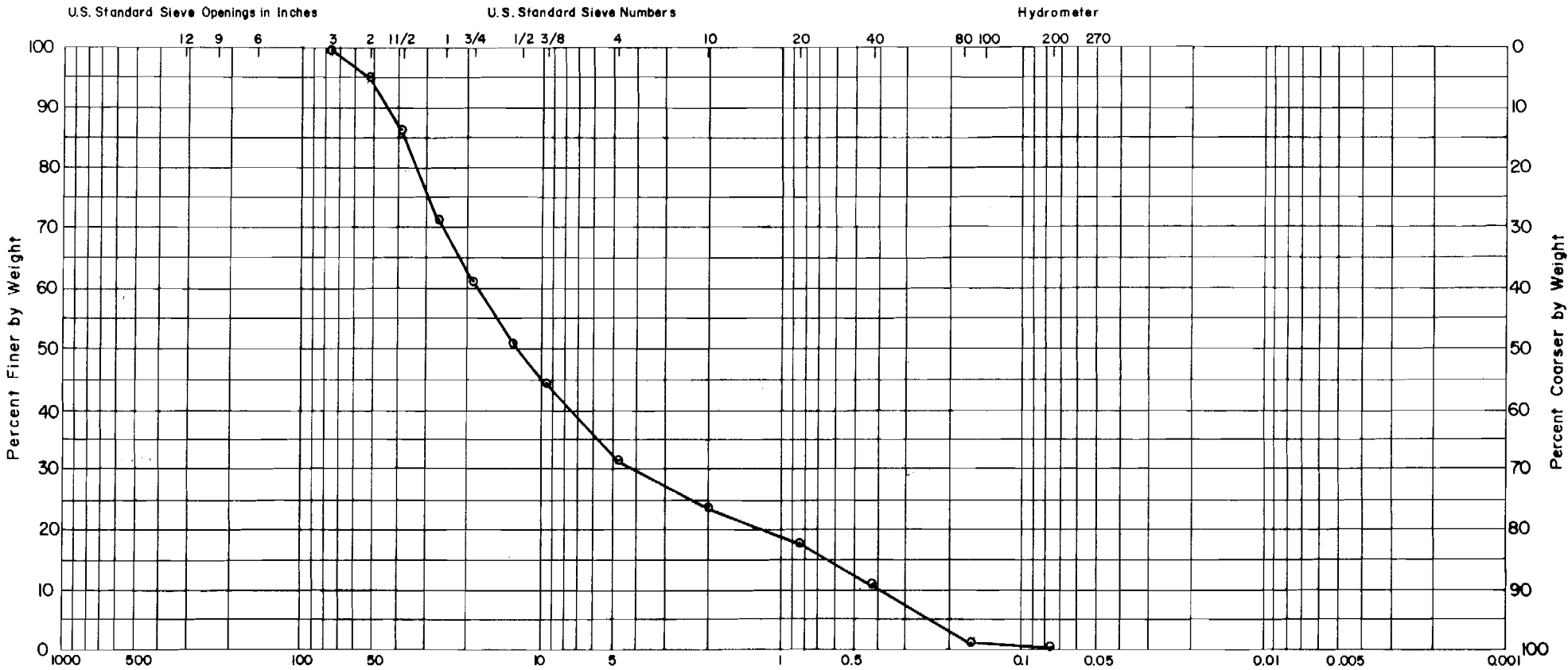
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R6 #2				ML-SM	SILTY SAND (FIELD GEOLOGIST NOTES TRACE ORGANICS)



RIVER ALLUVIUM
TEST PIT TP-R6

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



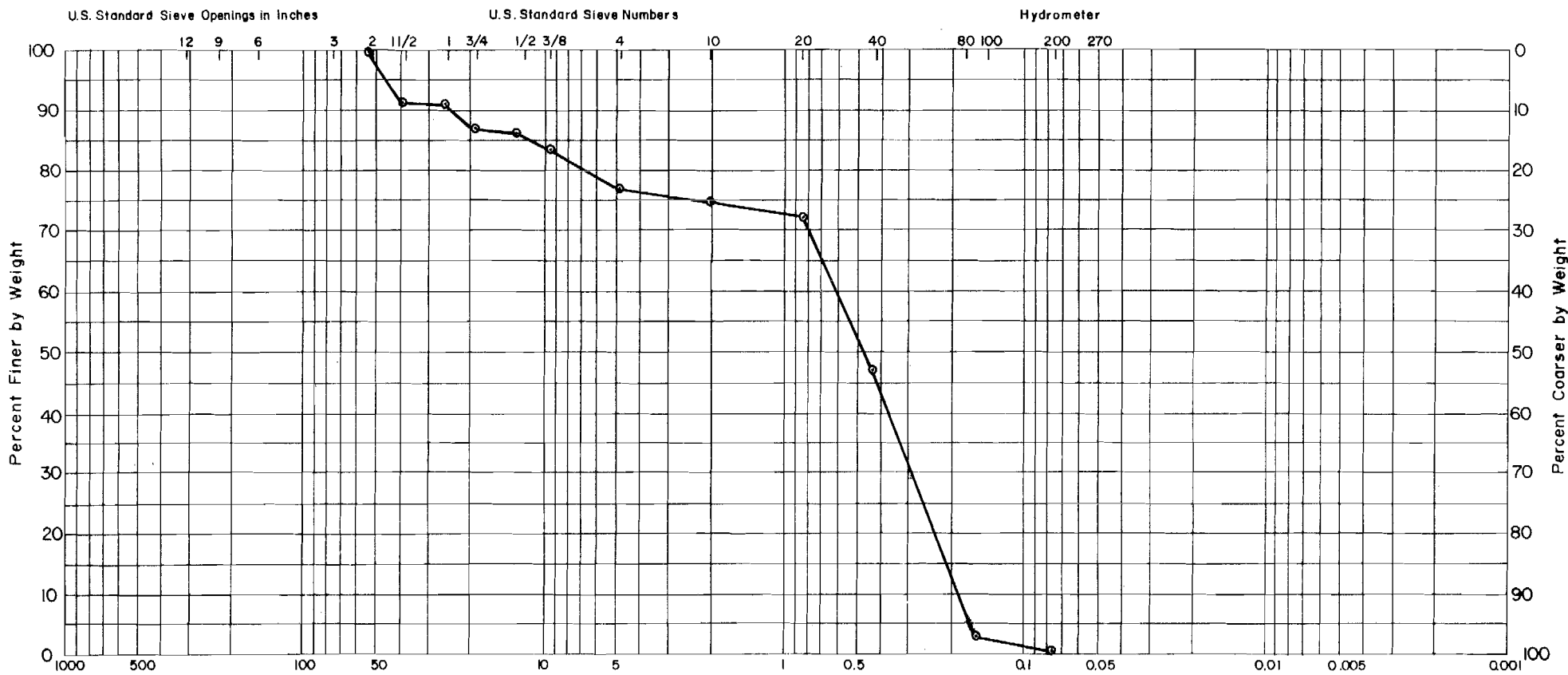
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R7 #1					GW SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R7

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



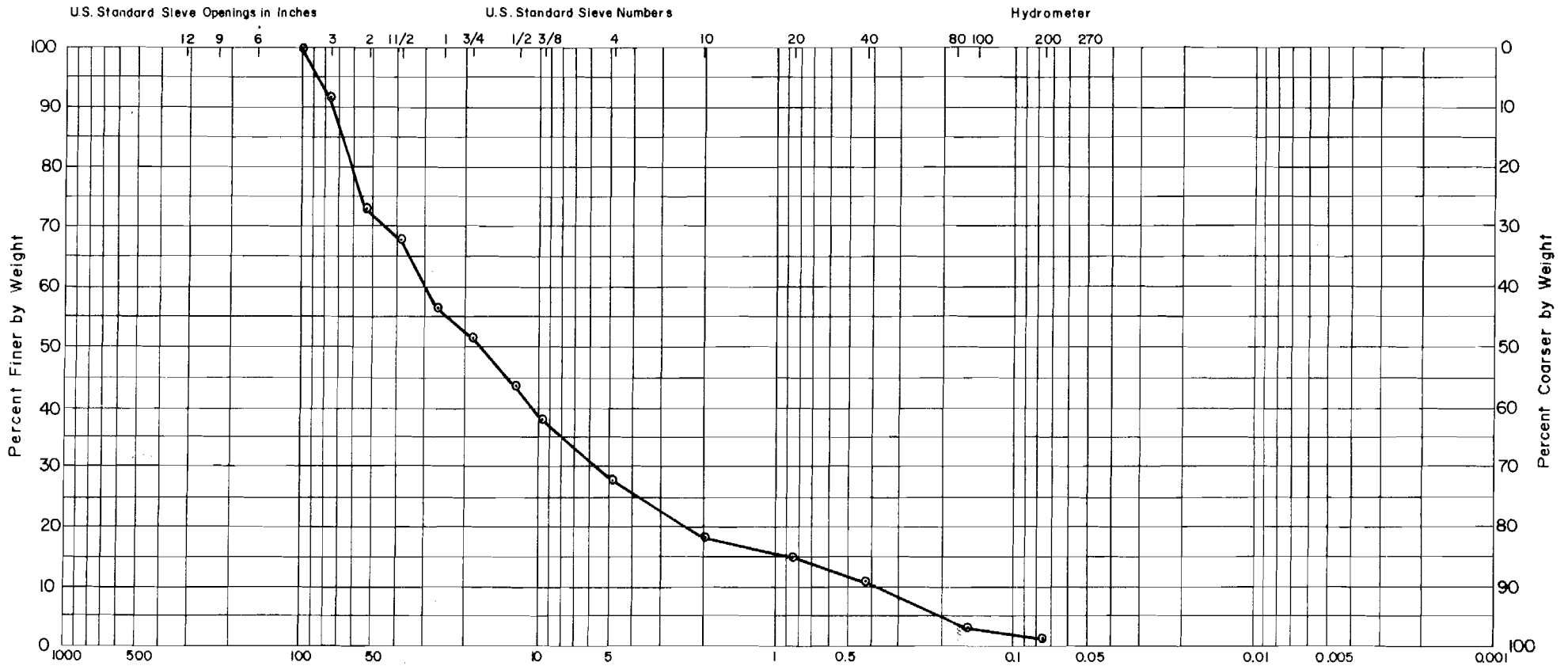
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R7 #2					SP	SAND WITH SOME GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R7

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



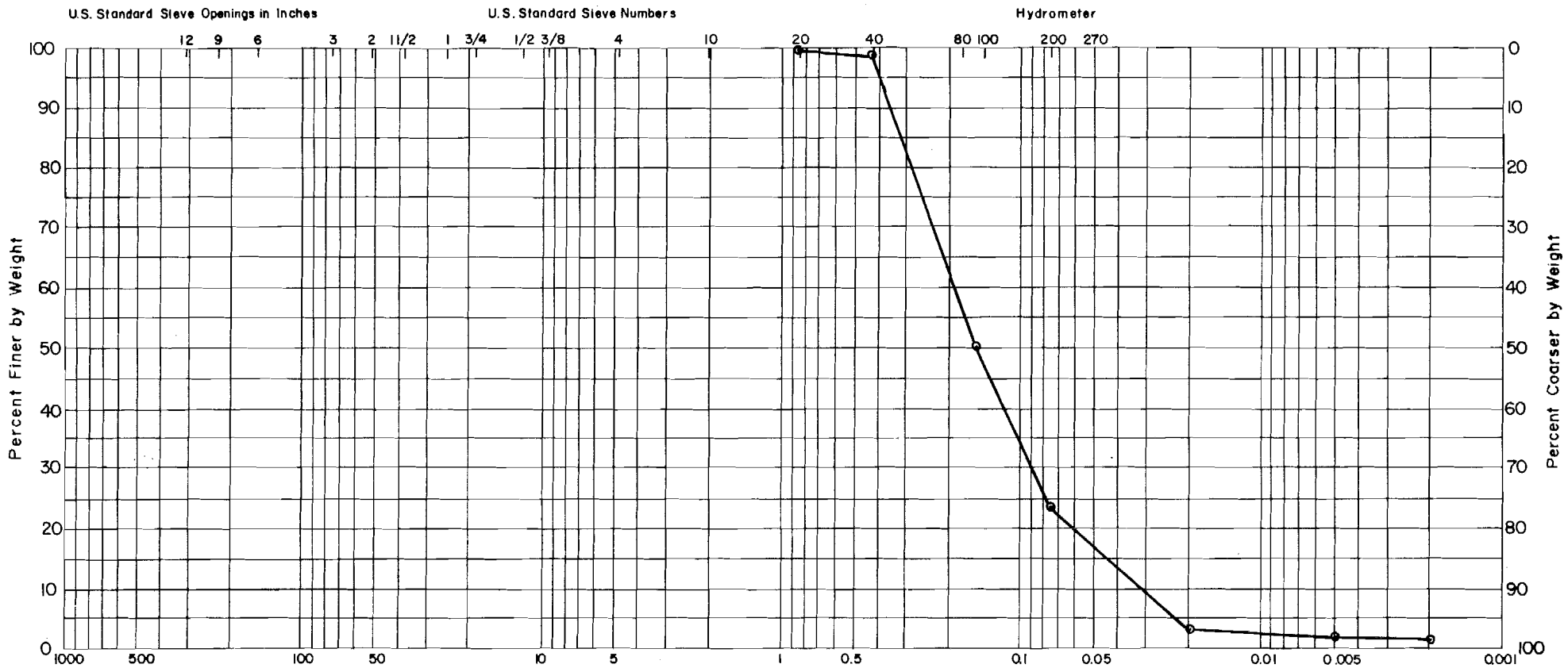
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R3 #1					GW GRAVEL WITH SOME SAND AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R3

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



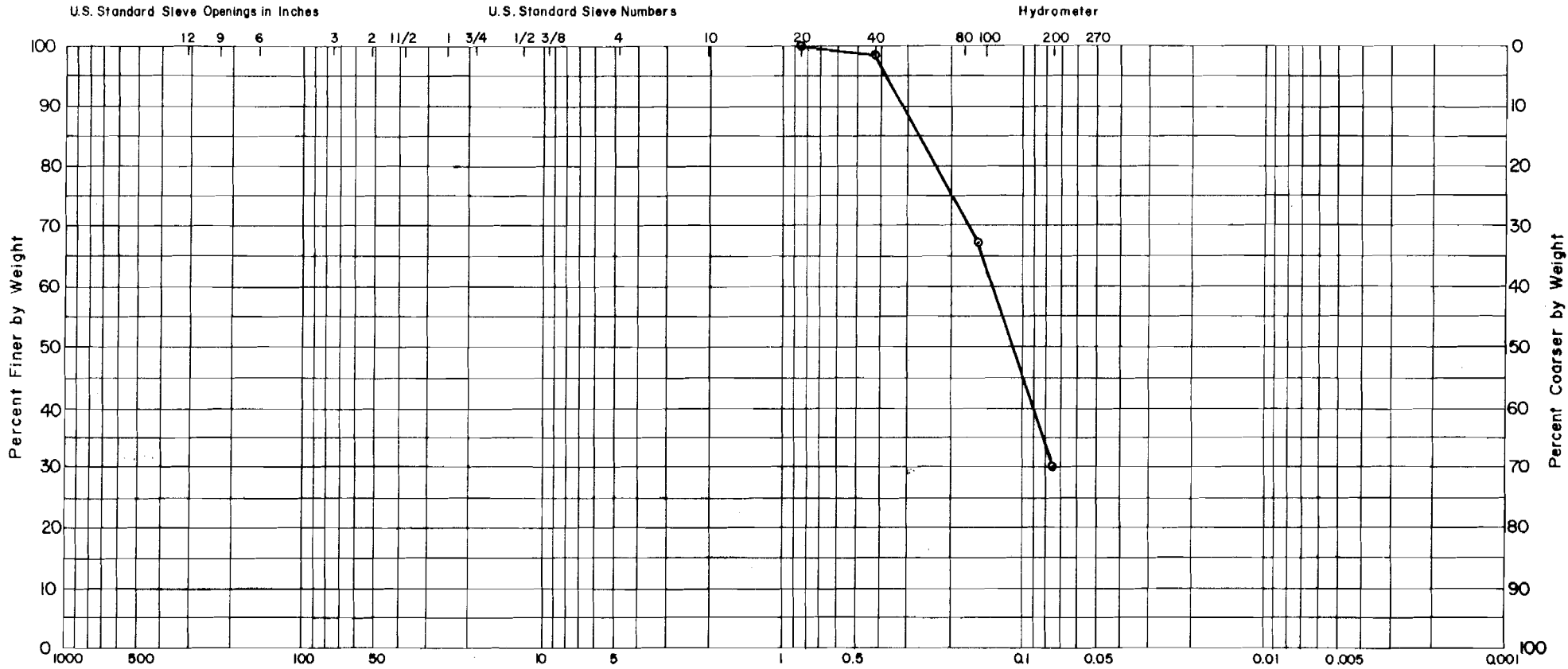
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R9 #1				SM	SAND WITH SOME SILT (FIELD GEOLOGIST NOTES TRACE ORGANICS)



RIVER ALLUVIUM
TEST PIT TP-R9

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



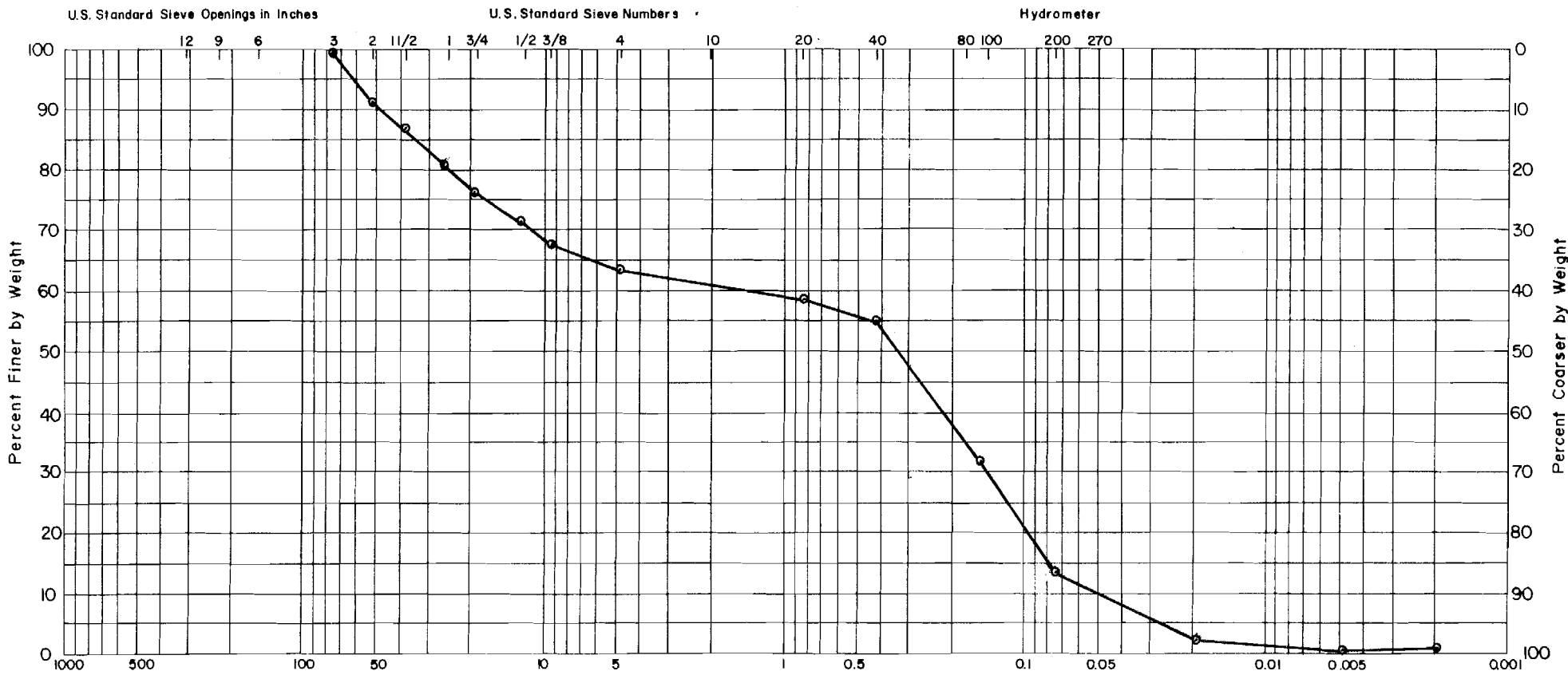
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R10 #1					SM	SILTY SAND



RIVER ALLUVIUM
TEST PIT TP-R10

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



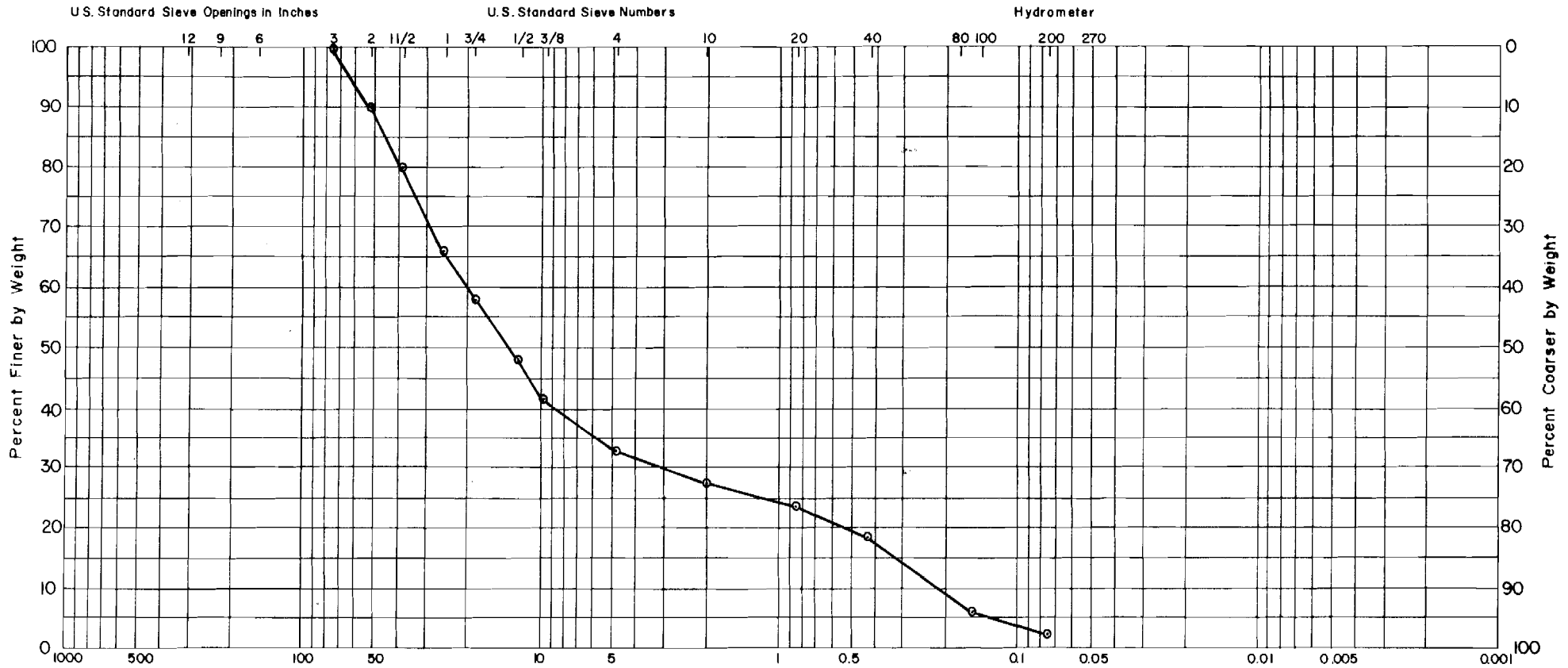
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R10 #2					SM-SP GRAVELLY SAND WITH SOME SILT



RIVER ALLUVIUM
TEST PIT TP-R10

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



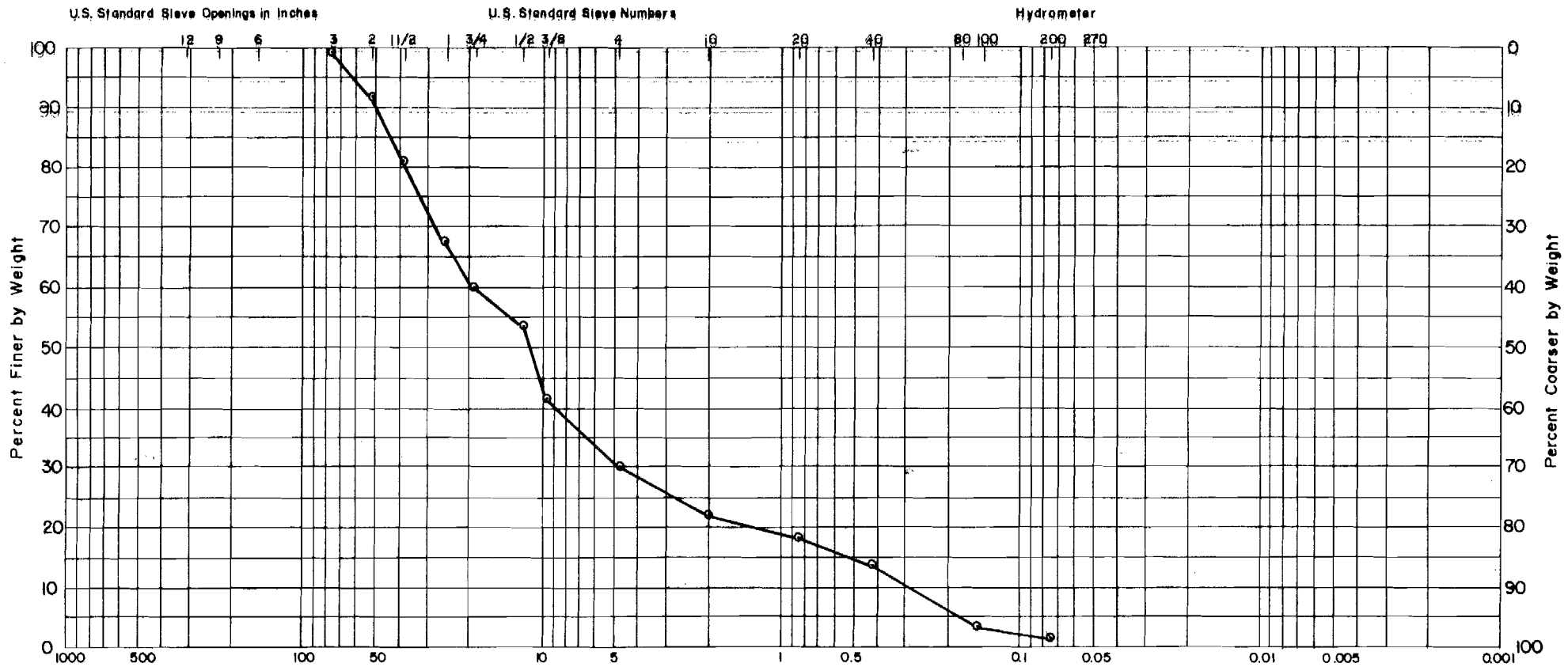
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R11 #1					GP SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R11

DRAWN BY: P.T.
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DATE: 11-6-81
PROJECT NO. 052506



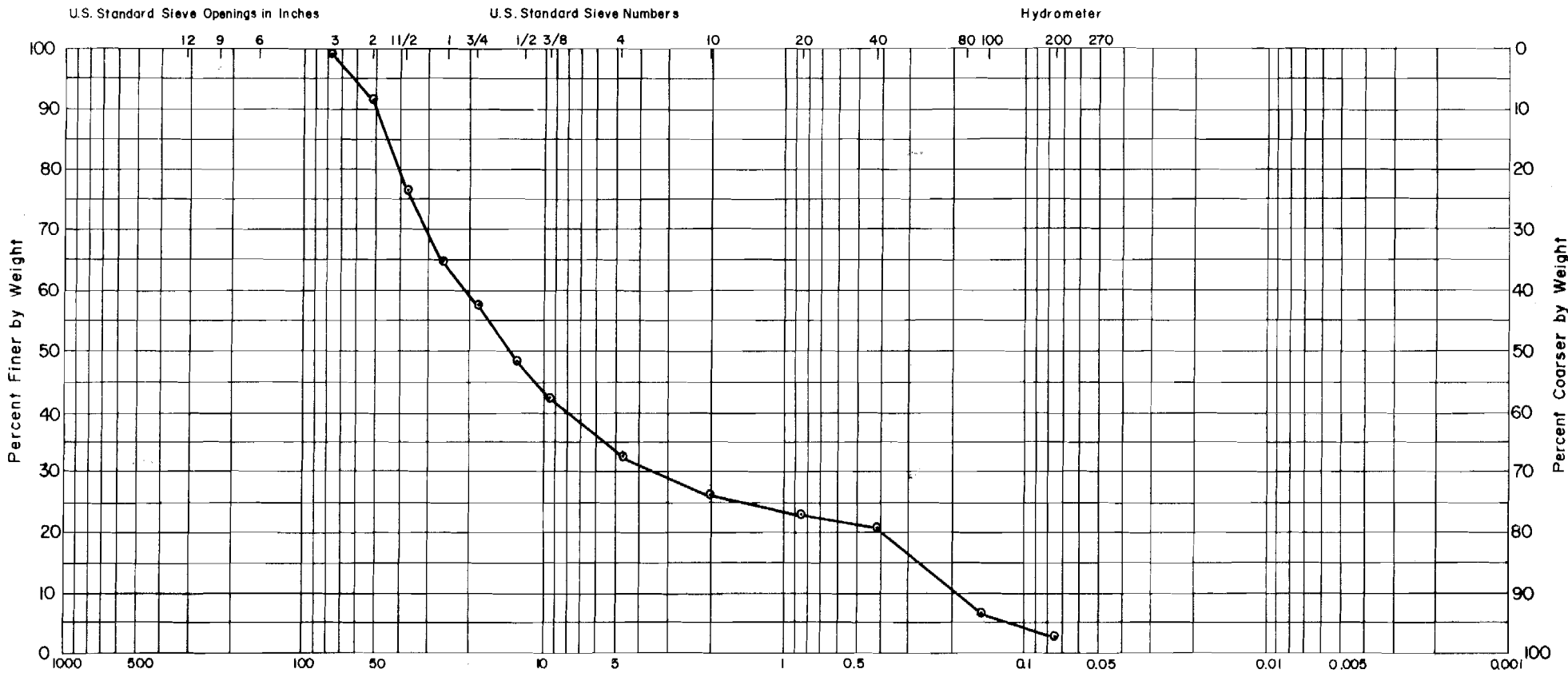
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		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R11 #2					GRAVEL WITH SOME SAND



RIVER ALLUVIUM
TEST PIT TP-R11

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



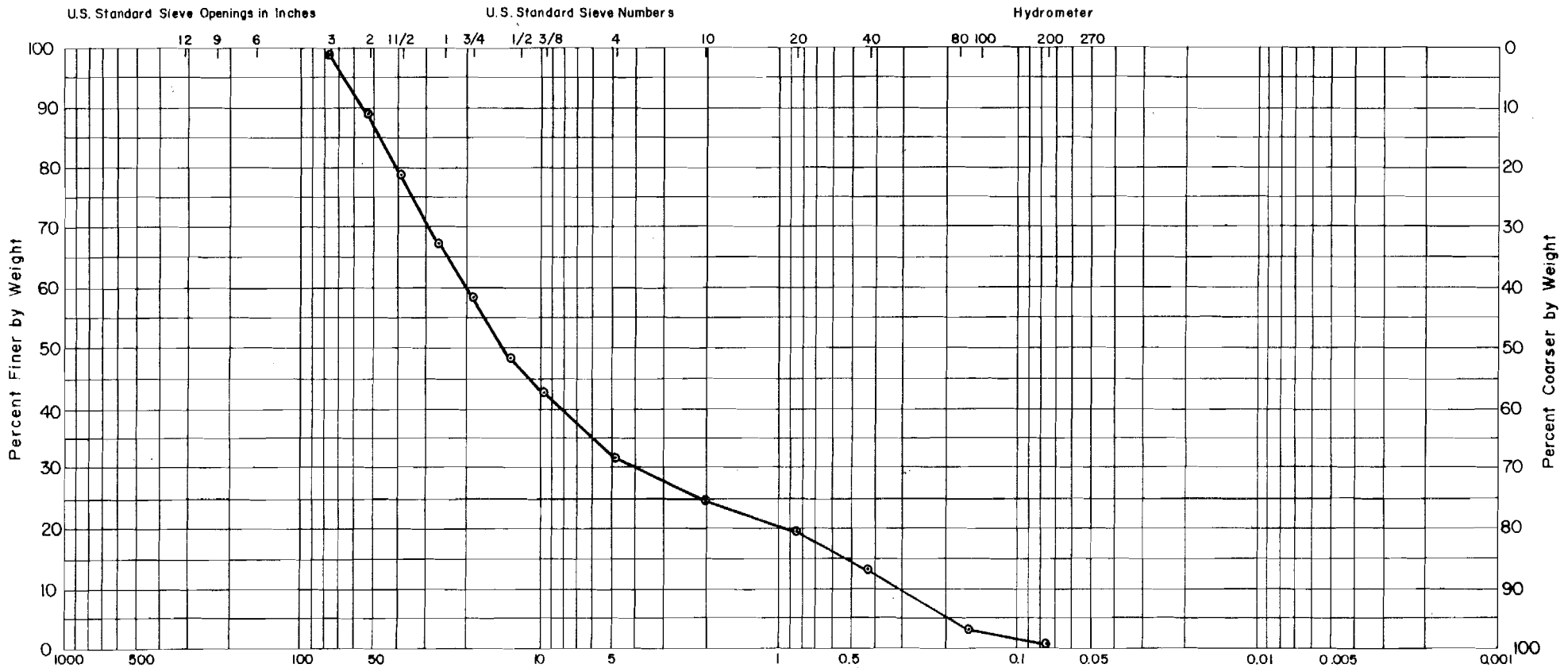
BOULDERS	COBBLES	GRAVEL			SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes	

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R12 #1				GP	SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R12

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



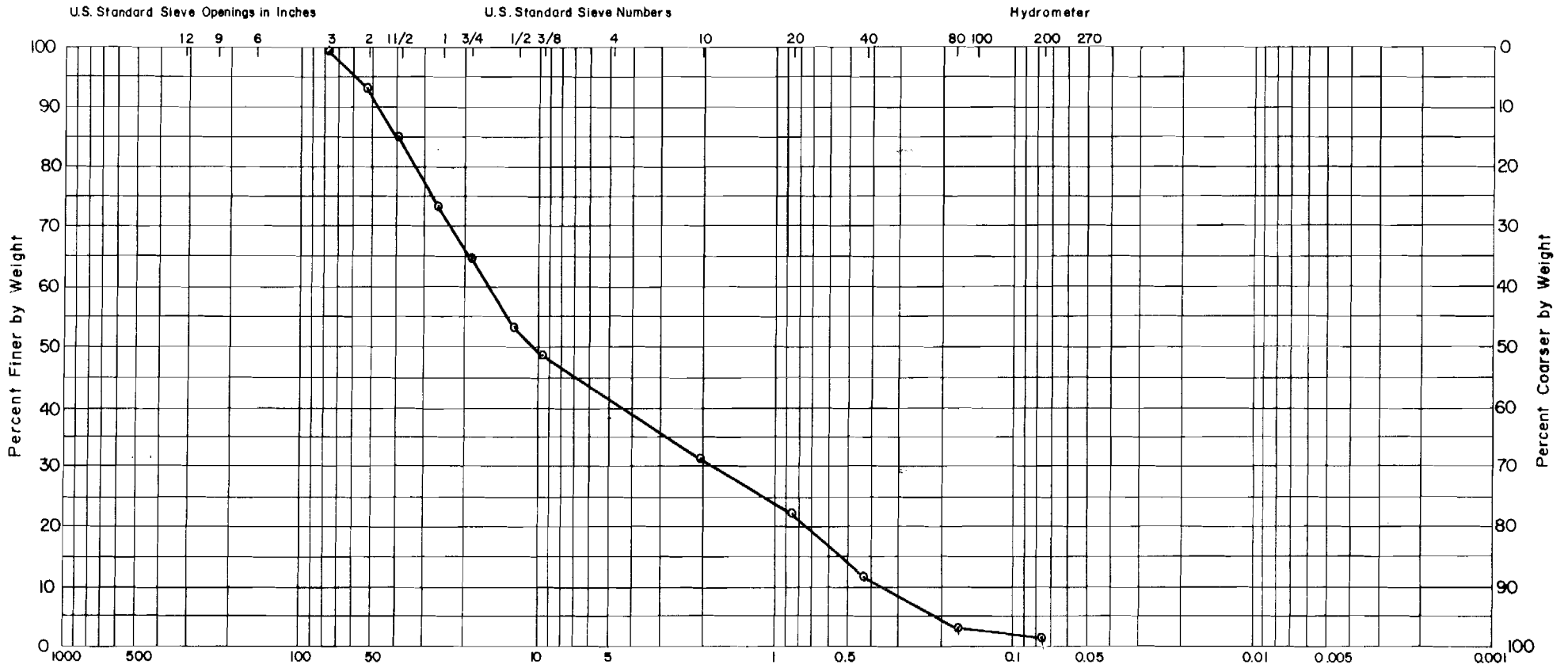
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R12 #2					GW SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R12

DRAWN BY: P.M.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



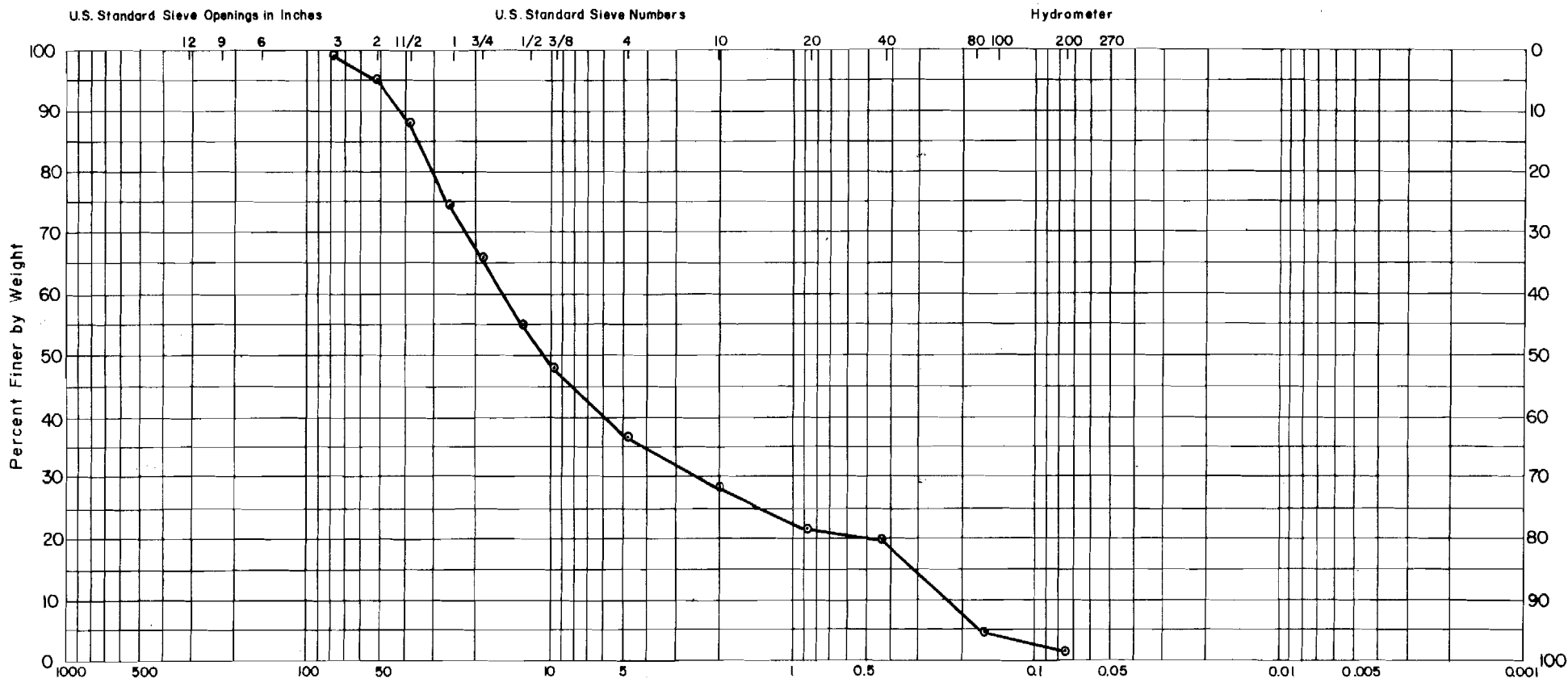
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R13 #2				GP	SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R13

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



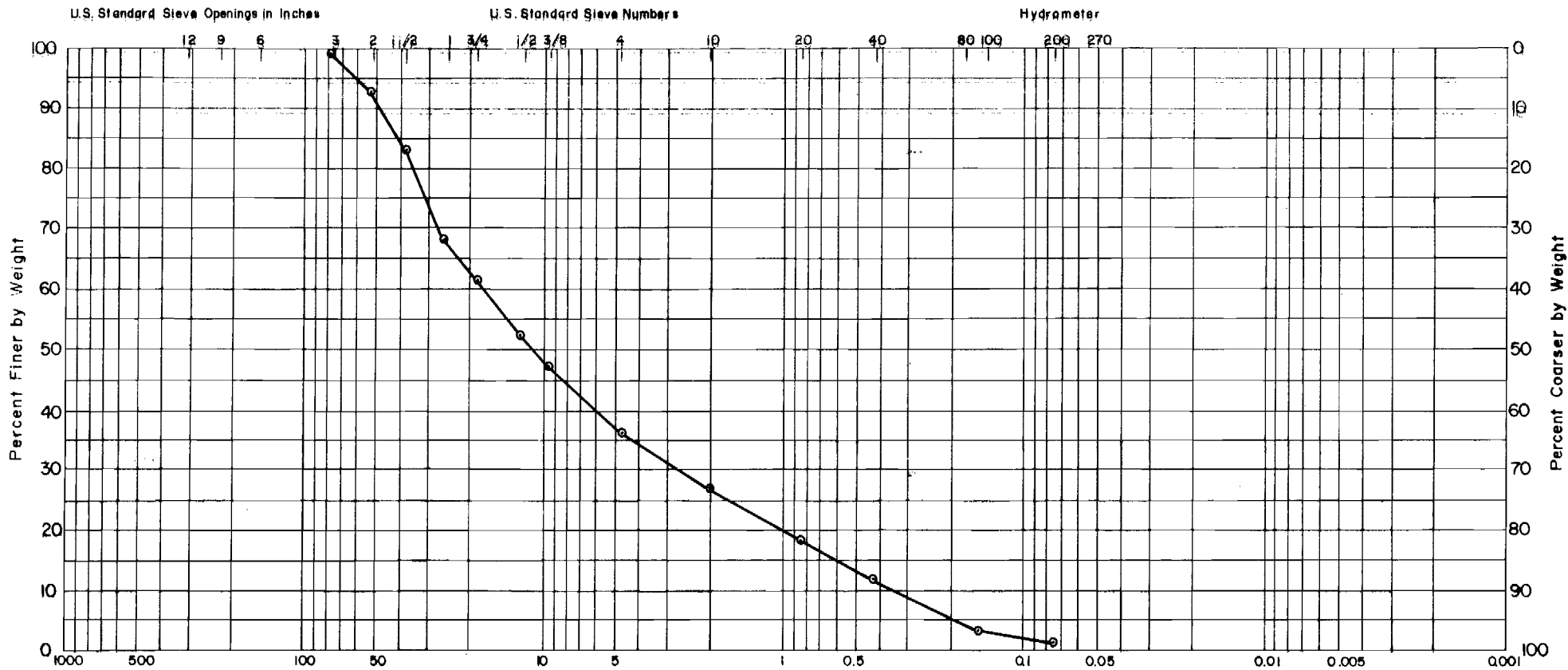
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R14 #1					GW	SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R14

DRAWN BY: P.T.
 APPROVED BY: T.I.
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 PROJECT NO. 052506



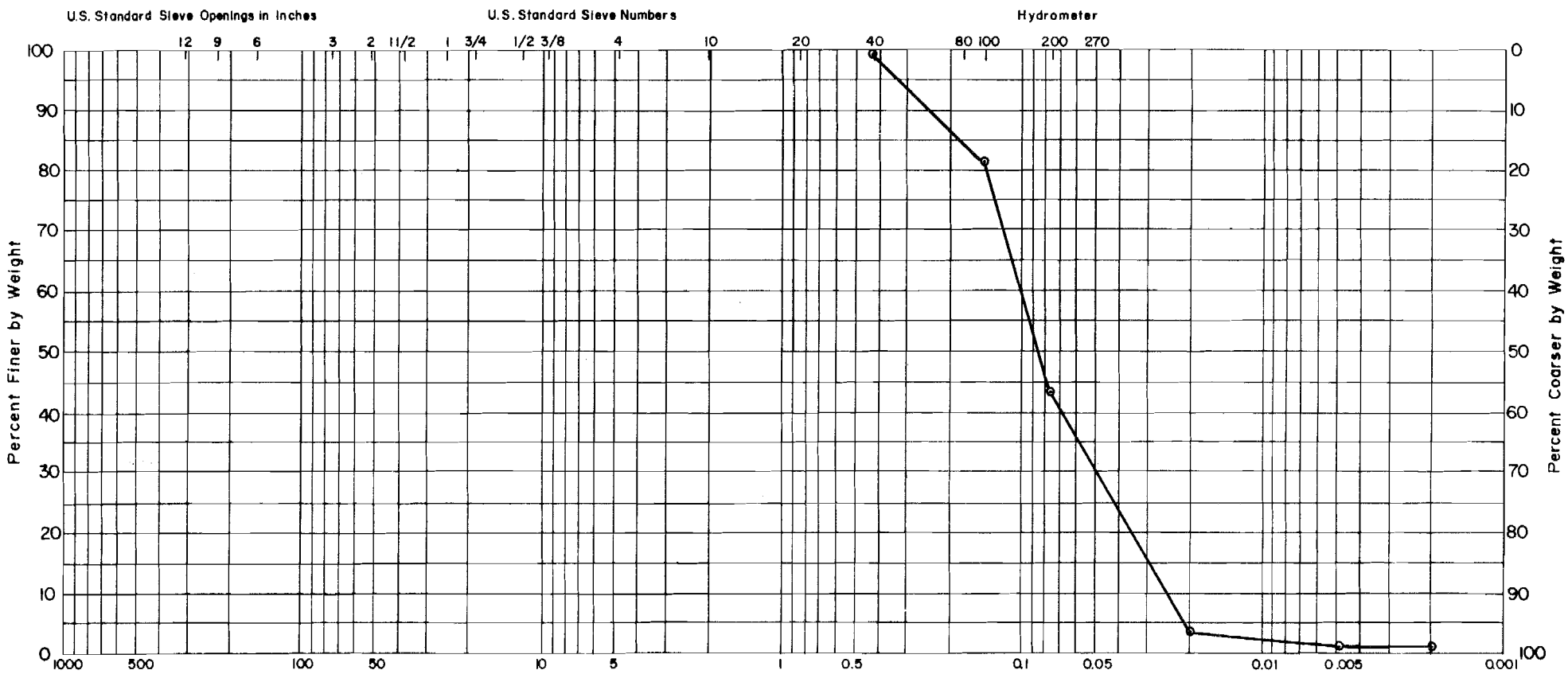
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R14 #2					GP SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R14

DRAWN BY: P. T.
 APPROVED BY: T. I.
 DATE: 11-6-81
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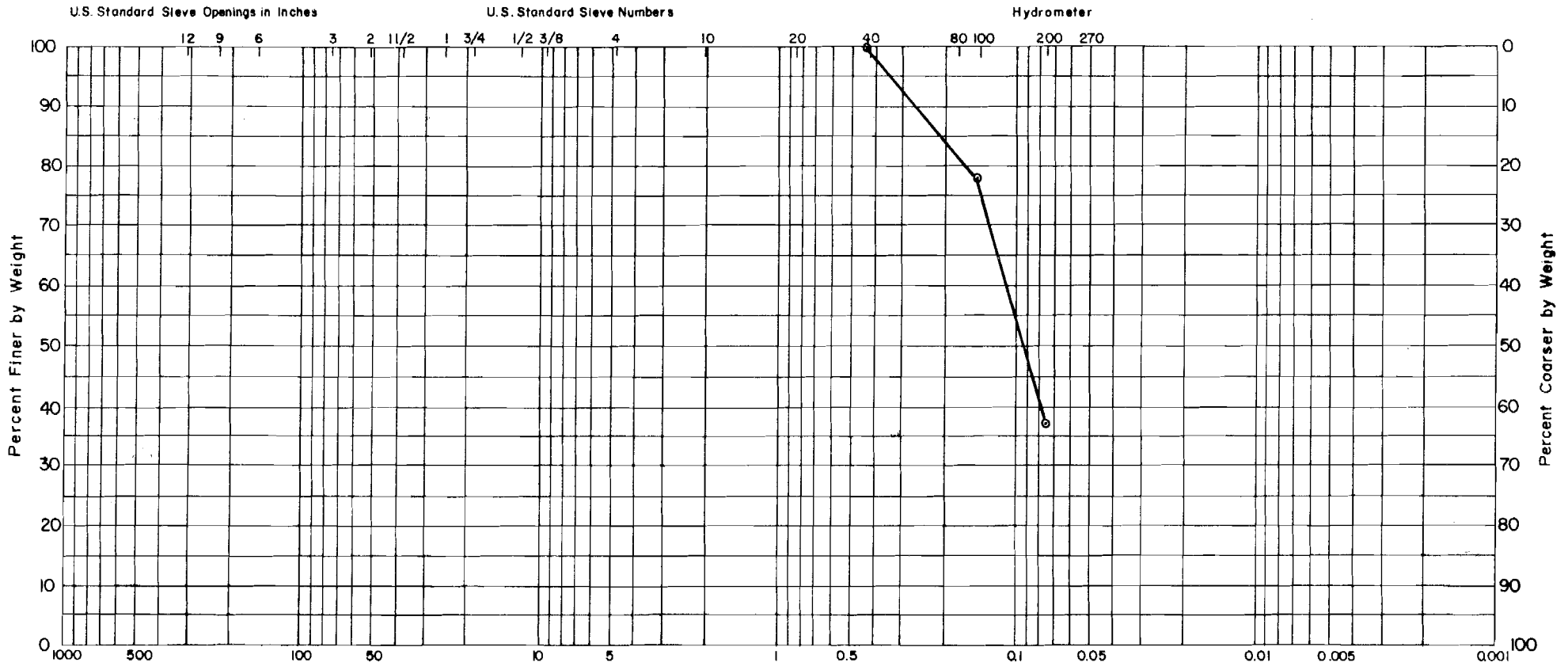
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R15 #2				SM	SILTY SAND (FIELD GEOLOGIST NOTES TRACE ORGANICS)



RIVER ALLUVIUM
TEST PIT TP-R15

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PROJECT NO. 052506



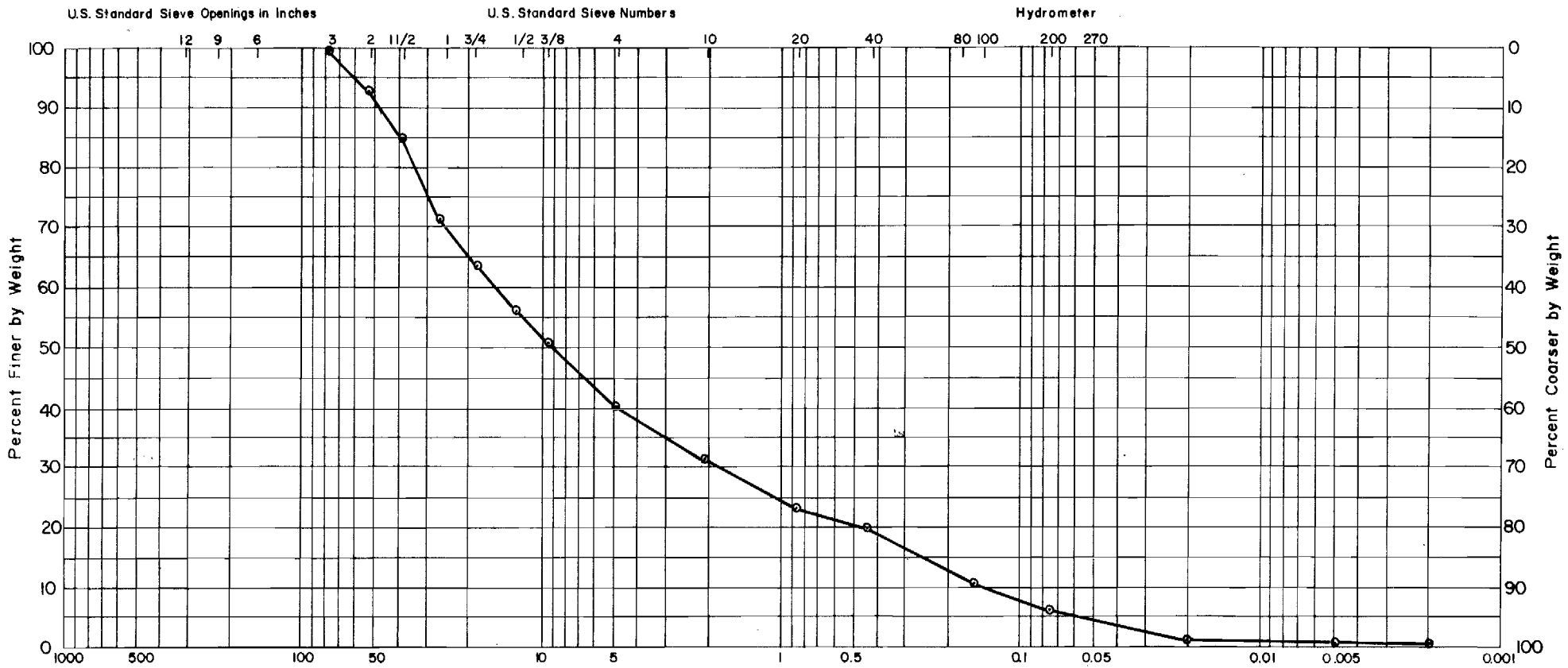
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R16 #1					SM	SILTY SAND (FIELD GEOLOGIST NOTES TRACE ORGANICS)



RIVER ALLUVIUM
TEST PIT TP-R16

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



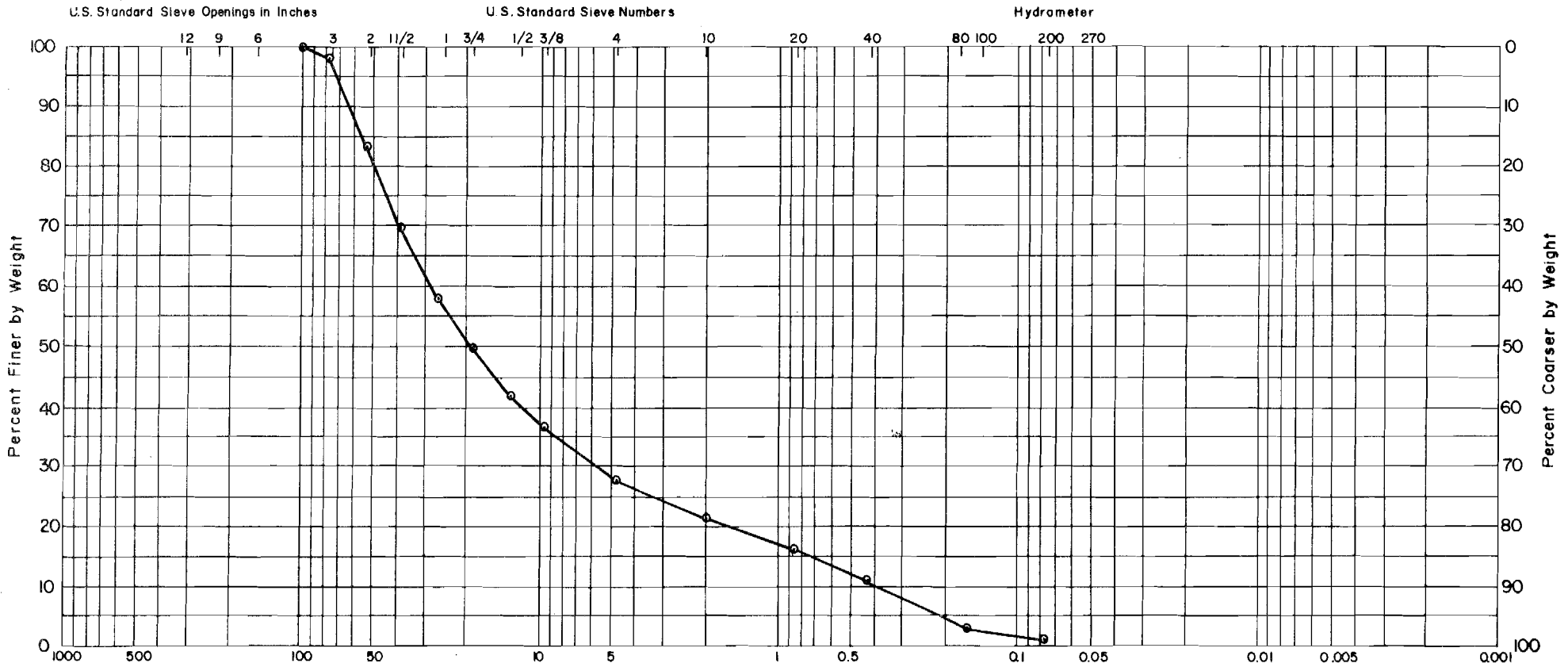
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R16 #2					GW-GM SANDY GRAVEL WITH TRACE SILT



RIVER ALLUVIUM
TEST PIT TP-R16

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



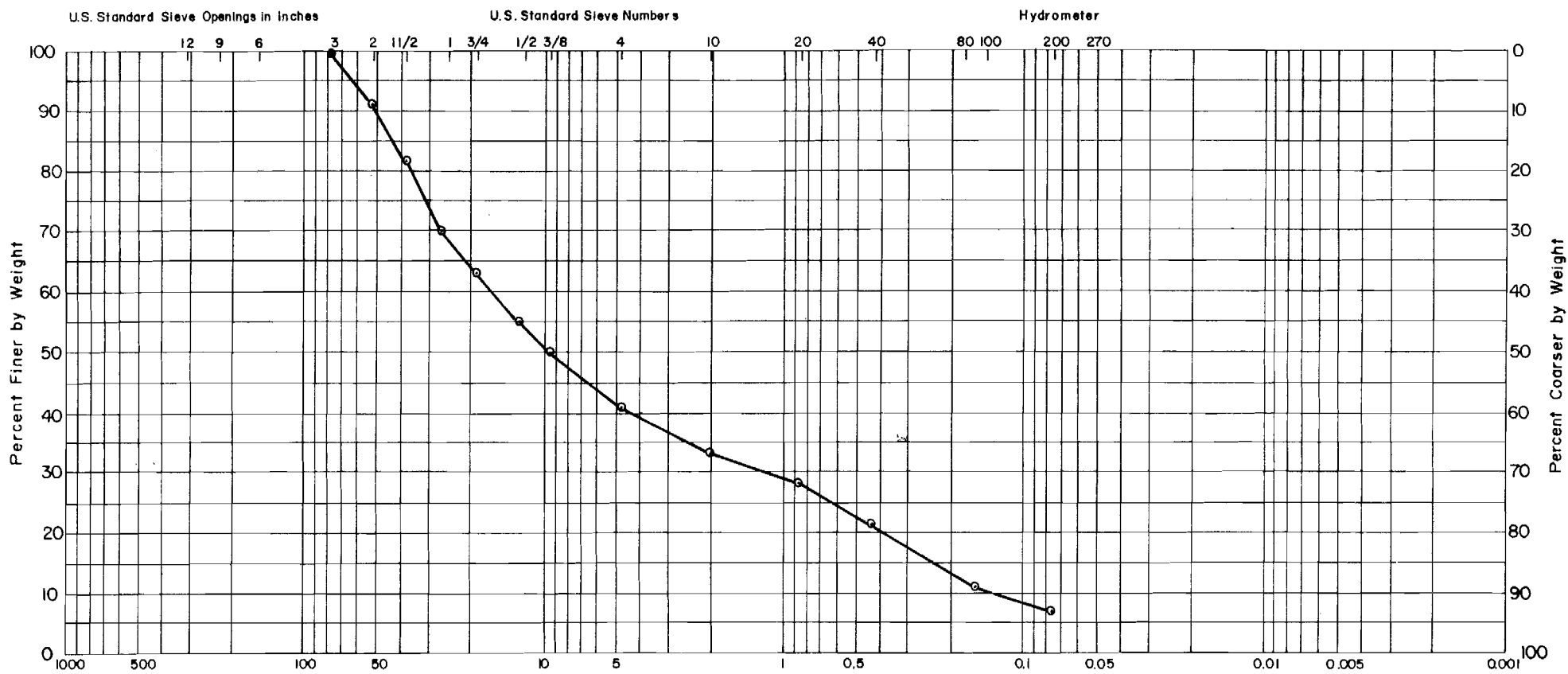
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R17 #1					GW	GRAVEL WITH SOME SAND AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R17

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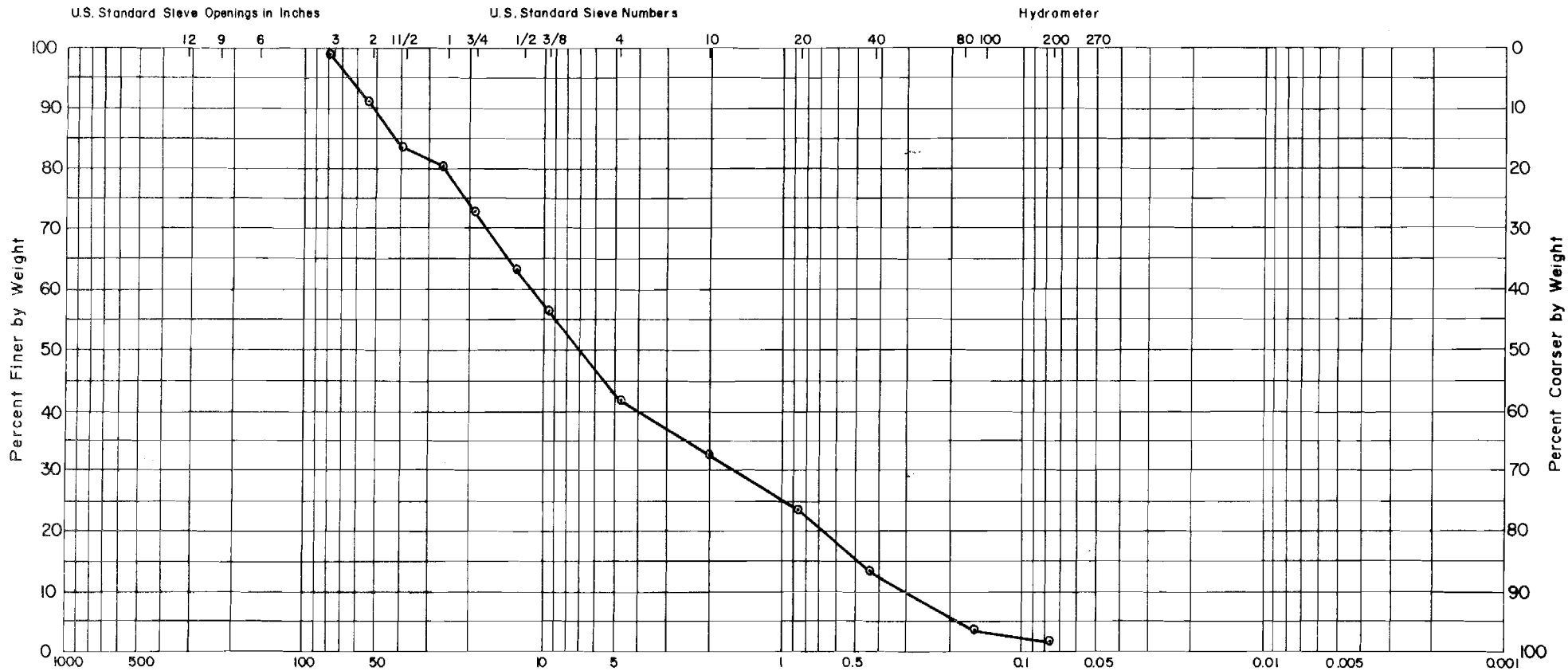
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R17 #2					GP-GM	SANDY GRAVEL WITH TRACE SILT



RIVER ALLUVIUM
TEST PIT TP-R17

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
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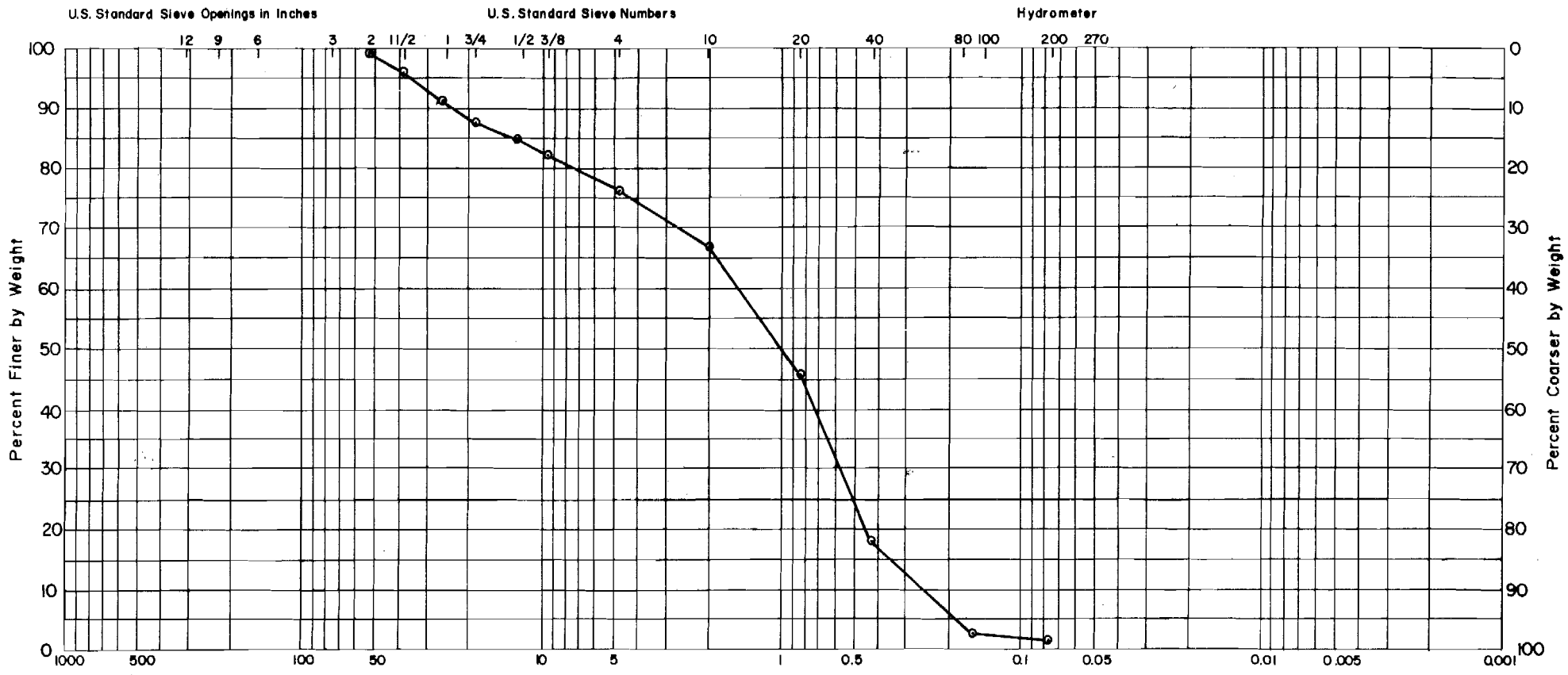
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R18 #2					GP SANDY GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R18

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
 PROJECT NO. 052506



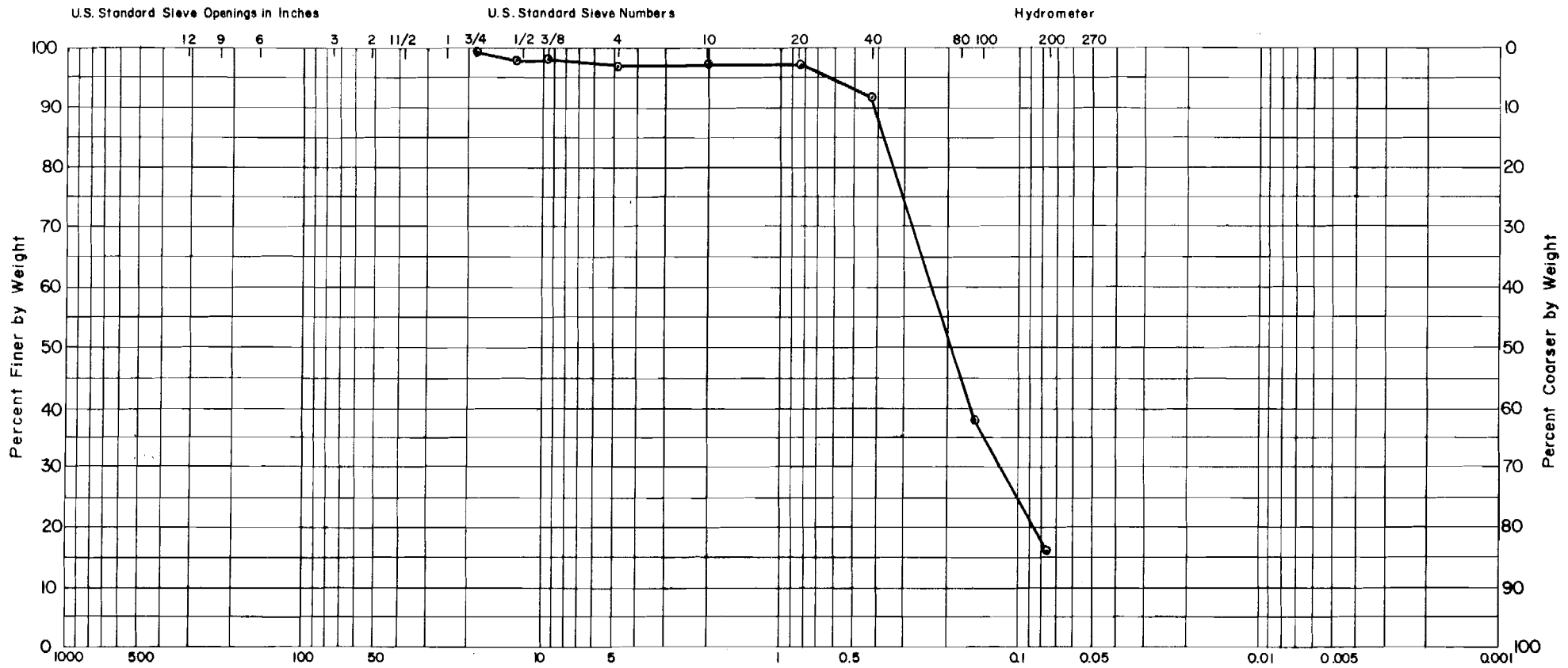
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R19 #2					SW-SP SAND WITH SOME GRAVEL



RIVER ALLUVIUM
TEST PIT TP-R19

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



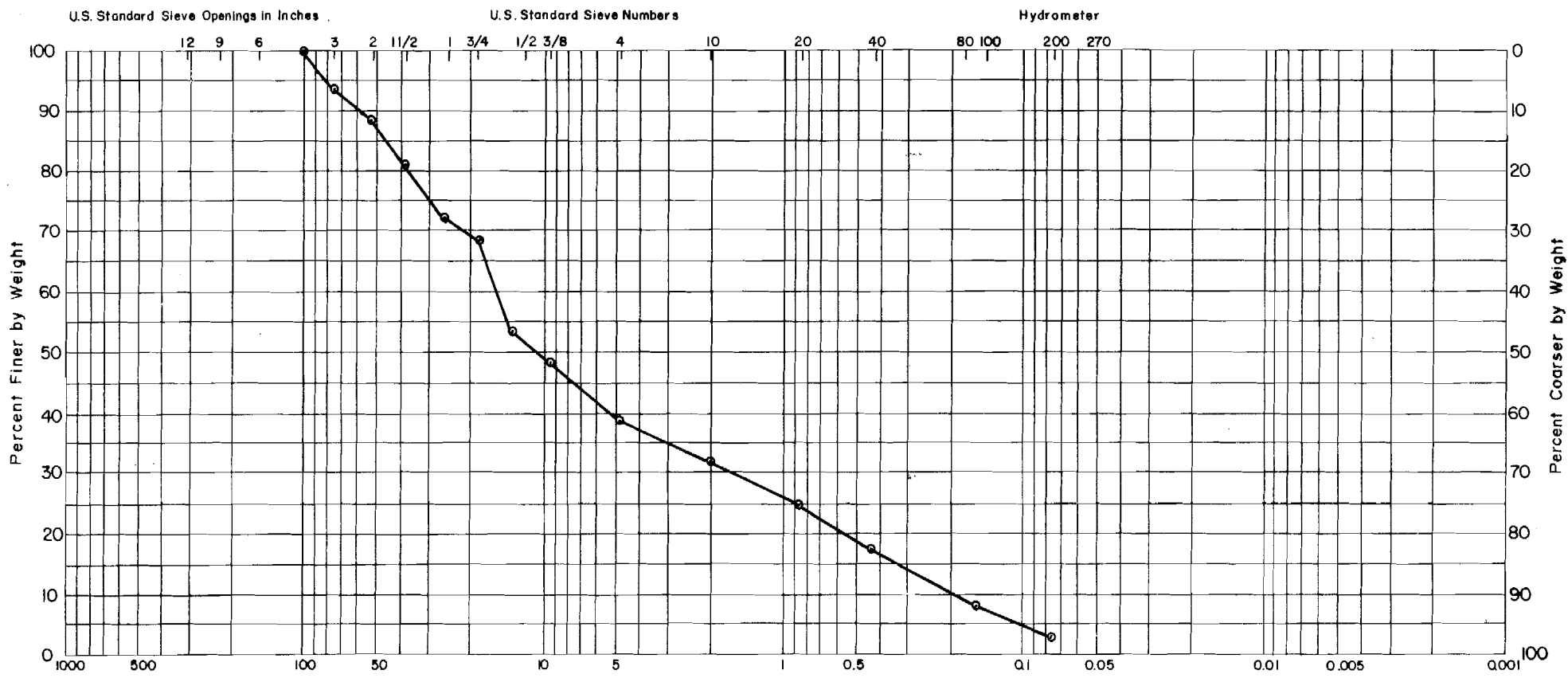
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R20 #1					SM-SP	SAND WITH SOME SILT AND TRACE GRAVEL (FIELD GEOLOGIST NOTES TRACE ORGANICS)



RIVER ALLUVIUM
TEST PIT TP-R20

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506



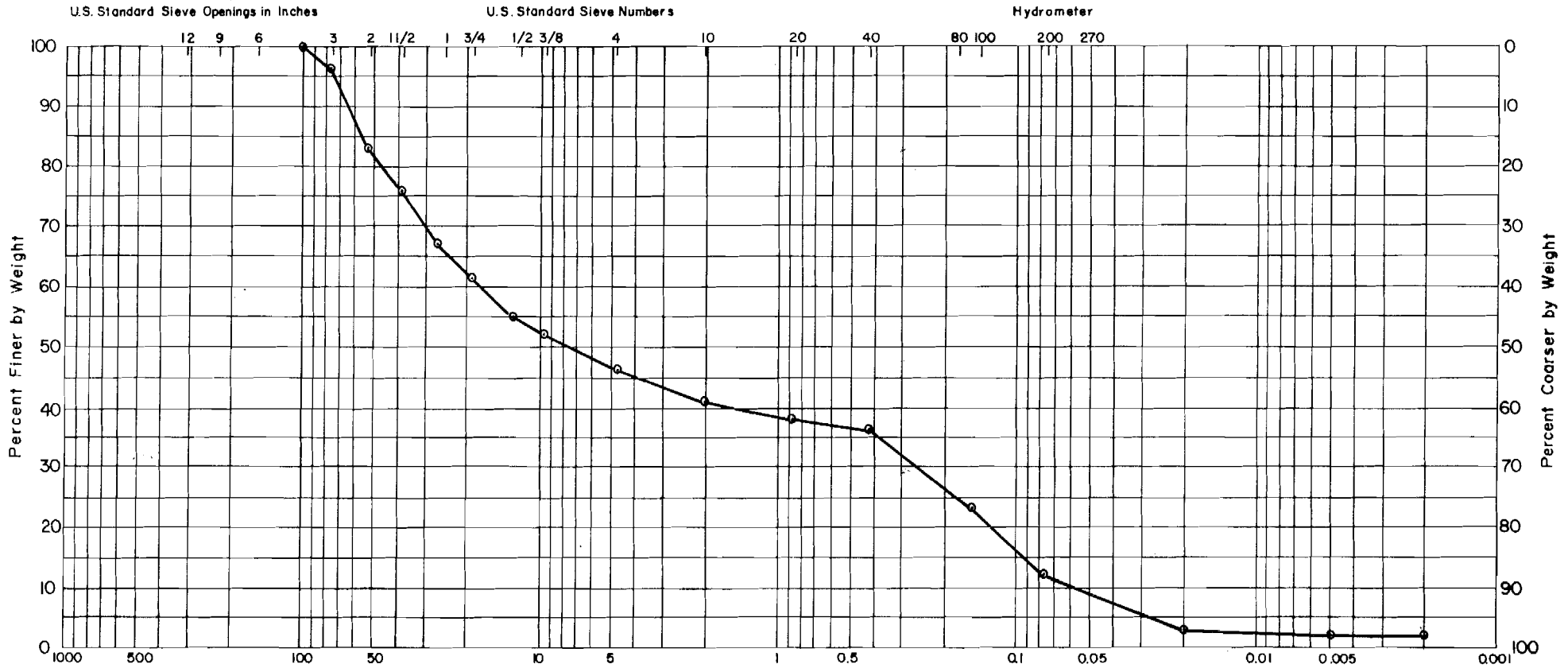
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R20 #2					GW SANDY GRAVEL WITH TRACE SILT AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R20

DRAWN BY: P.T.
 APPROVED BY: T.I.
 DATE: 11-6-81
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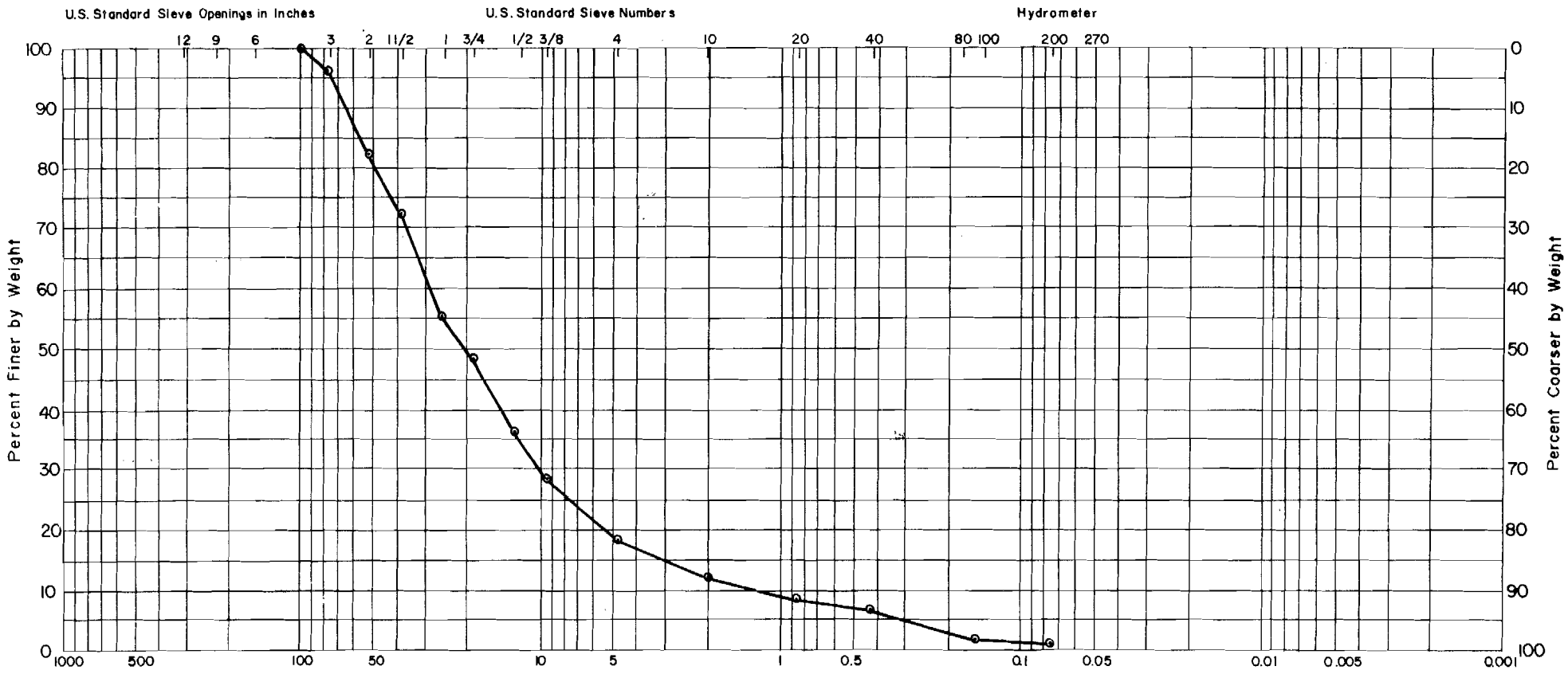
BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION	
TP-R22 #1					GP-GM	SANDY GRAVEL WITH SOME SILT AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R22

DRAWN BY: J.M.
APPROVED BY: T.I.
DATE: 12-81
PROJECT NO. 052506



BOULDERS	COBBLES	GRAVEL			SAND			FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes	

SAMPLE NO.	MOISTURE CONTENT	DRY DENSITY	LL	PI	CLASSIFICATION & DESCRIPTION
TP-R22 #2				GW	GRAVEL WITH SOME SAND AND SCATTERED COBBLES



RIVER ALLUVIUM
TEST PIT TP-R22

DRAWN BY: P.T.
APPROVED BY: T.I.
DATE: 11-6-81
PROJECT NO. 052506