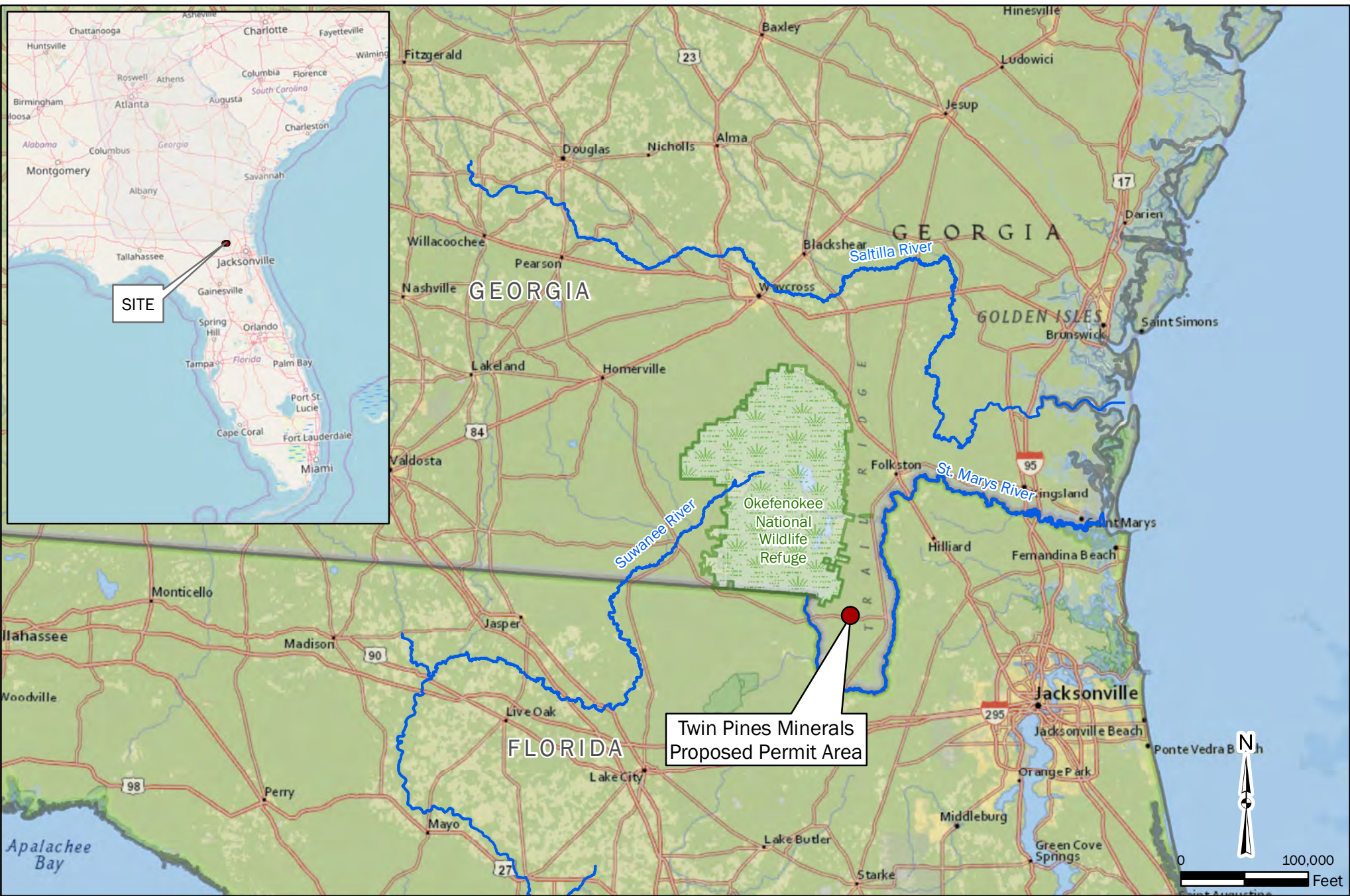


# FIGURES



**FIGURE 1: LOCATION OF THE PROPOSED TWIN PINES MINE**  
**TWIN PINES MINERALS**

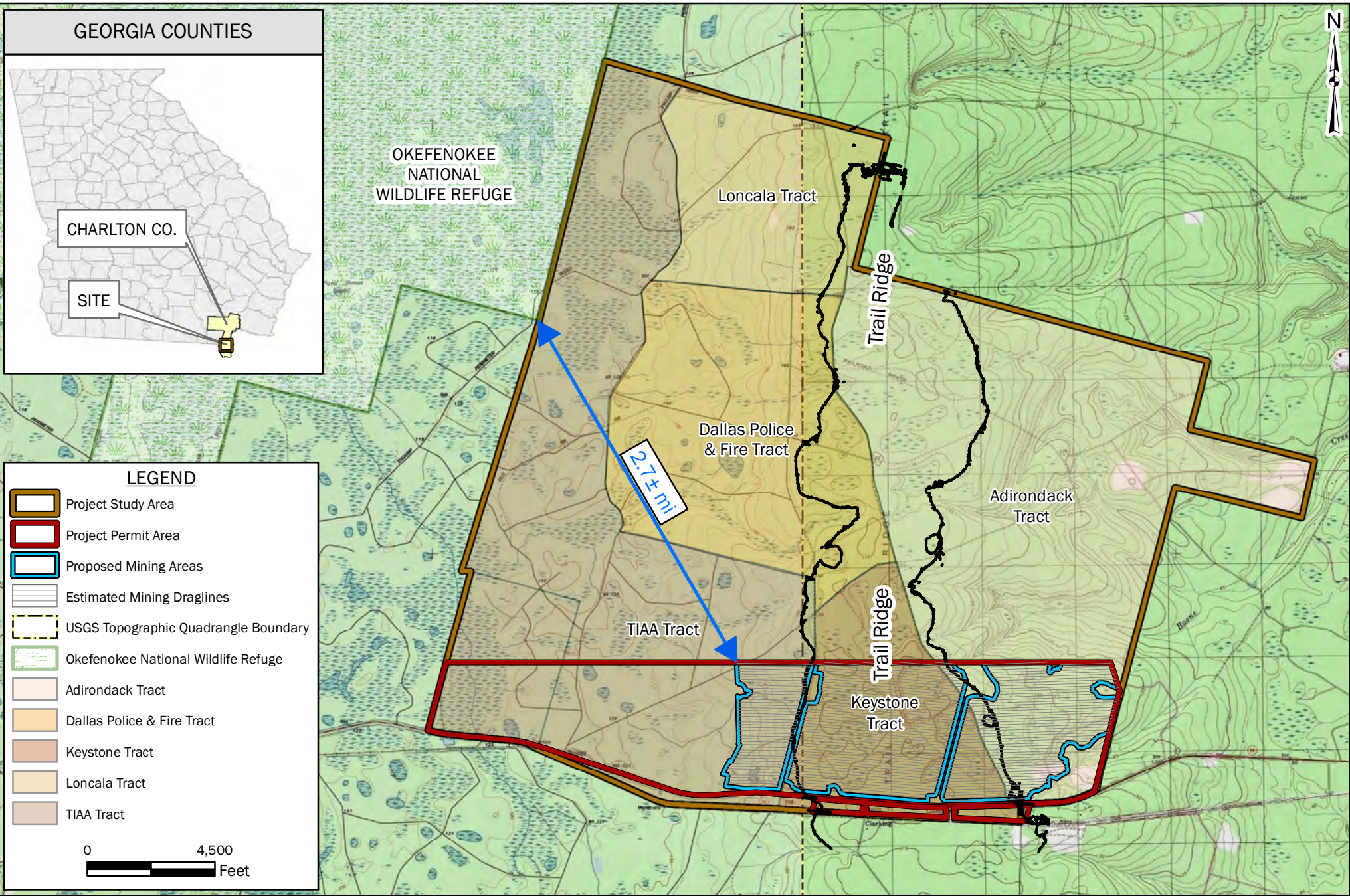
ST. GEORGE, CHARLTON COUNTY, GEORGIA

INSET BASEMAP: Open Street Map. BASEMAP: National Geographic World Map.



DRAWN BY: DEK
CHECKED BY: JMT
DRAWING DATE: 10/28/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 100,000 ft



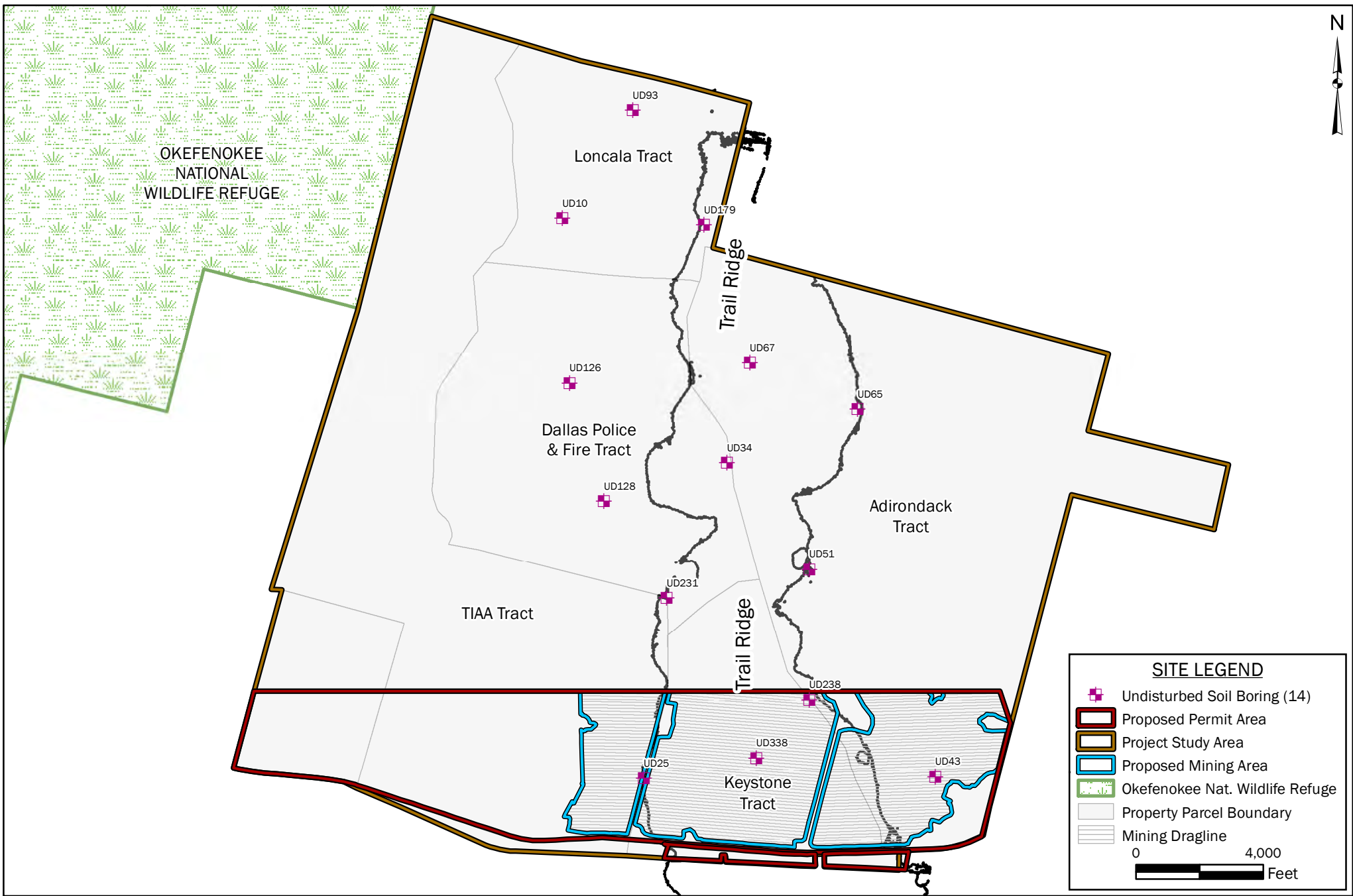


**FIGURE 2: PROJECT STUDY & PROPOSED PERMIT AREA**  
**TWIN PINES MINERALS**  
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: USGS 7.5 Minute Quadrangle Map, Florida & Georgia, (West) Moniac 1968 (10-ft Contour Interval), (East) Saint George 1982 (5-ft Contour Interval).

DRAWN BY: DEK
CHECKED BY: JMT
DRAWING DATE: 10/28/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 4,500 ft



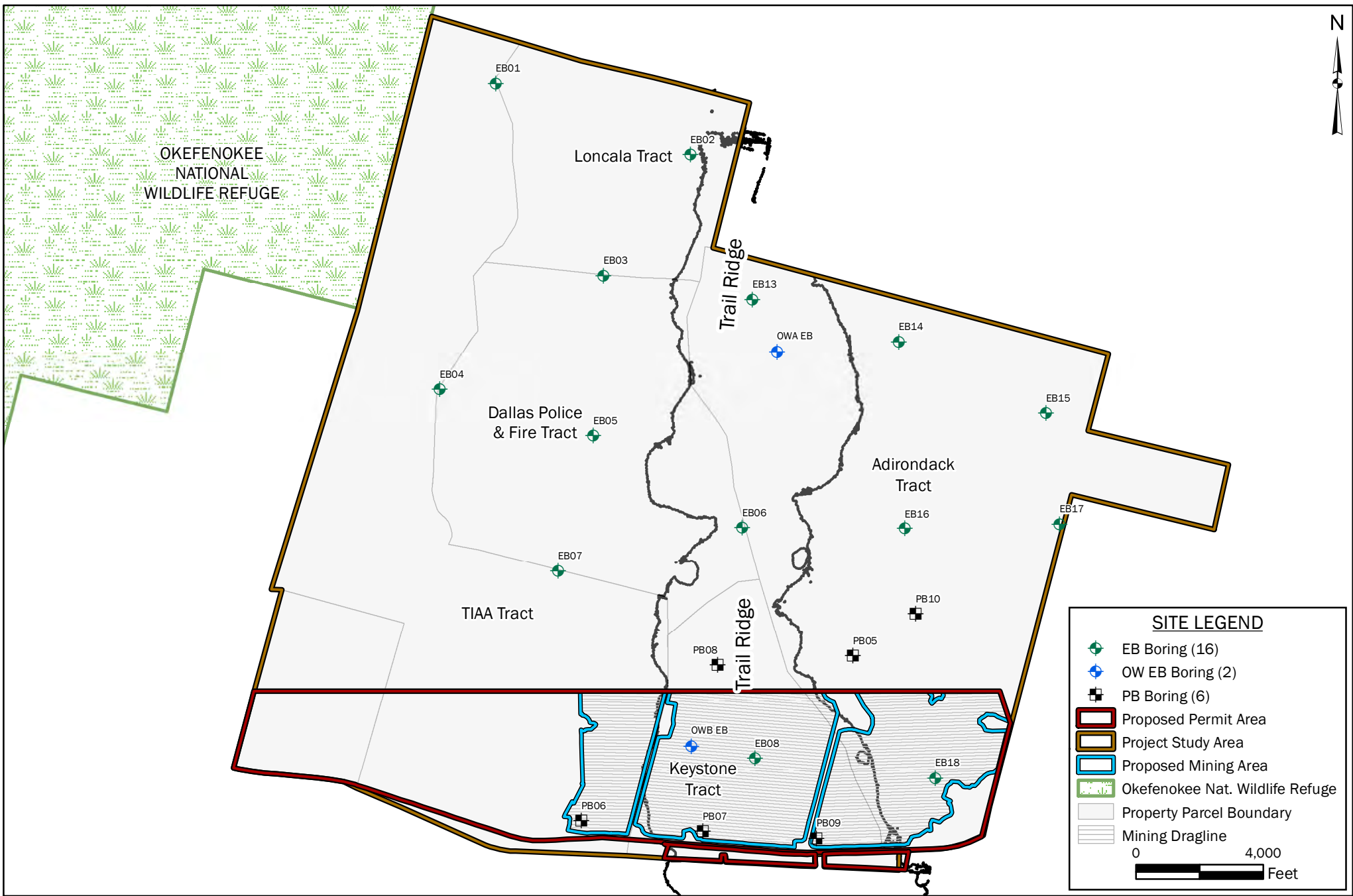


**FIGURE 3: UNDISTURBED (UD) SOIL BORING LOCATION MAP**  
**TWIN PINES MINERALS**  
 ST. GEORGE, CHARLTON COUNTY, GEORGIA



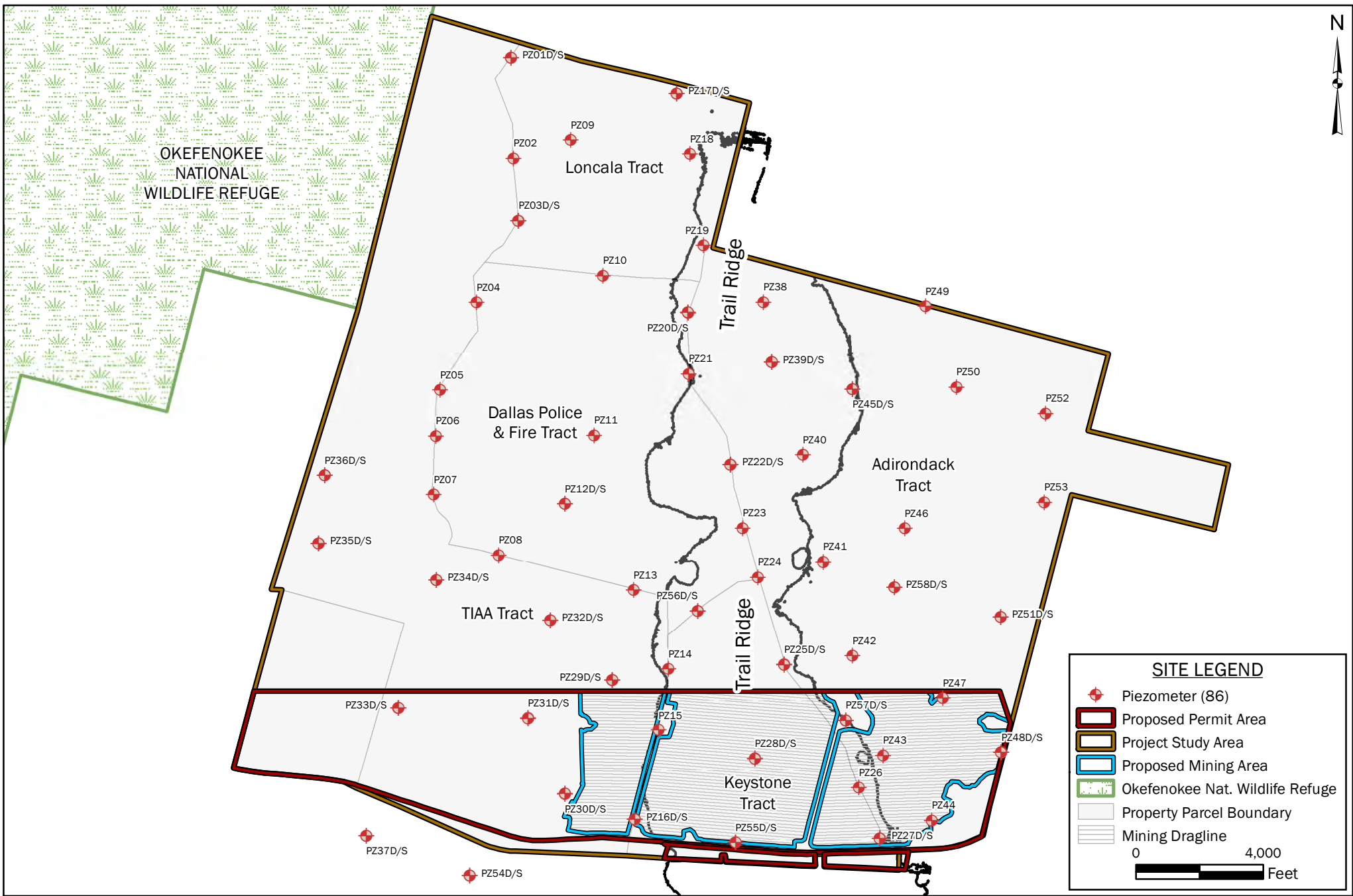
DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 10/28/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 4,000 ft





**FIGURE 4: EXPLORATORY BORING LOCATION MAP**  
**TWIN PINES MINERALS**  
**ST. GEORGE, CHARLTON COUNTY, GEORGIA**

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 10/28/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 4,000 ft

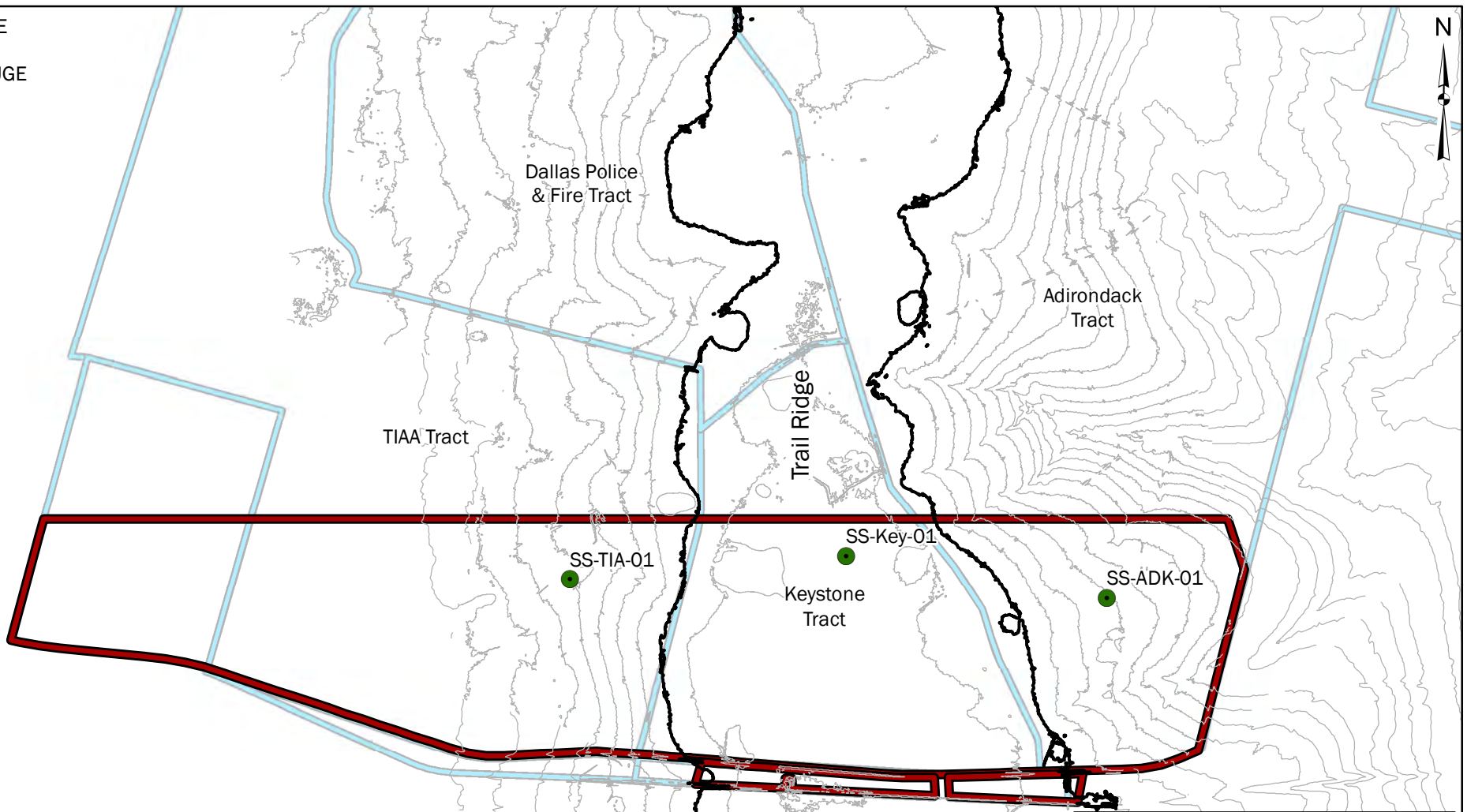


**FIGURE 5: PIEZOMETER LOCATION MAP**  
**TWIN PINES MINERALS**  
 ST. GEORGE, CHARLTON COUNTY, GEORGIA

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 10/28/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 4,000 ft



OKEFENOKEE  
NATIONAL  
WILDLIFE REFUGE



**LEGEND**

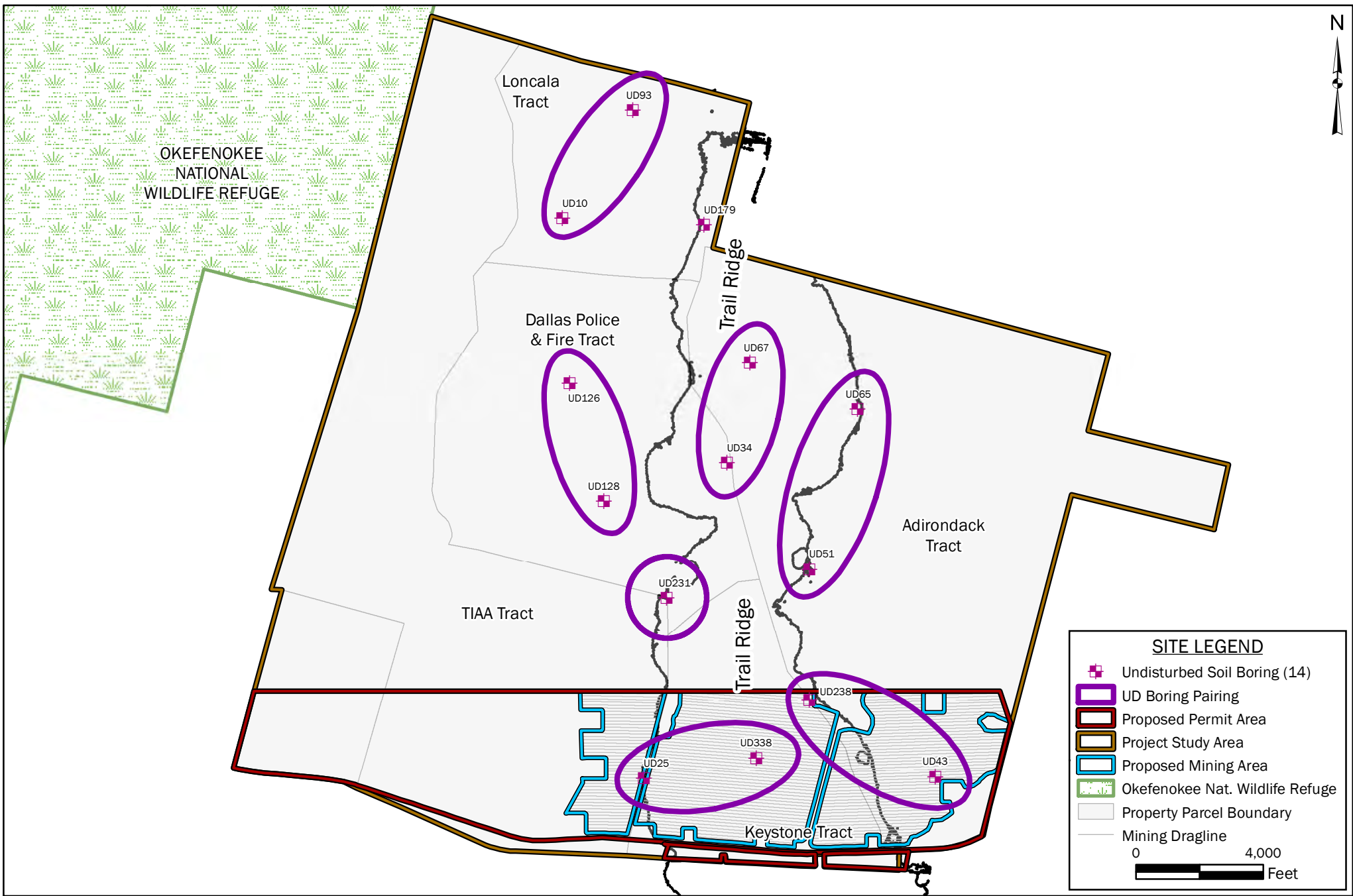
- Soil Sample Location
- ▭ Mining Permit Boundary
- ▭ Parcel Boundary
- ▭ Okefenokee National Wildlife Refuge

0 3,000  
Feet



**FIGURE 6: SOIL MOISTURE SAMPLING LOCATION MAP**  
TWIN PINES MINERALS  
ST. GEORGE, CHARLTON COUNTY, GEORGIA

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 9/17/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 3,000 ft



**FIGURE 7: UNDISTURBED (UD) SOIL BORING LOCATION & POST MINERAL PROCESSING PAIRING MAP**  
**TWIN PINES MINERALS**  
**ST. GEORGE, CHARLTON COUNTY, GEORGIA**

DRAWN BY: DEK
CHECKED BY: JRS
DRAWING DATE: 10/1/2019
REVISION DATE: N/A
TTL JOB NO.: 000180200804.00
APPROX. SCALE: 1 in = 4,000 ft



# TABLES

**Table 1:** Summary of Undisturbed Samples Collected for Vertical Hydraulic Conductivity Analysis from Undisturbed Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Depth Top (ft. amsl)	Sample Depth Bottom (ft. amsl)	Undisturbed/ Remolded?	Analytical Method	Laboratory
UD10	208093.3130	666408.7486	131.70	13	15	118.70	116.70	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD10	208093.3130	666408.7486	131.70	28	30	103.70	101.70	Undisturbed		
UD10	208093.3130	666408.7486	131.70	43	45	88.70	86.70	Undisturbed		
UD25	190488.7166	668975.1185	165.49	15	17	150.49	148.49	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD25	190488.7166	668975.1185	165.49	30	32	135.49	133.49	Undisturbed		
UD25	190488.7166	668975.1185	165.49	43	45	122.49	120.49	Undisturbed		
UD34	200408.2230	671582.2720	170.29	13	15	157.29	155.29	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD34	200408.2230	671582.2720	170.29	28	29	142.29	141.29	Undisturbed		
UD34	200408.2230	671582.2720	170.29	48	50	122.29	120.29	Undisturbed		
UD43	190542.5306	678135.6130	148.55	13	15	135.55	133.55	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD43	190542.5306	678135.6130	148.55	30	32	118.55	116.55	Undisturbed		
UD43	190542.5306	678135.6130	148.55	43	45	105.55	103.55	Undisturbed		
UD51	197065.1026	674174.9889	165.00	13	15	152.00	150.00	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD51	197065.1026	674174.9889	165.00	28	30	137.00	135.00	Undisturbed		
UD51	197065.1026	674174.9889	165.00	43	45	122.00	120.00	Undisturbed		
UD65	202093.9328	675684.2974	166.76	17	19	149.76	147.76	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD65	202093.9328	675684.2974	166.76	28	30	138.76	136.76	Undisturbed		
UD65	202093.9328	675684.2974	166.76	43	45	123.76	121.76	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	
UD67	203551.9396	672306.1274	172.06	17	19	155.06	153.06	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD67	203551.9396	672306.1274	172.06	28	30	144.06	142.06	Undisturbed		
UD67	203551.9396	672306.1274	172.06	43	45	129.06	127.06	Undisturbed		
UD93	211493.3310	668617.5144	150.25	13	15	137.25	135.25	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD93	211493.3310	668617.5144	150.25	28	30	122.25	120.25	Undisturbed		
UD93	211493.3310	668617.5144	150.25	43	45	107.25	105.25	Undisturbed		
UD126	202917.1019	666640.3662	140.22	13	15	127.22	125.22	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD126	202917.1019	666640.3662	140.22	28	30	112.22	110.22	Undisturbed		
UD126	202917.1019	666640.3662	140.22	43	45	97.22	95.22	Undisturbed		
UD128	199193.1410	667712.6820	150.52	13	15	137.52	135.52	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD128	199193.1410	667712.6820	150.52	30	32	120.52	118.52	Undisturbed		
UD128	199193.1410	667712.6820	150.52	43	45	107.52	105.52	Undisturbed		
UD179	207884.9971	670857.1818	166.08	13	15	153.08	151.08	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD179	207884.9971	670857.1818	166.08	28	30	138.08	136.08	Undisturbed		
UD179	207884.9971	670857.1818	166.08	43	45	123.08	121.08	Undisturbed		



**Table 1:** Summary of Undisturbed Samples Collected for Vertical Hydraulic Conductivity Analysis from Undisturbed Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Depth Top (ft. amsl)	Sample Depth Bottom (ft. amsl)	Undisturbed/ Remolded?	Analytical Method	Laboratory
UD231	196158.7390	669687.5038	167.53	13	15	154.53	152.53	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD231	196158.7390	669687.5038	167.53	30	32	137.53	135.53	Undisturbed		
UD231	196158.7390	669687.5038	167.53	43	45	124.53	122.53	Undisturbed		
UD238	192952.8585	674171.2238	168.31	13	15	155.31	153.31	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD238	192952.8585	674171.2238	168.31	28	30	140.31	138.31	Undisturbed		
UD238	192952.8585	674171.2238	168.31	43	45	125.31	123.31	Undisturbed		
UD338	191127.7310	672504.6590	173.56	13	15	160.56	158.56	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	Bowser-Morner, Inc.
UD338	191127.7310	672504.6590	173.56	28	30	145.56	143.56	Undisturbed		
UD338	191127.7310	672504.6590	173.56	43	45	130.56	128.56	Undisturbed		
UD25R	NS	NS	NS	3	5	NS	NS	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
UD25R	NS	NS	NS	10	12	NS	NS	Undisturbed		
UD43R	NS	NS	NS	5	7	NS	NS	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
UD43R	NS	NS	NS	10	12	NS	NS	Undisturbed		
UD238R	NS	NS	NS	6	8	NS	NS	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
UD238R	NS	NS	NS	10	12	NS	NS	Undisturbed		
UD338R	NS	NS	NS	9	11	NS	NS	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.

Notes: ft bgs = feet below ground surface      NS = Not surveyed; borings performed within 5-10 feet of original UD boring  
ft. amsl = feet above mean sea level

**Table 2:** Summary of Undisturbed Samples Collected for Vertical Hydraulic Conductivity Analysis from Exploratory and Piezometer Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Depth Top (ft. amsl)	Sample Depth Bottom (ft. amsl)	Undisturbed/ Remolded?	Analytical Method	Laboratory
EB03	667706.7987	206290.6294	145.44	92.5	94	52.94	51.44	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB06	672066.9668	198366.9546	171.50	120	122	51.50	49.50	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB08	672464.5741	191112.0239	173.68	130	133	43.68	40.68	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	12	12.5	128.28	127.78	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	15.5	17	124.78	123.28	Disturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	25.5	26	114.78	114.28	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	34.5	36	105.78	104.28	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	44.5	46	95.78	94.28	Remolded	ASTM D 2434 "Measurement of Hydraulic Conductivity"	TTL, Inc.
EB16	677166.6458	198336.5709	140.28	86	90	54.28	50.28	Disturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
PZ57D	675314.5224	192314.0733	165.62	20	22	145.62	143.62	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.
PZ57D	675314.5224	192314.0733	165.62	25	27	140.62	138.62	Undisturbed	ASTM D 5084 "Measurement of Hydraulic Conductivity"	TTL, Inc.

Notes: ft bgs = feet below ground surface  
ft. amsl = feet above mean sea level



**Table 3:** Laboratory Results of Soil Samples Analyzed for Vertical Hydraulic Conductivity; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	USCS	Vertical Hydraulic Conductivity (Kv) (cm/sec)	Undisturbed/ Remolded?	Laboratory	Sample Notes
UD10	208093.3130	666408.7486	131.70	13	15	118.70	116.70	SP-SM	1.30E-04	Undisturbed	Bowser-Morner, Inc.	Unconsolidated Sand
UD10	208093.3130	666408.7486	131.70	28	30	103.70	101.70	SP	2.00E-05	Undisturbed		Unconsolidated Sand
UD10	208093.3130	666408.7486	131.70	43	45	88.70	86.70	SP-SM	1.90E-05	Undisturbed		Unconsolidated Sand
UD25	190488.7166	668975.1185	165.49	15	17	150.49	148.49	SP-SM	1.40E-05	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD25	190488.7166	668975.1185	165.49	30	32	135.49	133.49	SP	8.20E-05	Undisturbed		Unconsolidated Sand
UD25	190488.7166	668975.1185	165.49	43	45	122.49	120.49	SP	1.40E-06	Undisturbed		Unconsolidated Sand
UD34	200408.2230	671582.2720	170.29	13	15	157.29	155.29	SP-SM	1.00E-05	Undisturbed	Bowser-Morner, Inc.	Consolidated Sand
UD34	200408.2230	671582.2720	170.29	28	29	142.29	141.29	SP	7.80E-07	Undisturbed		Unconsolidated Sand
UD34	200408.2230	671582.2720	170.29	48	50	122.29	120.29	SP	4.40E-07	Undisturbed		Semi-consolidated Sand
UD43	190542.5306	678135.6130	148.55	13	15	135.55	133.55	SP	7.00E-06	Undisturbed	Bowser-Morner, Inc.	Unconsolidated Sand
UD43	190542.5306	678135.6130	148.55	30	32	118.55	116.55	SP-SM	3.80E-06	Undisturbed		Unconsolidated Sand
UD43	190542.5306	678135.6130	148.55	43	45	105.55	103.55	SC	1.70E-08	Undisturbed		Clayey Sand
UD51	197065.1026	674174.9889	165.00	13	15	152.00	150.00	SP-SM	5.20E-06	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand (Black)
UD51	197065.1026	674174.9889	165.00	28	30	137.00	135.00	SP-SM	7.60E-06	Undisturbed		Unconsolidated Sand
UD51	197065.1026	674174.9889	165.00	43	45	122.00	120.00	SP	6.90E-05	Undisturbed		Unconsolidated Sand
UD65	202093.9328	675684.2974	166.76	17	19	149.76	147.76	SP	2.80E-04	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated
UD65	202093.9328	675684.2974	166.76	28	30	138.76	136.76	SP	1.10E-04	Undisturbed		Unconsolidated Sand
UD65	202093.9328	675684.2974	166.76	43	45	123.76	121.76	SP	6.30E-02	Remolded		Consolidated - Sity-Clay Sand
UD67	203551.9396	672306.1274	172.06	17	19	155.06	153.06	SP-SM	1.40E-04	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD67	203551.9396	672306.1274	172.06	28	30	144.06	142.06	SP	2.90E-04	Undisturbed		Unconsolidated Sand
UD67	203551.9396	672306.1274	172.06	43	45	129.06	127.06	SP	4.10E-06	Undisturbed		Unconsolidated Sand
UD93	211493.3310	668617.5144	150.25	13	15	137.25	135.25	SP	6.50E-07	Undisturbed	Bowser-Morner, Inc.	Consolidated Sand
UD93	211493.3310	668617.5144	150.25	28	30	122.25	120.25	SP-SM	2.40E-05	Undisturbed		Unconsolidated Sand
UD93	211493.3310	668617.5144	150.25	43	45	107.25	105.25	SP	2.80E-05	Undisturbed		Unconsolidated Sand
UD126	202917.1019	666640.3662	140.22	13	15	127.22	125.22	SP-SM	8.30E-05	Undisturbed	Bowser-Morner, Inc.	Consolidated Sand
UD126	202917.1019	666640.3662	140.22	28	30	112.22	110.22	SP	1.00E-05	Undisturbed		Unconsolidated Sand
UD126	202917.1019	666640.3662	140.22	43	45	97.22	95.22	SP-SM	9.30E-07	Undisturbed		Clayey Sand mixed w/ Fat Clay
UD128	199193.1410	667712.6820	150.52	13	15	137.52	135.52	SP	9.50E-05	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD128	199193.1410	667712.6820	150.52	30	32	120.52	118.52	SP-SM	2.20E-06	Undisturbed		Unconsolidated Sand
UD128	199193.1410	667712.6820	150.52	43	45	107.52	105.52	SP	1.70E-04	Undisturbed		Unconsolidated Sand
UD179	207884.9971	670857.1818	166.08	13	15	153.08	151.08	SP	2.10E-06	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD179	207884.9971	670857.1818	166.08	28	30	138.08	136.08	SP	3.90E-04	Undisturbed		Unconsolidated Sand
UD179	207884.9971	670857.1818	166.08	43	45	123.08	121.08	SP	2.00E-07	Undisturbed		Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	13	15	154.53	152.53	SP-SM	2.70E-06	Undisturbed	Bowser-Morner, Inc.	Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	30	32	137.53	135.53	SP-SM	6.00E-06	Undisturbed		Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	43	45	124.53	122.53	SP-SM	1.90E-05	Undisturbed		Semi-consolidated Sand

**Table 3:** Laboratory Results of Soil Samples Analyzed for Vertical Hydraulic Conductivity; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	USCS	Vertical Hydraulic Conductivity (Kv) (cm/sec)	Undisturbed/ Remolded?	Laboratory	Sample Notes
UD238	192952.8585	674171.2238	168.31	13	15	155.31	153.31	SP-SM	1.00E-04	Undisturbed	Bowser-Morner, Inc.	Unconsolidated Sand
UD238	192952.8585	674171.2238	168.31	28	30	140.31	138.31	SP	3.30E-04	Undisturbed		Unconsolidated Sand
UD238	192952.8585	674171.2238	168.31	43	45	125.31	123.31	SP	1.20E-04	Undisturbed		Unconsolidated Sand
UD338	191127.7310	672504.6590	173.56	13	15	160.56	158.56	SP-SM	2.60E-06	Undisturbed	Bowser-Morner, Inc.	Semi-Consolidated Sand
UD338	191127.7310	672504.6590	173.56	28	30	145.56	143.56	SP-SM	2.20E-05	Undisturbed		Unconsolidated Sand
UD338	191127.7310	672504.6590	173.56	43	45	130.56	128.56	SP	9.20E-05	Undisturbed		Unconsolidated Sand
EB03	206290.6294	667706.7987	145.44	92.5	94	52.94	51.44	CH	1.61E-09	Undisturbed	TTL, Inc.	Clay
EB06	198366.9546	672066.9668	171.50	120	122	51.50	49.50	CL	1.29E-05	Undisturbed	TTL, Inc.	Clay
EB08	191112.0239	672464.5741	173.68	130	133	43.68	40.68	CH	9.29E-09	Undisturbed	TTL, Inc.	Clay
EB16	198336.5709	677166.6458	140.28	12	12.5	128.28	127.78	SP	9.60E-02	Remolded	TTL, Inc.	Unconsolidated Sand
EB16	198336.5709	677166.6458	140.28	15.5	17	124.78	123.28	SM	1.80E-04	Disturbed		Consolidated Sand
EB16	198336.5709	677166.6458	140.28	25.5	26	114.78	114.28	SM	2.30E-02	Remolded		Unconsolidated Sand
EB16	198336.5709	677166.6458	140.28	34.5	36	105.78	104.28	SP	1.90E-02	Remolded		Unconsolidated Sand
EB16	198336.5709	677166.6458	140.28	44.5	46	95.78	94.28	SP	2.40E-02	Remolded		Unconsolidated Sand
EB16	198336.5709	677166.6458	140.28	86	90	54.28	50.28	CH	1.30E-08	Disturbed		Clay
PZ57D	192314.0733	675314.5224	165.62	20	22	145.62	143.62	SM	2.70E-08	Undisturbed	TTL, Inc.	Consolidated Sand
PZ57D	192314.0733	675314.5224	165.62	25	27	140.62	138.62	SM	3.40E-07	Undisturbed		Consolidated Sand
UD25R	NS	NS	NS	3	5	NS	NS	SP-SM	3.20E-04	Undisturbed	TTL, Inc.	Unconsolidated Sand
UD25R	NS	NS	NS	10	12	NS	NS	SP	2.30E-04	Undisturbed		Unconsolidated Sand
UD43R	NS	NS	NS	5	7	NS	NS	SP	6.20E-04	Undisturbed	TTL, Inc.	Unconsolidated Sand
UD43R	NS	NS	NS	10	12	NS	NS	SP	4.50E-04	Undisturbed		Unconsolidated Sand
UD238R	NS	NS	NS	6	8	NS	NS	SP	8.50E-04	Undisturbed	TTL, Inc.	Unconsolidated Sand
UD238R	NS	NS	NS	10	12	NS	NS	SP	4.00E-04	Undisturbed		Unconsolidated Sand
UD338R	NS	NS	NS	9	11	NS	NS	SP	3.00E-04	Undisturbed	TTL, Inc.	Unconsolidated Sand

Notes: ft bgs = feet below ground surface USCS = Unified Soil Classification System NS = Not surveyed; borings performed within 5-10 feet of original UD boring  
ft. amsl = feet above mean sea level cm/sec = centimeters per second

**Table 4:** Laboratory Results of Soil Samples Analyzed for Porosity; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	USCS	Porosity	Sample Notes
UD10	208093.3130	666408.7486	131.70	13	15	118.70	116.70	SP-SM	36.7%	Unconsolidated Sand
UD10	208093.3130	666408.7486	131.70	28	30	103.70	101.70	SP	38.7%	Unconsolidated Sand
UD10	208093.3130	666408.7486	131.70	43	45	88.70	86.70	SP-SM	35.5%	Unconsolidated Sand
UD25	190488.7166	668975.1185	165.49	15	17	150.49	148.49	SP-SM	43.7%	Semi-Consolidated Sand
UD25	190488.7166	668975.1185	165.49	30	32	135.49	133.49	SP	41.6%	Unconsolidated Sand
UD25	190488.7166	668975.1185	165.49	43	45	122.49	120.49	SP	35.0%	Unconsolidated Sand
UD34	200408.2230	671582.2720	170.29	13	15	157.29	155.29	SP-SM	32.9%	Consolidated Sand
UD34	200408.2230	671582.2720	170.29	28	29	142.29	141.29	SP	42.0%	Unconsolidated Sand
UD34	200408.2230	671582.2720	170.29	48	50	122.29	120.29	SP	40.8%	Semi-consolidated Sand
UD43	190542.5306	678135.6130	148.55	13	15	135.55	133.55	SP	39.6%	Unconsolidated Sand
UD43	190542.5306	678135.6130	148.55	30	32	118.55	116.55	SP-SM	36.6%	Unconsolidated Sand
UD43	190542.5306	678135.6130	148.55	43	45	105.55	103.55	SC	35.2%	Clayey Sand
UD51	197065.1026	674174.9889	165.00	13	15	152.00	150.00	SP-SM	33.8%	Semi-Consolidated Sand (Black)
UD51	197065.1026	674174.9889	165.00	28	30	137.00	135.00	SP-SM	39.1%	Unconsolidated Sand
UD51	197065.1026	674174.9889	165.00	43	45	122.00	120.00	SP	32.0%	Unconsolidated Sand
UD65	202093.9328	675684.2974	166.76	17	19	149.76	147.76	SP	40.0%	Semi-Consolidated
UD65	202093.9328	675684.2974	166.76	28	30	138.76	136.76	SP	37.7%	Unconsolidated Sand
UD65	202093.9328	675684.2974	166.76	43	45	123.76	121.76	SP	36.5%	Consolidated - Sity-Clay Sand
UD67	203551.9396	672306.1274	172.06	17	19	155.06	153.06	SP-SM	33.1%	Semi-Consolidated Sand
UD67	203551.9396	672306.1274	172.06	28	30	144.06	142.06	SP	39.8%	Unconsolidated Sand
UD67	203551.9396	672306.1274	172.06	43	45	129.06	127.06	SP	31.7%	Unconsolidated Sand
UD93	211493.3310	668617.5144	150.25	13	15	137.25	135.25	SP	37.7%	Consolidated Sand
UD93	211493.3310	668617.5144	150.25	28	30	122.25	120.25	SP-SM	33.7%	Unconsolidated Sand
UD93	211493.3310	668617.5144	150.25	43	45	107.25	105.25	SP	35.5%	Unconsolidated Sand
UD126	202917.1019	666640.3662	140.22	13	15	127.22	125.22	SP-SM	31.3%	Consolidated Sand
UD126	202917.1019	666640.3662	140.22	28	30	112.22	110.22	SP	31.3%	Unconsolidated Sand
UD126	202917.1019	666640.3662	140.22	43	45	97.22	95.22	SP-SM	33.0%	Clayey Sand mixed w/ Fat Clay
UD128	199193.1410	667712.6820	150.52	13	15	137.52	135.52	SP	37.5%	Semi-Consolidated Sand
UD128	199193.1410	667712.6820	150.52	30	32	120.52	118.52	SP-SM	39.1%	Unconsolidated Sand
UD128	199193.1410	667712.6820	150.52	43	45	107.52	105.52	SP	36.0%	Unconsolidated Sand
UD179	207884.9971	670857.1818	166.08	13	15	153.08	151.08	SP	38.5%	Semi-Consolidated Sand
UD179	207884.9971	670857.1818	166.08	28	30	138.08	136.08	SP	34.6%	Unconsolidated Sand
UD179	207884.9971	670857.1818	166.08	43	45	123.08	121.08	SP	34.4%	Unconsolidated Sand



**Table 4:** Laboratory Results of Soil Samples Analyzed for Porosity; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	USCS	Porosity	Sample Notes
UD231	196158.7390	669687.5038	167.53	13	15	154.53	152.53	SP-SM	37.1%	Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	30	32	137.53	135.53	SP-SM	30.1%	Unconsolidated Sand
UD231	196158.7390	669687.5038	167.53	43	45	124.53	122.53	SP-SM	35.4%	Semi-consolidated Sand
UD238	192952.8585	674171.2238	168.31	13	15	155.31	153.31	SP-SM	33.5%	Unconsolidated Sand
UD238	192952.8585	674171.2238	168.31	28	30	140.31	138.31	SP	35.9%	Unconsolidated Sand
UD238	192952.8585	674171.2238	168.31	43	45	125.31	123.31	SP	33.2%	Unconsolidated Sand
UD338	191127.7310	672504.6590	173.56	13	15	160.56	158.56	SP-SM	33.9%	Semi-Consolidated Sand
UD338	191127.7310	672504.6590	173.56	28	30	145.56	143.56	SP-SM	37.0%	Unconsolidated Sand
UD338	191127.7310	672504.6590	173.56	43	45	130.56	128.56	SP	35.3%	Unconsolidated Sand

Notes: ft bgs = feet below ground surface  
ft. amsl = feet above mean sea level

USCS = Unified Soil Classification System

**Table 5 :** Summary of Grain-Size Distribution Analysis of Soil Samples Collected from Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	Gradation Percent Sand	Gradation Percent Silt/Clay
PZ01S	213145.7250	664792.9515	122.98	6	9	116.98	113.98	84.9	15.1
PZ01S	213145.7250	664792.9515	122.98	12.5	20	110.48	102.98	95.0	5.0
PZ02	209988.5659	664881.4667	126.02	4	10	122.02	116.02	90.3	9.7
PZ02	209988.5659	664881.4667	126.02	17.5	20	108.52	106.02	95.8	4.2
PZ03S	208020.1141	665029.0251	123.77	3	7	120.77	116.77	88.9	11.1
PZ03S	208020.1141	665029.0251	123.77	18	20	105.77	103.77	92.5	7.5
PZ03D	208027.2407	665032.2313	123.50	7	12	116.50	111.50	49.5	50.5
PZ03D	208027.2407	665032.2313	123.50	36	50	87.50	73.50	48.9	51.1
PZ04	205447.0841	663720.3298	123.94	6	11	117.94	112.94	92.0	8.0
PZ04	205447.0841	663720.3298	123.94	15	20	108.94	103.94	96.1	3.9
PZ05	202705.7568	662571.7449	124.62	5	11	119.62	113.62	69.2	30.8
PZ05	202705.7568	662571.7449	124.62	15	20	109.62	104.62	90.1	9.9
PZ06	201256.8347	662436.2138	124.39	7.5	8	116.89	116.39	94.8	5.2
PZ06	201256.8347	662436.2138	124.39	14	20	110.39	104.39	78.8	21.2
PZ07	199410.2734	662371.7196	123.08	5	7	118.08	116.08	85.3	14.7
PZ07	199410.2734	662371.7196	123.08	9	20	114.08	103.08	93.2	6.8
PZ08	197508.9048	664403.2655	130.19	5	6.5	125.19	123.69	85.1	14.9
PZ08	197508.9048	664403.2655	130.19	15	20	115.19	110.19	92.5	7.5
PZ09	210549.7044	666674.5353	135.39	7	10	128.39	125.39	91.8	8.2
PZ09	210549.7044	666674.5353	135.39	27	30	108.39	105.39	95.4	4.6
PZ10	206292.4778	667689.3258	145.72	5	8	140.72	137.72	93.2	6.8
PZ10	206292.4778	667689.3258	145.72	28	30	117.72	115.72	92.4	7.6
PZ11	201281.0529	667407.6724	147.48	8	13	139.48	134.48	92.0	8.0
PZ11	201281.0529	667407.6724	147.48	13	19	134.48	128.48	98.3	1.7
PZ12S	199119.7966	666484.6179	138.16	5	9	133.16	129.16	77.6	22.4
PZ12S	199119.7966	666484.6179	138.16	19	20	119.16	118.16	92.0	8.0
PZ12D	199125.8047	666484.2013	137.52	9	19	128.52	118.52	49.2	50.8
PZ12D	199125.8047	666484.2013	137.52	26	40	111.52	97.52	47.3	52.7
PZ13	196413.6877	668652.4560	157.47	5	20	152.47	137.47	90.3	9.7
PZ13	196413.6877	668652.4560	157.47	27	28	130.47	129.47	93.4	6.6
PZ14	193936.6051	669743.4272	167.32	3	9	164.32	158.32	95.8	4.2
PZ14	193936.6051	669743.4272	167.32	27	30	140.32	137.32	97.2	2.8
PZ15	192000.6802	669433.9007	166.95	4	5.5	162.95	161.45	92.9	7.1
PZ15	192000.6802	669433.9007	166.95	6	9	160.95	157.95	84.9	15.1
PZ15	192000.6802	669433.9007	166.95	9	12	157.95	154.95	48.4	51.6
PZ15	192000.6802	669433.9007	166.95	12.5	20	154.45	146.95	95.0	5.0
PZ15	192000.6802	669433.9007	166.95	28	29	138.95	137.95	98.5	1.5
PZ16S	189192.1062	668683.7808	160.60	5	8	155.60	152.60	90.2	9.8
PZ16S	189192.1062	668683.7808	160.60	18	20	142.60	140.60	98.0	2.0
PZ16D	189193.4656	668689.3844	160.43	10	19	150.43	141.43	48.0	52.0
PZ16D	189193.4656	668689.3844	160.43	41	42.5	119.43	117.93	48.0	52.0
PZ17S	212018.9084	669994.2076	161.58	9	10	152.58	151.58	48.7	51.3
PZ17D	212015.6518	670005.1448	160.89	8	10	152.89	150.89	97.4	2.6
PZ17D	212015.6518	670005.1448	160.89	40	45	120.89	115.89	99.2	0.8
PZ18	210112.6384	670419.4050	164.38	13	18	151.38	146.38	97.0	3.0
PZ18	210112.6384	670419.4050	164.38	18	20	146.38	144.38	91.2	8.8
PZ19	207234.6924	670845.9142	169.57	6	13	163.57	156.57	98.2	1.8
PZ19	207234.6924	670845.9142	169.57	13	18	156.57	151.57	95.5	4.5
PZ20D	205134.8784	670360.6665	168.43	7	16	161.43	152.43	97.4	2.6
PZ20D	205134.8784	670360.6665	168.43	33	40	135.43	128.43	98.1	1.9
PZ21	203215.0202	670383.6651	164.61	3	5	161.61	159.61	91.1	8.9
PZ21	203215.0202	670383.6651	164.61	6	17	158.61	147.61	93.0	7.0
PZ22S	200359.9896	671694.6840	170.17	9	10	161.17	160.17	48.2	51.8

**Table 5 :** Summary of Grain-Size Distribution Analysis of Soil Samples Collected from Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	Gradation Percent Sand	Gradation Percent Silt/Clay
PZ22D	200357.7075	671700.7149	170.54	18	23	152.54	147.54	95.3	4.7
PZ22D	200357.7075	671700.7149	170.54	35	38	135.54	132.54	98.9	1.1
PZ23	198353.0813	672071.4617	169.31	12.5	15	156.81	154.31	46.3	53.7
PZ24	196807.9532	672562.2118	169.44	6	7	163.44	162.44	95.2	4.8
PZ24	196807.9532	672562.2118	169.44	10	18	159.44	151.44	93.2	6.8
PZ25S	194061.9564	673383.9824	169.99	3	5	166.99	164.99	94.9	5.1
PZ25S	194061.9564	673383.9824	169.99	13	19	156.99	150.99	95.8	4.2
PZ25D	194070.0069	673381.4148	169.68	9	11	160.68	158.68	48.9	51.1
PZ25D	194070.0069	673381.4148	169.68	28.5	29	141.18	140.68	47.3	52.7
PZ26	190199.0854	675725.3696	168.99	0	6	168.99	162.99	93.0	7.0
PZ26	190199.0854	675725.3696	168.99	13.5	20	155.49	148.99	92.9	7.1
PZ27S	188607.1176	676385.2376	168.02	9	10	159.02	158.02	47.9	52.1
PZ27D	188607.9571	676394.0349	168.01	8	13	160.01	155.01	96.1	3.9
PZ27D	188607.9571	676394.0349	168.01	24	30	144.01	138.01	97.5	2.5
PZ28D	191101.7018	672470.6111	174.13	9	19	165.13	155.13	89.3	10.7
PZ28D	191101.7018	672470.6111	174.13	27	30	147.13	144.13	74.0	26.0
PZ38	205467.2108	672734.7122	171.69	6	7	165.69	164.69	48.0	52.0
PZ39D	203579.2608	672985.6825	171.84	19	20	152.84	151.84	46.7	53.3
PZ39D	203579.2608	672985.6825	171.84	77	79	94.84	92.84	51.0	49.0
PZ40	200660.5583	673966.9078	169.48	14	15	155.48	154.48	50.4	49.6
PZ43	191206.1308	676493.9937	161.68	5.5	18	156.18	143.68	50.7	49.3
PZ45D	202715.5700	675525.2030	166.58	18	22	148.58	144.58	49.9	50.1
PZ45D	202715.5700	675525.2030	166.58	49	49.5	117.58	117.08	50.9	49.1
PZ45S	202723.2096	675524.3128	166.64	6.5	7	160.14	159.64	50.5	49.5
PZ46	198343.7772	677166.5936	139.98	4	10	135.98	129.98	45.5	54.5
PZ47	193012.6975	678365.3361	138.30	13	15	125.30	123.30	49.8	50.2
PZ49	205324.4574	677820.5368	142.97	13.5	15	129.47	127.97	48.4	51.6
PZ50	202797.9514	678800.9975	127.64	12	13	115.64	114.64	48.9	51.1
PZ53	199168.3109	681563.2307	111.31	5	8	106.31	103.31	48.3	51.7
PZ53	199168.3109	681563.2307	111.31	7	10	104.31	101.31	48.8	51.2
UD10	208093.3130	666408.7486	131.70	13	15	118.70	116.70	93.6	6.4
UD10	208093.3130	666408.7486	131.70	28	30	103.70	101.70	95.6	4.4
UD10	208093.3130	666408.7486	131.70	43	45	88.70	86.70	94.7	5.3
UD25	190488.7166	668975.1185	165.49	15	17	150.49	148.49	93.8	6.2
UD25	190488.7166	668975.1185	165.49	30	32	135.49	133.49	96.1	3.9
UD25	190488.7166	668975.1185	165.49	43	45	122.49	120.49	95.3	4.7
UD34	200408.2230	671582.2720	170.29	13	15	157.29	155.29	92.3	7.7
UD34	200408.2230	671582.2720	170.29	28	29	142.29	141.29	96.7	3.3
UD34	200408.2230	671582.2720	170.29	48	50	122.29	120.29	95.8	4.2
UD43	190542.5306	678135.6130	148.55	13	15	135.55	133.55	96.1	3.9
UD43	190542.5306	678135.6130	148.55	30	32	118.55	116.55	93.9	6.1
UD43	190542.5306	678135.6130	148.55	43	45	105.55	103.55	73.8	26.2
UD51	197065.1026	674174.9889	165.00	13	15	152.00	150.00	92.7	7.3
UD51	197065.1026	674174.9889	165.00	28	30	137.00	135.00	93.4	6.6
UD51	197065.1026	674174.9889	165.00	43	45	122.00	120.00	98.5	1.5
UD65	202093.9328	675684.2974	166.76	17	19	149.76	147.76	97.5	2.5
UD65	202093.9328	675684.2974	166.76	28	30	138.76	136.76	98.3	1.7
UD65	202093.9328	675684.2974	166.76	43	45	123.76	121.76	98.7	1.3
UD67	203551.9396	672306.1274	172.06	17	19	155.06	153.06	92.4	5.4
UD67	203551.9396	672306.1274	172.06	28	30	144.06	142.06	96.3	2.3
UD67	203551.9396	672306.1274	172.06	43	45	129.06	127.06	97.0	2.8
UD93	211493.3310	668617.5144	150.25	13	15	137.25	135.25	95.5	4.5
UD93	211493.3310	668617.5144	150.25	28	30	122.25	120.25	94.3	5.7
UD93	211493.3310	668617.5144	150.25	43	45	107.25	105.25	97.6	2.4



**Table 5 :** Summary of Grain-Size Distribution Analysis of Soil Samples Collected from Borings; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Northing	Easting	Land Surface Elevation (ft. amsl)	Sample Depth Top (ft. bgs)	Sample Depth Bottom (ft. bgs)	Sample Elevation Top (ft. amsl)	Sample Elevation Bottom (ft. amsl)	Gradation Percent Sand	Gradation Percent Silt/Clay
UD126	202917.1019	666640.3662	140.22	13	15	127.22	125.22	92.3	7.7
UD126	202917.1019	666640.3662	140.22	28	30	112.22	110.22	96.8	3.2
UD126	202917.1019	666640.3662	140.22	43	45	97.22	95.22	90.5	9.5
UD128	199193.1410	667712.6820	150.52	13	15	137.52	135.52	96.7	3.3
UD128	199193.1410	667712.6820	150.52	30	32	120.52	118.52	89.5	10.5
UD128	199193.1410	667712.6820	150.52	43	45	107.52	105.52	96.8	3.2
UD179	207884.9971	670857.1818	166.08	13	15	153.08	151.08	98.0	2.0
UD179	207884.9971	670857.1818	166.08	28	30	138.08	136.08	96.0	4.0
UD179	207884.9971	670857.1818	166.08	43	45	123.08	121.08	95.9	4.1
UD231	196158.7390	669687.5038	167.53	13	15	154.53	152.53	94.3	5.7
UD231	196158.7390	669687.5038	167.53	30	32	137.53	135.53	93.6	6.4
UD231	196158.7390	669687.5038	167.53	43	45	124.53	122.53	92.5	7.5
UD238	192952.8585	674171.2238	168.31	13	15	155.31	153.31	94.9	5.1
UD238	192952.8585	674171.2238	168.31	28	30	140.31	138.31	96.4	3.6
UD238	192952.8585	674171.2238	168.31	43	45	125.31	123.31	97.1	2.9
UD338	191127.7310	672504.6590	173.56	13	15	160.56	158.56	94.5	5.5
UD338	191127.7310	672504.6590	173.56	28	30	145.56	143.56	94.5	5.5
UD338	191127.7310	672504.6590	173.56	43	45	130.56	128.56	96.9	3.1
UD25R	NS	NS	NS	3	5	NS	NS	91.4	8.6
UD25R	NS	NS	NS	10	12	NS	NS	96.8	3.2
UD43R	NS	NS	NS	5	7	NS	NS	96.6	3.4
UD43R	NS	NS	NS	10	12	NS	NS	99.0	1.0
UD238R	NS	NS	NS	6	8	NS	NS	98.3	1.7
UD238R	NS	NS	NS	10	12	NS	NS	98.7	1.4
UD338R	NS	NS	NS	9	11	NS	NS	96.2	3.8

Notes: ft bgs = feet below ground surface  
ft amsl = feet above mean sea level

NS = Not surveyed; borings performed within 5-10 feet of original UD boring

**Table 6.** Results of Bench-Scale Study Vertical Hydraulic Conductivity Testing of Post-Processed Soils Compared to Undisturbed Sample PZ57D. Hydrogeology of the Twin Pines Project Area; Twin Pines Minerals, LLC; St. George, Charlton County, Georgia. TTL Project No. 000180200804.00

Sample Identifier	Bentonite Addition (%)	Hydraulic Conductivity (cm/sec)	Sample Type	ASTM Method
<b>Post-Processed Sand Sample UD338/25</b>				
UD338/25-A	0% bentonite	$1.1 \times 10^{-3}$	Simulated In Situ	D 5084
UD338/25-B	0% bentonite	$1.1 \times 10^{-3}$	Simulated In Situ	D 5084
UD338/25-C	0% bentonite	$7.2 \times 10^{-4}$	Simulated In Situ	D 5084
UD338/25-A	0.35% bentonite to sand	$7.0 \times 10^{-4}$	Simulated In Situ	D 5084
UD338/25-B	0.35% bentonite to sand	$5.6 \times 10^{-4}$	Simulated In Situ	D 5084
UD338/25-C	0.35% bentonite to sand	$1.2 \times 10^{-3}$	Simulated In Situ	D 5084
UD338/25-A	1.42% bentonite to sand	$1.7 \times 10^{-3}$	Simulated In Situ	D 5084
UD338/25-B	1.42% bentonite to sand	$1.6 \times 10^{-3}$	Simulated In Situ	D 5084
UD338/25-C	1.42% bentonite to sand	$1.5 \times 10^{-3}$	Simulated In Situ	D 5084
UD338/25	5% bentonite to sand	$5.7 \times 10^{-6}$	Remolded	D 5084
UD338/25	7.5% bentonite to sand	$2.0 \times 10^{-6}$	Remolded	D 5084
UD338/25	10% bentonite to sand	$3.0 \times 10^{-7}$	Remolded	D 5084
UD338/25	10% bentonite to sand	$6.8 \times 10^{-7}$	Remolded	D 5084
UD338/25	12.5% bentonite to sand	$1.0 \times 10^{-8}$	Remolded	D 5084
UD338/25	15% bentonite to sand	$5.8 \times 10^{-9}$	Remolded	D 5084
UD338/25	15% bentonite to sand	$5.0 \times 10^{-9}$	Remolded	D 5084
UD338/25	30% bentonite to sand	$2.7 \times 10^{-9}$	Remolded	D 5084
UD338/25	30% bentonite to sand	$2.0 \times 10^{-9}$	Remolded	D 5084
<b>Undisturbed Soil Sample PZ57 - Consolidated Black Sand</b>				
PZ57D (20'-22') Black Sand	0% bentonite	$2.7 \times 10^{-8}$	Undisturbed	D 5084
PZ57D (25'-27') Black Sand	0% bentonite	$3.4 \times 10^{-7}$	Undisturbed	D 5084

Notes: cm/sec = centimeters per second

# APPENDIX A

## VERTICAL HYDRAULIC CONDUCTIVITY AND POROSITY TEST REPORTS

Attached Documents:  
Bowser-Morner Laboratory Reports  
TTL Laboratory Reports

# **BOWSER-MORNER LABORATORY REPORTS**



# BOWSER-MORNER, INC.

Delivery Address: 4518 Taylorsville Road • Dayton, Ohio 45424 Mailing Address: P. O. Box 51 • Dayton, Ohio 45401

AASHTO/ISO 17025 Accredited • USACE Validated



## LABORATORY REPORT

**Report To:** TTL  
Attn: Mark Tanner  
3516 Greensboro Ave.  
Tuscaloosa, AL 35401

**Report Date:** February 21, 2019  
**Job No.:** 187609  
**Report No.:** 430601E  
**No. of Pages:** 8 + Appendices

**Report On:** Laboratory Analysis of Forty-Two Thin Wall Tube Samples – **Final Report**  
Project: TTL Job No. 000180200804.00  
Sample ID: Forty-Two Thin Wall Tube Samples

On November 21, 2018, forty-two thin wall tube samples were submitted for selected laboratory analysis from the above referenced project. Testing was performed as specified by the client and in accordance with the following procedures:

- ASTM D 422, "Particle-Size Analysis of Soils".
- ASTM D 854, "Specific Gravity of Soils Solids by Water Pycnometer".
- ASTM D 2216, "Laboratory Determination of Water (Moisture) Content of Soil and Rock".
- ASTM D 2434, "Permeability of Granular Soils (Constant Head)".
- ASTM D 2487, "Classification of Soils for Engineering Purposes (Unified Soil Classification System)".
- ASTM D 4318, "Liquid Limit, Plastic Limit, and Plasticity Index of Soils".
- ASTM D 5084, "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter".
- ASTM D 7263, "Laboratory Determination of Density (Unit Weight) of Soil Specimens - Method B".

Results are summarized in the following tables and detailed on the attached data sheets found in Appendix I and Appendix II.

Should you have any questions, or if we may be of further service, please contact me at (937) 236-8805, extension 322.

Respectfully submitted,

BOWSER-MORNER, INC.

Karl A. Fletcher, Manager  
Construction Materials and  
Geotechnical Laboratories

KAF/blc  
430601E  
1-File  
1-mtanner@ttlusa.com

**TABLE I**  
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-10 & UD-25

Test Parameter	UD-10			UD-25		
	13'-15'	28'-30'	43'-45'	15'-17'	30'-32'	43'-45'
Gradation (Cumulative % Passing)						
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	99.8	100.0	100.0	100.0	99.9
No. 20	99.8	87.4	99.2	99.9	99.9	99.5
No. 40	85.7	61.8	92.6	89.1	92.7	87.2
No. 60	31.2	37.7	58.6	40.2	46.7	37.1
No. 100	10.2	12.1	14.6	9.5	14.0	11.1
No. 200	6.4	4.4	5.3	6.2	3.9	4.7
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP	SP-SM	SP-SM	SP	SP
Permeability (k), cm/sec:	1.3 x 10 <sup>-4</sup>	2.0 x 10 <sup>-5</sup>	1.9 x 10 <sup>-5</sup>	1.4 x 10 <sup>-5</sup>	8.2 x 10 <sup>-5</sup>	1.4 x 10 <sup>-6</sup>
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.63	2.68	2.67	2.61	2.72	2.66
Wet Unit Weight, pcf:	125.5	124.5	129.1	115.4	122.1	129.7
Dry Unit Weight, pcf:	104.1	102.6	107.4	91.7	99.0	107.9
Moisture Content, %:	20.5	21.4	20.2	25.9	23.3	20.2
Void Ratio:	0.5788	0.6303	0.5500	0.7754	0.7112	0.5387
Porosity, %:	36.7	38.7	35.5	43.7	41.6	35.0
Degree of Saturation, %:	93.4	90.9	97.9	87.0	89.0	99.7
Volume of Voids, %:	36.7	38.7	35.5	43.7	41.6	35.0
Volume of Water, %:	34.2	35.1	34.7	38.0	37.0	34.9
Volume of Solids, %:	63.3	61.3	64.5	56.3	58.4	65.0
Air Filled Voids, %:	6.6	9.1	2.1	13.0	11.0	0.3
Water Filled Voids, %:	93.4	90.9	97.9	87.0	89.0	99.7

**TABLE II**  
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-34 & UD-43

Test Parameter	UD-34			UD-43		
	13'-15'	28'-29'	48'-50'	13'-15'	30'-32'	43'-45'
Gradation (Cumulative % Passing)						
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	100.0	100.0	100.0	100.0	100.0
No. 20	99.2	97.0	99.6	99.6	99.4	99.3
No. 40	79.5	54.4	84.8	86.8	66.6	97.4
No. 60	39.6	17.1	33.4	34.5	16.0	91.0
No. 100	11.4	5.5	9.3	7.3	7.9	82.5
No. 200	7.7	3.3	4.2	3.9	6.1	26.2
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	27
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	15
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	12
USCS Classification:	SP-SM	SP	SP	SP	SP-SM	SC
Permeability (k), cm/sec:	$1.0 \times 10^{-5}$	$7.8 \times 10^{-7}$	$4.4 \times 10^{-7}$	$7.0 \times 10^{-6}$	$3.8 \times 10^{-6}$	$1.7 \times 10^{-8}$
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.63	2.68	2.67	2.67	2.67	2.63
Wet Unit Weight, pcf:	130.5	120.0	122.5	123.7	128.0	127.8
Dry Unit Weight, pcf:	110.0	97.2	98.7	100.6	105.5	106.2
Moisture Content, %:	18.6	23.5	24.1	23.0	21.3	20.3
Void Ratio:	0.4913	0.7231	0.6895	0.6570	0.5781	0.5433
Porosity, %:	32.9	42.0	40.8	39.6	36.6	35.2
Degree of Saturation, %:	99.6	87.1	93.4	93.6	98.3	98.3
Volume of Voids, %:	32.9	42.0	40.8	39.6	36.6	35.2
Volume of Water, %:	32.8	36.5	38.1	37.1	36.0	34.6
Volume of Solids, %:	67.1	58.0	59.2	60.4	63.4	64.8
Air Filled Voids, %:	0.4	12.9	6.6	6.4	1.7	1.7
Water Filled Voids, %:	99.6	87.1	93.4	93.6	98.3	98.3

**TABLE III**  
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-51 & UD-65

Test Parameter	UD-51			UD-65		
	13'-15'	28'-30'	43'-45'	17'-19'	28'-30'	43'-45'
Gradation (Cumulative % Passing)						
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	100.0	100.0	100.0	100.0	100.0
No. 20	99.4	99.6	99.9	99.6	99.8	99.9
No. 40	88.4	80.1	85.8	80.6	89.0	92.8
No. 60	31.4	35.9	30.7	29.9	32.5	30.4
No. 100	12.5	11.5	4.1	5.5	4.4	3.2
No. 200	7.3	6.6	1.5	2.5	1.7	1.3
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP-SM	SP	SP	SP	SP
Permeability (k), cm/sec:	$5.2 \times 10^{-6}$	$7.6 \times 10^{-6}$	$6.9 \times 10^{-5}$	$2.8 \times 10^{-4}$	$1.1 \times 10^{-4}$	$6.3 \times 10^{-2}$
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.55	2.69	2.68	2.65	2.63	2.65
Wet Unit Weight, pcf:	125.7	126.0	133.1	121.1	125.3	121.7
Dry Unit Weight, pcf:	105.5	102.2	113.8	99.3	102.4	104.9
Moisture Content, %:	19.2	23.3	17.0	22.0	22.4	16.0
Void Ratio:	0.5095	0.6425	0.4701	0.6667	0.6048	0.5747
Porosity, %:	33.8	39.1	32.0	40.0	37.7	36.5
Degree of Saturation, %:	96.0	97.4	96.9	87.5	97.4	73.7
Volume of Voids, %:	33.8	39.1	32.0	40.0	37.7	36.5
Volume of Water, %:	32.4	38.1	31.0	35.0	36.7	26.9
Volume of Solids, %:	66.2	60.9	68.0	60.0	62.3	63.5
Air Filled Voids, %:	4.0	2.6	3.1	12.5	2.6	26.3
Water Filled Voids, %:	96.0	97.4	96.9	87.5	97.4	73.7



**TABLE IV**  
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-67 & UD-93

Test Parameter	UD-67			UD-93		
	17'-19'	28'-30'	43'-45'	13'-15'	28'-30'	43'-45'
Gradation (Cumulative % Passing)						
3/4"	100.0	100.0	100.0	100.0	100.0	100.0
1/2"	100.0	98.8	100.0	100.0	100.0	100.0
3/8"	100.0	98.8	100.0	100.0	100.0	100.0
No. 4	97.8	98.6	99.8	100.0	100.0	100.0
No. 10	97.4	98.3	99.8	100.0	100.0	100.0
No. 20	95.8	97.3	99.5	99.8	99.4	99.4
No. 40	72.6	73.6	81.9	88.7	84.4	77.9
No. 60	29.4	25.3	29.8	45.0	40.4	29.0
No. 100	9.3	5.2	6.2	9.7	10.0	6.2
No. 200	5.4	2.3	2.8	4.5	5.7	2.4
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP	SP	SP	SP-SM	SP
Permeability (k), cm/sec:	1.4 x 10 <sup>-4</sup>	2.9 x 10 <sup>-4</sup>	4.1 x 10 <sup>-6</sup>	6.5 x 10 <sup>-7</sup>	2.4 x 10 <sup>-5</sup>	2.8 x 10 <sup>-5</sup>
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.64	2.64	2.64	2.63	2.62	2.69
Wet Unit Weight, pcf:	129.9	119.5	131.5	124.1	128.8	129.3
Dry Unit Weight, pcf:	110.0	99.0	112.6	102.1	108.3	108.2
Moisture Content, %:	18.1	20.6	16.8	21.5	18.9	19.5
Void Ratio:	0.4949	0.6598	0.4649	0.6045	0.5077	0.5512
Porosity, %:	33.1	39.8	31.7	37.7	33.7	35.5
Degree of Saturation, %:	96.3	82.1	95.4	93.3	97.3	95.2
Volume of Voids, %:	33.1	39.8	31.7	37.7	33.7	35.5
Volume of Water, %:	31.9	32.7	30.3	35.2	32.8	33.8
Volume of Solids, %:	66.9	60.2	68.3	62.3	66.3	64.5
Air Filled Voids, %:	3.7	17.9	4.6	6.7	2.7	4.8
Water Filled Voids, %:	96.3	82.1	95.4	93.3	97.3	95.2

**TABLE V**  
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-126 & UD-128

Test Parameter	UD-126			UD-128		
	13'-15'	28'-30'	43'-45'	13'-15'	30'-32'	43'-45'
Gradation (Cumulative % Passing)						
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	99.9	99.7	100.0	100.0	99.9
No. 20	99.5	98.7	98.5	99.7	99.9	99.3
No. 40	84.5	79.5	92.2	87.1	97.4	95.0
No. 60	40.3	34.3	67.4	36.9	76.3	72.9
No. 100	12.2	8.4	25.5	7.9	34.9	8.7
No. 200	7.7	3.2	9.5	3.3	10.5	3.2
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP	SP-SM	SP	SP-SM	SP
Permeability (k), cm/sec:	8.3 x 10 <sup>-5</sup>	1.0 x 10 <sup>-5</sup>	9.3 x 10 <sup>-7</sup>	9.5 x 10 <sup>-5</sup>	2.2 x 10 <sup>-6</sup>	1.7 x 10 <sup>-4</sup>
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.60	2.67	2.64	2.65	2.68	2.66
Wet Unit Weight, pcf:	1301.0	133.9	131.0	125.3	125.9	128.7
Dry Unit Weight, pcf:	111.5	114.5	110.5	103.4	101.9	106.4
Moisture Content, %:	17.5	16.9	18.6	21.2	23.6	21.0
Void Ratio:	0.4557	0.4546	0.4921	0.5993	0.6424	0.5626
Porosity, %:	31.3	31.3	33.0	37.5	39.1	36.0
Degree of Saturation, %:	99.8	99.2	99.8	93.7	98.6	99.5
Volume of Voids, %:	31.3	31.3	33.0	37.5	39.1	36.0
Volume of Water, %:	31.2	31.0	32.9	35.1	38.6	35.8
Volume of Solids, %:	68.7	68.7	67.0	62.5	60.9	64.0
Air Filled Voids, %:	0.2	0.8	0.2	6.3	1.4	0.5
Water Filled Voids, %:	99.8	99.2	99.8	93.7	98.6	99.5

**TABLE VI**  
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-179 & UD-231

Test Parameter	UD-179			UD-231		
	13'-15'	28'-30'	43'-45'	13'-15'	30'-32'	43'-45'
Gradation (Cumulative % Passing)						
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	99.6	100.0	100.0	100.0	100.0	100.0
No. 20	96.9	99.5	99.0	99.9	96.4	99.8
No. 40	74.0	76.1	76.4	92.0	61.6	88.1
No. 60	27.3	21.5	31.3	51.2	25.3	42.8
No. 100	4.5	6.1	8.9	13.2	13.0	16.2
No. 200	2.0	4.0	4.1	5.7	6.4	7.5
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP	SP	SP	SP-SM	SP-SM	SP-SM
Permeability (k), cm/sec:	2.1 x 10 <sup>-6</sup>	3.9 x 10 <sup>-4</sup>	2.0 x 10 <sup>-7</sup>	2.7 x 10 <sup>-6</sup>	6.0 x 10 <sup>-6</sup>	1.9 x 10 <sup>-5</sup>
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.67	2.65	2.62	2.62	2.63	2.61
Wet Unit Weight, pcf:	123.7	129.5	128.3	124.1	133.3	127.0
Dry Unit Weight, pcf:	102.5	108.1	107.3	102.9	114.7	105.3
Moisture Content, %:	20.7	19.8	19.6	20.6	16.2	20.6
Void Ratio:	0.6261	0.5297	0.5240	0.5901	0.4299	0.5483
Porosity, %:	38.5	34.6	34.4	37.1	30.1	35.4
Degree of Saturation, %:	88.5	99.0	97.8	91.5	99.3	98.4
Volume of Voids, %:	38.5	34.6	34.4	37.1	30.1	35.4
Volume of Water, %:	34.1	34.3	33.6	34.0	29.8	34.8
Volume of Solids, %:	61.5	65.4	65.6	62.9	69.9	64.6
Air Filled Voids, %:	11.5	1.0	2.2	8.5	0.7	1.6
Water Filled Voids, %:	88.5	99.0	97.8	91.5	99.3	98.4

**TABLE VII**  
 Summary of Results for Forty-Two Thin Wall Tube Samples – Boring Locations UD-238 & UD-338

Test Parameter	UD-238			UD-338		
	13'-15'	28'-30'	43'-45'	13'-15'	28'-30'	43'-45'
Gradation (Cumulative % Passing)						
No. 4	100.0	100.0	100.0	100.0	100.0	100.0
No. 10	100.0	100.0	100.0	100.0	100.0	100.0
No. 20	99.6	99.4	99.9	98.4	99.9	99.8
No. 40	86.7	81.2	95.5	77.9	87.3	86.4
No. 60	33.8	32.9	40.3	34.4	32.9	26.5
No. 100	9.3	7.2	7.3	11.1	11.3	6.3
No. 200	5.1	3.6	2.9	5.5	5.5	3.1
Atterberg Limits	---	---	---	---	---	---
Liquid Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plastic Limit:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
Plasticity Index:	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic	Non-Plastic
USCS Classification:	SP-SM	SP	SP	SP-SM	SP-SM	SP
Permeability (k), cm/sec:	1.0 x 10 <sup>-4</sup>	3.3 x 10 <sup>-4</sup>	1.2 x 10 <sup>-4</sup>	2.6 x 10 <sup>-6</sup>	2.2 x 10 <sup>-5</sup>	9.2 x 10 <sup>-5</sup>
Natural Unit Weight	---	---	---	---	---	---
Apparent Specific Gravity:	2.66	2.64	2.64	2.67	2.67	2.67
Wet Unit Weight, pcf:	131.1	126.5	130.4	131.2	127.7	129.3
Dry Unit Weight, pcf:	110.4	105.5	109.9	110.1	104.9	107.8
Moisture Content, %:	18.8	19.9	18.6	19.2	21.7	20.0
Void Ratio:	0.5030	0.5608	0.4981	0.5136	0.5875	0.5454
Porosity, %:	33.5	35.9	33.2	33.9	37.0	35.3
Degree of Saturation, %:	99.5	93.5	98.7	99.9	98.5	97.9
Volume of Voids, %:	33.5	35.9	33.2	33.9	37.0	35.3
Volume of Water, %:	33.3	33.6	32.8	33.9	36.4	34.5
Volume of Solids, %:	66.5	64.1	66.8	66.1	63.0	64.7
Air Filled Voids, %:	0.5	6.5	1.3	0.1	1.5	2.1
Water Filled Voids, %:	99.5	93.5	98.7	99.9	98.5	97.9



**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-10
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown silty SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.788
Diameter:	2.785
Mass, lbs:	1.233
Moisture Content, %	
Initial:	20.5
Final:	19.8
Wet Unit Weight, pcf	
Initial:	125.5
Final:	124.7
Initial Dry Unit Weight, pcf:	104.1
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $1.3 \times 10^{-4}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-10
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.154
Diameter:	2.734
Mass, lbs:	1.334
Moisture Content, %	
Initial:	21.4
Final:	19.7
Wet Unit Weight, pcf	
Initial:	124.5
Final:	122.8
Initial Dry Unit Weight, pcf:	102.6
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $2.0 \times 10^{-5}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-10
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.054
Diameter:	2.753
Mass, lbs:	1.358
Moisture Content, %	
Initial:	20.2
Final:	19.3
Wet Unit Weight, pcf	
Initial:	129.1
Final:	128.1
Initial Dry Unit Weight, pcf:	107.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	53
Lateral Pressure:	57

**Permeability (k), cm/sec:**  $1.9 \times 10^{-5}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-25
Depth, ft:	15.0' - 17.0'
USCS Classification:	brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.097
Diameter:	2.8
Mass, lbs:	1.273
Moisture Content, %	
Initial:	25.9
Final:	24.2
Wet Unit Weight, pcf	
Initial:	115.4
Final:	113.9
Initial Dry Unit Weight, pcf:	91.7
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	52
Lateral Pressure:	55

**Permeability (k), cm/sec:**  $1.4 \times 10^{-5}$



**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-25
Depth, ft:	30.0' - 32.0'
USCS Classification:	dark brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.962
Diameter:	2.755
Mass, lbs:	1.248
Moisture Content, %	
Initial:	23.3
Final:	21.8
Wet Unit Weight, pcf	
Initial:	122.1
Final:	120.6
Initial Dry Unit Weight, pcf:	99.0
Back Pressure Saturation, psi	
Back Pressure, Exit:	60
Back Pressure, Enter:	61
Lateral Pressure:	63

**Permeability (k), cm/sec:**  $8.2 \times 10^{-5}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-25
Depth, ft:	43.0' - 45.0'
USCS Classification:	dark brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.853
Diameter:	2.759
Mass, lbs:	1.280
Moisture Content, %	
Initial:	20.2
Final:	17.3
Wet Unit Weight, pcf	
Initial:	129.7
Final:	126.6
Initial Dry Unit Weight, pcf:	107.9
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

**Permeability (k), cm/sec:**  $1.4 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-34
Depth, ft:	13.0' - 15.0'
USCS Classification:	dark brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.076
Diameter:	2.773
Mass, lbs:	1.403
Moisture Content, %	
Initial:	18.6
Final:	18.1
Wet Unit Weight, pcf	
Initial:	130.5
Final:	129.9
Initial Dry Unit Weight, pcf:	110.0
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

**Permeability (k), cm/sec:**  $1.0 \times 10^{-5}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-34
Depth, ft:	28.0' - 29.0'
USCS Classification:	brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.987
Diameter:	2.776
Mass, lbs:	1.255
Moisture Content, %	
Initial:	23.5
Final:	21.9
Wet Unit Weight, pcf	
Initial:	120.0
Final:	118.5
Initial Dry Unit Weight, pcf:	97.2
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $7.8 \times 10^{-7}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client: TTL  
Project: TTL Job No. 000180200804.00  
BMI Work Order Number: 187609  
Sample Identification: UD-34  
Depth, ft: 48.0' - 50.0'  
USCS Classification: brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches  
    Height: 2.972  
    Diameter: 2.753  
Mass, lbs: 1.254  
Moisture Content, %  
    Initial: 24.1  
    Final: 21.4  
Wet Unit Weight, pcf  
    Initial: 122.5  
    Final: 119.8  
Initial Dry Unit Weight, pcf: 98.7  
Back Pressure Saturation, psi  
    Back Pressure, Exit: 40  
    Back Pressure, Enter: 43  
    Lateral Pressure: 47

**Permeability (k), cm/sec:  $4.4 \times 10^{-7}$**



**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-43
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.981
Diameter:	2.766
Mass, lbs:	1.282
Moisture Content, %	
Initial:	23.0
Final:	20.8
Wet Unit Weight, pcf	
Initial:	123.7
Final:	121.5
Initial Dry Unit Weight, pcf:	100.6
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

**Permeability (k), cm/sec:**  $7.0 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-43
Depth, ft:	30.0' - 32.0'
USCS Classification:	black/brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.027
Diameter:	2.768
Mass, lbs:	1.349
Moisture Content, %	
Initial:	21.3
Final:	20.9
Wet Unit Weight, pcf	
Initial:	128.0
Final:	127.5
Initial Dry Unit Weight, pcf:	105.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

**Permeability (k), cm/sec:**  $3.8 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-43
Depth, ft:	43.0' - 45.0'
USCS Classification:	black/brown clayey SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.994
Diameter:	2.795
Mass, lbs:	1.358
Moisture Content, %	
Initial:	20.3
Final:	16.9
Wet Unit Weight, pcf	
Initial:	127.7
Final:	124.1
Initial Dry Unit Weight, pcf:	106.2
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	53
Lateral Pressure:	57

**Permeability (k), cm/sec:**  $1.7 \times 10^{-8}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-51
Depth, ft:	13.0' - 15.0'
USCS Classification:	dark brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.957
Diameter:	2.804
Mass, lbs:	1.328
Moisture Content, %	
Initial:	19.2
Final:	19.5
Wet Unit Weight, pcf	
Initial:	125.7
Final:	126.1
Initial Dry Unit Weight, pcf:	105.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

**Permeability (k), cm/sec:**  $5.2 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-51
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.994
Diameter:	2.7
Mass, lbs:	1.250
Moisture Content, %	
Initial:	23.3
Final:	20.0
Wet Unit Weight, pcf	
Initial:	126.0
Final:	122.6
Initial Dry Unit Weight, pcf:	102.2
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	52
Lateral Pressure:	55

**Permeability (k), cm/sec:**  $7.6 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client: TTL  
Project: TTL Job No. 000180200804.00  
BMI Work Order Number: 187609  
Sample Identification: UD-51  
Depth, ft: 43.0' - 45.0'  
USCS Classification: brown/black poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches  
    Height: 2.957  
    Diameter: 2.777  
Mass, lbs: 1.380  
Moisture Content, %  
    Initial: 17.0  
    Final: 15.5  
Wet Unit Weight, pcf  
    Initial: 133.1  
    Final: 131.4  
Initial Dry Unit Weight, pcf: 113.8  
Back Pressure Saturation, psi  
    Back Pressure, Exit: 50  
    Back Pressure, Enter: 53  
    Lateral Pressure: 57

**Permeability (k), cm/sec:  $6.9 \times 10^{-5}$**



**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-65
Depth, ft:	17.0' - 19.0'
USCS Classification:	dark brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.004
Diameter:	2.802
Mass, lbs:	1.298
Moisture Content, %	
Initial:	22.0
Final:	21.3
Wet Unit Weight, pcf	
Initial:	121.1
Final:	120.5
Initial Dry Unit Weight, pcf:	99.3
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	52
Lateral Pressure:	55

**Permeability (k), cm/sec:**  $2.8 \times 10^{-4}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-65
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.93
Diameter:	2.694
Mass, lbs:	1.211
Moisture Content, %	
Initial:	22.4
Final:	20.3
Wet Unit Weight, pcf	
Initial:	125.3
Final:	123.2
Initial Dry Unit Weight, pcf:	102.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $1.1 \times 10^{-4}$

**PERMEABILITY OF GRANULAR SOILS (CONSTANT HEAD)**  
ASTM D 2434, Measurement of Hydraulic Conductivity

**LABORATORY COMPACTED**

Client:	TTL
Project:	<b>TTL Job No. 000180200804.00</b>
BMI Work Order Number:	187609
Sample Identification:	UD-65
Depth, ft:	43' - 45'
Material Description:	brown poorly graded SAND

**NATURAL UNIT WEIGHT DATA:**

As Received Unit Weight (Wet), pcf:	121.7
As Received Unit Weight (Dry), pcf:	104.9
As Received MC, %:	16.0

**REMOLED SPECIMEN DATA:**

Dimension, inches	
Height:	5.567
Diameter:	3.000
Mass, lbs:	2.760
Moisture Content, %	
Initial:	16.0
Remolded Unit Weight (Wet), pcf	
Initial:	121.2
Remolded Unit Weight (Dry), pcf:	
Initial:	104.5
Percent Compaction:	99.6

<b>Permeability (k), cm/sec:</b>	<b><math>6.3 \times 10^{-2}</math></b>
----------------------------------	--

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-67
Depth, ft:	17.0' - 19.0'
USCS Classification:	brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.028
Diameter:	2.75
Mass, lbs:	1.352
Moisture Content, %	
Initial:	18.1
Final:	17.6
Wet Unit Weight, pcf	
Initial:	129.9
Final:	129.4
Initial Dry Unit Weight, pcf:	110.0
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53
<b>Permeability (k), cm/sec:</b>	<b>1.4 x 10<sup>-4</sup></b>

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-67
Depth, ft:	28.0' - 30.0'
USCS Classification:	brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.972
Diameter:	2.75
Mass, lbs:	1.220
Moisture Content, %	
Initial:	20.6
Final:	23.3
Wet Unit Weight, pcf	
Initial:	119.4
Final:	122.1
Initial Dry Unit Weight, pcf:	99.0
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

**Permeability (k), cm/sec:**  $2.9 \times 10^{-4}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-67
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.948
Diameter:	2.74
Mass, lbs:	1.323
Moisture Content, %	
Initial:	16.8
Final:	18.8
Wet Unit Weight, pcf	
Initial:	131.5
Final:	133.8
Initial Dry Unit Weight, pcf:	112.6
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	43
Lateral Pressure:	47

**Permeability (k), cm/sec:**  $4.1 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-93
Depth, ft:	13.0' - 15.0'
USCS Classification:	black poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.994
Diameter:	2.774
Mass, lbs:	1.300
Moisture Content, %	
Initial:	21.5
Final:	20.9
Wet Unit Weight, pcf	
Initial:	124.1
Final:	123.4
Initial Dry Unit Weight, pcf:	102.1
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	42
Lateral Pressure:	45

**Permeability (k), cm/sec:**  $6.5 \times 10^{-7}$



**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-93
Depth, ft:	28.0' - 30.0'
USCS Classification:	black poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.919
Diameter:	2.762
Mass, lbs:	1.304
Moisture Content, %	
Initial:	18.9
Final:	19.3
Wet Unit Weight, pcf	
Initial:	128.8
Final:	129.2
Initial Dry Unit Weight, pcf:	108.3
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $2.4 \times 10^{-5}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client: **TTL**

Project: **TTL Job No. 000180200804.00**

BMI Work Order Number: 187609

Sample Identification: UD-93

Depth, ft: 43.0' - 45.0'

USCS Classification: brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches

Height: 2.977

Diameter: 2.793

Mass, lbs: 1.365

Moisture Content, %

Initial: 19.5

Final: 19.7

Wet Unit Weight, pcf

Initial: 129.3

Final: 129.5

Initial Dry Unit Weight, pcf: 108.2

Back Pressure Saturation, psi

Back Pressure, Exit: 50

Back Pressure, Enter: 52

Lateral Pressure: 55

**Permeability (k), cm/sec:  $2.8 \times 10^{-5}$**

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-126
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.015
Diameter:	2.71
Mass, lbs:	1.318
Moisture Content, %	
Initial:	17.5
Final:	16.8
Wet Unit Weight, pcf	
Initial:	131.0
Final:	130.2
Initial Dry Unit Weight, pcf:	111.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $8.3 \times 10^{-5}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client: TTL  
Project: TTL Job No. 000180200804.00  
BMI Work Order Number: 187609  
Sample Identification: UD-126  
Depth, ft: 28.0' - 30.0'  
USCS Classification: brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches  
    Height: 3.078  
    Diameter: 2.745  
Mass, lbs: 1.411  
Moisture Content, %  
    Initial: 16.9  
    Final: 16.3  
Wet Unit Weight, pcf  
    Initial: 133.9  
    Final: 133.2  
Initial Dry Unit Weight, pcf: 114.5  
Back Pressure Saturation, psi  
    Back Pressure, Exit: 50  
    Back Pressure, Enter: 51  
    Lateral Pressure: 53

**Permeability (k), cm/sec:  $1.0 \times 10^{-5}$**

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-126
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.86
Diameter:	2.753
Mass, lbs:	1.291
Moisture Content, %	
Initial:	18.6
Final:	17.9
Wet Unit Weight, pcf	
Initial:	131.0
Final:	130.3
Initial Dry Unit Weight, pcf:	110.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43
<b>Permeability (k), cm/sec:</b>	<b>9.3 x 10<sup>-7</sup></b>

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-128
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.059
Diameter:	2.792
Mass, lbs:	1.358
Moisture Content, %	
Initial:	21.2
Final:	21.6
Wet Unit Weight, pcf	
Initial:	125.3
Final:	125.7
Initial Dry Unit Weight, pcf:	103.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	42
Lateral Pressure:	45

**Permeability (k), cm/sec:**  $9.5 \times 10^{-5}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client: TTL  
Project: TTL Job No. 000180200804.00  
BMI Work Order Number: 187609  
Sample Identification: UD-128  
Depth, ft: 30.0' - 32.0'  
USCS Classification: brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches  
    Height: 2.931  
    Diameter: 2.718  
Mass, lbs: 1.239  
Moisture Content, %  
    Initial: 23.6  
    Final: 20.4  
Wet Unit Weight, pcf  
    Initial: 125.9  
    Final: 122.7  
Initial Dry Unit Weight, pcf: 101.9  
Back Pressure Saturation, psi  
    Back Pressure, Exit: 40  
    Back Pressure, Enter: 41  
    Lateral Pressure: 43

**Permeability (k), cm/sec:  $2.2 \times 10^{-6}$**



**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-128
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown/gray poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.945
Diameter:	2.778
Mass, lbs:	1.329
Moisture Content, %	
Initial:	21.0
Final:	19.9
Wet Unit Weight, pcf	
Initial:	128.7
Final:	127.6
Initial Dry Unit Weight, pcf:	106.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $1.7 \times 10^{-4}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-179
Depth, ft:	13.0' - 15.0'
USCS Classification:	dark brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.12
Diameter:	2.776
Mass, lbs:	1.352
Moisture Content, %	
Initial:	20.7
Final:	20.4
Wet Unit Weight, pcf	
Initial:	123.7
Final:	123.4
Initial Dry Unit Weight, pcf:	102.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53

**Permeability (k), cm/sec:**  $2.1 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-179
Depth, ft:	28.0' - 30.0'
USCS Classification:	dark brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.042
Diameter:	2.769
Mass, lbs:	1.373
Moisture Content, %	
Initial:	19.8
Final:	19.3
Wet Unit Weight, pcf	
Initial:	129.5
Final:	129.0
Initial Dry Unit Weight, pcf:	108.1
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $3.9 \times 10^{-4}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-179
Depth, ft:	43.0' - 45.0'
USCS Classification:	dark brown/black poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.995
Diameter:	2.718
Mass, lbs:	1.290
Moisture Content, %	
Initial:	19.6
Final:	18.0
Wet Unit Weight, pcf	
Initial:	128.3
Final:	126.6
Initial Dry Unit Weight, pcf:	107.3
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	42
Lateral Pressure:	45

**Permeability (k), cm/sec:**  $2.0 \times 10^{-7}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-231
Depth, ft:	13.0' - 15.0'
USCS Classification:	dark brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.021
Diameter:	2.822
Mass, lbs:	1.357
Moisture Content, %	
Initial:	20.6
Final:	20.5
Wet Unit Weight, pcf	
Initial:	124.1
Final:	124.0
Initial Dry Unit Weight, pcf:	102.9
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $2.7 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-231
Depth, ft:	30.0' - 32.0'
USCS Classification:	dark brown/black poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.065
Diameter:	2.739
Mass, lbs:	1.393
Moisture Content, %	
Initial:	16.2
Final:	16.0
Wet Unit Weight, pcf	
Initial:	133.3
Final:	133.1
Initial Dry Unit Weight, pcf:	114.7
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $6.0 \times 10^{-6}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client: **TTL**

Project: **TTL Job No. 000180200804.00**

BMI Work Order Number: 187609

Sample Identification: UD-231

Depth, ft: 43.0' - 45.0'

USCS Classification: dark brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches  
    Height: 2.936  
    Diameter: 2.734

Mass, lbs: 1.267

Moisture Content, %  
    Initial: 20.6  
    Final: 19.0

Wet Unit Weight, pcf  
    Initial: 127.0  
    Final: 125.3

Initial Dry Unit Weight, pcf: 105.3

Back Pressure Saturation, psi  
    Back Pressure, Exit: 50  
    Back Pressure, Enter: 51  
    Lateral Pressure: 53

**Permeability (k), cm/sec:  $1.9 \times 10^{-5}$**



**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-238
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown/gray poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.976
Diameter:	2.726
Mass, lbs:	1.318
Moisture Content, %	
Initial:	18.8
Final:	18.2
Wet Unit Weight, pcf	
Initial:	131.1
Final:	130.5
Initial Dry Unit Weight, pcf:	110.4
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43
<b>Permeability (k), cm/sec:</b>	<b>1.0 x 10<sup>-4</sup></b>

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-238
Depth, ft:	28.0' - 30.0'
USCS Classification:	dark brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.046
Diameter:	2.723
Mass, lbs:	1.299
Moisture Content, %	
Initial:	19.9
Final:	21.1
Wet Unit Weight, pcf	
Initial:	126.5
Final:	127.8
Initial Dry Unit Weight, pcf:	105.5
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $3.3 \times 10^{-4}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client: TTL  
Project: TTL Job No. 000180200804.00  
BMI Work Order Number: 187609  
Sample Identification: UD-238  
Depth, ft: 43.0' - 45.0'  
USCS Classification: dark brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches  
    Height: 2.992  
    Diameter: 2.672  
Mass, lbs: 1.266  
Moisture Content, %  
    Initial: 18.6  
    Final: 18.1  
Wet Unit Weight, pcf  
    Initial: 130.4  
    Final: 129.8  
Initial Dry Unit Weight, pcf: 109.9  
Back Pressure Saturation, psi  
    Back Pressure, Exit: 40  
    Back Pressure, Enter: 41  
    Lateral Pressure: 43

**Permeability (k), cm/sec:  $1.2 \times 10^{-4}$**

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-338
Depth, ft:	13.0' - 15.0'
USCS Classification:	brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	3.062
Diameter:	2.715
Mass, lbs:	1.346
Moisture Content, %	
Initial:	19.2
Final:	18.7
Wet Unit Weight, pcf	
Initial:	131.2
Final:	130.7
Initial Dry Unit Weight, pcf:	110.1
Back Pressure Saturation, psi	
Back Pressure, Exit:	50
Back Pressure, Enter:	51
Lateral Pressure:	53
<b>Permeability (k), cm/sec:</b>	<b>2.6 x 10<sup>-6</sup></b>

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-338
Depth, ft:	28.0' - 30.0'
USCS Classification:	dark brown poorly graded SAND with silt

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.994
Diameter:	2.716
Mass, lbs:	1.282
Moisture Content, %	
Initial:	21.7
Final:	19.6
Wet Unit Weight, pcf	
Initial:	127.7
Final:	125.5
Initial Dry Unit Weight, pcf:	104.9
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $2.2 \times 10^{-5}$

**FALLING HEAD PERMEABILITY TEST**  
ASTM D 5084, Measurement of Hydraulic Conductivity

**UNDISTURBED**

Client:	TTL
Project:	TTL Job No. 000180200804.00
BMI Work Order Number:	187609
Sample Identification:	UD-338
Depth, ft:	43.0' - 45.0'
USCS Classification:	brown poorly graded SAND

**SPECIMEN DATA:**

Dimension, inches	
Height:	2.987
Diameter:	2.723
Mass, lbs:	1.302
Moisture Content, %	
Initial:	20.0
Final:	19.0
Wet Unit Weight, pcf	
Initial:	129.3
Final:	128.3
Initial Dry Unit Weight, pcf:	107.8
Back Pressure Saturation, psi	
Back Pressure, Exit:	40
Back Pressure, Enter:	41
Lateral Pressure:	43

**Permeability (k), cm/sec:**  $9.2 \times 10^{-5}$

# TTL LABORATORY REPORTS



3516 Greensboro Avenue  
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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**September 2018**

<u>Material Description:</u>	Dark Green Fat Clay (CH)
<u>Sample:</u>	EB-03 (92.5'-94.0')
<u>Sample Date:</u>	September 2018
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	59.1 pcf
<u>In Situ Moisture:</u>	56.4 %
<u>Hydraulic Conductivity "k":</u>	1.6 x 10 <sup>-9</sup> cm/sec





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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**September 2018**

<u>Material Description:</u>	Light Gray Lean Clay (CL)
<u>Sample:</u>	EB-06 (120.0'-122.0')
<u>Sample Date:</u>	September 2018
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	97.1 pcf
<u>In Situ Moisture:</u>	22.3 %
<u>Hydraulic Conductivity "k":</u>	1.3 x 10 <sup>-5</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**September 2018**

<u>Material Description:</u>	Greenish Gray Fat Clay (CH)
<u>Sample:</u>	EB-08 (130.0'-133.0')
<u>Sample Date:</u>	September 2018
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	82.8 pcf
<u>In Situ Moisture:</u>	16.1 %
<u>Hydraulic Conductivity "k":</u>	9.3 x 10 <sup>-9</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 2434**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**December 2018**

<u>Material Description:</u>	Black Sand (SP)
<u>Sample:</u>	EB-16 (12.0'-12.5')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	TTL, Inc.
<u>Remolded Dry Density:</u>	99.3 pcf
<u>Remolded Moisture:</u>	10.7 %
<u>Hydraulic Conductivity "k":</u>	9.6 X 10 <sup>-2</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**December 2018**

<u>Material Description:</u>	Black Sand with Silt (SP-SM)
<u>Sample:</u>	EB-16 (15.5'-17.0')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	TTL, Inc.
<u>Simulated In Situ Dry Density:</u>	97.8 pcf
<u>Simulated In Situ Moisture:</u>	17.3 %
<u>Hydraulic Conductivity "k":</u>	1.8 X 10 <sup>-4</sup> cm/sec

*Note: Not an undisturbed sample. Soil sample collected directly from sonic rig core.*



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 2434**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**December 2018**

<u>Material Description:</u>	Black Sand (SP)
<u>Sample:</u>	EB-16 (25.5'-26.0')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	TTL, Inc.
<u>Remolded Dry Density:</u>	98.5 pcf
<u>Remolded Moisture:</u>	17.0 %
<u>Hydraulic Conductivity "k":</u>	2.3 X 10 <sup>-2</sup> cm/sec



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ASTM D 2434**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**December 2018**

<u>Material Description:</u>	Black Sand (SP)
<u>Sample:</u>	EB-16 (34.5'-36.0')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	TTL, Inc.
<u>Remolded Dry Density:</u>	101.3 pcf
<u>Remolded Moisture:</u>	13.0 %
<u>Hydraulic Conductivity "k":</u>	$1.9 \times 10^{-2}$ cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 2434**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**December 2018**

<u>Material Description:</u>	Black Sand (SP)
<u>Sample:</u>	EB-16 (44.5'-46.0')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	TTL, Inc.
<u>Remolded Dry Density:</u>	97.6 pcf
<u>Remolded Moisture:</u>	21.7 %
<u>Hydraulic Conductivity "k":</u>	2.4 X 10 <sup>-2</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**December 2018**

<u>Material Description:</u>	Gray Fat Clay (CH)
<u>Sample:</u>	EB-16 (86.0'-90.0')
<u>Sample Date:</u>	December 2018
<u>Sampled By:</u>	<b>TTL, Inc.</b>
<u>Simulated In Situ Dry Density:</u>	79.5 pcf
<u>Simulated In Situ Moisture:</u>	38.2 %
<u>Hydraulic Conductivity "k":</u>	1.3 x 10 <sup>-8</sup> cm/sec

*Note: Not an undisturbed sample. Soil sample collected directly from sonic rig core.*





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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**May 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: PZ-57 (20.0'-22.0')

Sample Date: May 2019

Sampled By: TTL, Inc.

In Situ Dry Density: 104.1 pcf

In Situ Moisture: 18.9 %

Hydraulic Conductivity "k": 2.7 X 10<sup>-8</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**May 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: PZ-57 (25.0'-27.0')

Sample Date: May 2019

Sampled By: TTL, Inc.

In Situ Dry Density: 95.7 pcf

In Situ Moisture: 22.2 %

Hydraulic Conductivity "k":  $3.4 \times 10^{-7}$  cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**November 2019**

<u>Material Description:</u>	Light Brown Sand with Silt (SP-SM)
<u>Sample:</u>	UD 25R (3.0'-5.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	100.8 pcf
<u>In Situ Moisture:</u>	18.2 %
<u>Hydraulic Conductivity "k":</u>	3.2 x 10 <sup>-4</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**November 2019**

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 25R (10.0'-12.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	<b>TTL, Inc.</b>
<u>In Situ Dry Density:</u>	97.4 pcf
<u>In Situ Moisture:</u>	24.2 %
<u>Hydraulic Conductivity "k":</u>	2.3 x 10 <sup>-4</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**November 2019**

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 43R (5.0'-7.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	101.2 pcf
<u>In Situ Moisture:</u>	18.9 %
<u>Hydraulic Conductivity "k":</u>	6.2 x 10 <sup>-4</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**November 2019**

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 43R (10.0'-12.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	101.6 pcf
<u>In Situ Moisture:</u>	18.9 %
<u>Hydraulic Conductivity "k":</u>	4.5 x 10 <sup>-4</sup> cm/sec



3516 Greensboro Avenue  
Tuscaloosa, AL 35401  
205.345.0816  
[www.TTLUSA.com](http://www.TTLUSA.com)

**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**November 2019**

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 238R (6.0'-8.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	100.6 pcf
<u>In Situ Moisture:</u>	18.8 %
<u>Hydraulic Conductivity "k":</u>	8.5 x 10 <sup>-4</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**November 2019**

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 238R (10.0'-12.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	95.7 pcf
<u>In Situ Moisture:</u>	17.1 %
<u>Hydraulic Conductivity "k":</u>	4.0 x 10 <sup>-4</sup> cm/sec





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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**November 2019**

<u>Material Description:</u>	Black Brown Sand (SP)
<u>Sample:</u>	UD 338R (9.0'-11.0')
<u>Sample Date:</u>	November 2019
<u>Sampled By:</u>	TTL, Inc.
<u>In Situ Dry Density:</u>	108.2 pcf
<u>In Situ Moisture:</u>	19.3 %
<u>Hydraulic Conductivity "k":</u>	3.0 x 10 <sup>-4</sup> cm/sec

# **ATTACHMENT B**

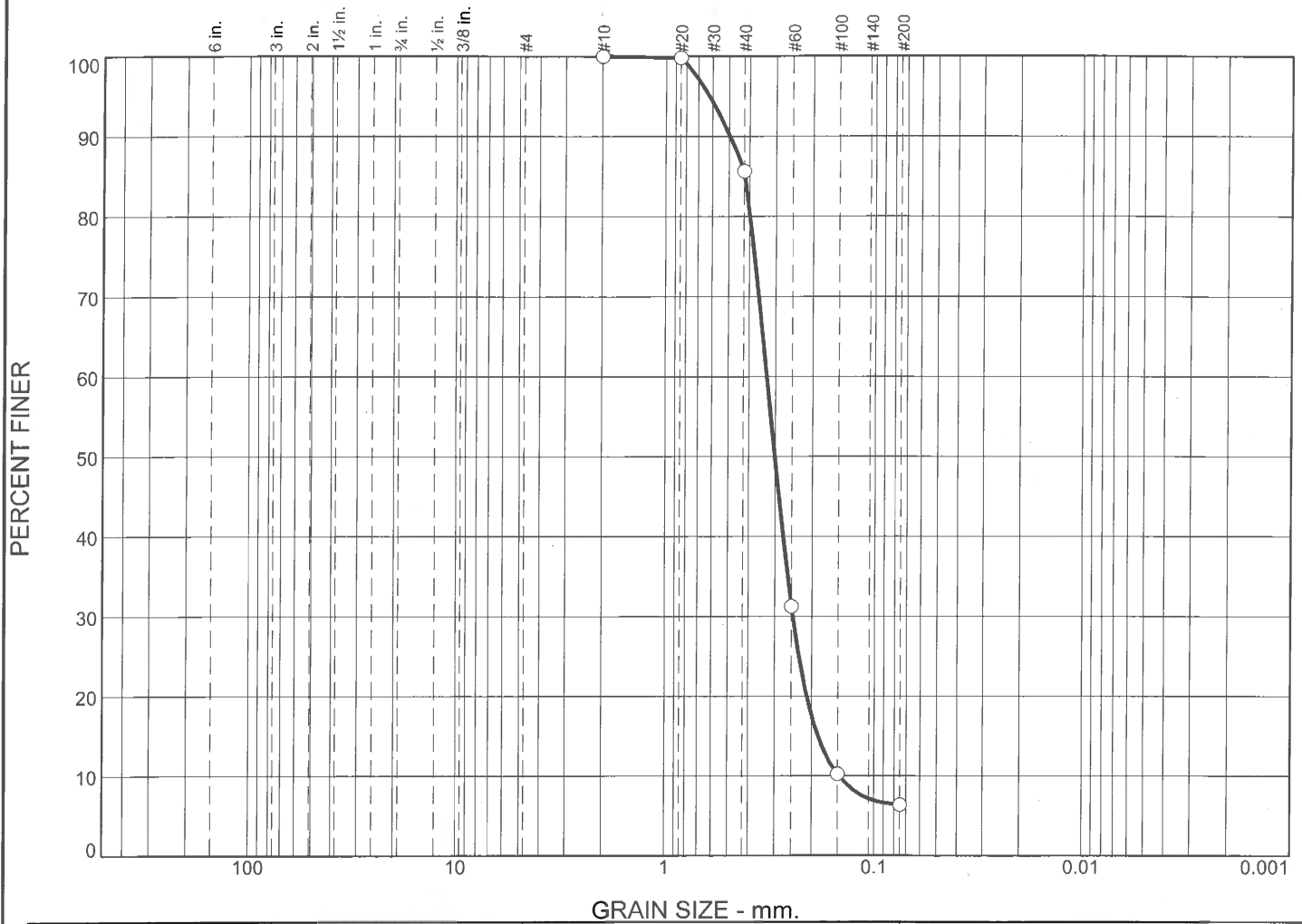
## **GRAIN-SIZE DISTRIBUTION TEST REPORTS**

Attached Documents:

Bowser-Morner Laboratory Reports  
TTL Laboratory Reports

# **BOWSER-MORNER LABORATORY REPORTS**

# GRAIN SIZE DISTRIBUTION REPORT



%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
<input type="radio"/>	0.0	0.0	0.0	0.0	14.3	79.3	6.4			
<input checked="" type="checkbox"/>	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
<input type="radio"/>	NV	NP	0.4214	0.3292	0.3013	0.2463	0.1865	0.1474	1.25	2.23

Material Description	USCS	AASHTO
<input type="radio"/> brown silty SAND	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 **Source of Sample:** UD-10      **Depth:** 13' - 15'      **Sample Number:** UD-10

BOWSER-MORNER, INC.  
 Dayton, Ohio

**Remarks:**  
 As Received  
 Moisture Content: 20.5%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-10

**Depth:** 13' - 15'

**Sample Number:** UD-10

**Material Description:** brown silty SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 20.5%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
564.05	114.28	0.00	#10	0.00	100.0
			#20	0.86	99.8
			#40	64.44	85.7
			#60	309.28	31.2
			#100	403.67	10.2
			#200	420.98	6.4

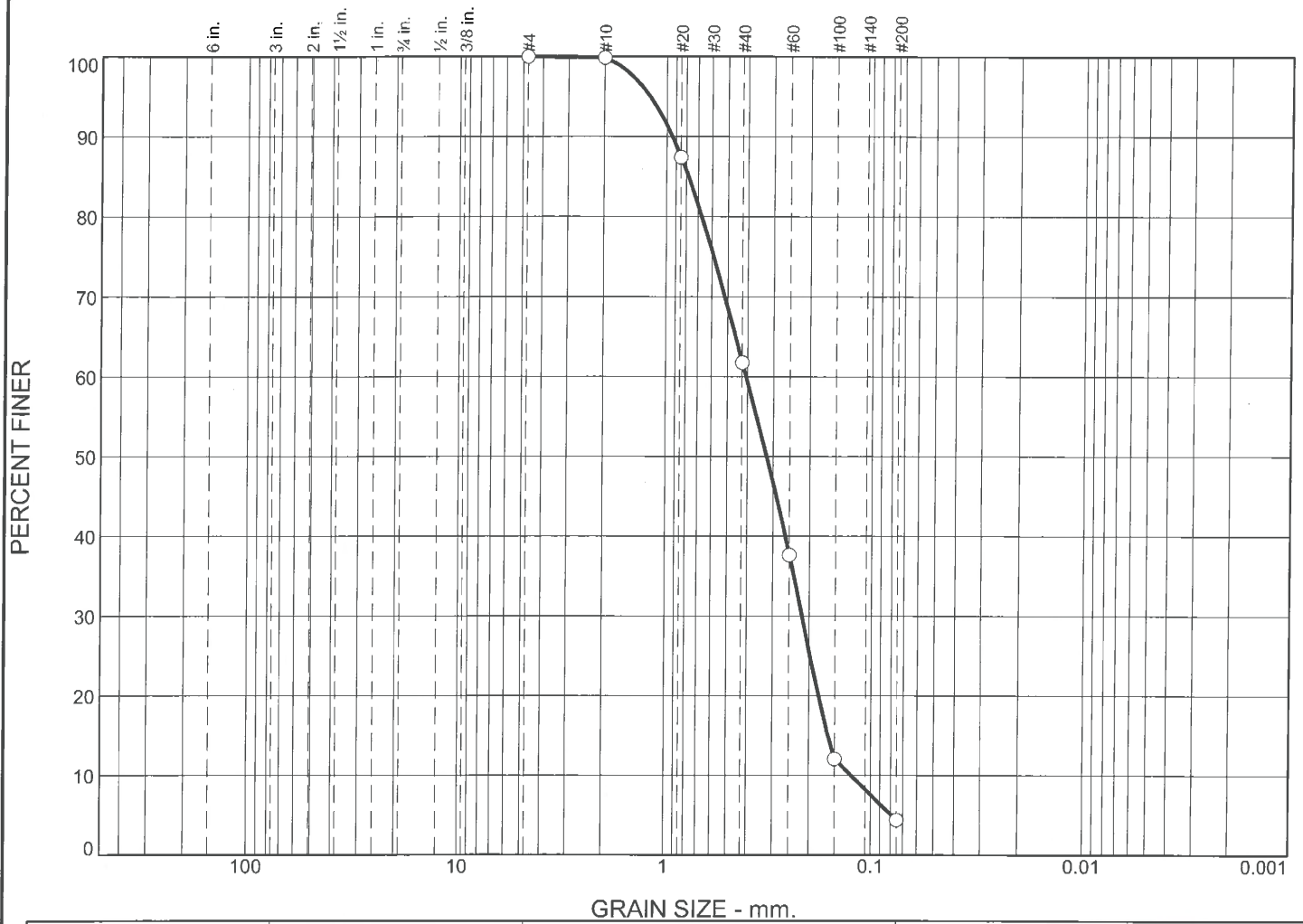
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	14.3	79.3	93.6			6.4

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1474	0.1865	0.2109	0.2463	0.2745	0.3013	0.3292	0.3977	0.4214	0.4978	0.6224

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.46	2.23	1.25

# GRAIN SIZE DISTRIBUTION REPORT



	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.2	38.0	57.4	4.4			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.7822	0.4074	0.3229	0.2170	0.1616	0.1244	0.93	3.28

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>○ <b>Source of Sample:</b> UD-10      <b>Depth:</b> 28' - 30'      <b>Sample Number:</b> UD-10</p>	<p><b>Remarks:</b></p> <p>○ As Received</p> <p>Moisture Content: 21.4%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p><b>Dayton, Ohio</b></p>	

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-10

**Depth:** 28' - 30'

**Sample Number:** UD-10

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 21.4%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
293.25	117.40	0.00	#4	0.00	100.0
			#10	0.27	99.8
			#20	22.08	87.4
			#40	67.22	61.8
			#60	109.61	37.7
			#100	154.60	12.1
			#200	168.15	4.4

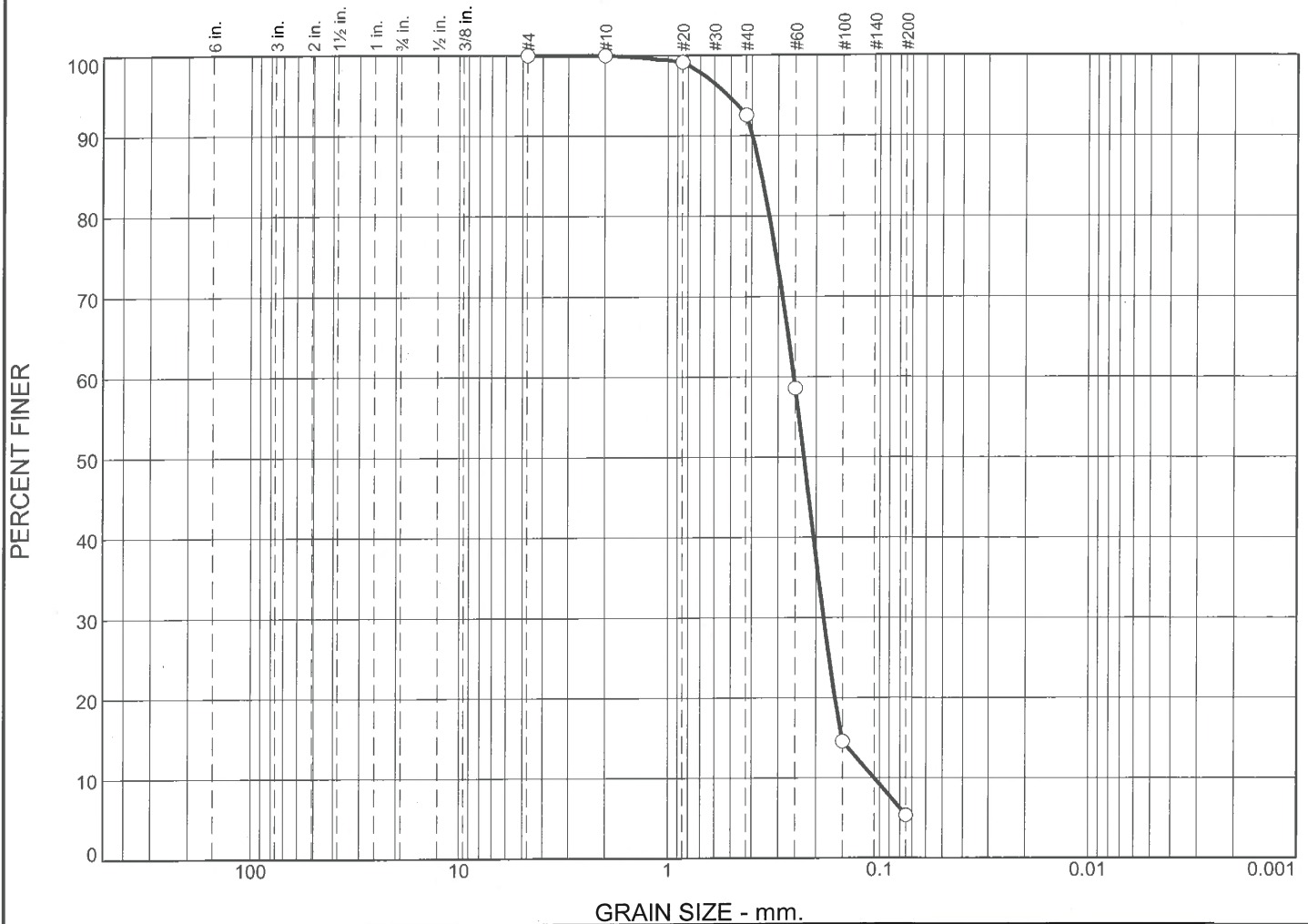
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.2	38.0	57.4	95.6			4.4

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0793	0.1244	0.1616	0.1799	0.2170	0.2616	0.3229	0.4074	0.6732	0.7822	0.9379	1.2070

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.71	3.28	0.93

# GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	7.4	87.3	5.3	

	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.3596	0.2540	0.2277	0.1839	0.1511	0.1065	1.25	2.39

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-10      **Depth:** 43' - 45'      **Sample Number:** UD-10

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 20.2%



**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-10

**Depth:** 43' - 45'

**Sample Number:** UD-10

**Material Description:** brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 20.2%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
648.50	119.43	0.00	#4	0.00	100.0
			#10	0.04	100.0
			#20	4.42	99.2
			#40	39.35	92.6
			#60	219.06	58.6
			#100	452.09	14.6
			#200	500.77	5.3

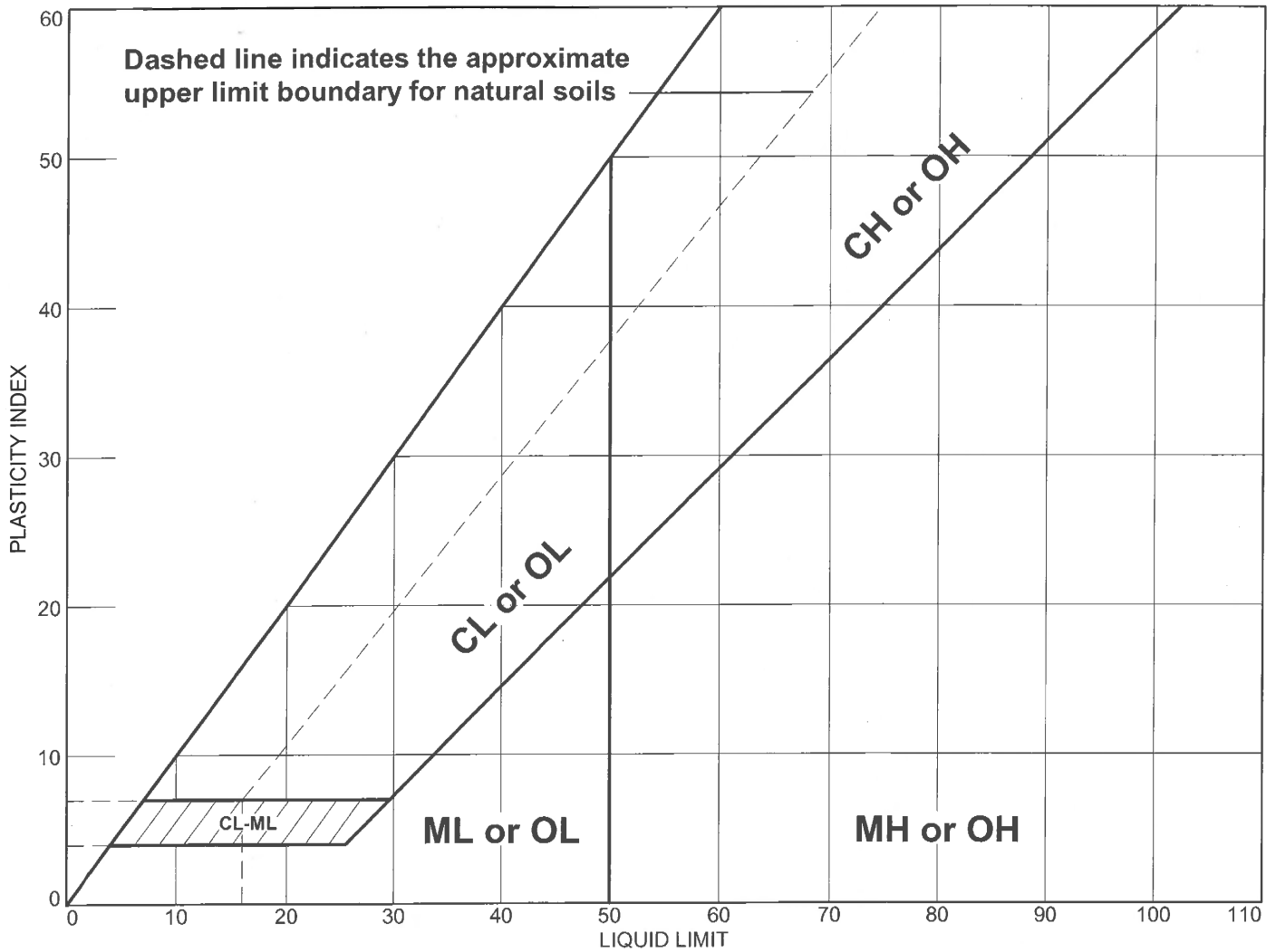
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	7.4	87.3	94.7			5.3

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1065	0.1511	0.1627	0.1839	0.2050	0.2277	0.2540	0.3304	0.3596	0.3983	0.5185

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.16	2.39	1.25

# LIQUID AND PLASTIC LIMITS TEST REPORT



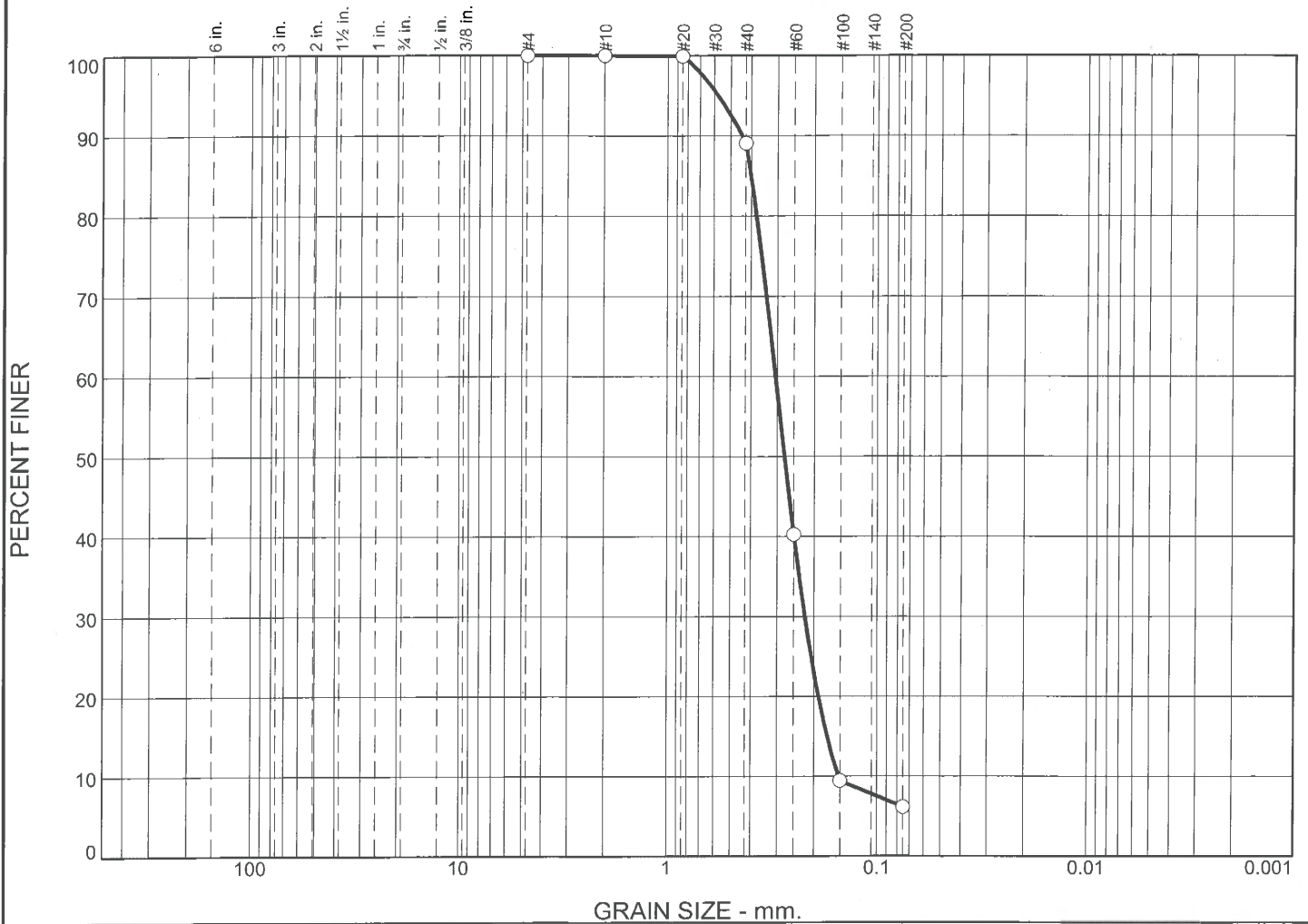
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown silty SAND	NV	NP	NP	85.7	6.4	SP-SM
■	brown poorly graded SAND	NV	NP	NP	61.8	4.4	SP
▲	brown poorly graded SAND with silt	NV	NP	NP	92.6	5.3	SP-SM

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-10      **Depth:** 13' - 15'      **Sample Number:** UD-10  
 ■ **Source of Sample:** UD-10      **Depth:** 28' - 30'      **Sample Number:** UD-10  
 ▲ **Source of Sample:** UD-10      **Depth:** 43' - 45'      **Sample Number:** UD-10

**BOWSER-MORNER, INC.**  
Dayton, Ohio

**Remarks:**

# GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	10.9	82.9	6.2	

LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
NV	NP	0.4009	0.3058	0.2769	0.2209	0.1729	0.1526	1.05	2.00

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-25      **Depth:** 15' - 17'      **Sample Number:** UD-25

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**  
 ○ As Received  
 Moisture Content: 25.9%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-25

**Depth:** 15' - 17'

**Sample Number:** UD-25

**Material Description:** brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 25.9%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
258.43	119.52	0.00	#4	0.00	100.0
			#10	0.02	100.0
			#20	0.12	99.9
			#40	15.16	89.1
			#60	83.00	40.2
			#100	125.77	9.5
			#200	130.33	6.2

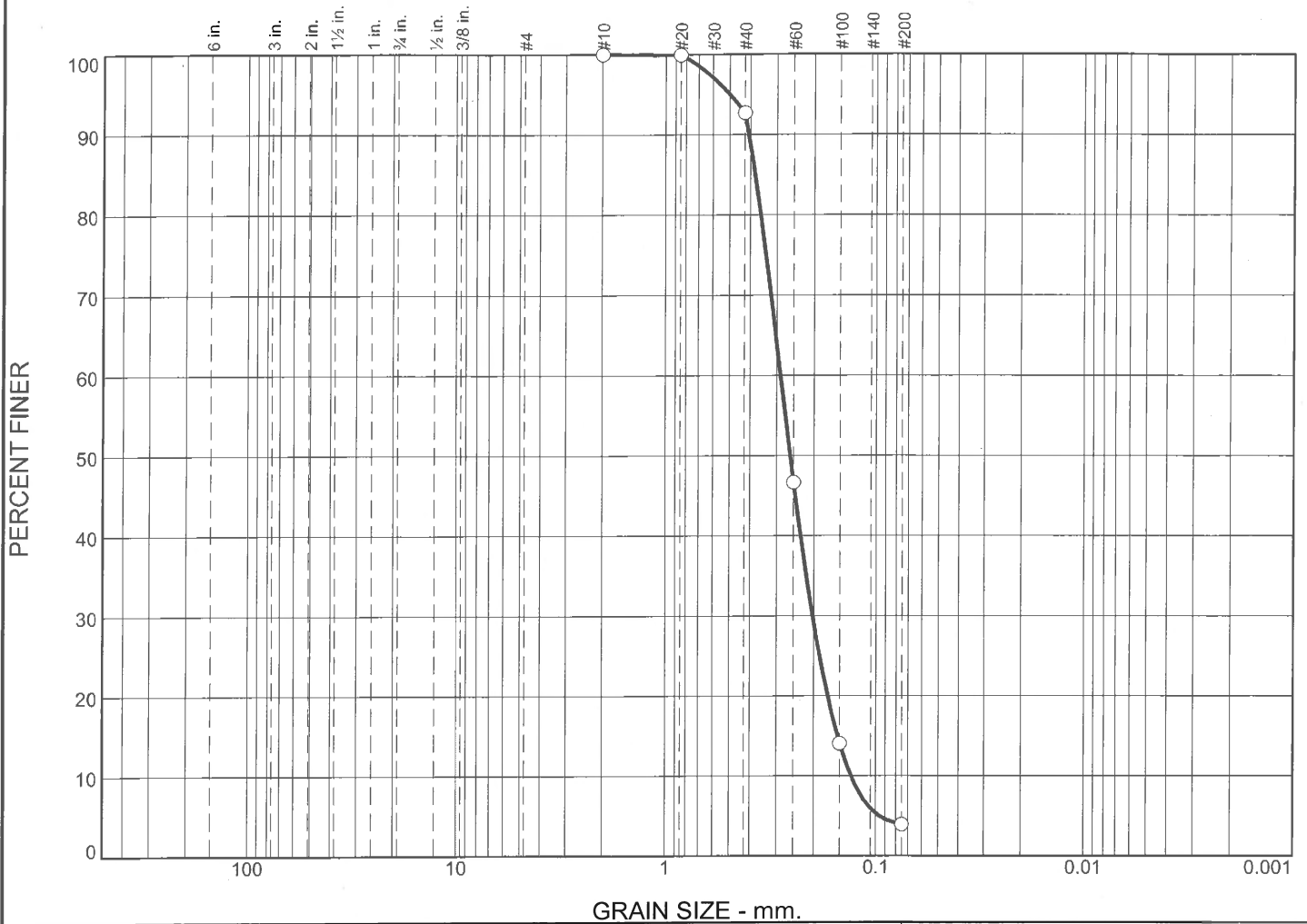
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	10.9	82.9	93.8			6.2

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1526	0.1729	0.1902	0.2209	0.2493	0.2769	0.3058	0.3768	0.4009	0.4429	0.5752

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.37	2.00	1.05

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	7.3	88.8	3.9			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.3795	0.2882	0.2594	0.2023	0.1537	0.1323	1.07	2.18

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-25      **Depth:** 30' - 32'      **Sample Number:** UD-25

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 23.3%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-25

**Depth:** 30' - 32'

**Sample Number:** UD-25

**Material Description:** dark brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 23.3%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
245.09	92.89	0.00	#10	0.00	100.0
			#20	0.14	99.9
			#40	11.10	92.7
			#60	81.18	46.7
			#100	130.83	14.0
			#200	146.25	3.9

### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	7.3	88.8	96.1			3.9

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0964	0.1323	0.1537	0.1712	0.2023	0.2312	0.2594	0.2882	0.3570	0.3795	0.4067	0.5013

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.25	2.18	1.07



**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-25

**Depth:** 43' - 45'

**Sample Number:** UD-25

**Material Description:** dark brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 20.2%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
348.38	114.21	0.00	#4	0.00	100.0
			#10	0.12	99.9
			#20	1.09	99.5
			#40	29.90	87.2
			#60	147.31	37.1
			#100	208.10	11.1
			#200	223.18	4.7

**Fractional Components**

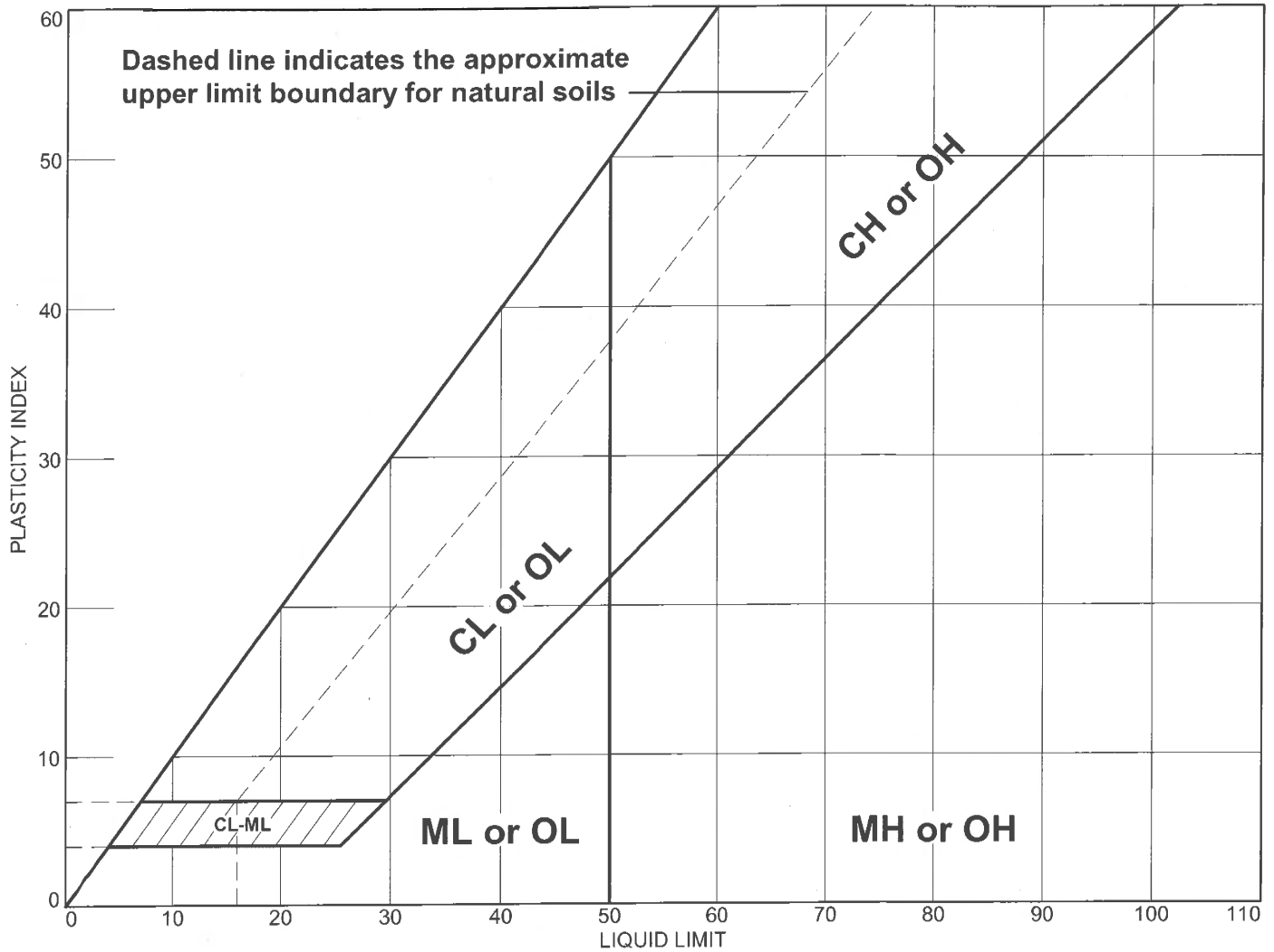
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	12.7	82.5	95.3			4.7

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0883	0.1429	0.1707	0.1926	0.2282	0.2584	0.2867	0.3159	0.3875	0.4120	0.4765	0.6106

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.40	2.21	1.15



# LIQUID AND PLASTIC LIMITS TEST REPORT



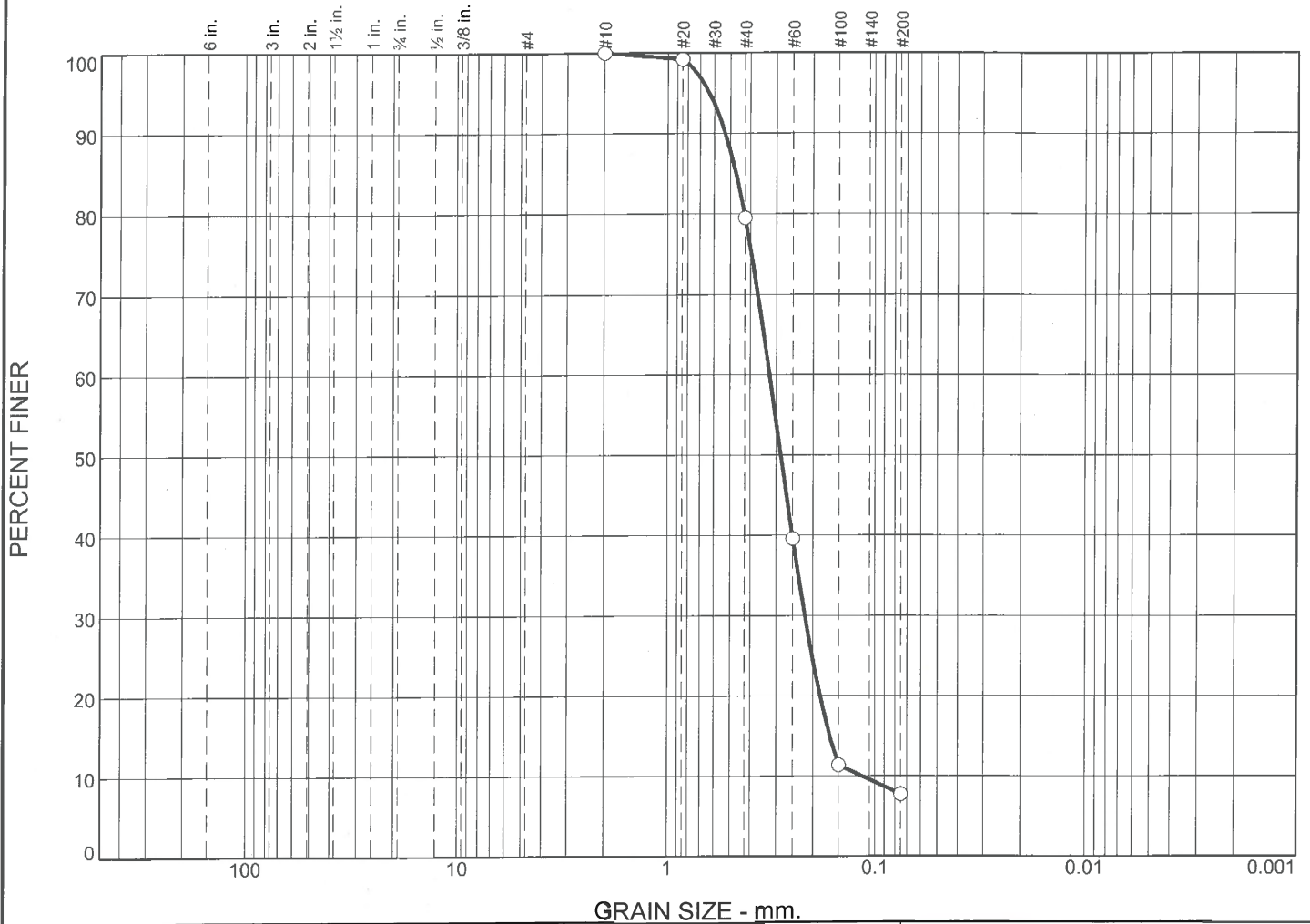
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND with silt	NV	NP	NP	89.1	6.2	SP-SM
■	dark brown poorly graded SAND	NV	NP	NP	92.7	3.9	SP
▲	dark brown poorly graded SAND	NV	NP	NP	87.2	4.7	SP

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-25      **Depth:** 15' - 17'      **Sample Number:** UD-25  
 ■ **Source of Sample:** UD-25      **Depth:** 30' - 32'      **Sample Number:** UD-25  
 ▲ **Source of Sample:** UD-25      **Depth:** 43' - 45'      **Sample Number:** UD-25

**BOWSER-MORNER, INC.**  
Dayton, Ohio

**Remarks:**

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines		Clay	
		Coarse	Fine	Coarse	Medium	Fine	Silt			
<input type="radio"/>	0.0	0.0	0.0	0.0	20.5	71.8	7.7			
<input checked="" type="checkbox"/>	LL	PL	D85	D60	D50	D30	D15	D10	Cc	Cu
<input type="radio"/>	NV	NP	0.4711	0.3235	0.2856	0.2182	0.1656	0.1153	1.28	2.81

Material Description	USCS	AASHTO
<input type="radio"/> dark brown poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 **Source of Sample:** UD-34      **Depth:** 13' - 15'      **Sample Number:** UD-34

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

As Received  
 Moisture Content: 18.6%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-34

**Depth:** 13' - 15'

**Sample Number:** UD-34

**Material Description:** dark brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 18.6%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
204.99	112.79	0.00	#10	0.00	100.0
			#20	0.74	99.2
			#40	18.89	79.5
			#60	55.69	39.6
			#100	81.70	11.4
			#200	85.07	7.7

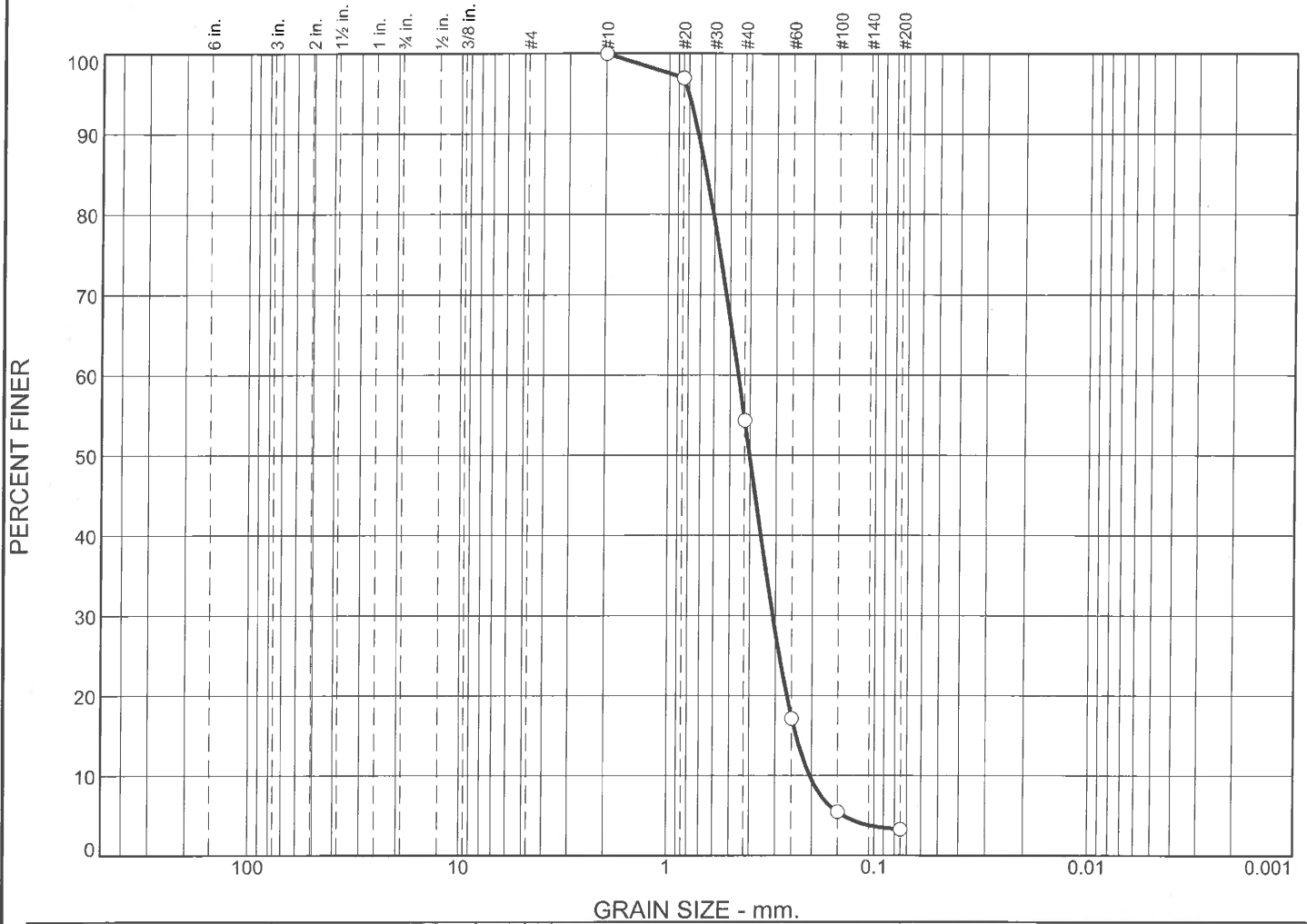
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	20.5	71.8	92.3			7.7

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1153	0.1656	0.1843	0.2182	0.2513	0.2856	0.3235	0.4285	0.4711	0.5314	0.6331

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.41	2.81	1.28

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
<input type="radio"/>	0.0	0.0	0.0	0.0	45.6	51.1	3.3			
<input checked="" type="checkbox"/>	LL	PL	D85	D60	D50	D30	D15	D10	Cc	Cu
<input type="radio"/>	NV	NP	0.6576	0.4569	0.4022	0.3097	0.2384	0.2048	1.02	2.23

Material Description	USCS	AASHTO
<input type="radio"/> brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 **Source of Sample:** UD-34      **Depth:** 28' - 29'      **Sample Number:** UD-34

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

- As Received
- Moisture Content: 23.5%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-34

**Depth:** 28' - 29'

**Sample Number:** UD-34

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 23.5%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
271.46	119.48	0.00	#10	0.00	100.0
			#20	4.60	97.0
			#40	69.36	54.4
			#60	125.96	17.1
			#100	143.67	5.5
			#200	147.00	3.3

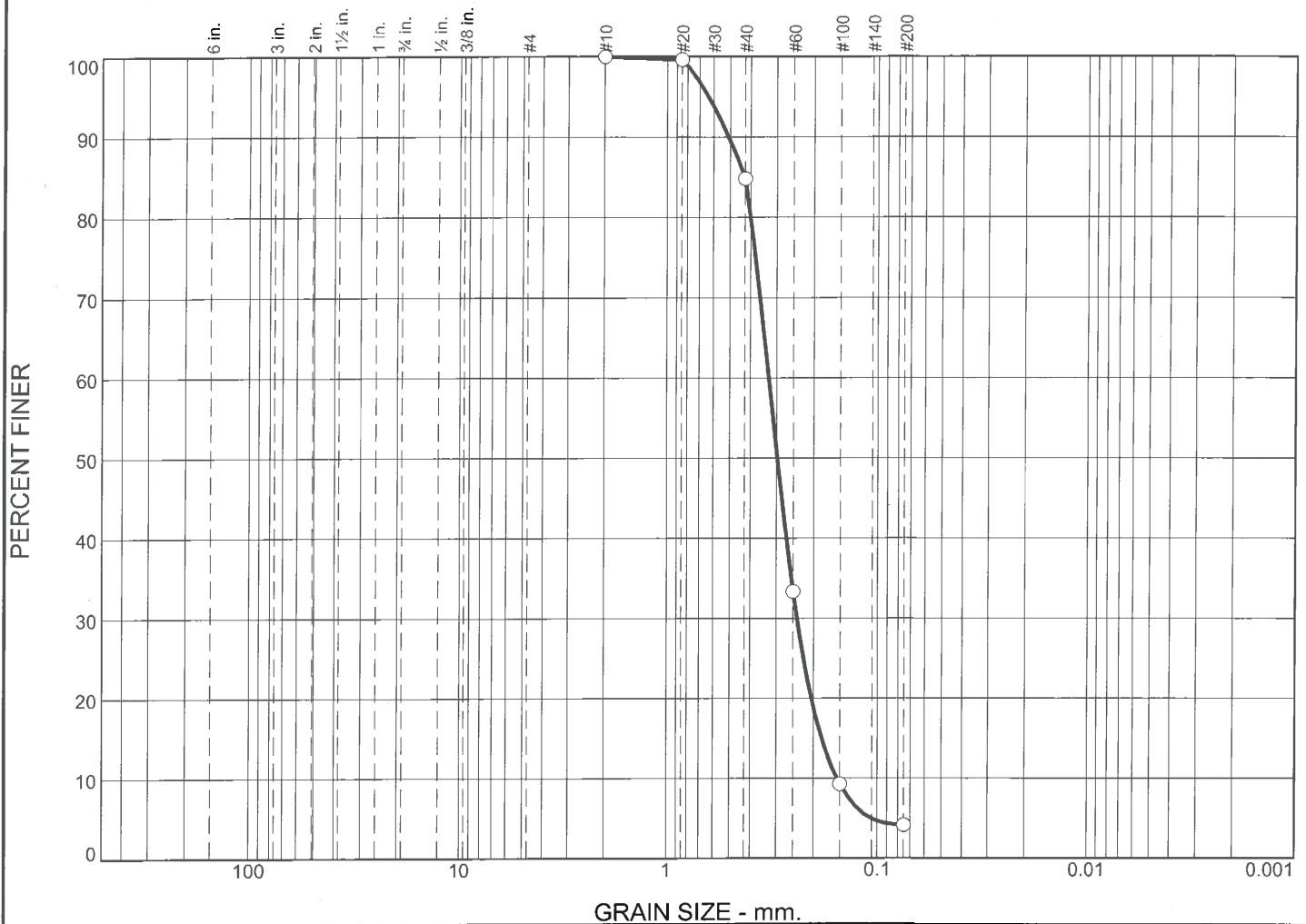
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	45.6	51.1	96.7			3.3

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1405	0.2048	0.2384	0.2644	0.3097	0.3543	0.4022	0.4569	0.6056	0.6576	0.7214	0.8059

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.89	2.23	1.02

# GRAIN SIZE DISTRIBUTION REPORT



	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	15.2	80.6	4.2			
⊗	<b>LL</b>	<b>PL</b>	<b>D85</b>	<b>D60</b>	<b>D50</b>	<b>D30</b>	<b>D15</b>	<b>D10</b>	<b>C<sub>c</sub></b>	<b>C<sub>u</sub></b>
○	NV	NP	0.4271	0.3265	0.2971	0.2397	0.1831	0.1549	1.14	2.11

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-34      **Depth:** 48' - 50'      **Sample Number:** UD-34

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 24.1%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-34

**Depth:** 48' - 50'

**Sample Number:** UD-34

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 24.1%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
224.07	124.56	0.00	#10	0.00	100.0
			#20	0.37	99.6
			#40	15.08	84.8
			#60	66.31	33.4
			#100	90.26	9.3
			#200	95.38	4.2

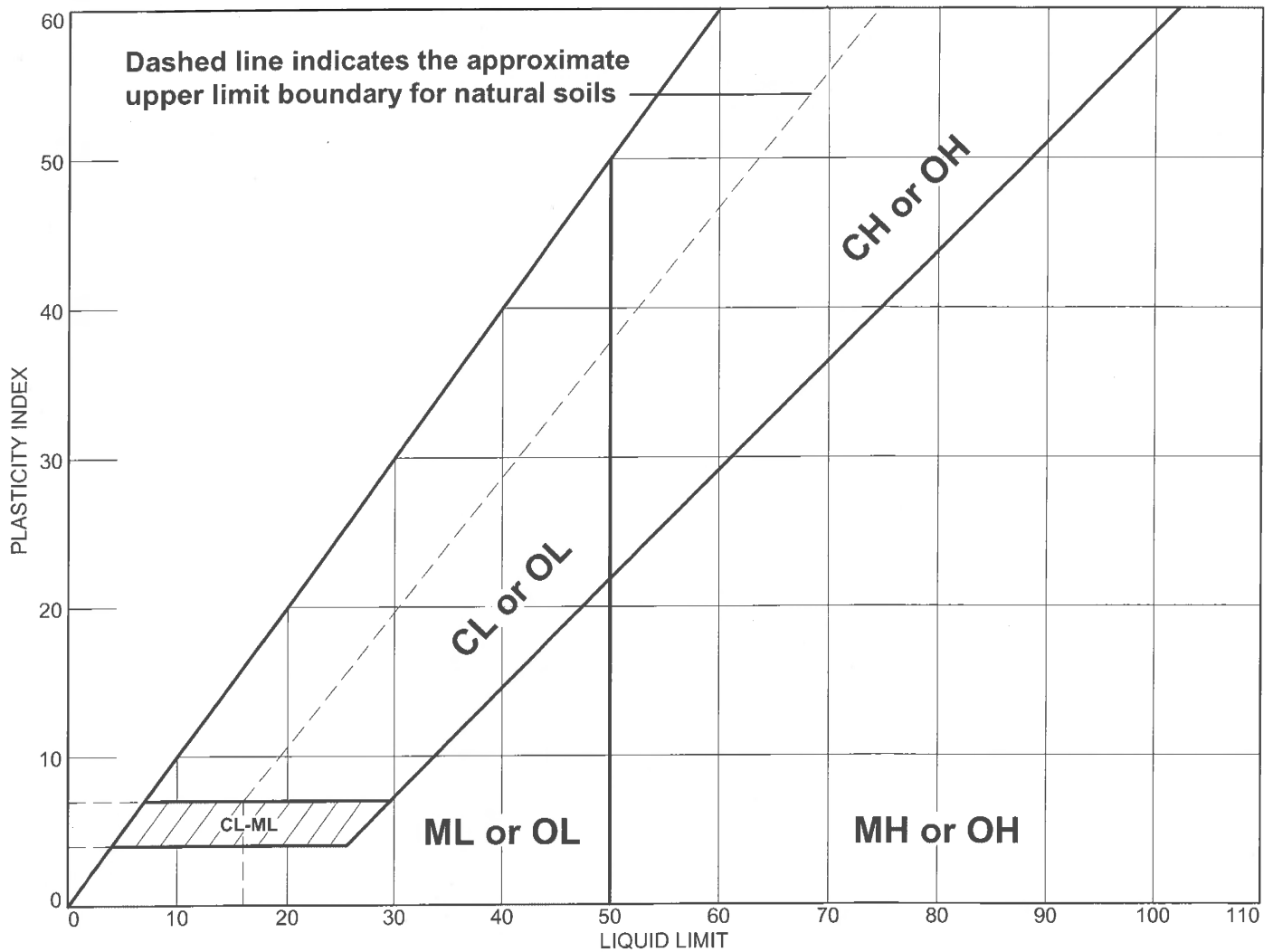
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	15.2	80.6	95.8			4.2

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1070	0.1549	0.1831	0.2048	0.2397	0.2691	0.2971	0.3265	0.3999	0.4271	0.5102	0.6354

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.46	2.11	1.14

# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND with silt	NV	NP	NP	79.5	7.7	SP-SM
■	brown poorly graded SAND	NV	NP	NP	54.4	3.3	SP
▲	brown poorly graded SAND	NV	NP	NP	84.8	4.2	SP

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-34      **Depth:** 13' - 15'      **Sample Number:** UD-34  
 ■ **Source of Sample:** UD-34      **Depth:** 28' - 29'      **Sample Number:** UD-34  
 ▲ **Source of Sample:** UD-34      **Depth:** 48' - 50'      **Sample Number:** UD-34

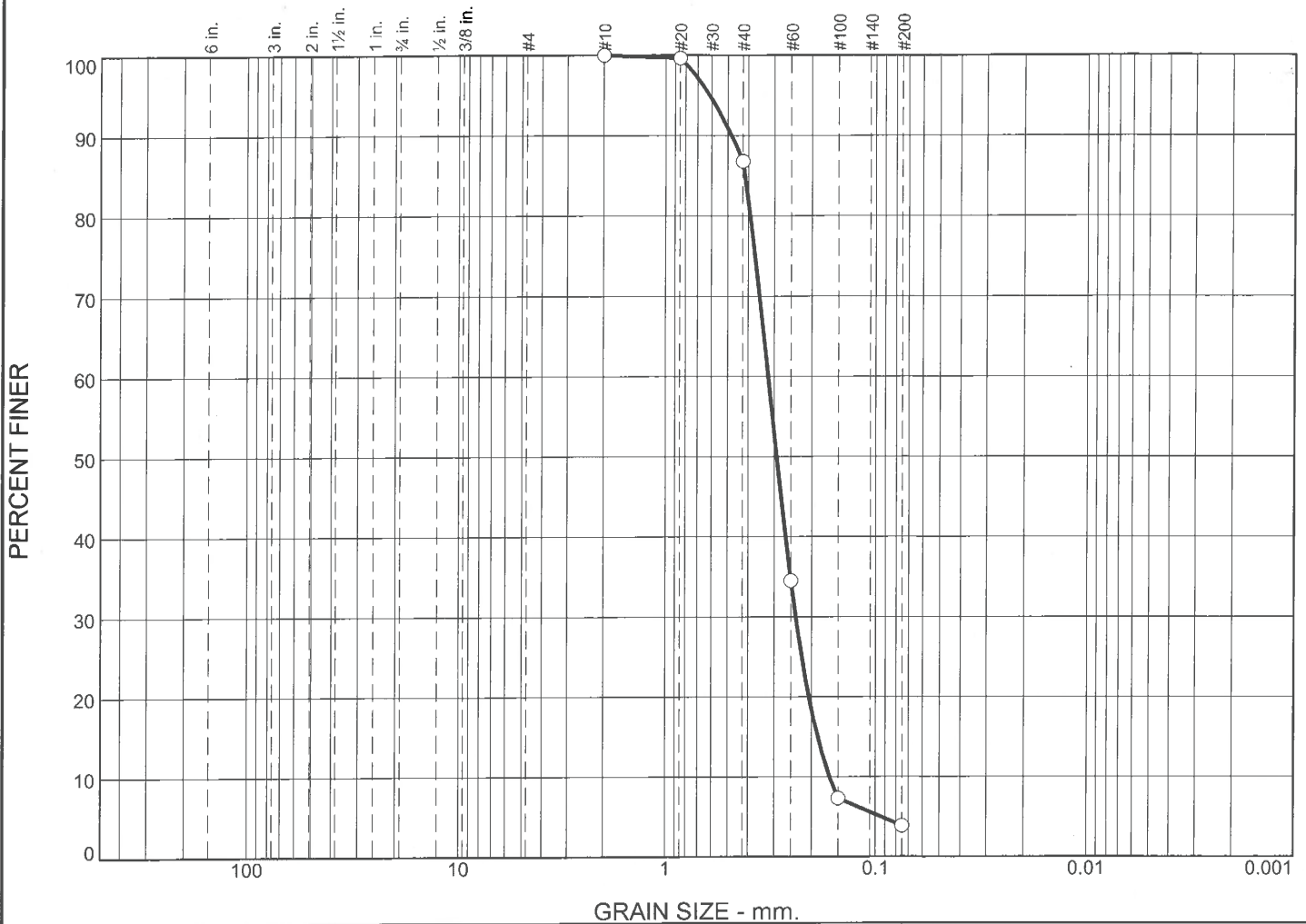
**Remarks:**

**BOWSER-MORNER, INC.**

Dayton, Ohio



# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	13.2	82.9	3.9			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4148	0.3204	0.2921	0.2371	0.1868	0.1647	1.07	1.95

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-43      **Depth:** 13' - 15'      **Sample Number:** UD-43

**BOWSER-MORNER, INC.**

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 23.0%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

Client: TTL

Project: TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

Project Number: 187609

Location: UD-43

Depth: 13' - 15'

Sample Number: UD-43

Material Description: brown poorly graded SAND

Liquid Limit: NV

Plastic Limit: NP

USCS Classification: SP

AASHTO Classification: A-3

Testing Remarks: As Received

Moisture Content: 23.0%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
225.13	96.15	0.00	#10	0.00	100.0
			#20	0.49	99.6
			#40	17.01	86.8
			#60	84.49	34.5
			#100	119.51	7.3
			#200	123.97	3.9

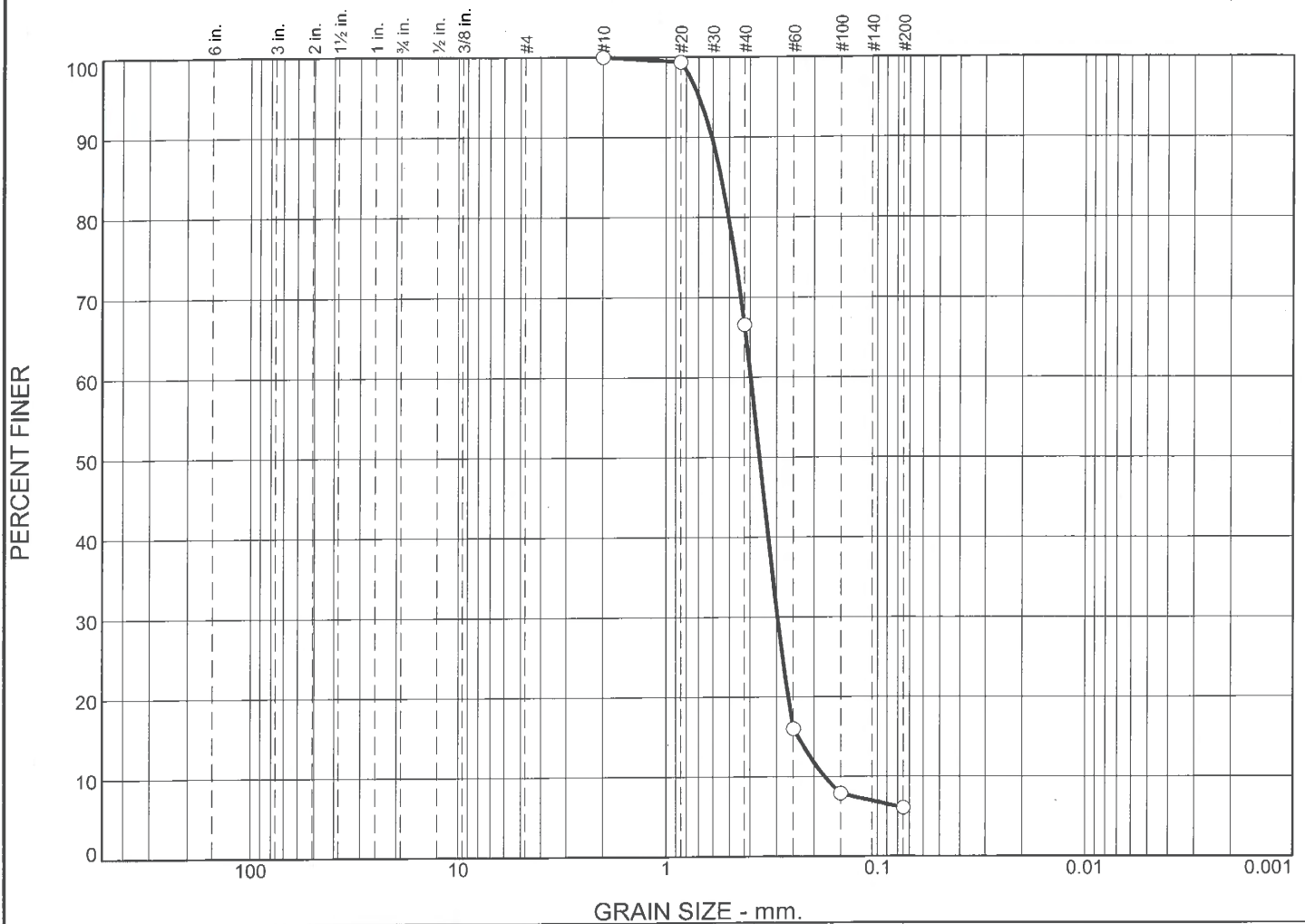
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	13.2	82.9	96.1			3.9

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0938	0.1647	0.1868	0.2054	0.2371	0.2651	0.2921	0.3204	0.3906	0.4148	0.4826	0.6139

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.45	1.95	1.07

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	33.4	60.5	6.1			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.5490	0.3968	0.3605	0.2973	0.2381	0.1784	1.25	2.22

Material Description	USCS	AASHTO
○ brown/black poorly graded SAND with silt	SP-SM	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>○ <b>Source of Sample:</b> UD-43      <b>Depth:</b> 30' - 32'      <b>Sample Number:</b> UD-43</p>	<p><b>Remarks:</b></p> <p>○ As Received</p> <p>Moisture Content: 21.3%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p><b>Dayton, Ohio</b></p>	

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-43

**Depth:** 30' - 32'

**Sample Number:** UD-43

**Material Description:** brown/black poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 21.3%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
185.15	97.67	0.00	#10	0.00	100.0
			#20	0.53	99.4
			#40	29.24	66.6
			#60	73.46	16.0
			#100	80.58	7.9
			#200	82.16	6.1

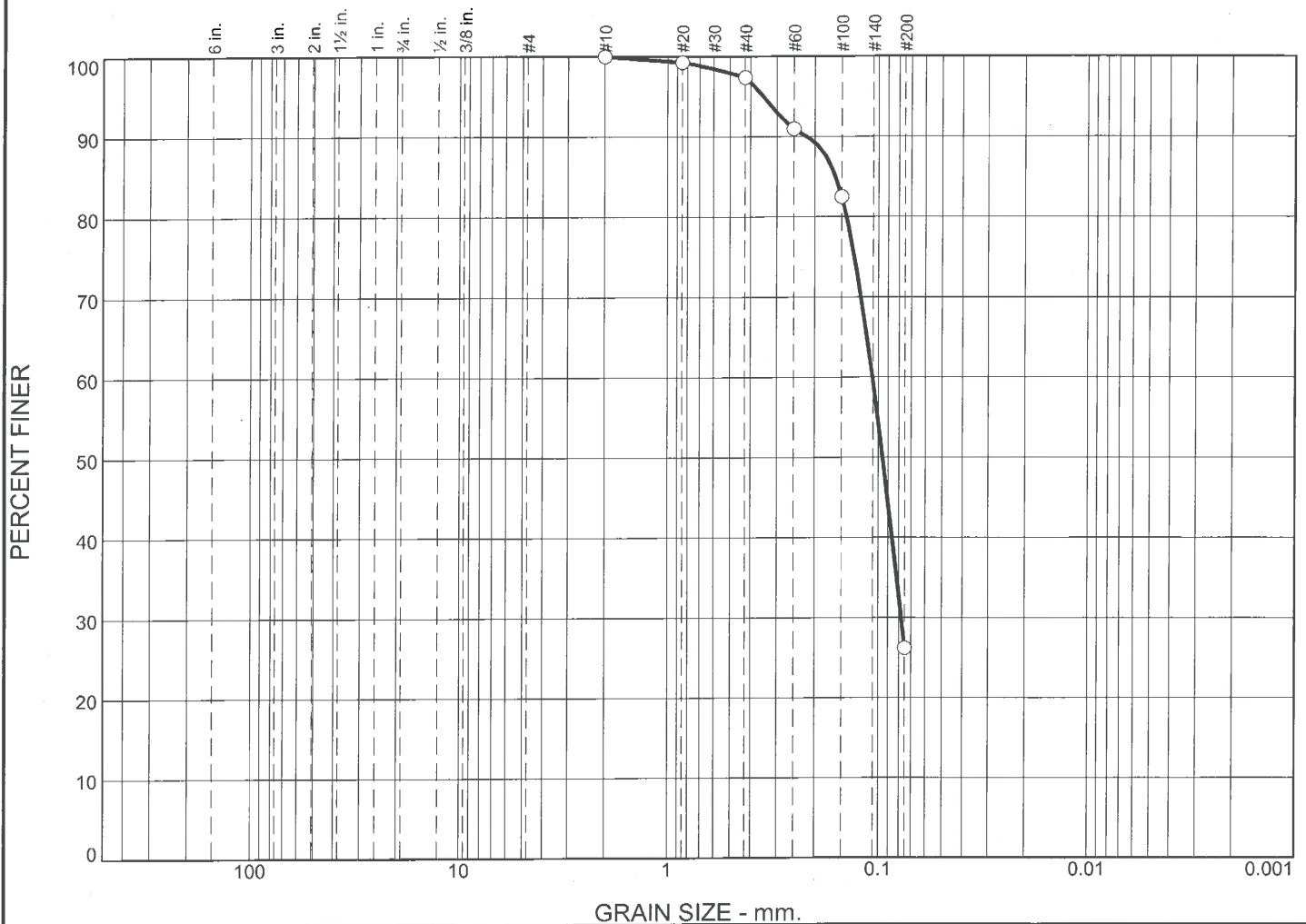
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	33.4	60.5	93.9			6.1

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1784	0.2381	0.2650	0.2973	0.3282	0.3605	0.3968	0.5050	0.5490	0.6084	0.6988

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.72	2.22	1.25

# GRAIN SIZE DISTRIBUTION REPORT



%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	2.6	71.2	26.2			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	27	15	0.1605	0.1068	0.0955	0.0779				

Material Description	USCS	AASHTO
○ brown/black clayey SAND	SC	A-2-6(0)

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-43      **Depth:** 43' - 45'      **Sample Number:** UD-43

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**  
 ○ As Received  
 Moisture Content: 20.3%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-43

**Depth:** 43' - 45'

**Sample Number:** UD-43

**Material Description:** brown/black clayey SAND

**Liquid Limit:** 27

**Plastic Limit:** 15

**USCS Classification:** SC

**AASHTO Classification:** A-2-6(0)

**Testing Remarks:** As Received

Moisture Content: 20.3%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
190.14	114.22	0.00	#10	0.00	100.0
			#20	0.56	99.3
			#40	1.99	97.4
			#60	6.84	91.0
			#100	13.28	82.5
			#200	56.04	26.2

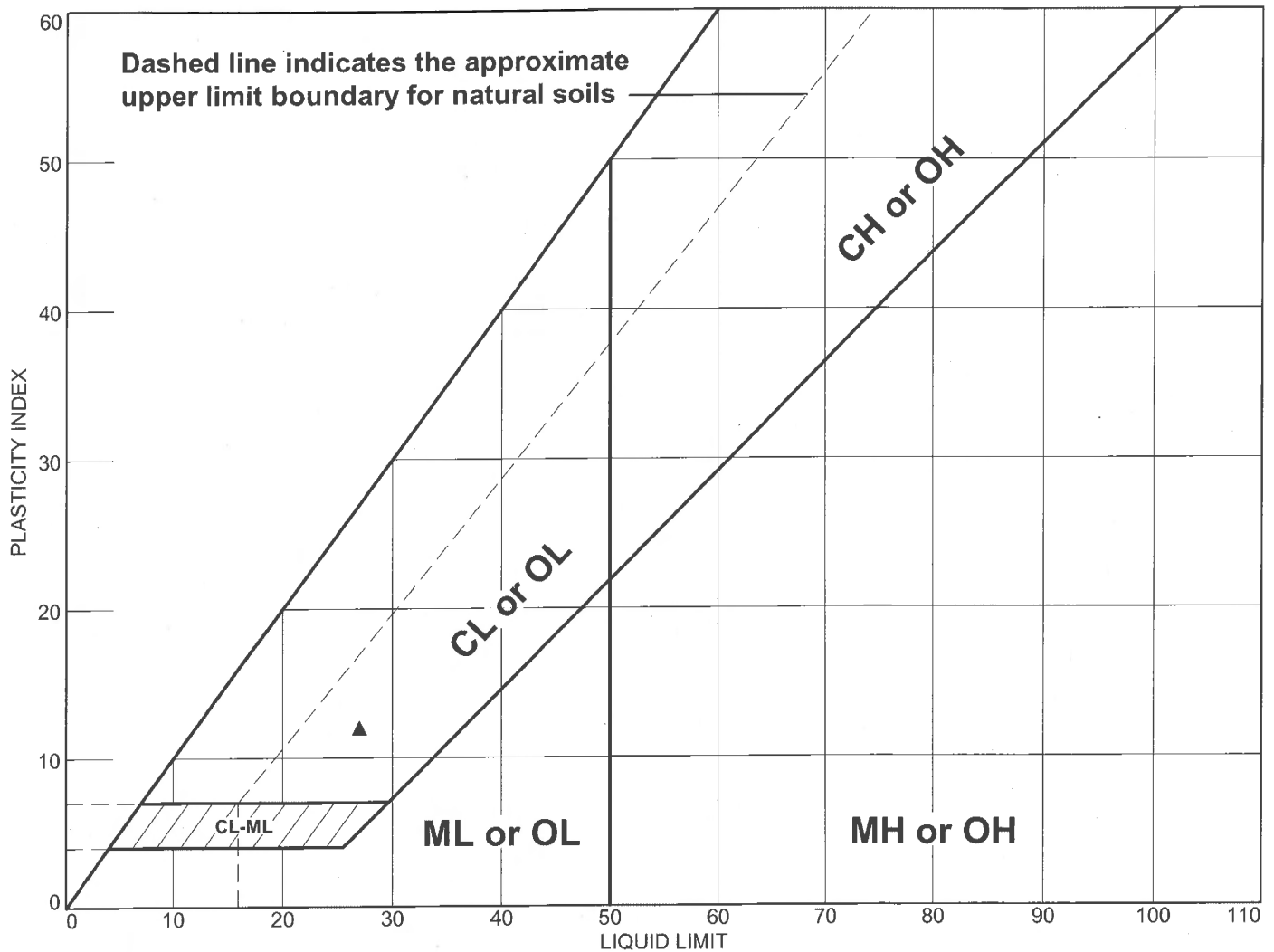
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	2.6	71.2	73.8			26.2

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
				0.0779	0.0861	0.0955	0.1068	0.1422	0.1605	0.2178	0.3483

<b>Fineness Modulus</b>
0.26

# LIQUID AND PLASTIC LIMITS TEST REPORT



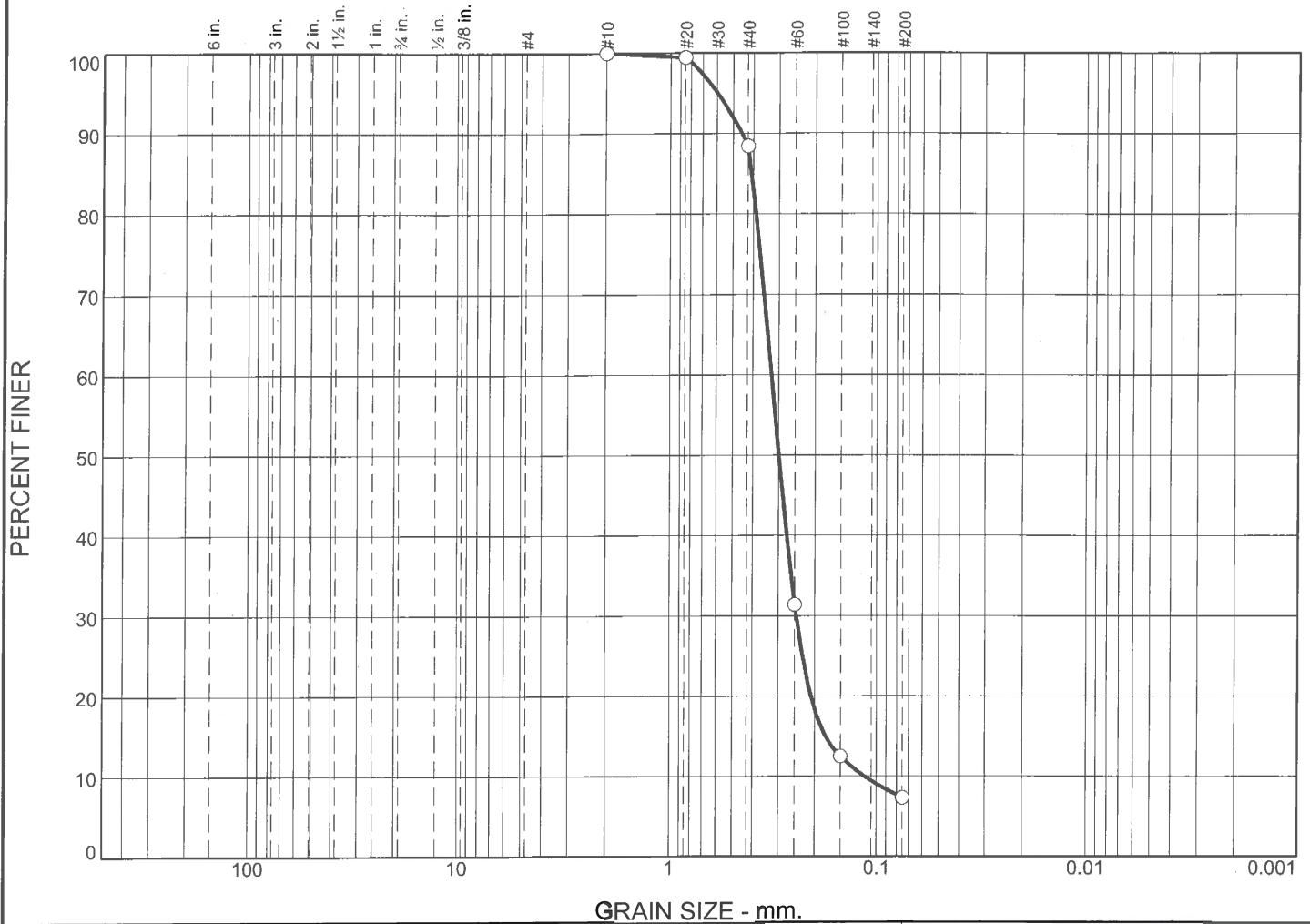
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND	NV	NP	NP	86.8	3.9	SP
■	brown/black poorly graded SAND with silt	NV	NP	NP	66.6	6.1	SP-SM
▲	black/brown clayey SAND	27	15	12	97.4	26.2	SC

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-43      **Depth:** 13' - 15'      **Sample Number:** UD-43  
 ■ **Source of Sample:** UD-43      **Depth:** 30' - 32'      **Sample Number:** UD-43  
 ▲ **Source of Sample:** UD-43      **Depth:** 43' - 45'      **Sample Number:** UD-43

**BOWSER-MORNER, INC.**  
Dayton, Ohio

**Remarks:**

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	11.6	81.1	7.3			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4082	0.3252	0.2990	0.2458	0.1776	0.1143	1.62	2.84

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-51      **Depth:** 13' - 15'      **Sample Number:** UD-51

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 19.2%



## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-51

**Depth:** 13' - 15'

**Sample Number:** UD-51

**Material Description:** dark brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 19.2%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
306.29	96.78	0.00	#10	0.00	100.0
			#20	1.18	99.4
			#40	24.21	88.4
			#60	143.71	31.4
			#100	183.31	12.5
			#200	194.19	7.3

### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.6	81.1	92.7			7.3

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1143	0.1776	0.2086	0.2458	0.2734	0.2990	0.3252	0.3876	0.4082	0.4562	0.5966

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.42	2.84	1.62



## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-51

**Depth:** 28' - 30'

**Sample Number:** UD-51

**Material Description:** brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 23.3%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
214.70	114.86	0.00	#10	0.00	100.0
			#20	0.38	99.6
			#40	19.91	80.1
			#60	64.00	35.9
			#100	88.35	11.5
			#200	93.27	6.6

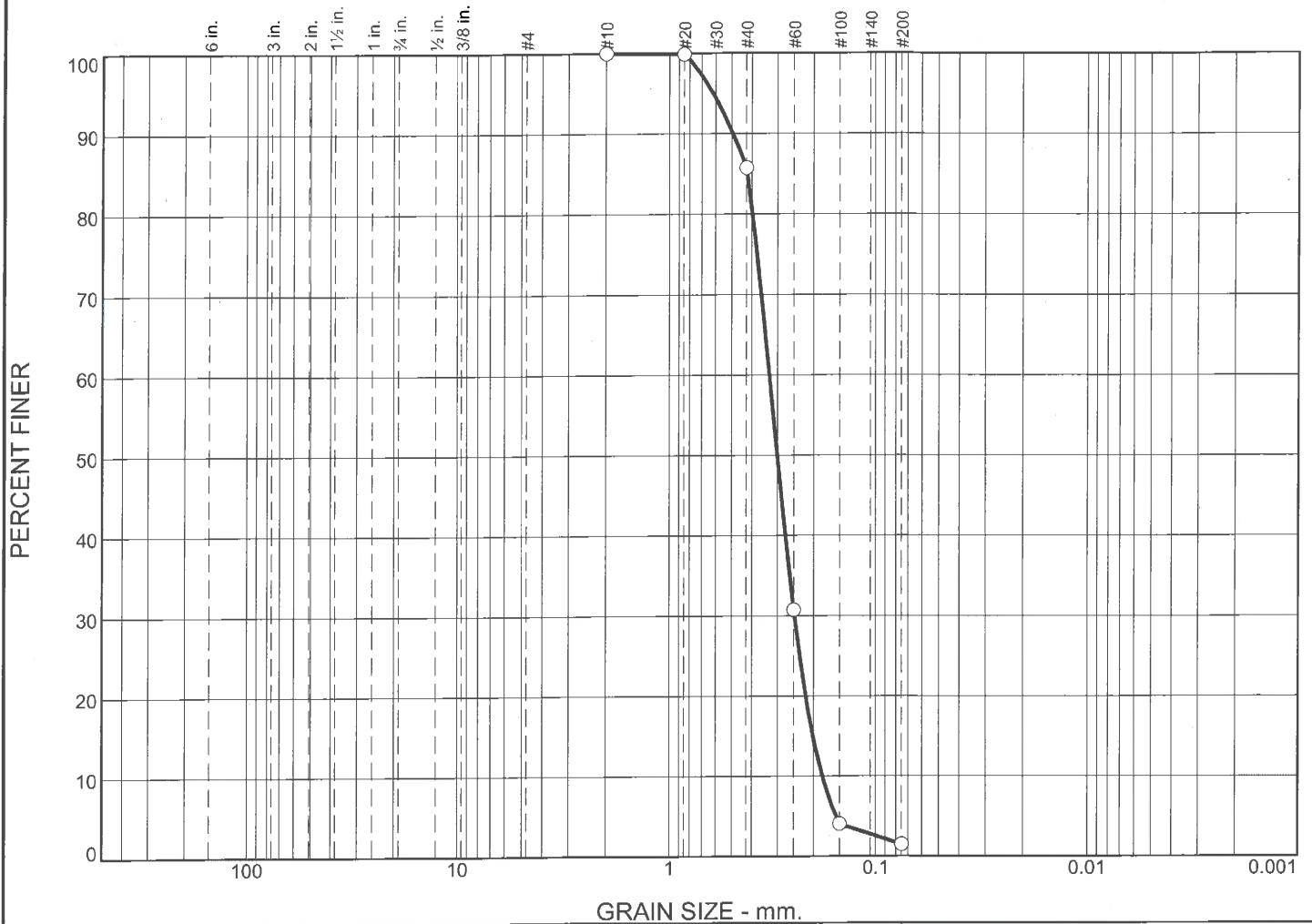
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	19.9	73.5	93.4			6.6

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1213	0.1691	0.1917	0.2298	0.2635	0.2962	0.3313	0.4246	0.4613	0.5127	0.5986

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.43	2.73	1.31

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	14.2	84.3	1.5			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4208	0.3281	0.3004	0.2480	0.2014	0.1815	1.03	1.81

Material Description	USCS	AASHTO
○ brown/black poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-51      **Depth:** 43' - 45'      **Sample Number:** UD-51

**BOWSER-MORNER, INC.**

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 17.0%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-51

**Depth:** 43' - 45'

**Sample Number:** UD-51

**Material Description:** brown/black poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 17.0%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
270.00	112.66	0.00	#10	0.00	100.0
			#20	0.15	99.9
			#40	22.39	85.8
			#60	108.99	30.7
			#100	150.96	4.1
			#200	154.98	1.5

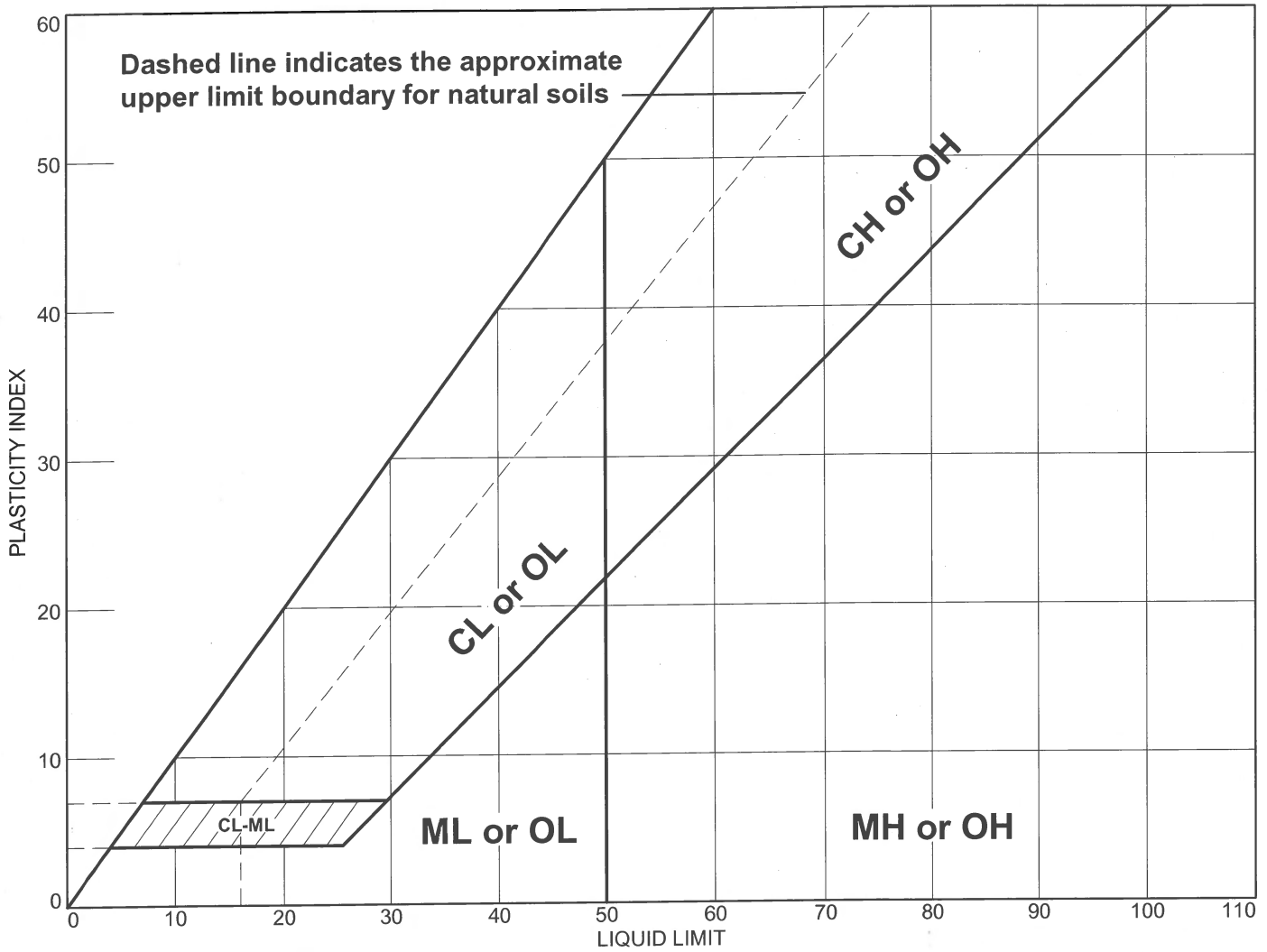
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	14.2	84.3	98.5			1.5

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1561	0.1815	0.2014	0.2184	0.2480	0.2744	0.3004	0.3281	0.3969	0.4208	0.4958	0.6190

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.52	1.81	1.03

# LIQUID AND PLASTIC LIMITS TEST REPORT



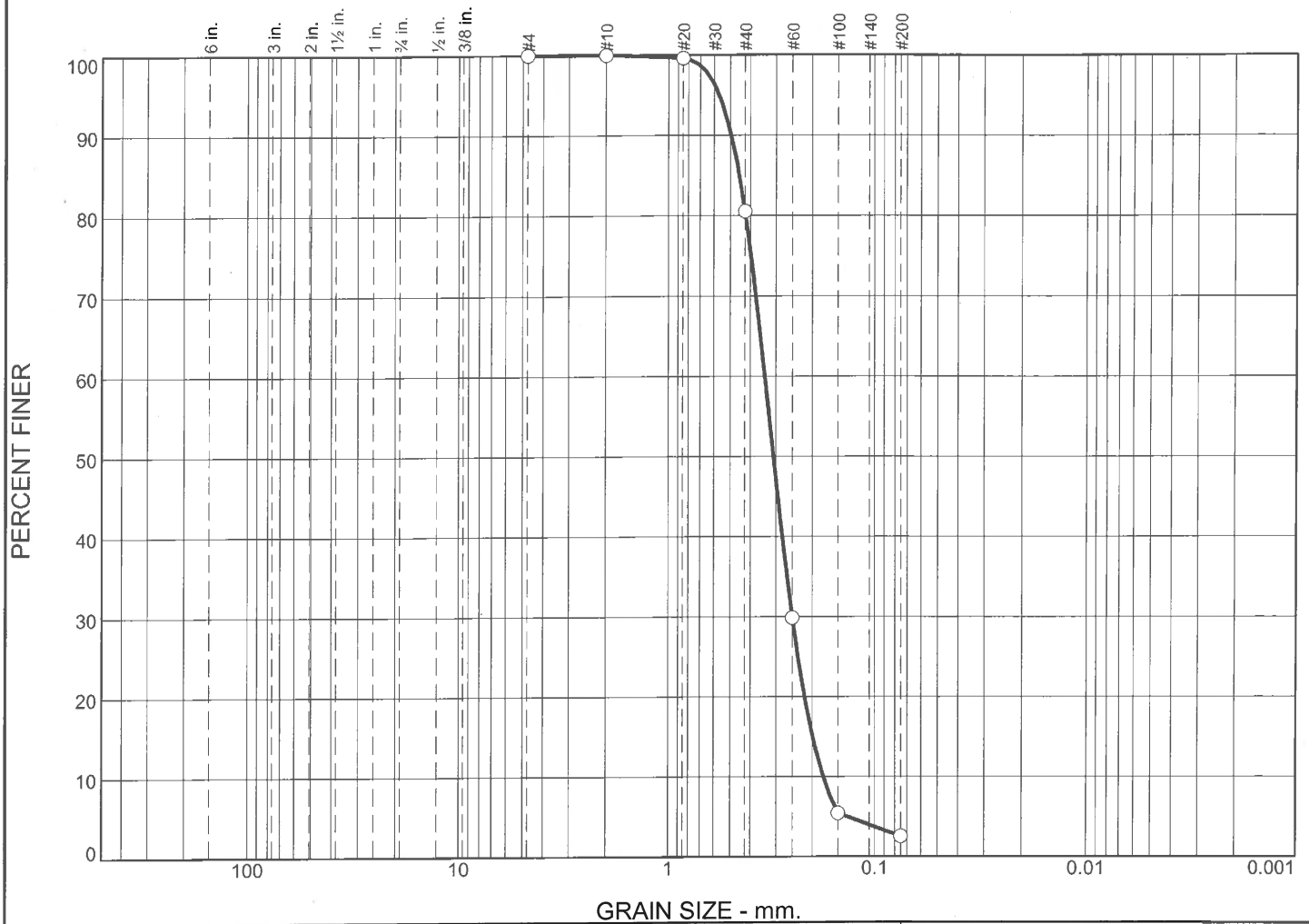
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND with silt	NV	NP	NP	88.4	7.3	SP-SM
■	brown poorly graded SAND with silt	NV	NP	NP	80.1	6.6	SP-SM
▲	brown/black poorly graded SAND	NV	NP	NP	85.8	1.5	SP

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-51      **Depth:** 13' - 15'      **Sample Number:** UD-51  
 ■ **Source of Sample:** UD-51      **Depth:** 28' - 30'      **Sample Number:** UD-51  
 ▲ **Source of Sample:** UD-51      **Depth:** 43' - 45'      **Sample Number:** UD-51

**BOWSER-MORNER, INC.**  
Dayton, Ohio

**Remarks:**

# GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines			
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
0.0	0.0	0.0	0.0	19.4	78.1	2.5			
LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
NV	NP	0.4534	0.3396	0.3084	0.2504	0.1990	0.1767	1.04	1.92

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>○ <b>Source of Sample:</b> UD-65      <b>Depth:</b> 17' - 19'      <b>Sample Number:</b> UD-65</p>	<p><b>Remarks:</b></p> <p>○ As Received</p> <p>Moisture Content: 22.0%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p><b>Dayton, Ohio</b></p>	

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-65

**Depth:** 17' - 19'

**Sample Number:** UD-65

**Material Description:** dark brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 22.0%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
323.36	114.12	0.00	#4	0.00	100.0
			#10	0.02	100.0
			#20	0.84	99.6
			#40	40.68	80.6
			#60	146.72	29.9
			#100	197.83	5.5
			#200	203.94	2.5

### Fractional Components

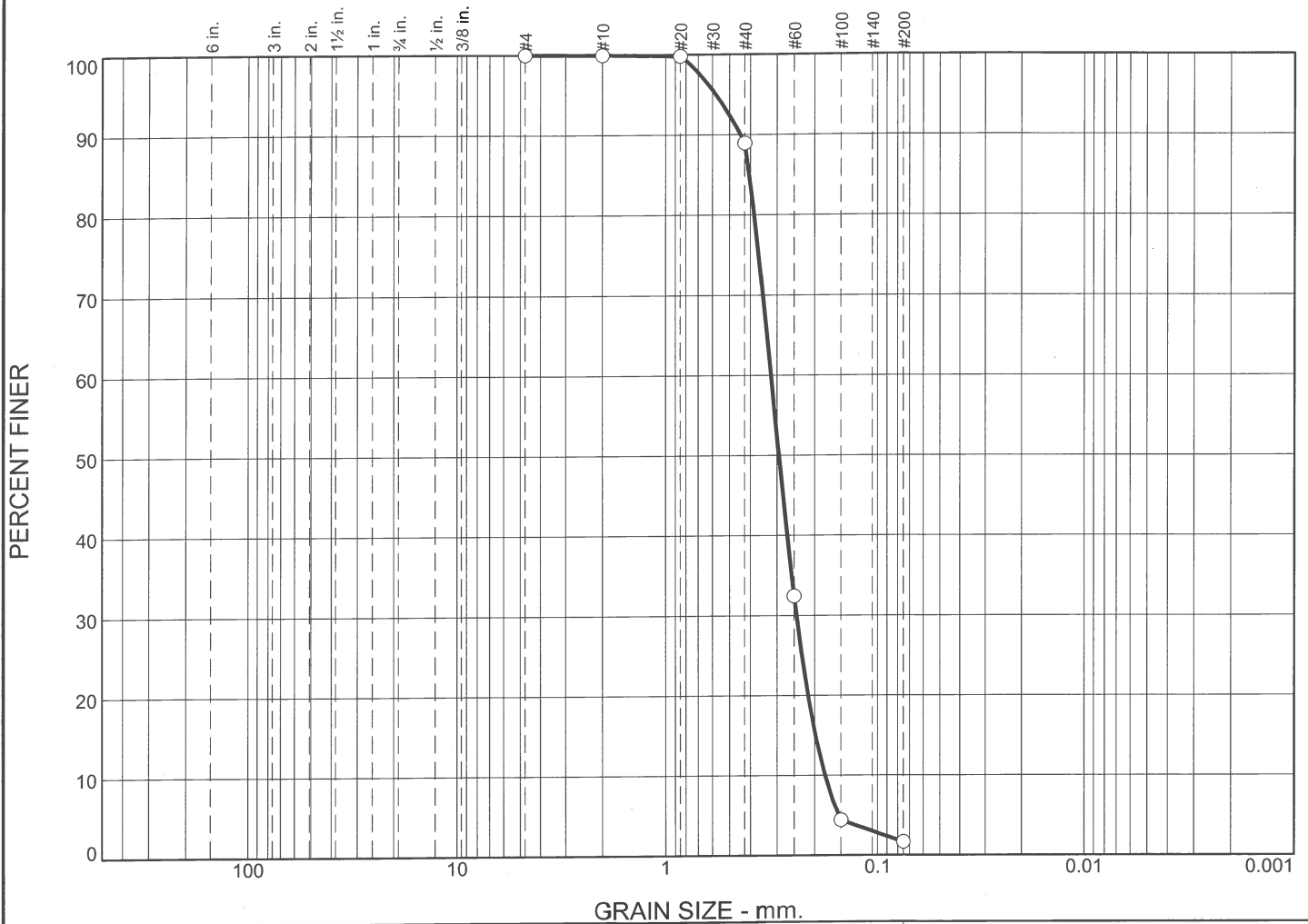
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	19.4	78.1	97.5			2.5

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1347	0.1767	0.1990	0.2179	0.2504	0.2794	0.3084	0.3396	0.4219	0.4534	0.4970	0.5690

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.51	1.92	1.04



# GRAIN SIZE DISTRIBUTION REPORT



## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-65

**Depth:** 28' - 30'

**Sample Number:** UD-65

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 22.4%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
315.14	92.86	0.00	#4	0.00	100.0
			#10	0.09	100.0
			#20	0.42	99.8
			#40	24.52	89.0
			#60	150.15	32.5
			#100	212.46	4.4
			#200	218.57	1.7

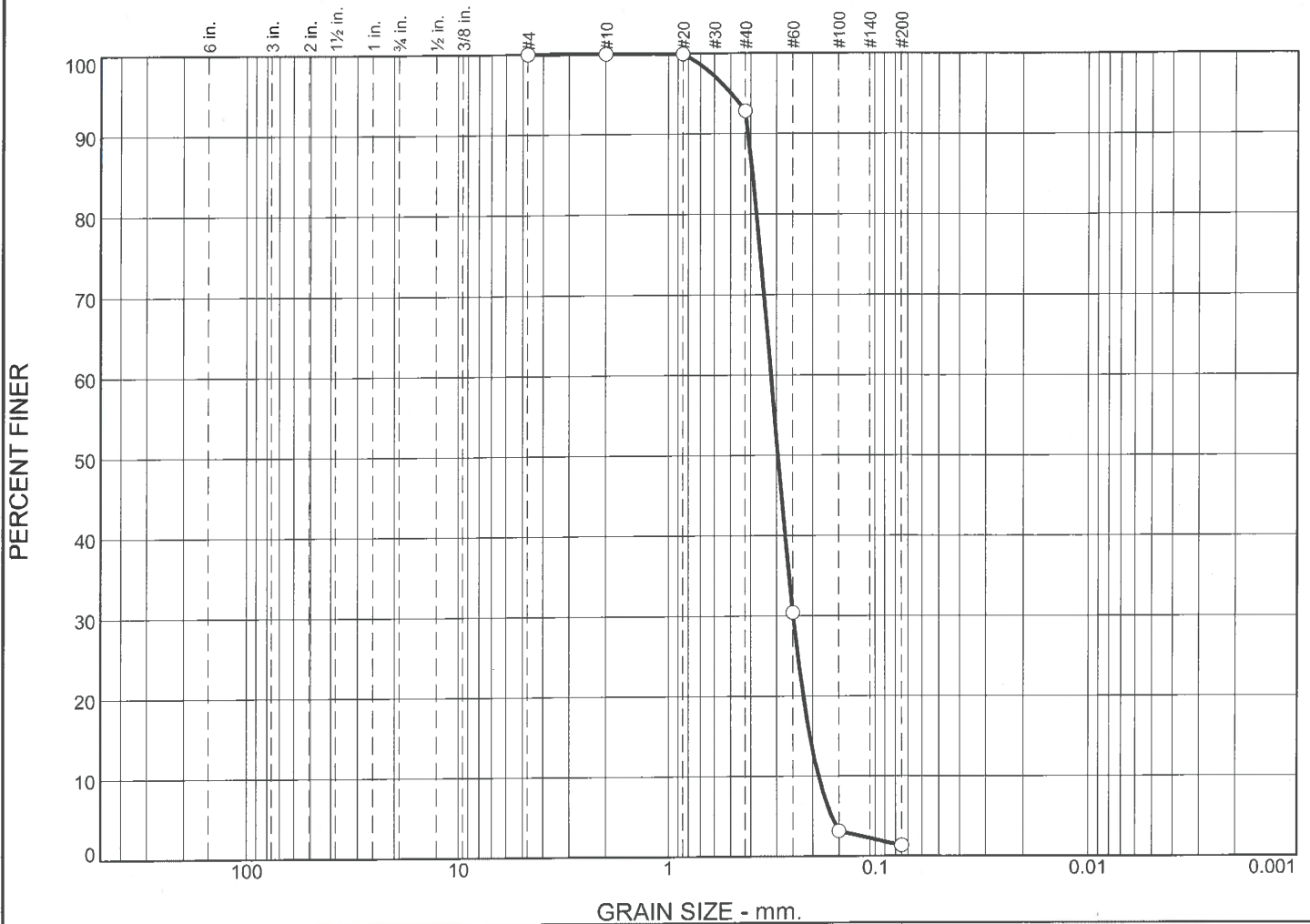
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.0	87.3	98.3			1.7

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1536	0.1785	0.1979	0.2146	0.2435	0.2691	0.2941	0.3203	0.3837	0.4048	0.4453	0.5793

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.48	1.79	1.04

# GRAIN SIZE DISTRIBUTION REPORT



	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	7.2	91.5	1.3			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.3909	0.3184	0.2950	0.2490	0.2064	0.1876	1.04	1.70

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-65      **Depth:** 43' - 45'      **Sample Number:** UD-65

**BOWSER-MORNER, INC.**

Dayton, Ohio

**Remarks:**

○ As Received

Moisture Content: 16.0%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-65

**Depth:** 43' - 45'

**Sample Number:** UD-65

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 16.0%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
356.98	112.90	0.00	#4	0.00	100.0
			#10	0.08	100.0
			#20	0.18	99.9
			#40	17.52	92.8
			#60	169.84	30.4
			#100	236.35	3.2
			#200	240.80	1.3

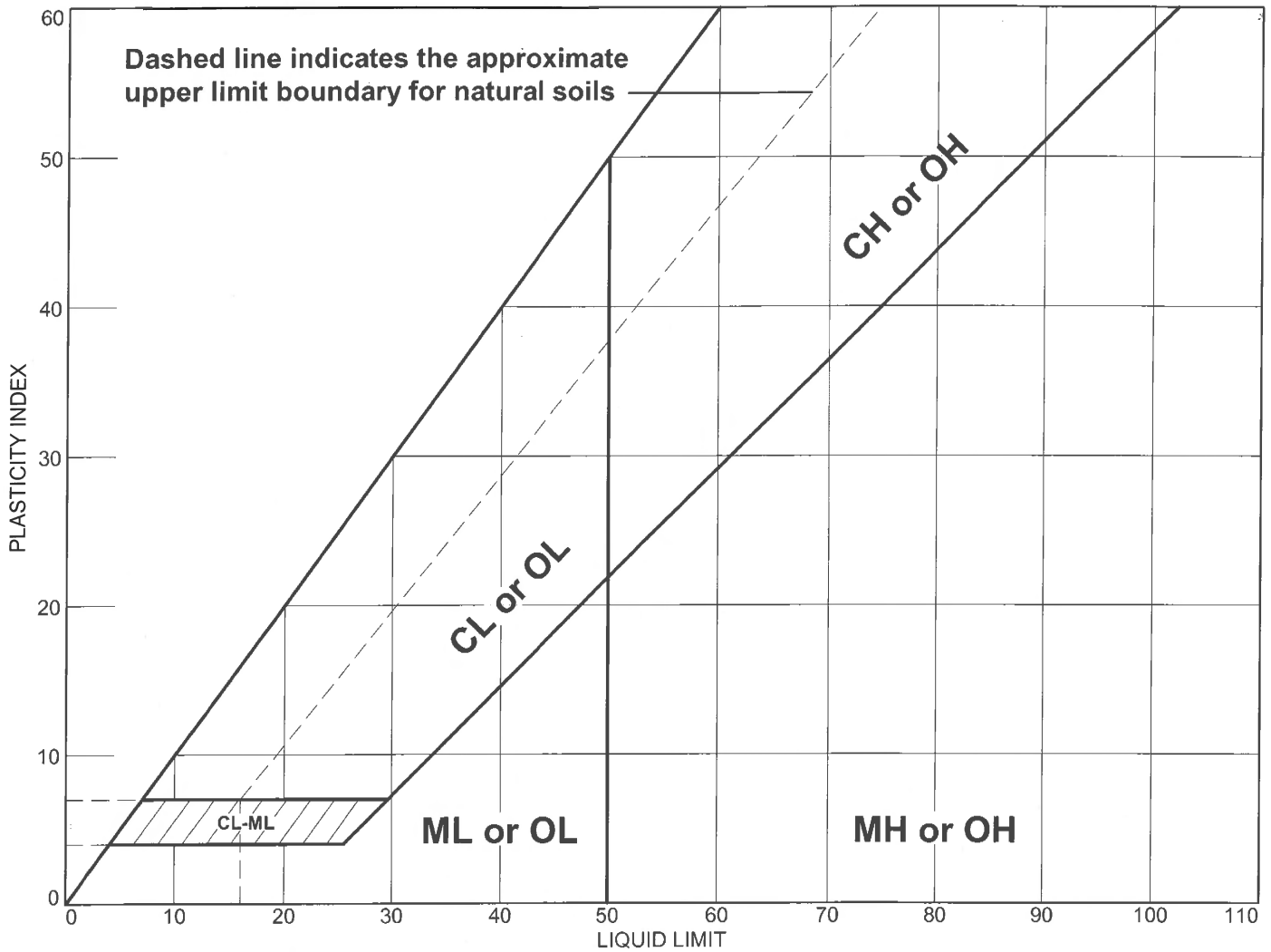
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	7.2	91.5	98.7			1.3

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1626	0.1876	0.2064	0.2222	0.2490	0.2723	0.2950	0.3184	0.3735	0.3909	0.4113	0.4978

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.48	1.70	1.04

# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND	NV	NP	NP	80.6	2.5	SP
■	brown poorly graded SAND	NV	NP	NP	89.0	1.7	SP
▲	brown poorly graded SAND	NV	NP	NP	92.8	1.3	SP

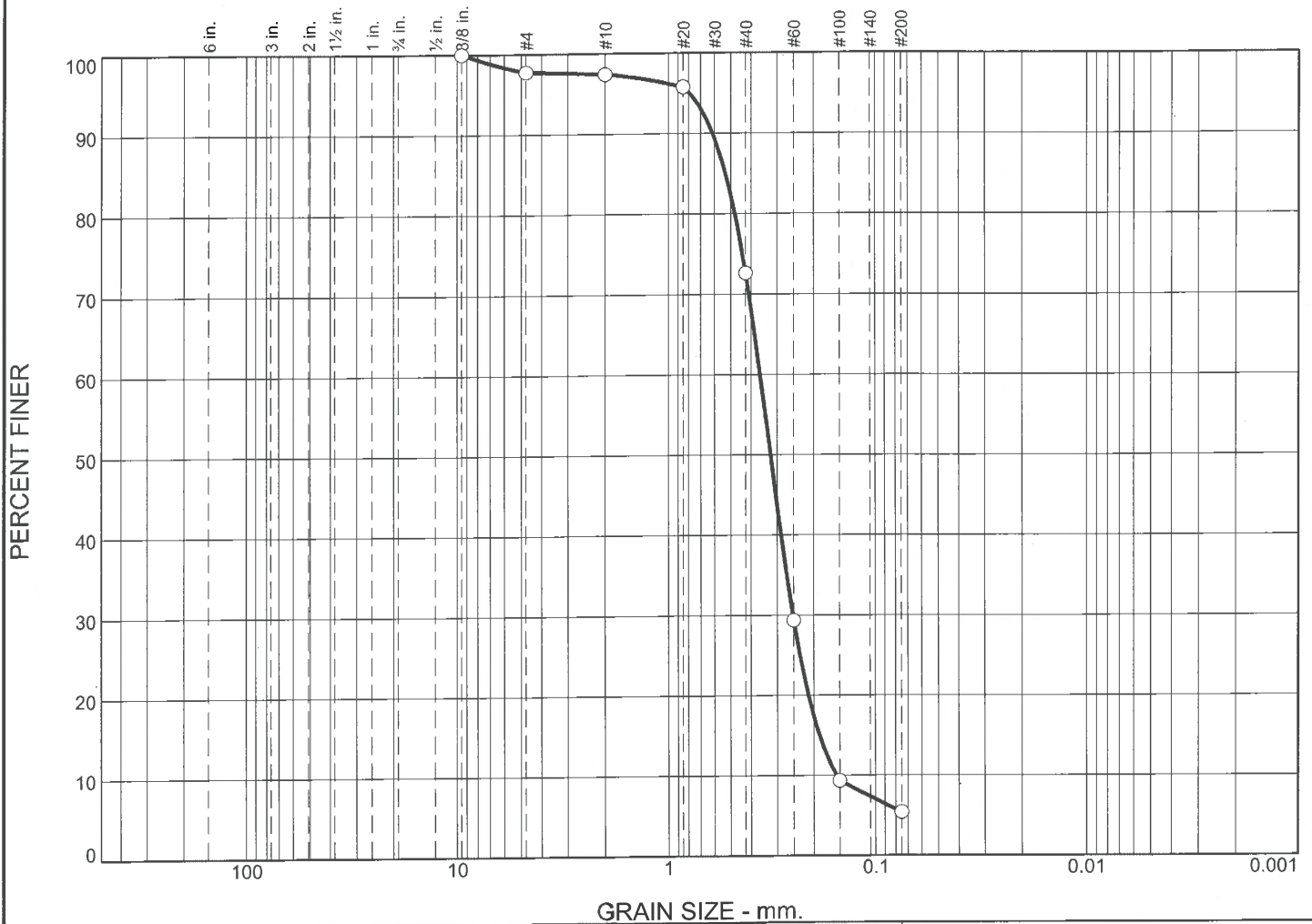
**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-65      **Depth:** 17' - 19'      **Sample Number:** UD-65  
 ■ **Source of Sample:** UD-65      **Depth:** 28' - 30'      **Sample Number:** UD-65  
 ▲ **Source of Sample:** UD-65      **Depth:** 43' - 45'      **Sample Number:** UD-65

**Remarks:**

**BOWSER-MORNER, INC.**

Dayton, Ohio

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.2	0.4	24.8	67.2	5.4	

LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
NV	NP	0.5321	0.3618	0.3226	0.2524	0.1877	0.1554	1.13	2.33

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-67      **Depth:** 17' - 19'      **Sample Number:** UD-67

**BOWSER-MORNER, INC.**

**Dayton, Ohio**

**Remarks:**

○ As Received

Moisture Content: 18.1%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-67

**Depth:** 17' - 19'

**Sample Number:** UD-67

**Material Description:** brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 18.1%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
398.68	112.85	0.00	0.375	0.00	100.0
			#4	6.40	97.8
			#10	7.32	97.4
			#20	12.00	95.8
			#40	78.21	72.6
			#60	201.93	29.4
			#100	259.14	9.3
			#200	270.40	5.4

### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	2.2	2.2	0.4	24.8	67.2	92.4			5.4

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1554	0.1877	0.2124	0.2524	0.2872	0.3226	0.3618	0.4791	0.5321	0.6142	0.7918

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.66	2.33	1.13





**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-67

**Depth:** 28' - 30'

**Sample Number:** UD-67

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 20.6%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
462.36	97.67	0.00	.75	0.00	100.0
			.5	4.26	98.8
			.375	4.33	98.8
			#4	4.96	98.6
			#10	6.04	98.3
			#20	9.83	97.3
			#40	96.17	73.6
			#60	272.41	25.3
			#100	345.89	5.2
			#200	356.23	2.3

**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	1.4	1.4	0.3	24.7	71.3	96.3			2.3

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1444	0.1855	0.2107	0.2311	0.2653	0.2963	0.3283	0.3636	0.4660	0.5100	0.5753	0.7017

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.69	1.96	1.04



**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-67

**Depth:** 43' - 45'

**Sample Number:** UD-67

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 16.8%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
401.14	96.76	0.00	.375	0.00	100.0
			#4	0.47	99.8
			#10	0.54	99.8
			#20	1.55	99.5
			#40	54.95	81.9
			#60	213.65	29.8
			#100	285.60	6.2
			#200	295.75	2.8

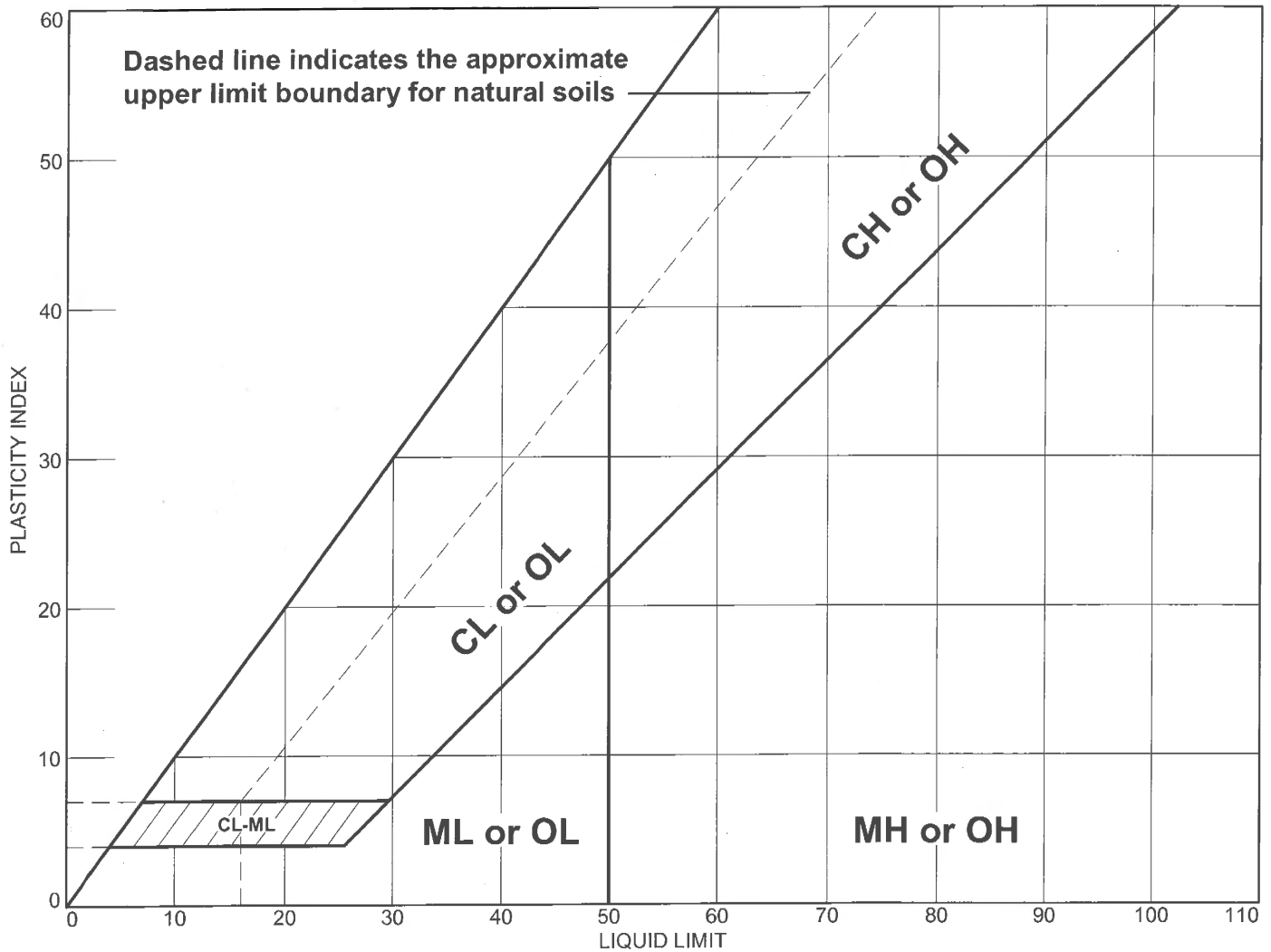
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.2	0.2	0.0	17.9	79.1	97.0			2.8

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1176	0.1747	0.1986	0.2181	0.2506	0.2790	0.3071	0.3371	0.4146	0.4435	0.4831	0.5472

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.50	1.93	1.07

# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND with silt	NV	NP	NP	72.6	5.4	SP-SM
■	brown poorly graded SAND	NV	NP	NP	81.9	2.8	SP
▲	brown poorly graded SAND	NV	NP	NP	73.6	2.3	SP

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples

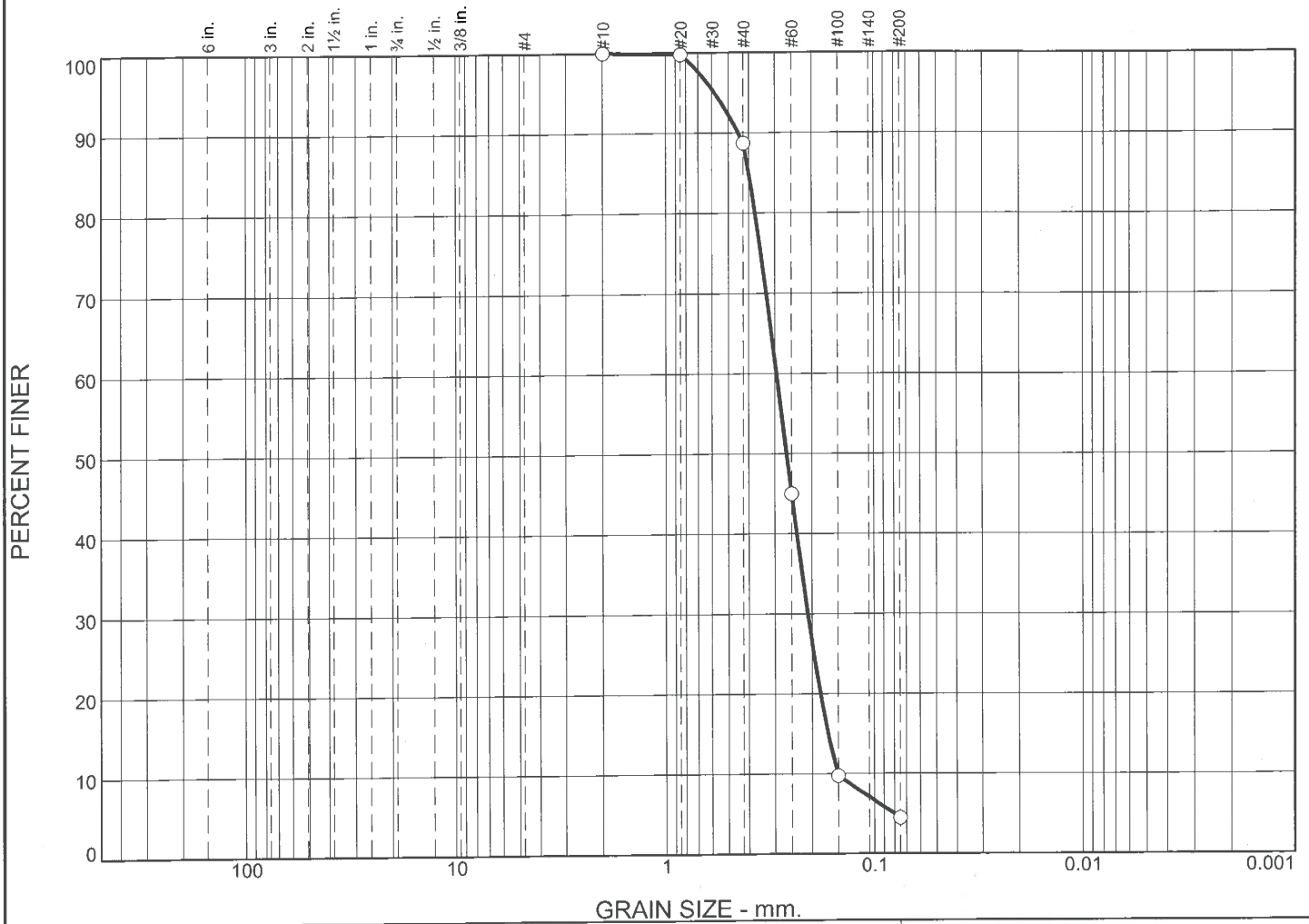
● <b>Source of Sample:</b> UD-67	<b>Depth:</b> 17' - 19'	<b>Sample Number:</b> UD-67
■ <b>Source of Sample:</b> UD-67	<b>Depth:</b> 43' - 45'	<b>Sample Number:</b> UD-67
▲ <b>Source of Sample:</b> UD-67	<b>Depth:</b> 28' - 30'	<b>Sample Number:</b> UD-67

**Remarks:**

**BOWSER-MORNER, INC.**

Dayton, Ohio

# GRAIN SIZE DISTRIBUTION REPORT



%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	11.3	84.2	4.5			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.3998	0.2945	0.2641	0.2091	0.1673	0.1509	0.98	1.95

Material Description	USCS	AASHTO
○ black poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-93      **Depth:** 13' - 15'      **Sample Number:** UD-93

**Remarks:**  
 ○ As Received  
 Moisture Content: 21.5%

**BOWSER-MORNER, INC.**  
  
**Dayton, Ohio**

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-93

**Depth:** 13' - 15'

**Sample Number:** UD-93

**Material Description:** black poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 21.5%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
458.81	114.88	0.00	#10	0.00	100.0
			#20	0.78	99.8
			#40	38.85	88.7
			#60	189.07	45.0
			#100	310.42	9.7
			#200	328.55	4.5

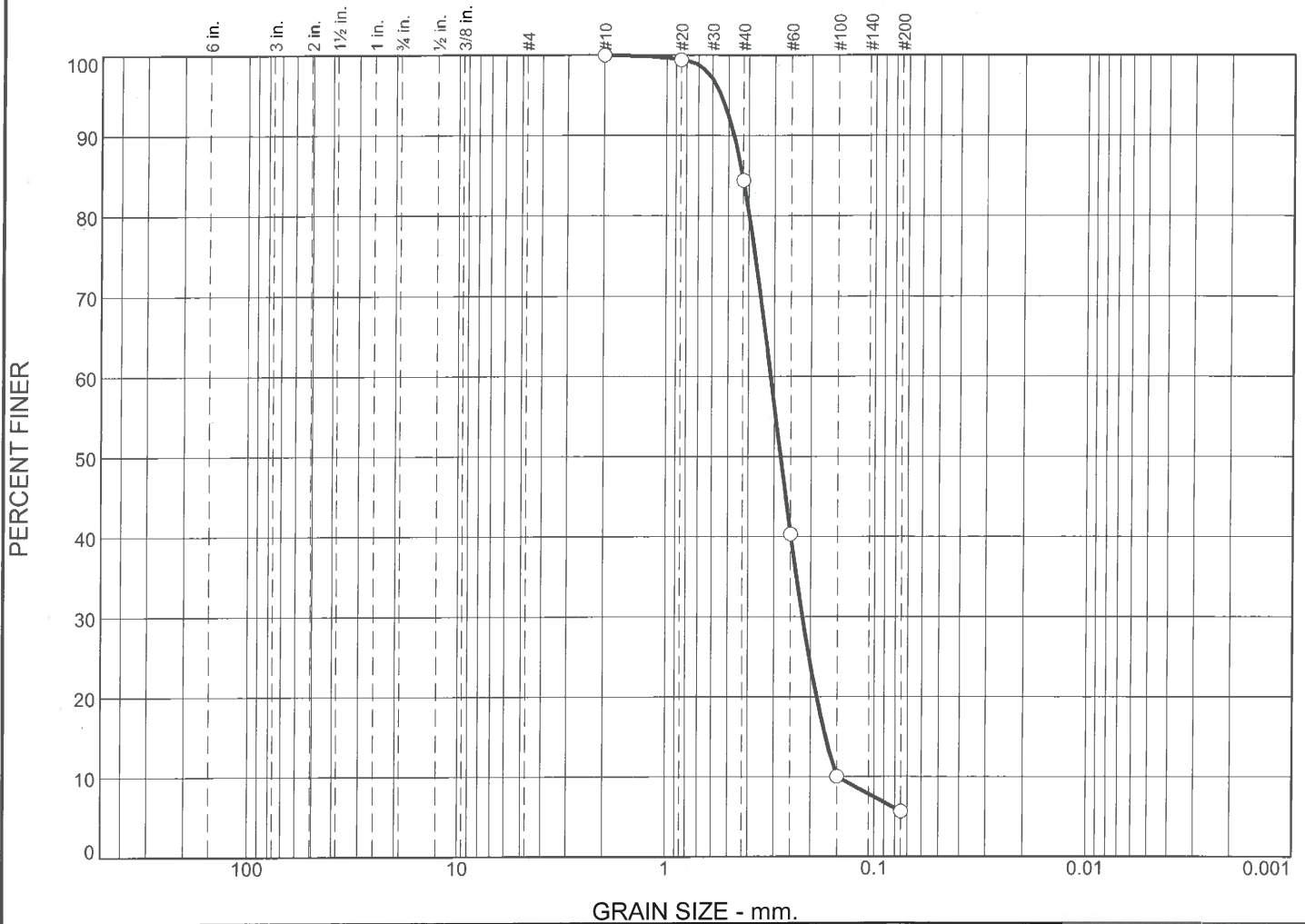
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.3	84.2	95.5			4.5

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0804	0.1509	0.1673	0.1819	0.2091	0.2361	0.2641	0.2945	0.3724	0.3998	0.4503	0.5844

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.33	1.95	0.98

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	15.6	78.7	5.7			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4290	0.3121	0.2794	0.2187	0.1699	0.1490	1.03	2.09

Material Description	USCS	AASHTO
○ black poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source of Sample:** UD-93      **Depth:** 28' - 30'      **Sample Number:** UD-93

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 18.9%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-93

**Depth:** 28' - 30'

**Sample Number:** UD-93

**Material Description:** black poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 18.9%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
518.74	96.07	0.00	#10	0.00	100.0
			#20	2.41	99.4
			#40	65.77	84.4
			#60	252.12	40.4
			#100	380.23	10.0
			#200	398.71	5.7

### Fractional Components

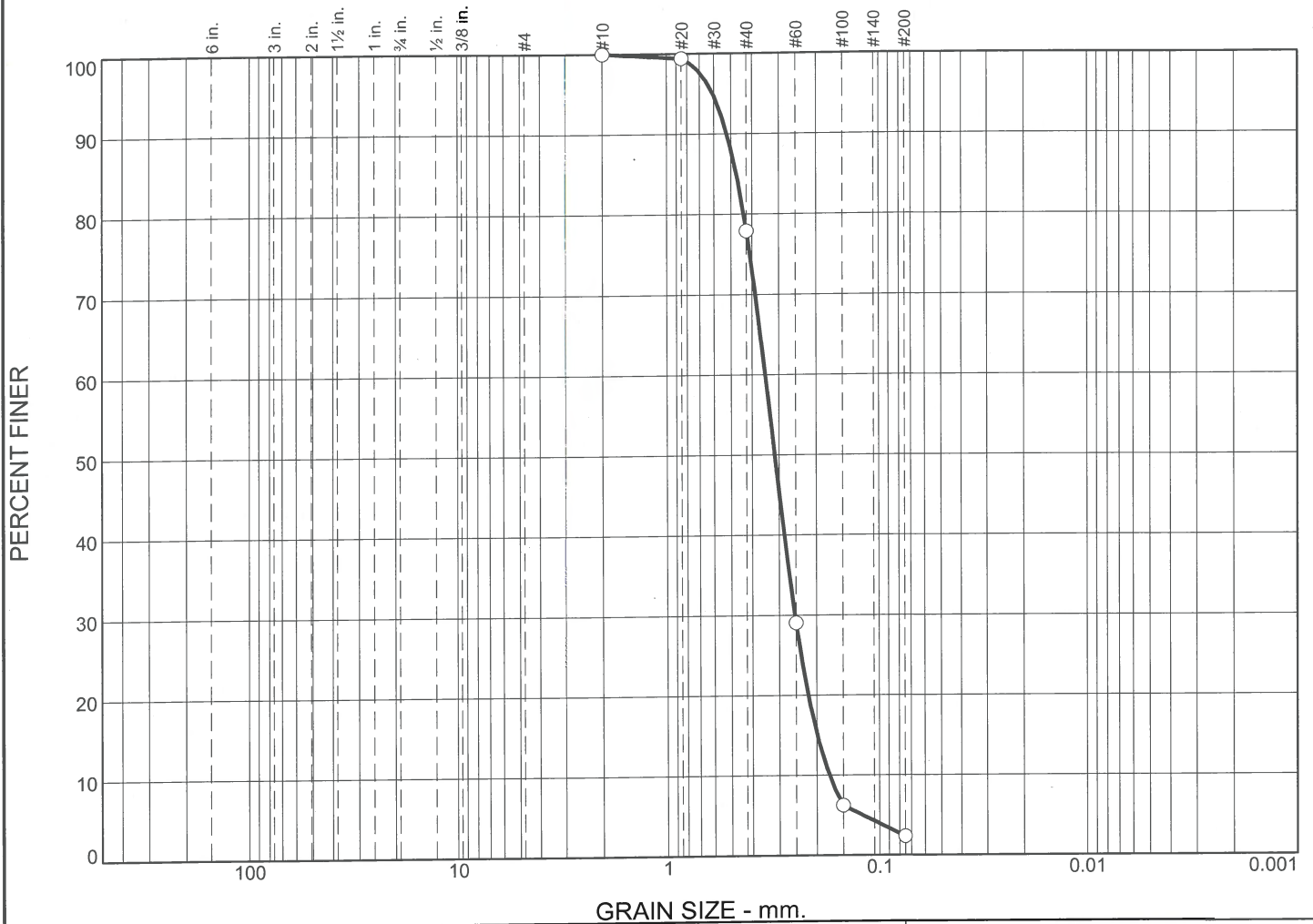
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	15.6	78.7	94.3			5.7

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1490	0.1699	0.1872	0.2187	0.2489	0.2794	0.3121	0.3974	0.4290	0.4727	0.5457

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.37	2.09	1.03



# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines			
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
0.0	0.0	0.0	0.0	22.1	75.5	2.4			
LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
NV	NP	0.4734	0.3473	0.3141	0.2531	0.1986	0.1742	1.06	1.99

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>○ <b>Source of Sample:</b> UD-93      <b>Depth:</b> 43' - 45'      <b>Sample Number:</b> UD-93</p>	<p><b>Remarks:</b></p> <p>○ As Received</p> <p>Moisture Content: 19.5%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p><b>Dayton, Ohio</b></p>	

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-93

**Depth:** 43' - 45'

**Sample Number:** UD-93

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 19.5%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
484.83	114.52	0.00	#10	0.00	100.0
			#20	2.21	99.4
			#40	81.75	77.9
			#60	262.79	29.0
			#100	347.23	6.2
			#200	361.58	2.4

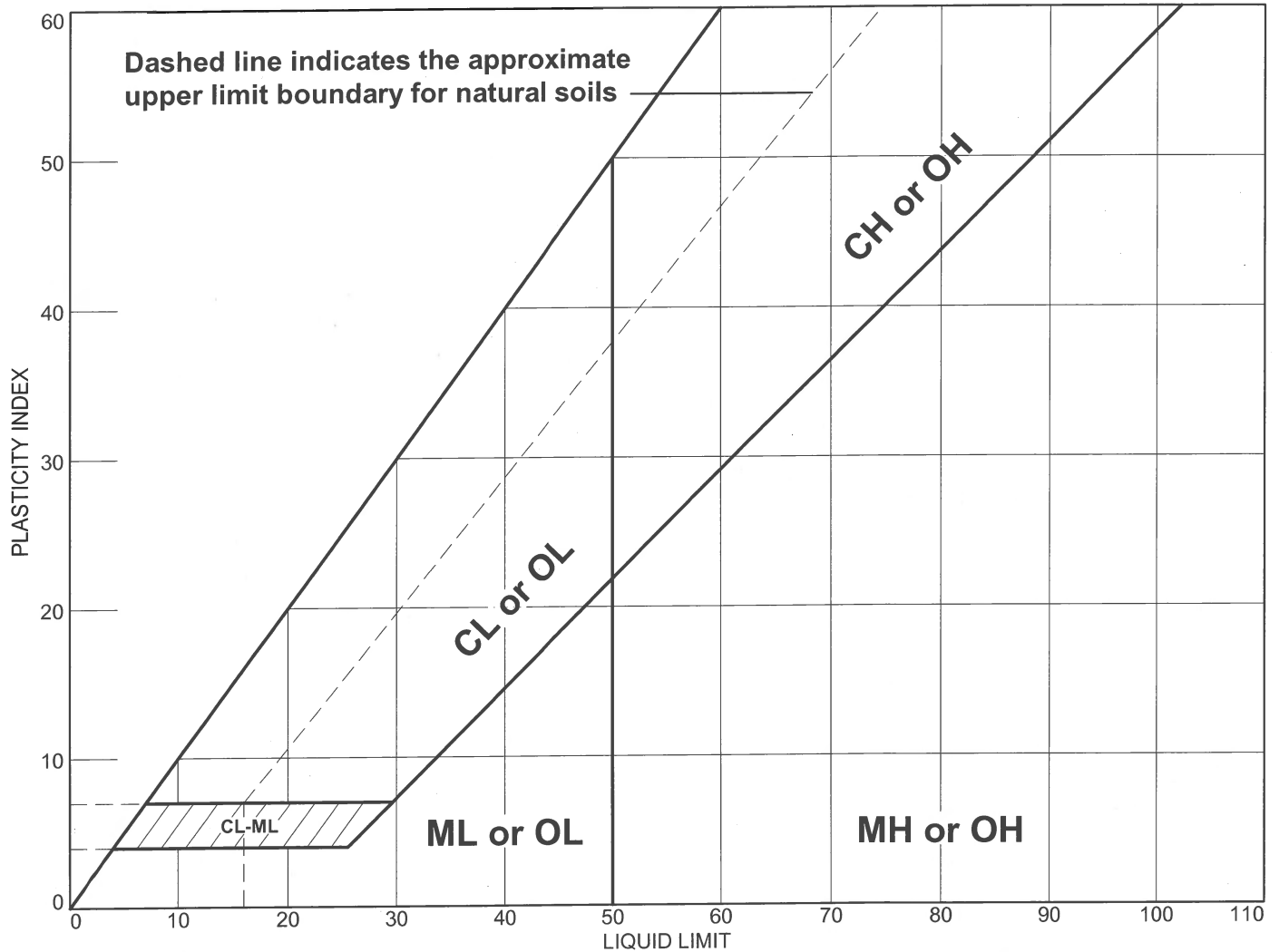
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	22.1	75.5	97.6			2.4

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1203	0.1742	0.1986	0.2189	0.2531	0.2835	0.3141	0.3473	0.4374	0.4734	0.5239	0.6094

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.54	1.99	1.06

# LIQUID AND PLASTIC LIMITS TEST REPORT



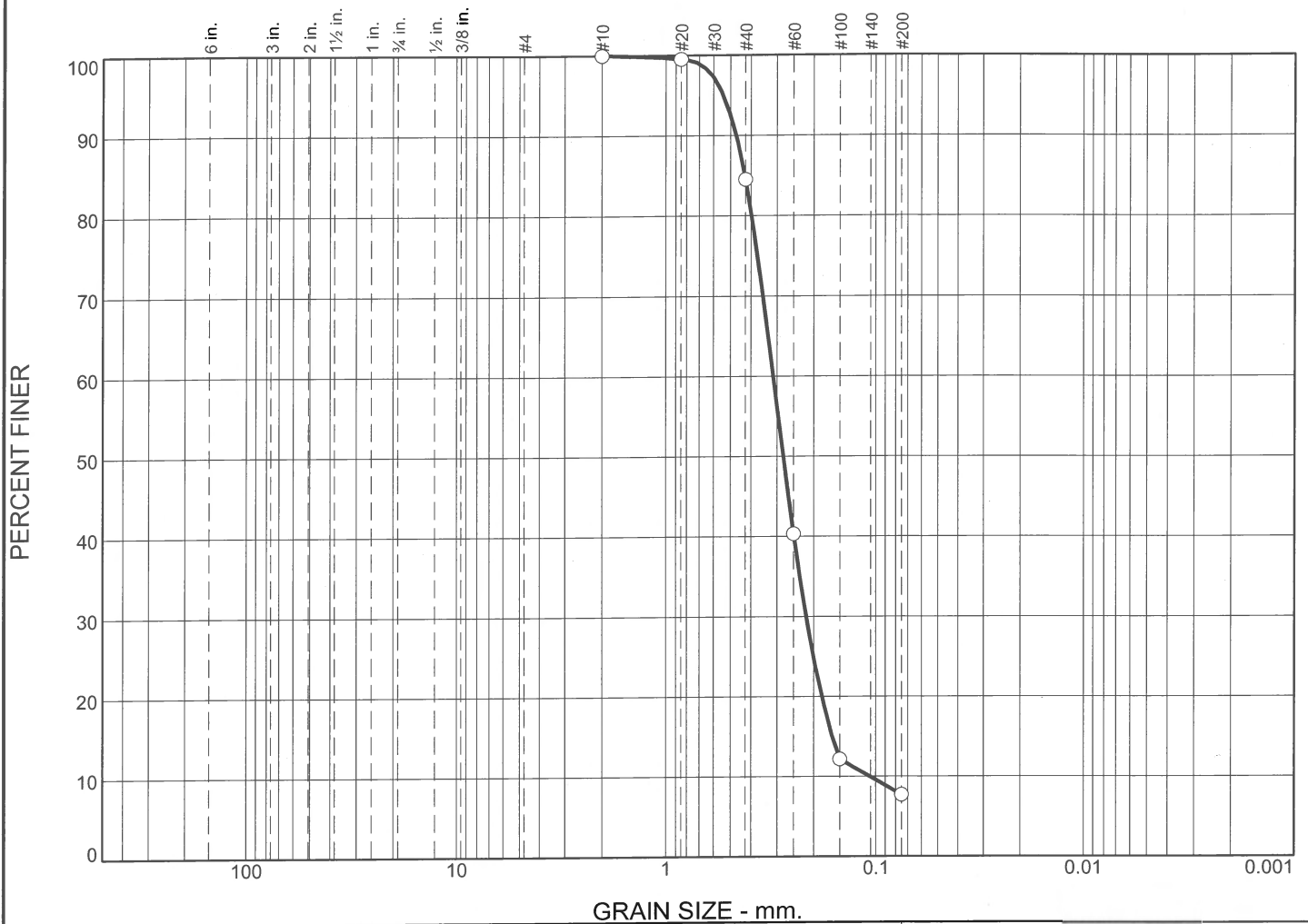
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	black poorly graded SAND	NV	NP	NP	88.7	4.5	SP
■	black poorly graded SAND with silt	NV	NP	NP	84.4	5.7	SP-SM
▲	brown poorly graded SAND	NV	NP	NP	77.9	2.4	SP

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-93      **Depth:** 13' - 15'      **Sample Number:** UD-93  
 ■ **Source of Sample:** UD-93      **Depth:** 28' - 30'      **Sample Number:** UD-93  
 ▲ **Source of Sample:** UD-93      **Depth:** 43' - 45'      **Sample Number:** UD-93

**BOWSER-MORNER, INC.**  
Dayton, Ohio

**Remarks:**

# GRAIN SIZE DISTRIBUTION REPORT



%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
<input type="radio"/>	0.0	0.0	0.0	0.0	15.5	76.8	7.7			
<input checked="" type="checkbox"/>	<b>LL</b>	<b>PL</b>	<b>D<sub>85</sub></b>	<b>D<sub>60</sub></b>	<b>D<sub>50</sub></b>	<b>D<sub>30</sub></b>	<b>D<sub>15</sub></b>	<b>D<sub>10</sub></b>	<b>C<sub>c</sub></b>	<b>C<sub>u</sub></b>
<input type="radio"/>	NV	NP	0.4283	0.3129	0.2800	0.2173	0.1631	0.1069	1.41	2.93

Material Description	USCS	AASHTO
<input type="radio"/> brown poorly graded SAND with silt	SP-SM	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p><input type="radio"/> <b>Source:</b> UD-126      <b>Depth:</b> 13' - 15'      <b>Sample No.:</b> UD-126</p>	<p><b>Remarks:</b></p> <p><input type="radio"/> As Received</p> <p>Moisture Content: 17.5%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p><b>Dayton, Ohio</b></p>	

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-126

**Depth:** 13' - 15'

**Sample Number:** UD-126

**Material Description:** brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 17.5%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
430.90	92.87	0.00	#10	0.00	100.0
			#20	1.63	99.5
			#40	52.32	84.5
			#60	201.71	40.3
			#100	296.85	12.2
			#200	311.93	7.7

**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	15.5	76.8	92.3			7.7

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1069	0.1631	0.1829	0.2173	0.2490	0.2800	0.3129	0.3973	0.4283	0.4710	0.5416

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.35	2.93	1.41



**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-126

**Depth:** 28' - 30'

**Sample Number:** UD-126

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 16.9%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
552.21	120.07	0.00	#4	0.00	100.0
			#10	0.27	99.9
			#20	5.65	98.7
			#40	88.45	79.5
			#60	284.08	34.3
			#100	395.82	8.4
			#200	418.11	3.2

**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	20.4	76.3	96.8			3.2

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0949	0.1586	0.1815	0.2012	0.2362	0.2681	0.3000	0.3345	0.4280	0.4656	0.5195	0.6158

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.48	2.11	1.05





**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-126

**Depth:** 43' - 45'

**Sample Number:** UD-126

**Material Description:** brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 18.6%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
352.76	112.56	0.00	#4	0.00	100.0
			#10	0.71	99.7
			#20	3.64	98.5
			#40	18.62	92.2
			#60	78.37	67.4
			#100	179.05	25.5
			#200	217.33	9.5

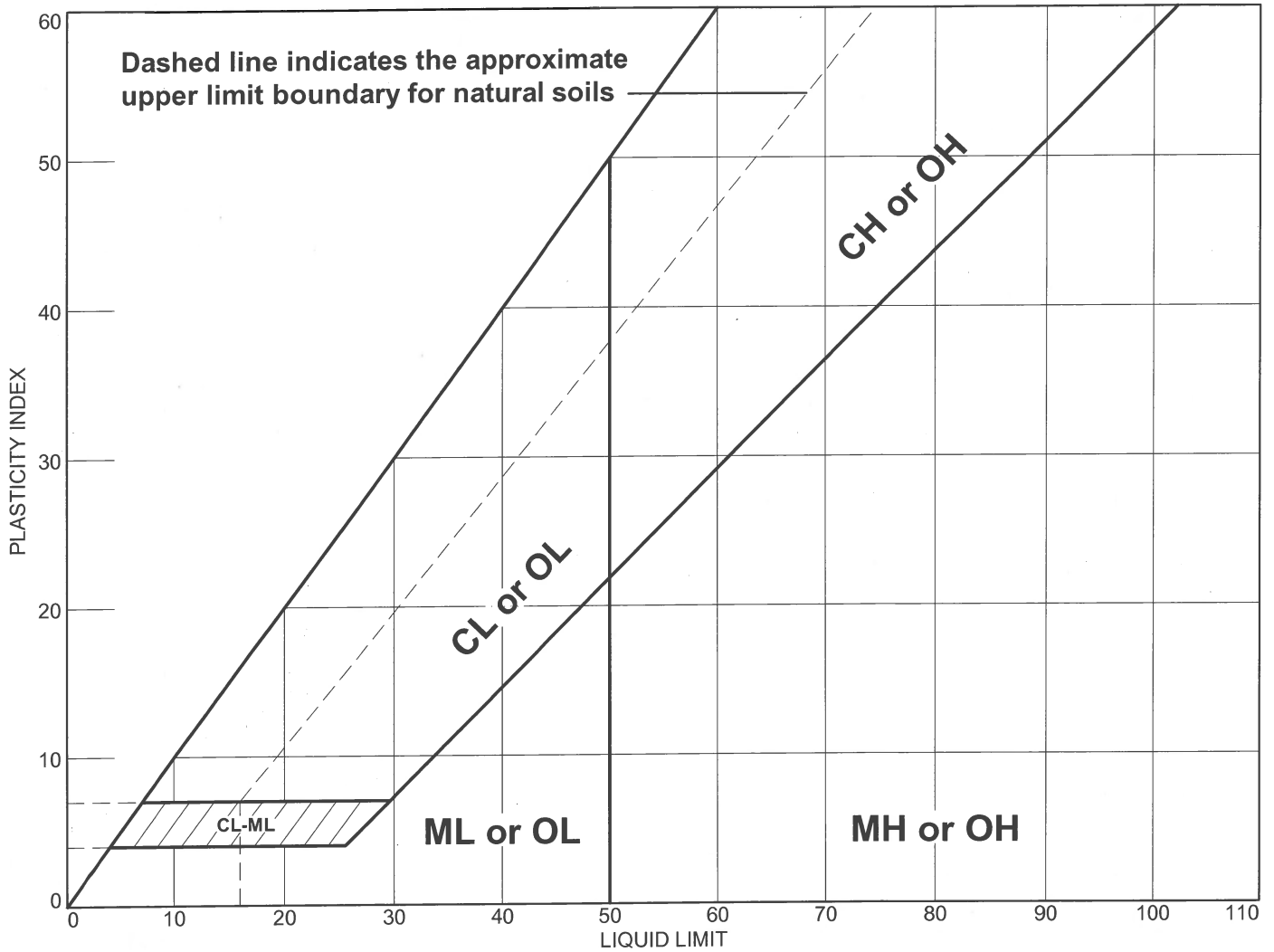
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.3	7.5	82.7	90.5			9.5

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.0856	0.1191	0.1358	0.1603	0.1815	0.2034	0.2280	0.3052	0.3397	0.3909	0.4883

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
0.99	2.66	1.32

# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND with silt	NV	NP	NP	84.5	7.7	SP-SM
■	brown poorly graded SAND	NV	NP	NP	79.5	3.2	SP
▲	brown poorly graded SAND with silt	NV	NP	NP	92.2	9.5	SP-SM

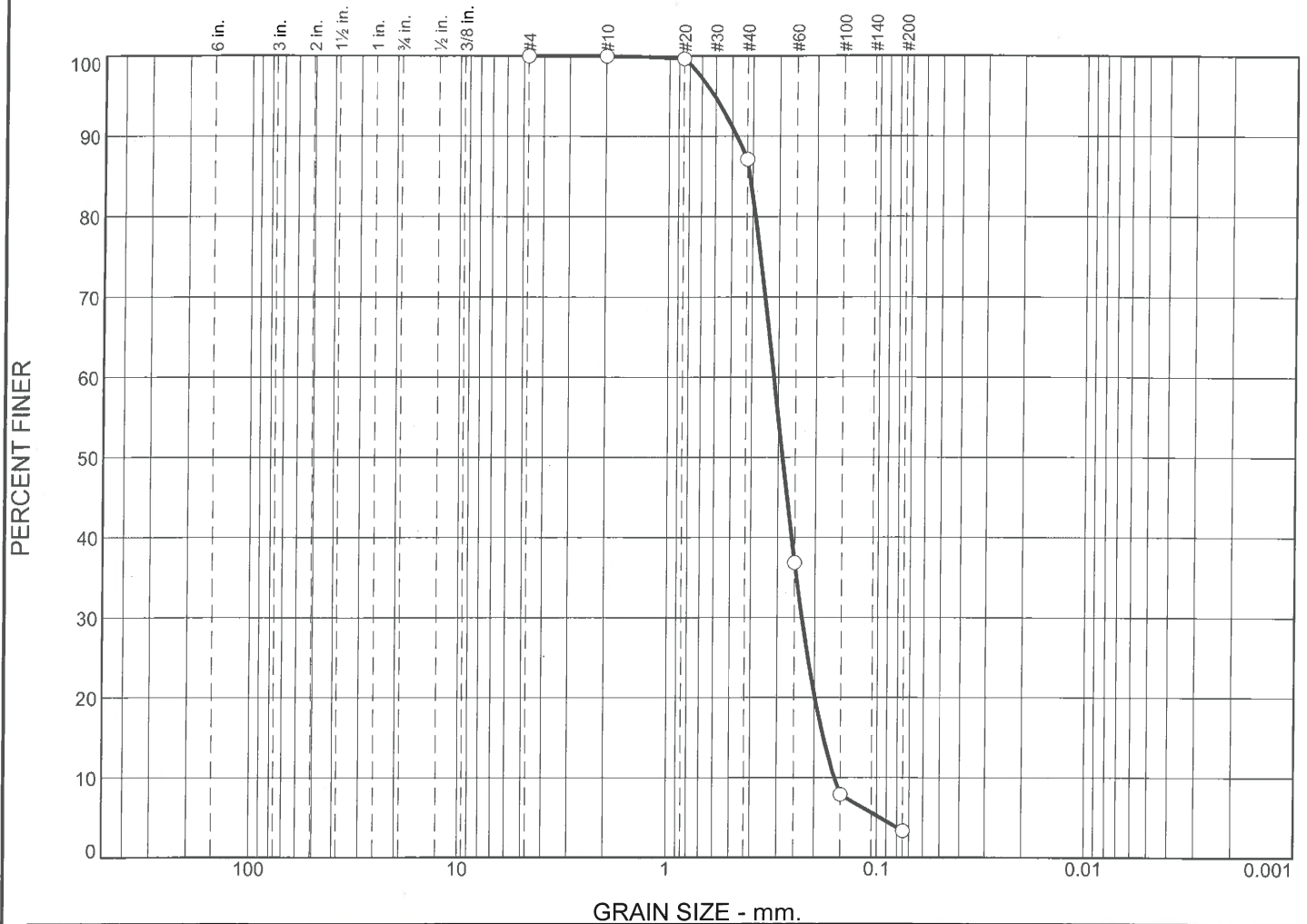
**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-126      **Depth:** 13' - 15'      **Sample Number:** UD-126  
 ■ **Source of Sample:** UD-126      **Depth:** 28' - 30'      **Sample Number:** UD-126  
 ▲ **Source of Sample:** UD-126      **Depth:** 43' - 45'      **Sample Number:** UD-126

**Remarks:**

**BOWSER-MORNER, INC.**

Dayton, Ohio

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines		Clay	
		Coarse	Fine	Coarse	Medium	Fine	Silt			
○	0.0	0.0	0.0	0.0	12.9	83.8	3.3			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4124	0.3153	0.2863	0.2302	0.1809	0.1603	1.05	1.97

Material Description	USCS	AASHTO
○ brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-128      **Depth:** 13' - 15'      **Sample No.:** UD-128

**BOWSER-MORNER, INC.**

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 21.2%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-128

**Depth:** 13' - 15'

**Sample Number:** UD-128

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 21.2%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
461.67	119.27	0.00	#4	0.00	100.0
			#10	0.03	100.0
			#20	1.09	99.7
			#40	44.03	87.1
			#60	216.13	36.9
			#100	315.33	7.9
			#200	330.94	3.3

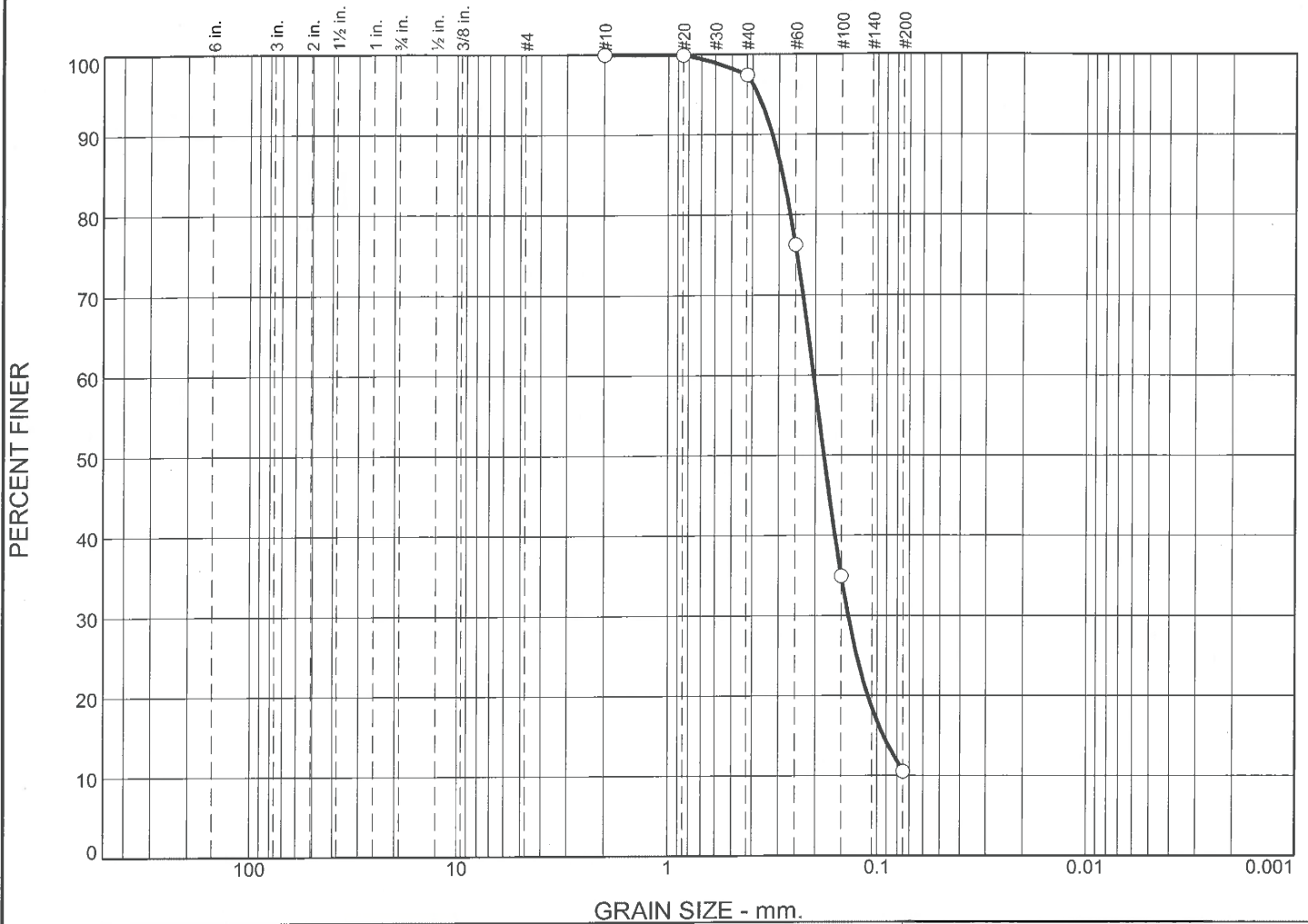
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	12.9	83.8	96.7			3.3

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0964	0.1603	0.1809	0.1987	0.2302	0.2587	0.2863	0.3153	0.3874	0.4124	0.4772	0.6082

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.43	1.97	1.05

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	2.6	86.9	10.5			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.2890	0.2039	0.1817	0.1387	0.0934			

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-128      **Depth:** 30' - 32'      **Sample No.:** UD-128

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 23.6%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-128

**Depth:** 30' - 32'

**Sample Number:** UD-128

**Material Description:** brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 23.6%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
418.04	96.04	0.00	#10	0.00	100.0
			#20	0.20	99.9
			#40	8.30	97.4
			#60	76.40	76.3
			#100	209.50	34.9
			#200	288.10	10.5

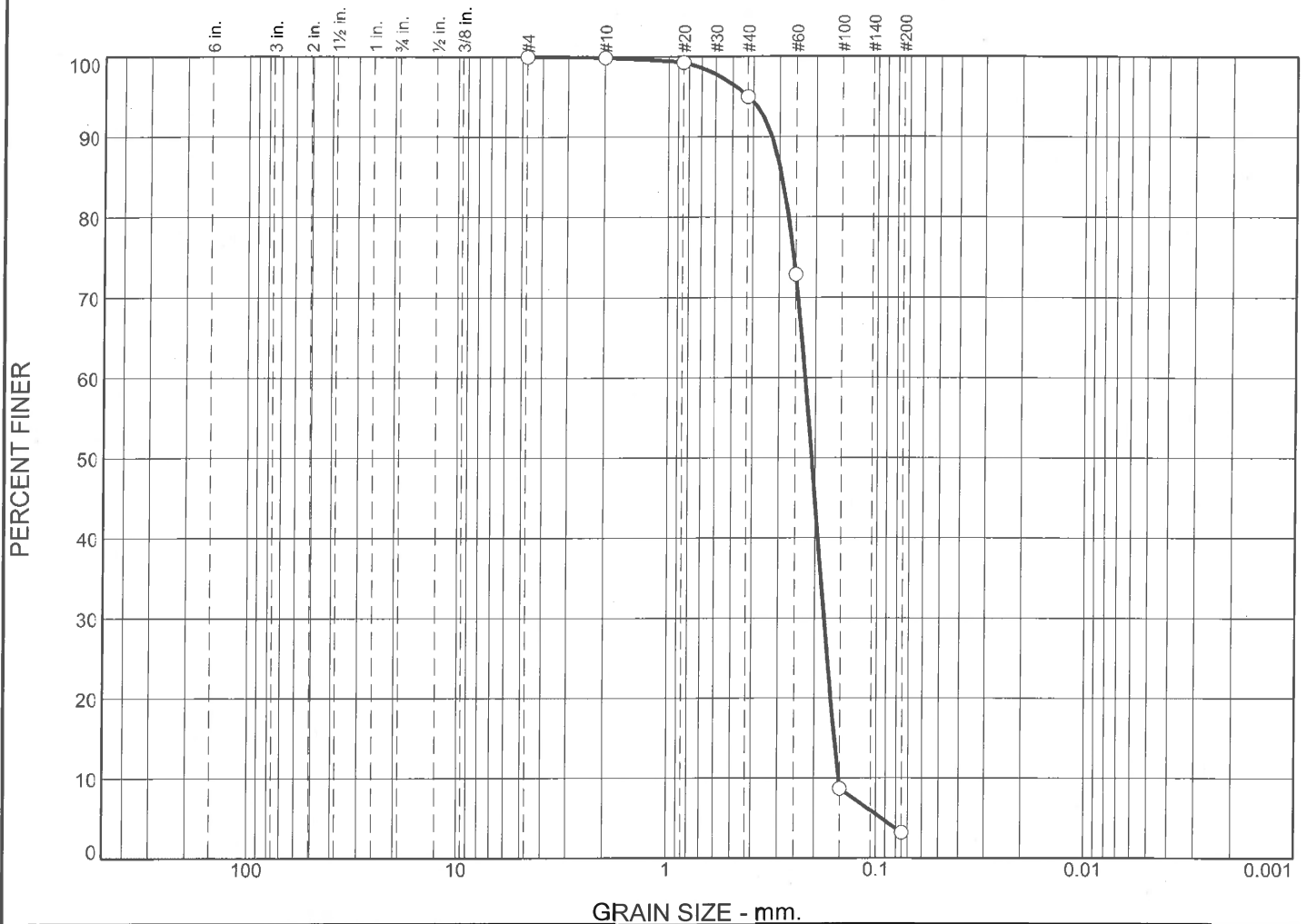
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	2.6	86.9	89.5			10.5

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
		0.0934	0.1112	0.1387	0.1608	0.1817	0.2039	0.2646	0.2890	0.3231	0.3782

<b>Fineness Modulus</b>
0.79

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.1	4.9	91.8	3.2			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.2923	0.2238	0.2077	0.1799	0.1595	0.1521	0.95	1.47

Material Description	USCS	AASHTO
○ brown/gray poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-128      **Depth:** 43' - 45'      **Sample No.:** UD-128

**BOWSER-MORNER, INC.**

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 21.0%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-128

**Depth:** 43' - 45'

**Sample Number:** UD-128

**Material Description:** brown/gray poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 21.0%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
567.66	96.99	0.00	#4	0.00	100.0
			#10	0.50	99.9
			#20	3.40	99.3
			#40	23.50	95.0
			#60	127.70	72.9
			#100	429.70	8.7
			#200	455.60	3.2

### Fractional Components

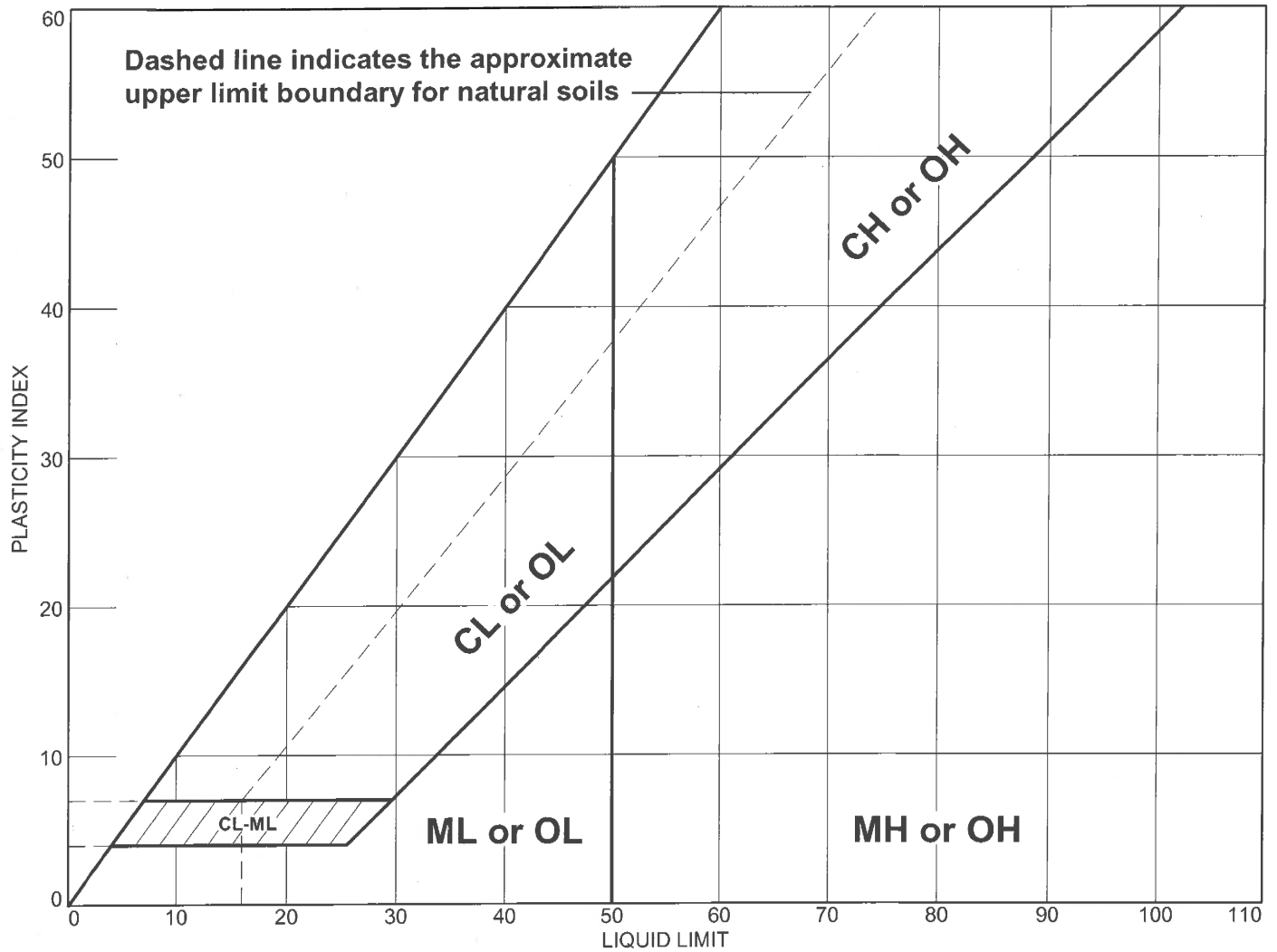
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	4.9	91.8	96.8			3.2

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0941	0.1521	0.1595	0.1665	0.1799	0.1934	0.2077	0.2238	0.2710	0.2923	0.3265	0.4247

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.08	1.47	0.95



# LIQUID AND PLASTIC LIMITS TEST REPORT



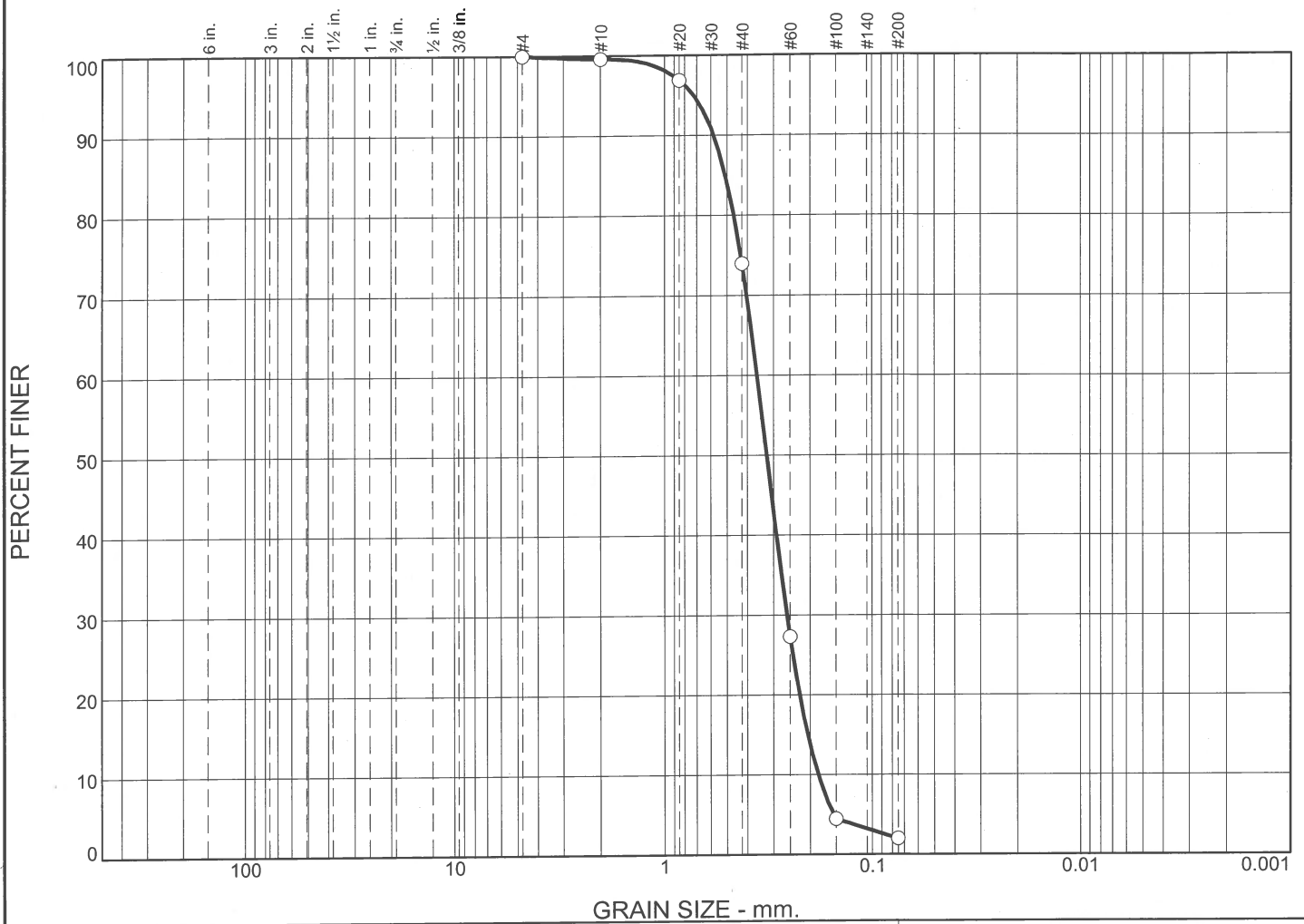
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND	NV	NP	NP	87.1	3.3	SP
■	brown poorly graded SAND with silt	NV	NP	NP	97.4	10.5	SP-SM
▲	brown/gray poorly graded SAND	NV	NP	NP	95.0	3.2	SP

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-128      **Depth:** 13' - 15'      **Sample Number:** UD-128  
 ■ **Source of Sample:** UD-128      **Depth:** 30' - 32'      **Sample Number:** UD-128  
 ▲ **Source of Sample:** UD-128      **Depth:** 43' - 45'      **Sample Number:** UD-128

**Remarks:**

**BOWSER-MORNER, INC.**  
 Dayton, Ohio

# GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	25.6	72.0	2.0	

LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
NV	NP	0.5128	0.3594	0.3230	0.2587	0.2051	0.1827	1.02	1.97

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-179      **Depth:** 13' - 15'      **Sample No.:** UD-179

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 20.7%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-179

**Depth:** 13' - 15'

**Sample Number:** UD-179

**Material Description:** dark brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Recieved

Moisture Content: 20.7%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
517.26	114.83	0.00	#4	0.00	100.0
			#10	1.62	99.6
			#20	12.55	96.9
			#40	104.78	74.0
			#60	292.49	27.3
			#100	384.40	4.5
			#200	394.42	2.0

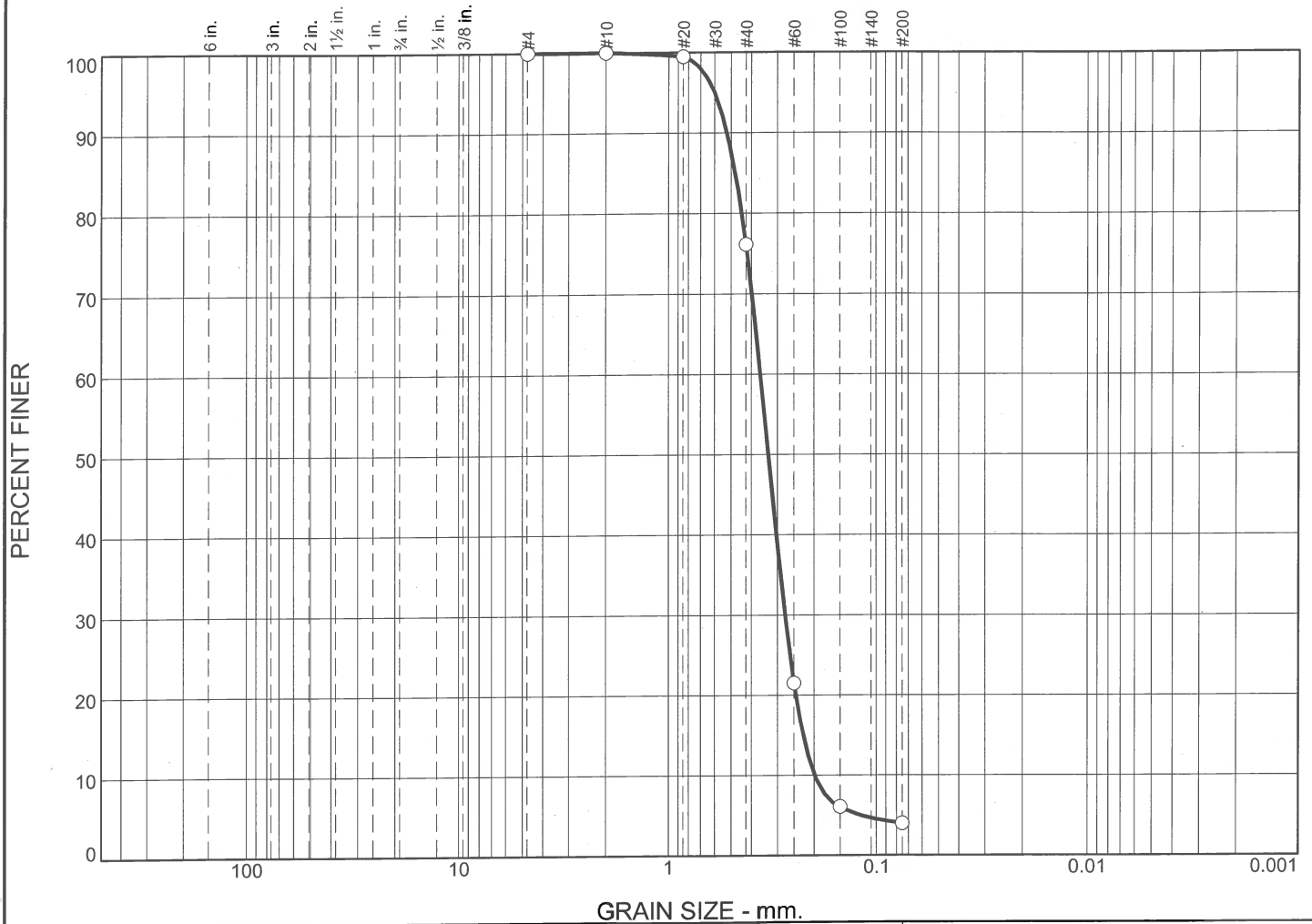
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.4	25.6	72.0	98.0			2.0

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1538	0.1827	0.2051	0.2246	0.2587	0.2903	0.3230	0.3594	0.4660	0.5128	0.5835	0.7265

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.63	1.97	1.02

# GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	23.9	72.1	4.0	

	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4788	0.3621	0.3314	0.2755	0.2256	0.1987	1.05	1.82

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>○ <b>Source:</b> UD-179      <b>Depth:</b> 28' - 30'      <b>Sample No.:</b> UD-179</p>	<p><b>Remarks:</b></p> <p>○ As Received</p> <p>Moisture Content: 19.8%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p>Dayton, Ohio</p>	

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-179

**Depth:** 28' - 30'

**Sample Number:** UD-179

**Material Description:** dark brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 19.8%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
542.64	120.06	0.00	#4	0.00	100.0
			#10	0.02	100.0
			#20	2.09	99.5
			#40	100.83	76.1
			#60	331.66	21.5
			#100	396.90	6.1
			#200	405.75	4.0

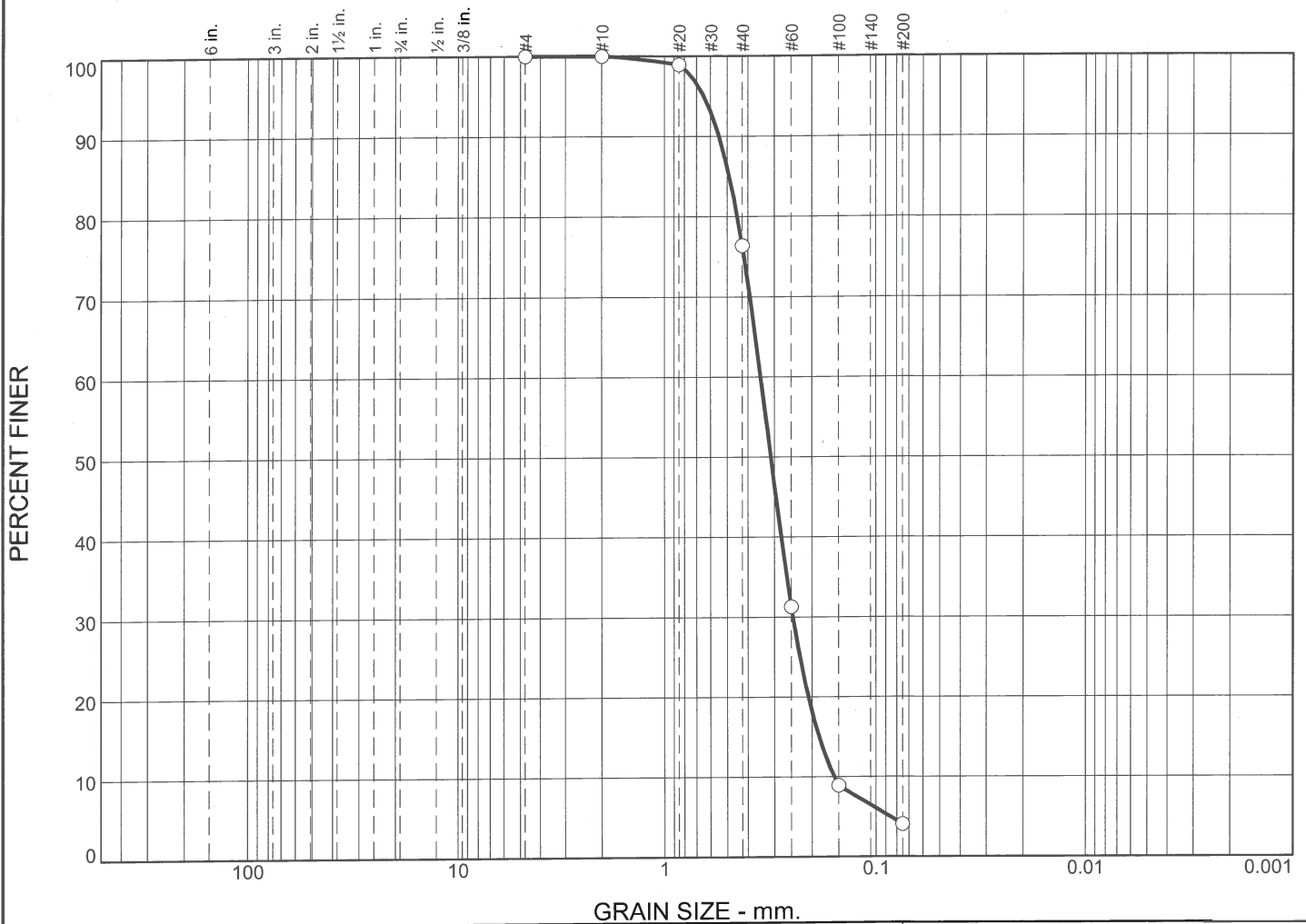
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	23.9	72.1	96.0			4.0

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1182	0.1987	0.2256	0.2449	0.2755	0.3032	0.3314	0.3621	0.4456	0.4788	0.5250	0.6019

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.60	1.82	1.05

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines			
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
0.0	0.0	0.0	0.0	23.6	72.3	4.1			
LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
NV	NP	0.4899	0.3482	0.3120	0.2456	0.1852	0.1574	1.10	2.21

Material Description	USCS	AASHTO
○ dark brown/black poorly graded SAND	SP	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>○ <b>Source:</b> UD-179      <b>Depth:</b> 43' - 45'      <b>Sample No.:</b> UD-179</p>	<p><b>Remarks:</b></p> <p>○ As Received</p> <p>Moisture Content: 19.6%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p><b>Dayton, Ohio</b></p>	

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-179

**Depth:** 43' - 45'

**Sample Number:** UD-179

**Material Description:** dark brown/black poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 19.6%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
367.92	97.03	0.00	#4	0.00	100.0
			#10	0.03	100.0
			#20	2.83	99.0
			#40	63.98	76.4
			#60	186.13	31.3
			#100	246.76	8.9
			#200	259.83	4.1

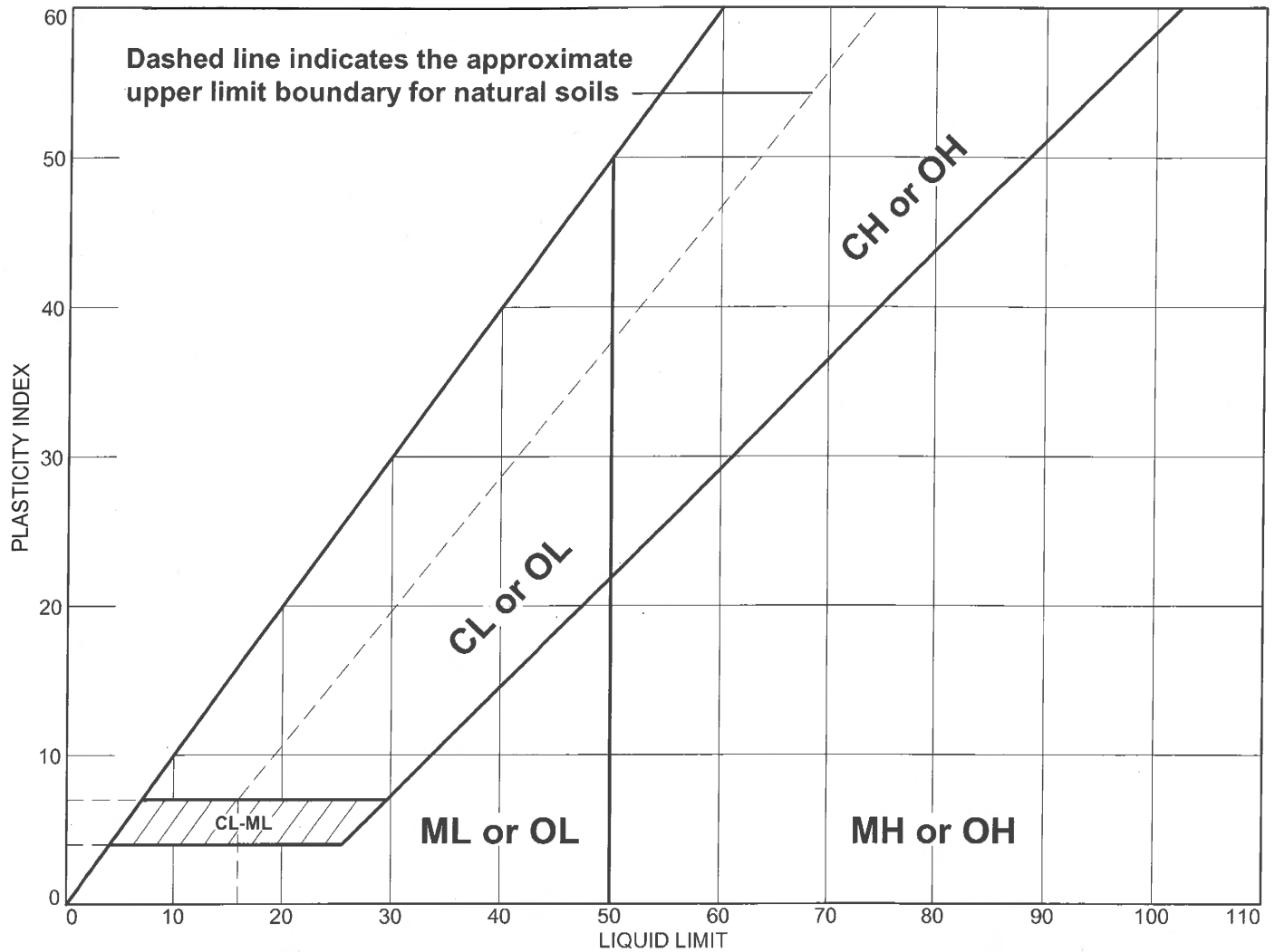
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	23.6	72.3	95.9			4.1

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0856	0.1574	0.1852	0.2078	0.2456	0.2788	0.3120	0.3482	0.4487	0.4899	0.5484	0.6480

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.52	2.21	1.10

# LIQUID AND PLASTIC LIMITS TEST REPORT

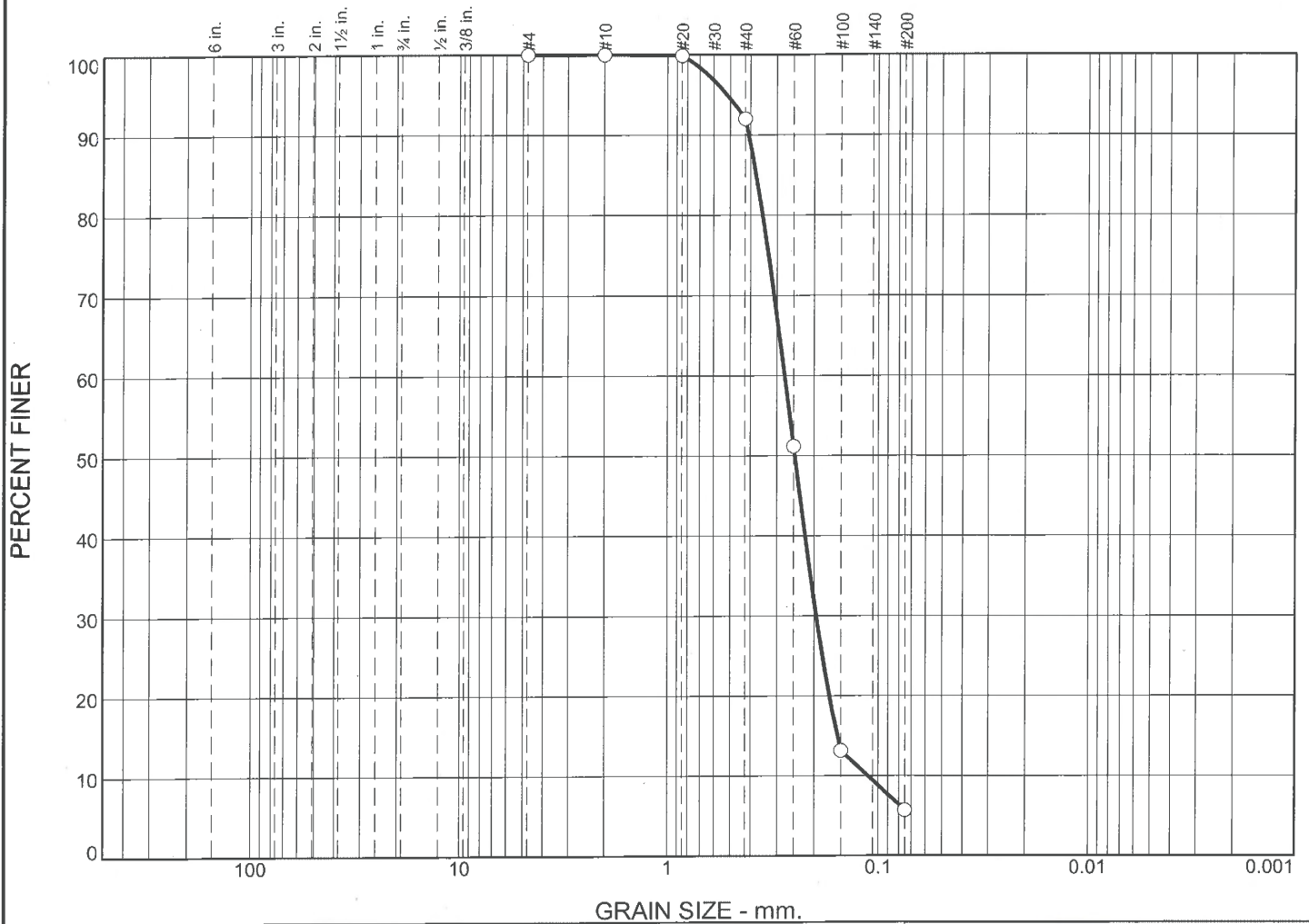


	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND	NV	NP	NP	76.1	4.0	SP
■	dark brown poorly graded SAND	NV	NP	NP	74.0	2.0	SP
▲	dark brown/black poorly graded SAND	NV	NP	NP	76.4	4.1	SP

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>● <b>Source of Sample:</b> UD-179      <b>Depth:</b> 28' - 30'      <b>Sample Number:</b> UD-179</p> <p>■ <b>Source of Sample:</b> UD-179      <b>Depth:</b> 13' - 15'      <b>Sample Number:</b> UD-179</p> <p>▲ <b>Source of Sample:</b> UD-179      <b>Depth:</b> 43' - 45'      <b>Sample Number:</b> UD-179</p> <p style="text-align: center;"><b>BOWSER-MORNER, INC.</b></p> <p style="text-align: center;">Dayton, Ohio</p>	<p><b>Remarks:</b></p>
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# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
<input type="radio"/>	0.0	0.0	0.0	0.0	8.0	86.3	5.7			
<input checked="" type="checkbox"/>	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
<input type="radio"/>	NV	NP	0.3762	0.2757	0.2467	0.1950	0.1557	0.1119	1.23	2.46

Material Description	USCS	AASHTO
<input type="radio"/> dark brown poorly graded SAND with silt	SP-SM	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p><input type="radio"/> <b>Source:</b> UD-231      <b>Depth:</b> 13' - 15'      <b>Sample No.:</b> UD-231</p>	<p><b>Remarks:</b></p> <p><input type="radio"/> As Received</p> <p>Moisture Content: 20.6%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p>Dayton, Ohio</p>	

## GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-231

**Depth:** 13' - 15'

**Sample Number:** UD-231

**Material Description:** dark brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 20.6%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
462.15	112.95	0.00	#4	0.00	100.0
			#10	0.01	100.0
			#20	0.34	99.9
			#40	27.85	92.0
			#60	170.41	51.2
			#100	303.25	13.2
			#200	329.34	5.7

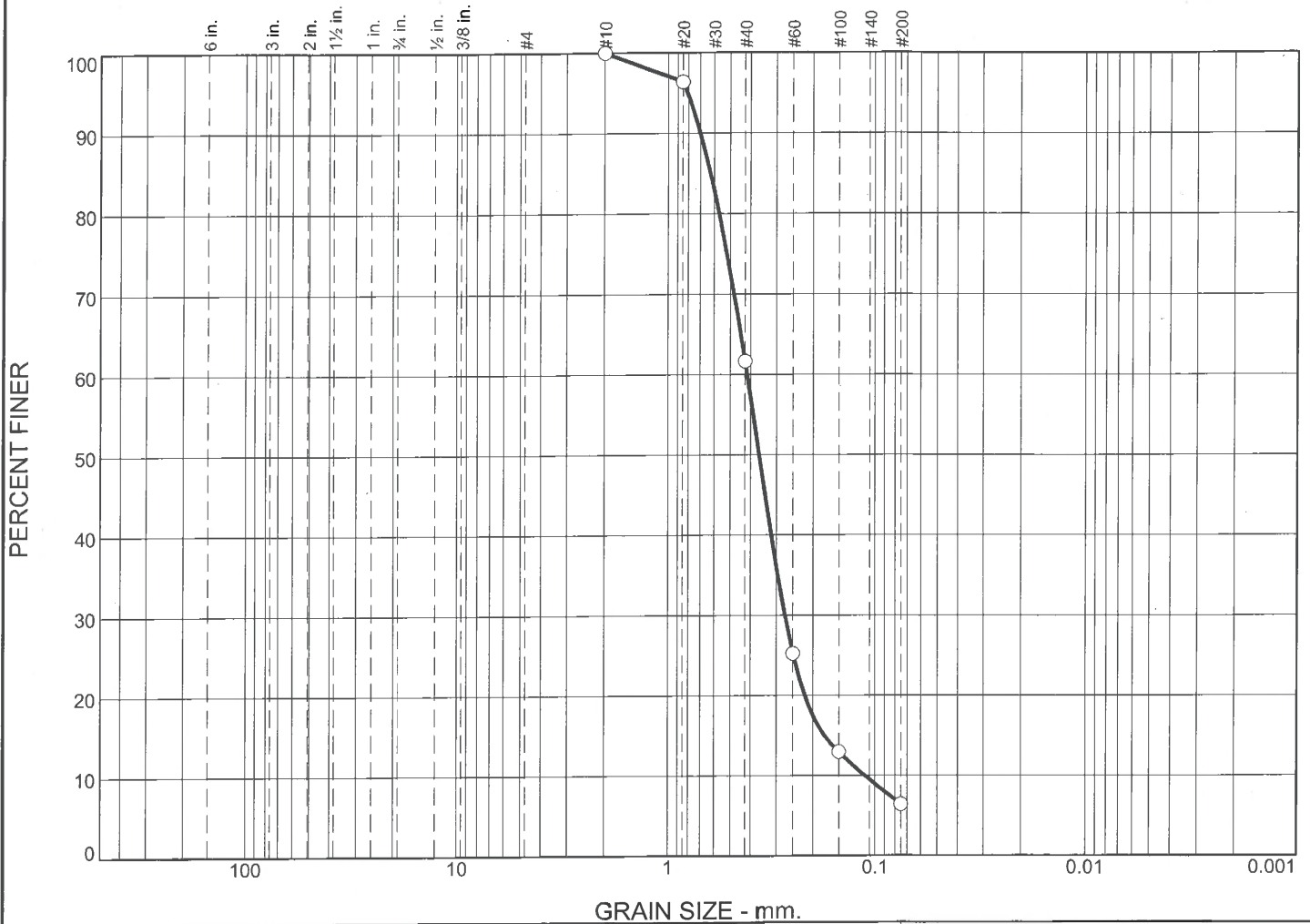
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	8.0	86.3	94.3			5.7

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1119	0.1557	0.1696	0.1950	0.2202	0.2467	0.2757	0.3504	0.3762	0.4086	0.5185

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.23	2.46	1.23

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	38.4	55.2	6.4			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.6266	0.4154	0.3632	0.2729	0.1763	0.1121	1.60	3.71

Material Description	USCS	AASHTO
○ dark brown/black poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-231      **Depth:** 30' - 32'      **Sample No.:** UD-231

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received

Moisture Content: 16.2%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-231

**Depth:** 30' - 32'

**Sample Number:** UD-231

**Material Description:** dark brown/black poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 16.2%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
518.15	114.14	0.00	#10	0.00	100.0
			#20	14.59	96.4
			#40	154.95	61.6
			#60	301.98	25.3
			#100	351.66	13.0
			#200	378.10	6.4

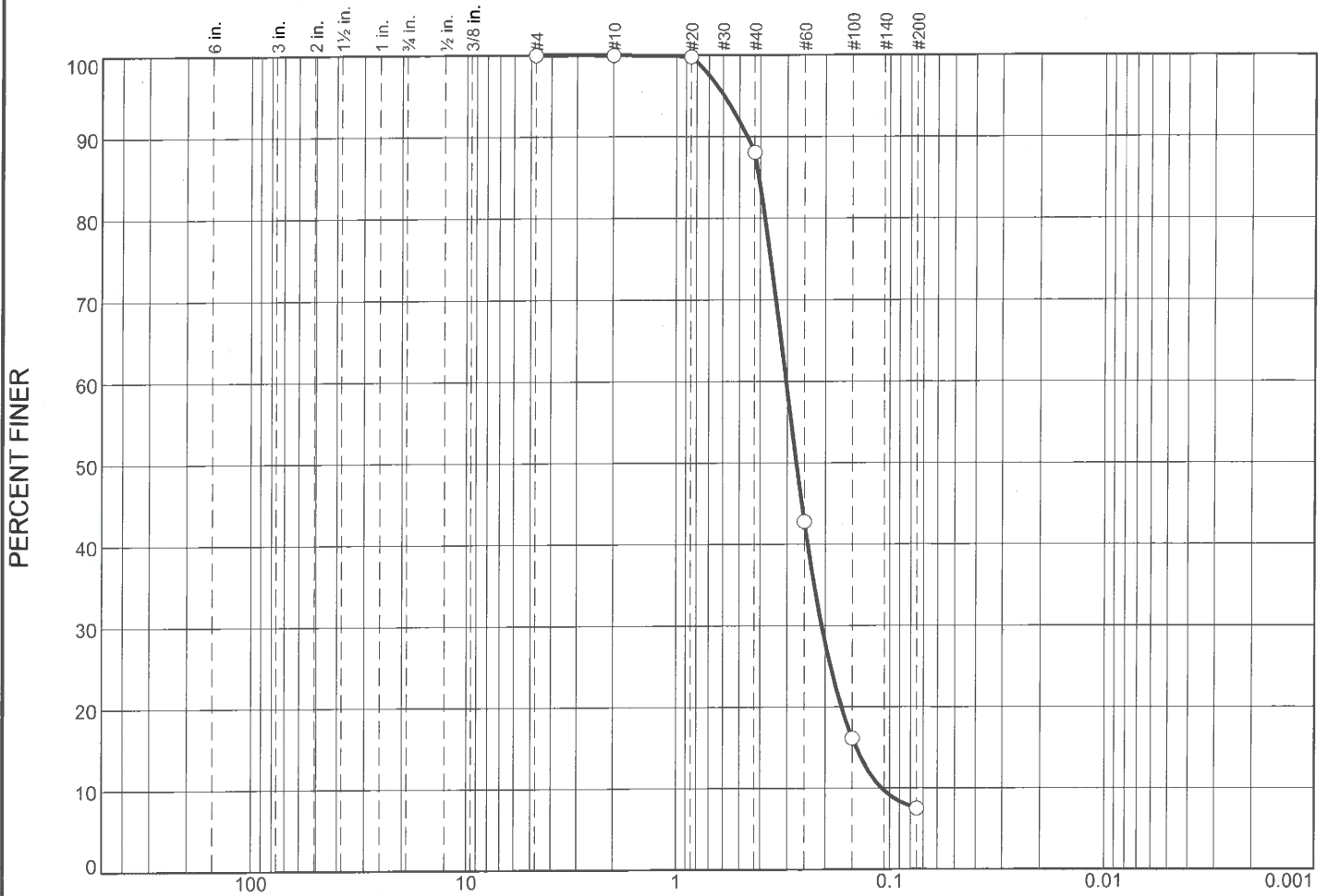
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	38.4	55.2	93.6			6.4

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1121	0.1763	0.2193	0.2729	0.3174	0.3632	0.4154	0.5683	0.6266	0.7016	0.8089

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.70	3.71	1.60

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

%	+3"	% Gravel		% Sand			% Fines		Clay	
		Coarse	Fine	Coarse	Medium	Fine	Silt			
○	0.0	0.0	0.0	0.0	11.9	80.6	7.5			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4056	0.3035	0.2721	0.2076	0.1438	0.1091	1.30	2.78

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND with silt	SP-SM	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>○ <b>Source:</b> UD-231      <b>Depth:</b> 43' - 45'      <b>Sample No.:</b> UD-231</p>	<p><b>Remarks:</b></p> <p>○ As Received</p> <p>Moisture Content: 20.6%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p>Dayton, Ohio</p>	

## GRAIN SIZE DISTRIBUTION TEST DATA

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-231

**Depth:** 43' - 45'

**Sample Number:** UD-231

**Material Description:** dark brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 20.6%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
441.29	114.22	0.00	#4	0.00	100.0
			#10	0.10	100.0
			#20	0.70	99.8
			#40	39.00	88.1
			#60	187.10	42.8
			#100	274.20	16.2
			#200	302.50	7.5

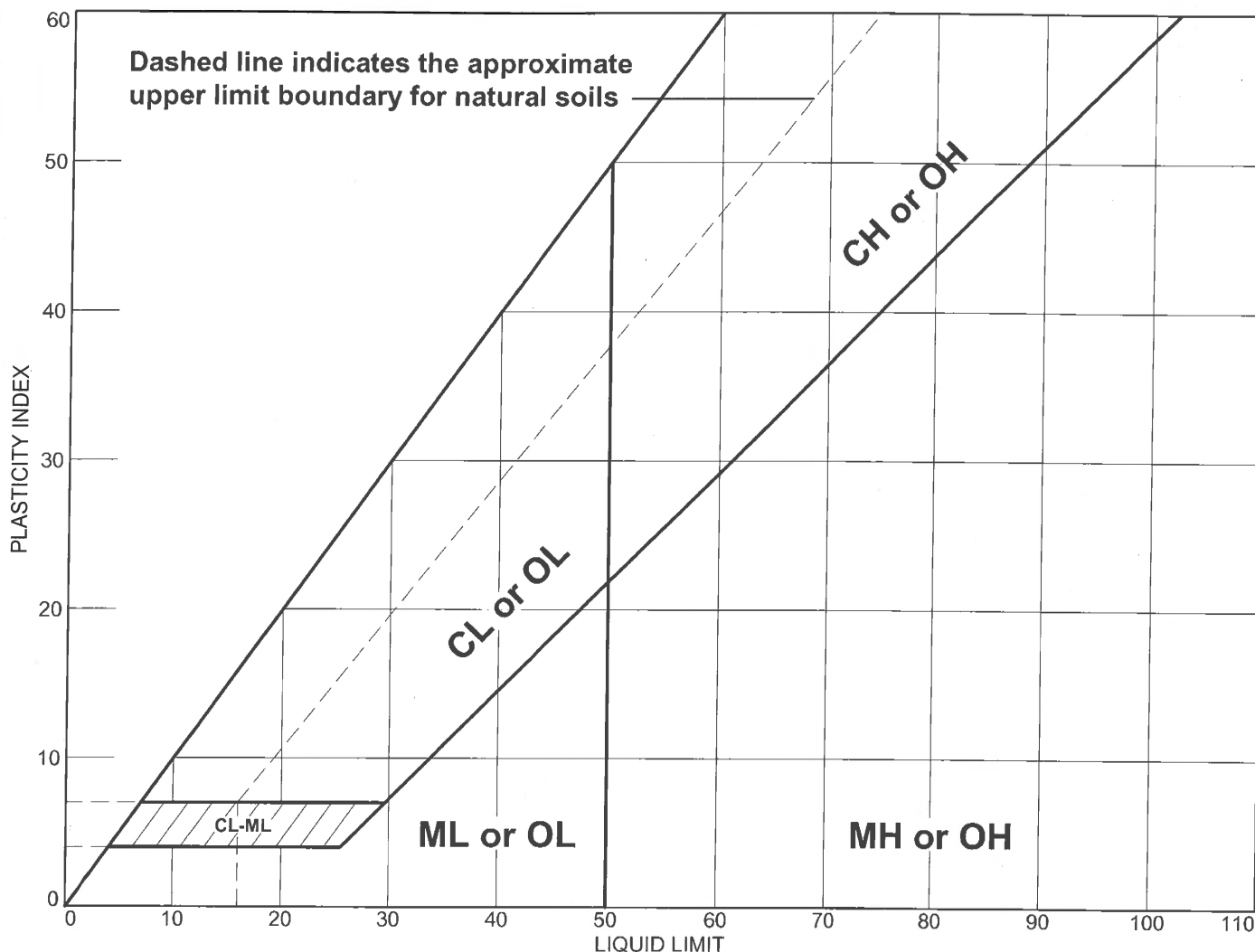
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	11.9	80.6	92.5			7.5

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1091	0.1438	0.1683	0.2076	0.2412	0.2721	0.3035	0.3796	0.4056	0.4613	0.5932

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.30	2.78	1.30

# LIQUID AND PLASTIC LIMITS TEST REPORT



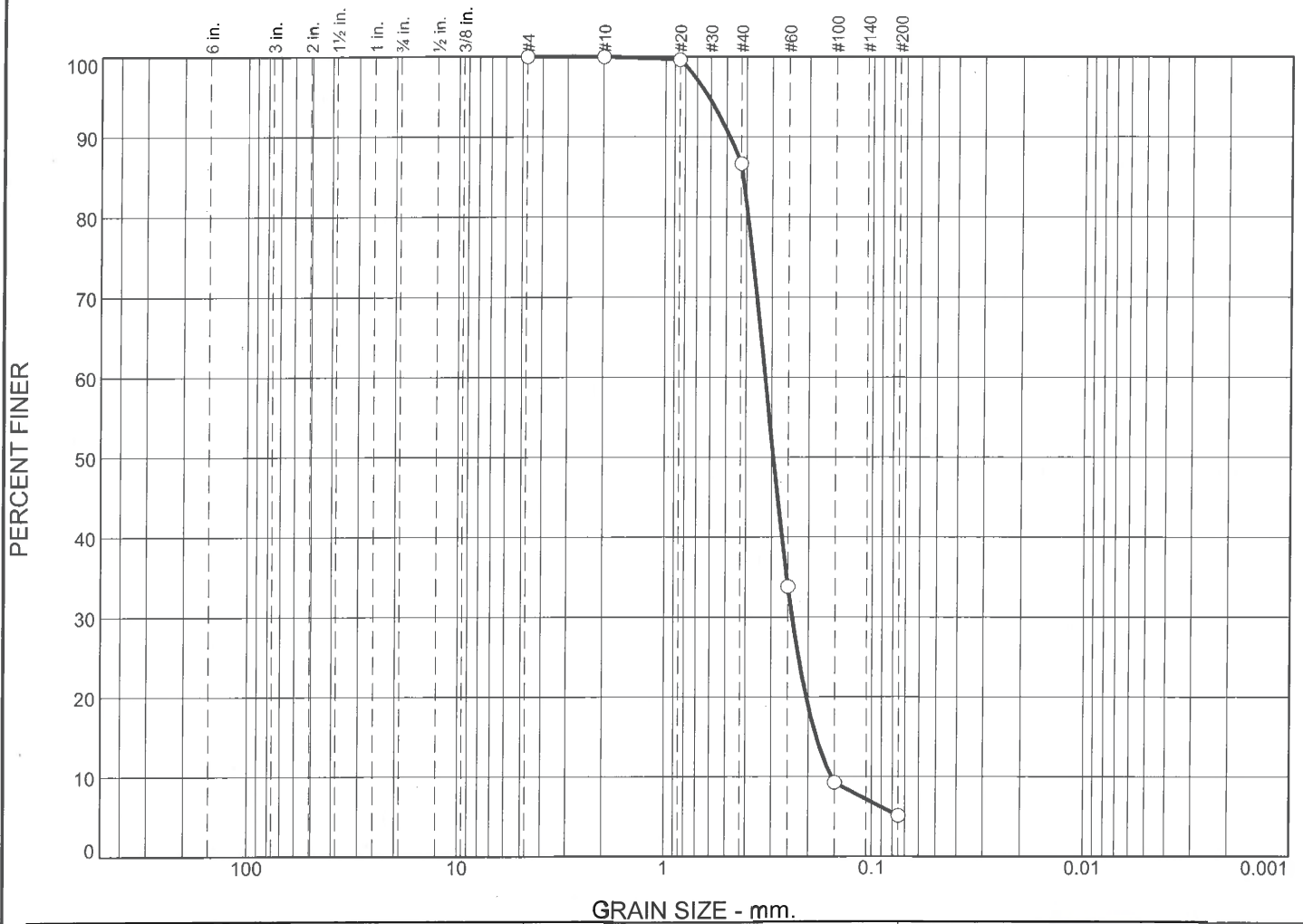
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	dark brown poorly graded SAND with silt	NV	NP	NP	92.0	5.7	SP-SM
■	dark brown/black poorly graded SAND with silt	NV	NP	NP	61.6	6.4	SP-SM
▲	dark brown poorly graded SAND with silt	NV	NP	NP	88.1	7.5	SP-SM

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-231      **Depth:** 13' - 15'      **Sample Number:** UD-231  
 ■ **Source of Sample:** UD-231      **Depth:** 30' - 32'      **Sample Number:** UD-231  
 ▲ **Source of Sample:** UD-231      **Depth:** 43' - 45'      **Sample Number:** UD-231

**BOWSER-MORNER, INC.**  
Dayton, Ohio

**Remarks:**

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	13.3	81.6	5.1			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4158	0.3226	0.2943	0.2386	0.1832	0.1551	1.14	2.08

Material Description	USCS	AASHTO
○ brown/gray poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-238      **Depth:** 13' - 15'      **Sample No.:** UD-238

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 18.8%



**GRAIN SIZE DISTRIBUTION TEST DATA**

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-238

**Depth:** 13' - 15'

**Sample Number:** UD-238

**Material Description:** brown/gray poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 18.8%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative	Percent Finer
				Weight Retained (grams)	
422.22	114.83	0.00	#4	0.00	100.0
			#10	0.10	100.0
			#20	1.20	99.6
			#40	41.00	86.7
			#60	203.40	33.8
			#100	278.90	9.3
			#200	291.70	5.1

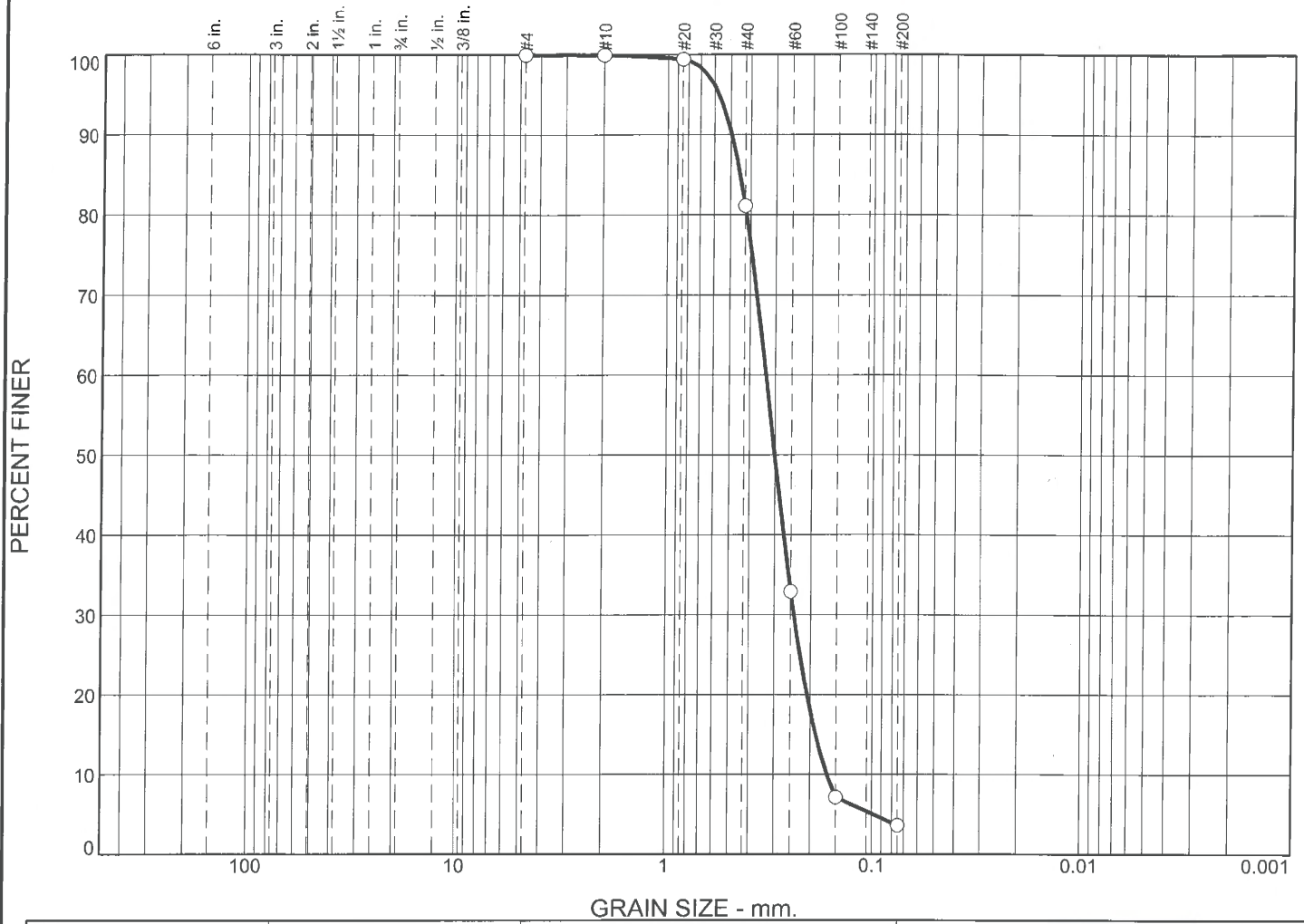
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	13.3	81.6	94.9			5.1

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1551	0.1832	0.2045	0.2386	0.2672	0.2943	0.3226	0.3920	0.4158	0.4850	0.6159

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.44	2.08	1.14

# GRAIN SIZE DISTRIBUTION REPORT



%	+3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	18.8	77.6	3.6			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4509	0.3333	0.3011	0.2409	0.1882	0.1658	1.05	2.01

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-238      **Depth:** 28' - 30'      **Sample No.:** UD-238

**BOWSER-MORNER, INC.**

Dayton, Ohio

**Remarks:**

○ As Received

Moisture Content: 19.9%

## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-238

**Depth:** 28' - 30'

**Sample Number:** UD-238

**Material Description:** dark brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 19.9%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
417.34	113.30	0.00	#4	0.00	100.0
			#10	0.10	100.0
			#20	1.80	99.4
			#40	57.30	81.2
			#60	203.90	32.9
			#100	282.30	7.2
			#200	293.10	3.6

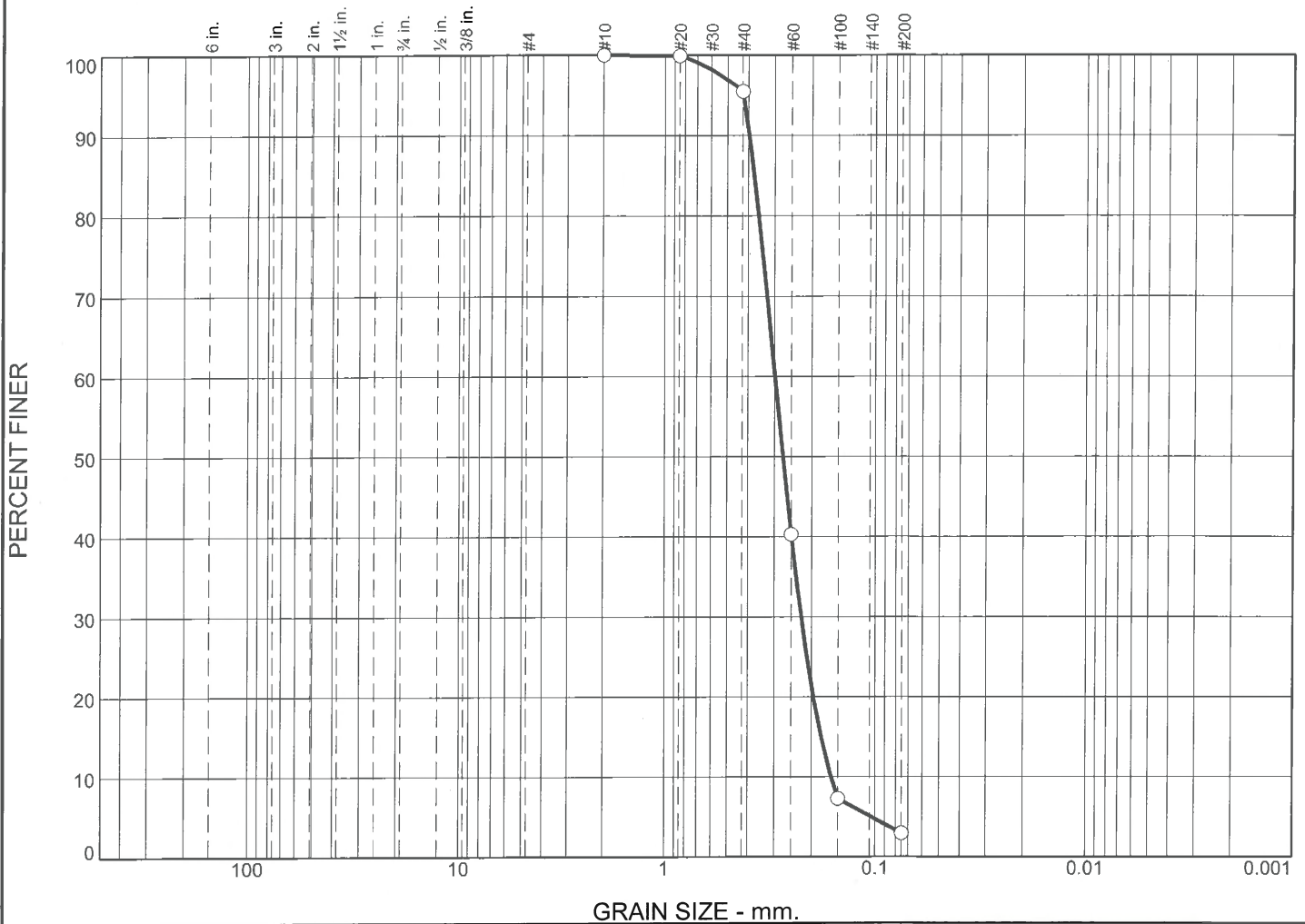
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	18.8	77.6	96.4			3.6

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0986	0.1658	0.1882	0.2074	0.2409	0.2711	0.3011	0.3333	0.4182	0.4509	0.4963	0.5727

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.47	2.01	1.05

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

○	% +3"	% Gravel		% Sand			% Fines		Clay	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	4.5	92.6	2.9			
×	<b>LL</b>	<b>PL</b>	<b>D<sub>85</sub></b>	<b>D<sub>60</sub></b>	<b>D<sub>50</sub></b>	<b>D<sub>30</sub></b>	<b>D<sub>15</sub></b>	<b>D<sub>10</sub></b>	<b>C<sub>c</sub></b>	<b>C<sub>u</sub></b>
○	NV	NP	0.3744	0.2985	0.2736	0.2237	0.1797	0.1616	1.04	1.85

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND	SP	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-238      **Depth:** 43' - 45'      **Sample No.:** UD-238

BOWSER-MORNER, INC.

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 18.6%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-238

**Depth:** 43' - 45'

**Sample Number:** UD-238

**Material Description:** dark brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 18.6%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
423.86	97.66	0.00	#10	0.00	100.0
			#20	0.20	99.9
			#40	14.60	95.5
			#60	194.70	40.3
			#100	302.40	7.3
			#200	316.60	2.9

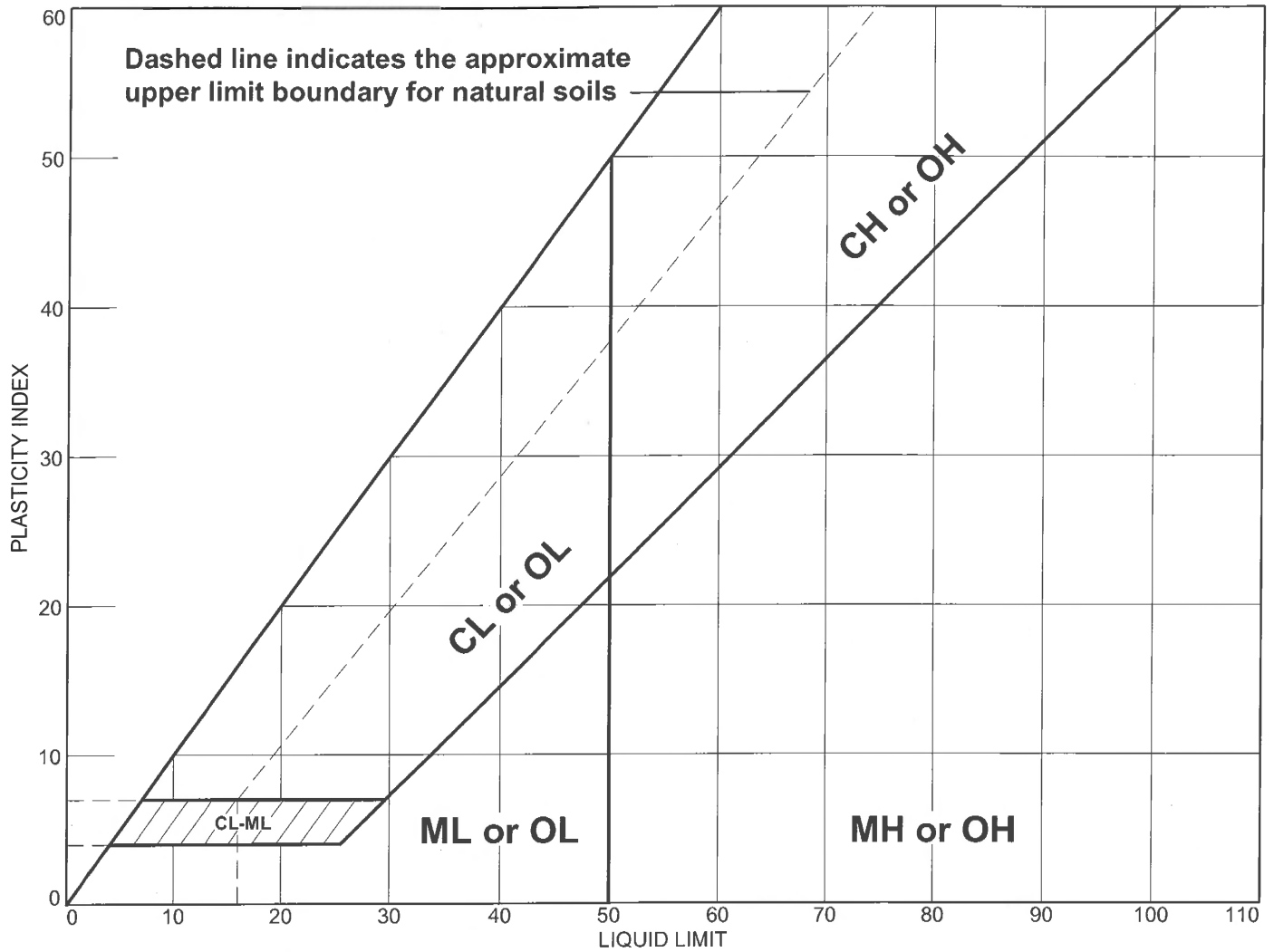
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	4.5	92.6	97.1			2.9

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1041	0.1616	0.1797	0.1955	0.2237	0.2492	0.2736	0.2985	0.3564	0.3744	0.3955	0.4217

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.34	1.85	1.04

# LIQUID AND PLASTIC LIMITS TEST REPORT



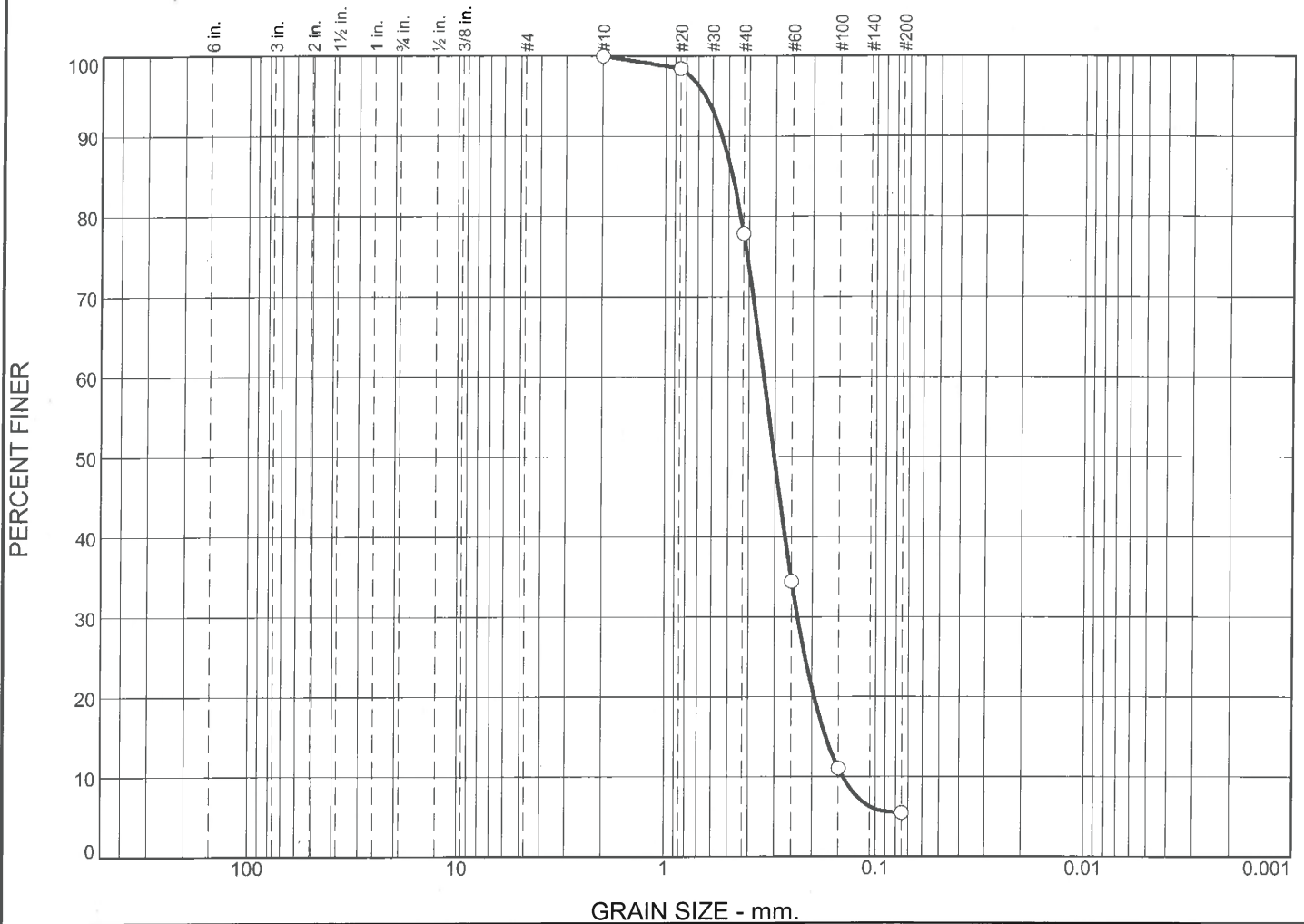
	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown/gray poorly graded SAND with silt	NV	NP	NP	86.7	5.1	SP-SM
■	dark brown poorly graded SAND	NV	NP	NP	81.2	3.6	SP
▲	dark brown poorly graded SAND	NV	NP	NP	95.5	2.9	SP

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-238      **Depth:** 13' - 15'      **Sample Number:** UD-238  
 ■ **Source of Sample:** UD-238      **Depth:** 28' - 30'      **Sample Number:** UD-238  
 ▲ **Source of Sample:** UD-238      **Depth:** 43' - 45'      **Sample Number:** UD-238

**BOWSER-MORNER, INC.**  
Dayton, Ohio

**Remarks:**

# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

○	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	22.1	72.4	5.5			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4807	0.3390	0.3025	0.2345	0.1722	0.1430	1.13	2.37

Material Description	USCS	AASHTO
○ brown poorly graded SAND with silt	SP-SM	A-3

<p><b>Project No.</b> 187609      <b>Client:</b> TTL</p> <p><b>Project:</b> TTL Job No 000180200804</p> <p>Analysis of Forty-Two Thin Wall Tube Samples</p> <p>○ <b>Source:</b> UD-338      <b>Depth:</b> 13' - 15'      <b>Sample No.:</b> UD-338</p>	<p><b>Remarks:</b></p> <p>○ As Received</p> <p>Moisture Content: 19.2%</p>
<p><b>BOWSER-MORNER, INC.</b></p> <p><b>Dayton, Ohio</b></p>	

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-338

**Depth:** 13' - 15'

**Sample Number:** UD-338

**Material Description:** brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 19.2%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
463.95	119.48	0.00	#10	0.00	100.0
			#20	5.40	98.4
			#40	76.20	77.9
			#60	225.90	34.4
			#100	306.40	11.1
			#200	325.60	5.5

**Fractional Components**

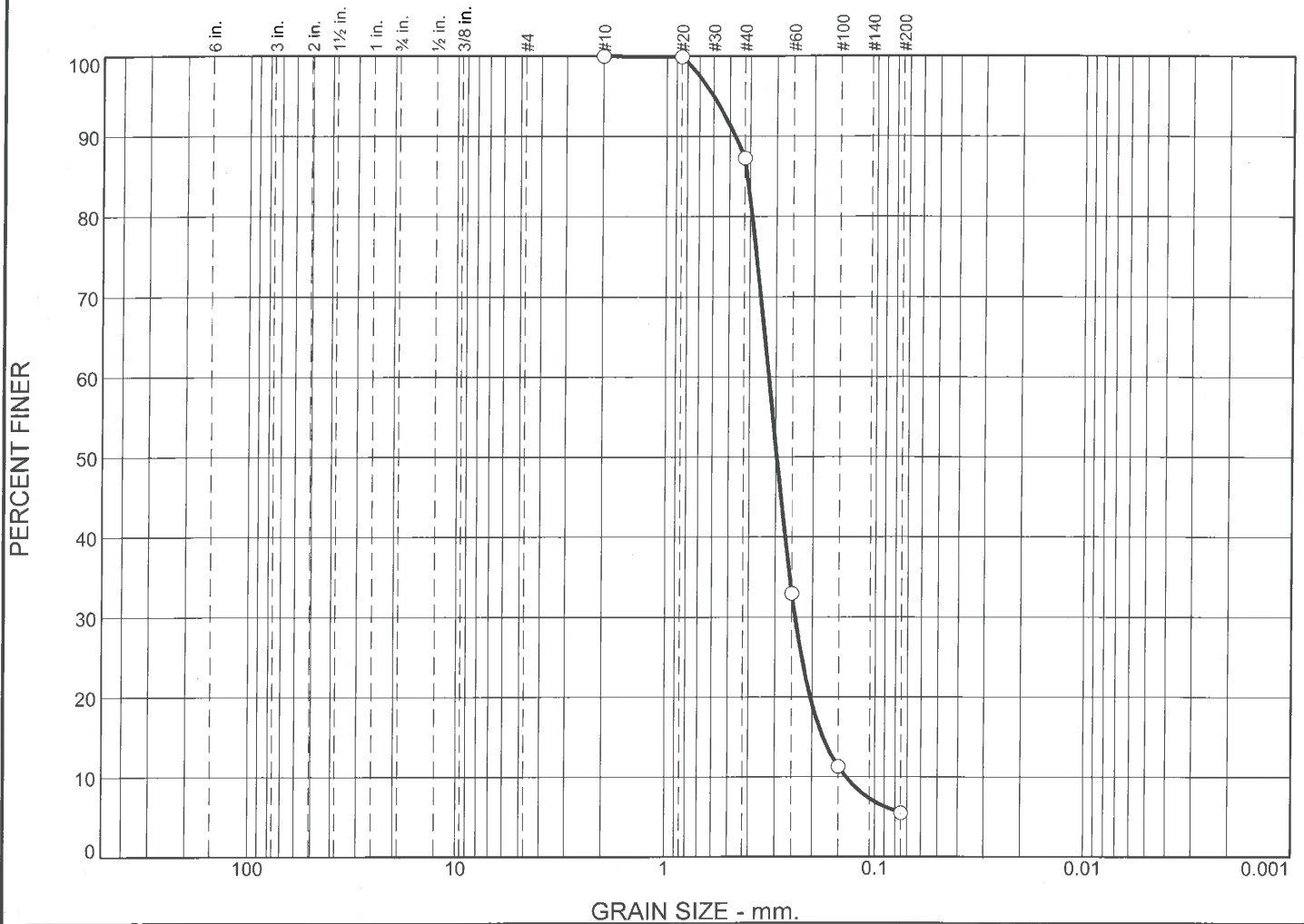
Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	22.1	72.4	94.5			5.5

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1430	0.1722	0.1954	0.2345	0.2688	0.3025	0.3390	0.4393	0.4807	0.5406	0.6486

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.47	2.37	1.13



# GRAIN SIZE DISTRIBUTION REPORT



GRAIN SIZE - mm.

	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	0.0	0.0	12.7	81.8	5.5			
⊗	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○	NV	NP	0.4129	0.3240	0.2965	0.2410	0.1781	0.1377	1.30	2.35

Material Description	USCS	AASHTO
○ dark brown poorly graded SAND with silt	SP-SM	A-3

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ○ **Source:** UD-338      **Depth:** 28' - 30'      **Sample No.:** UD-338

**BOWSER-MORNER, INC.**

Dayton, Ohio

**Remarks:**

○ As Received  
 Moisture Content: 21.7%

**GRAIN SIZE DISTRIBUTION TEST DATA**

2/21/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-338

**Depth:** 28' - 30'

**Sample Number:** UD-338

**Material Description:** dark brown poorly graded SAND with silt

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP-SM

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 21.7%

**Sieve Test Data**

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
446.38	119.46	0.00	#10	0.00	100.0
			#20	0.30	99.9
			#40	41.50	87.3
			#60	219.20	32.9
			#100	290.00	11.3
			#200	309.00	5.5

**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	12.7	81.8	94.5			5.5

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
	0.1377	0.1781	0.2042	0.2410	0.2698	0.2965	0.3240	0.3905	0.4129	0.4733	0.6008

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.42	2.35	1.30



## GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2019

**Client:** TTL

**Project:** TTL Job No 000180200804

Analysis of Forty-Two Thin Wall Tube Samples

**Project Number:** 187609

**Location:** UD-338

**Depth:** 43' - 45'

**Sample Number:** UD-338

**Material Description:** brown poorly graded SAND

**Liquid Limit:** NV

**Plastic Limit:** NP

**USCS Classification:** SP

**AASHTO Classification:** A-3

**Testing Remarks:** As Received

Moisture Content: 20.0%

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
413.54	92.80	0.00	#4	0.00	100.0
			#10	0.00	100.0
			#20	0.71	99.8
			#40	43.64	86.4
			#60	235.84	26.5
			#100	300.44	6.3
			#200	310.74	3.1

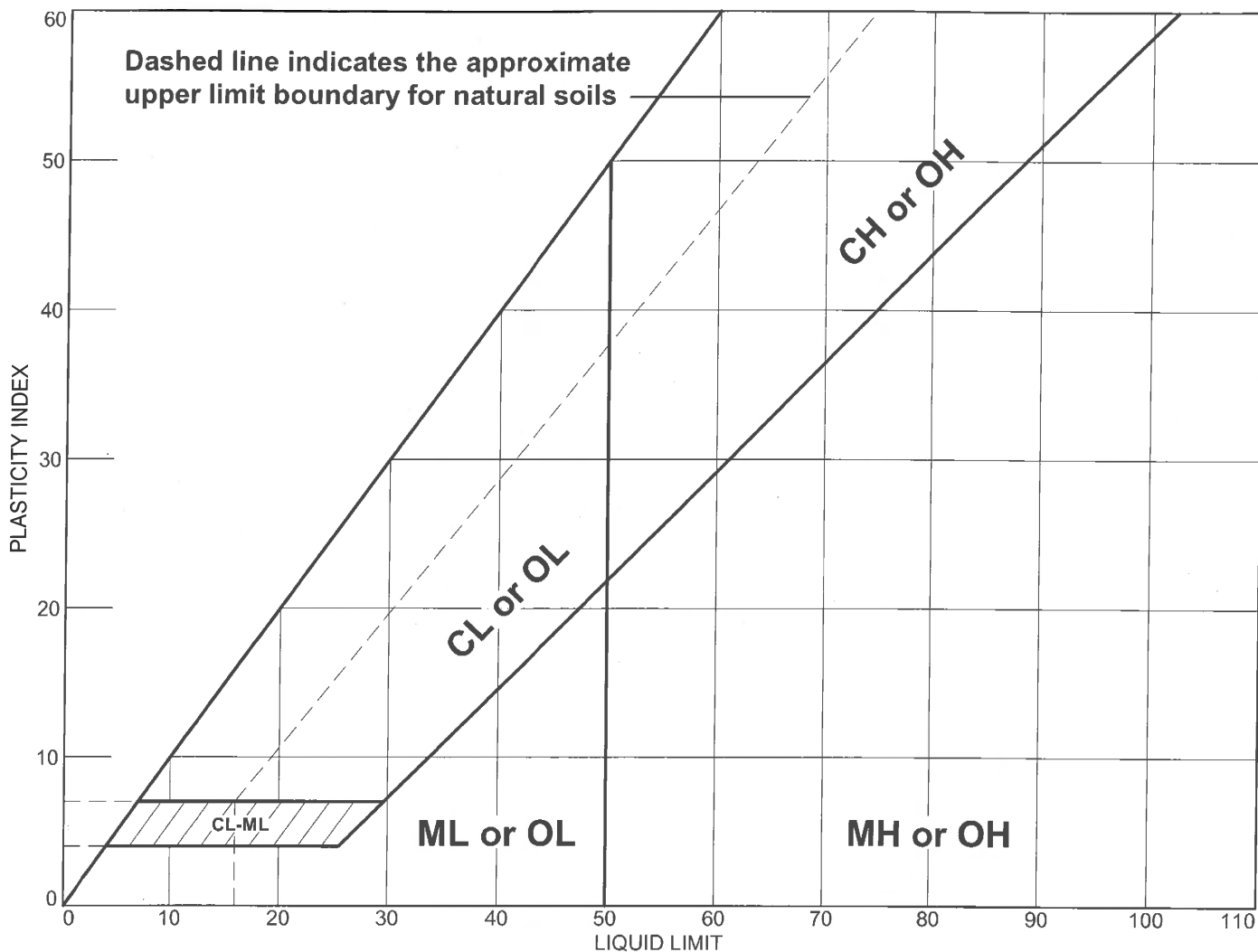
### Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	13.6	83.3	96.9			3.1

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.1295	0.1852	0.2114	0.2303	0.2595	0.2845	0.3089	0.3345	0.3971	0.4183	0.4879	0.6150

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.53	1.81	1.09

# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown poorly graded SAND with silt	NV	NP	NP	77.9	5.5	SP-SM
■	dark brown poorly graded SAND with silt	NV	NP	NP	87.3	5.5	SP-SM
▲	brown poorly graded SAND	NV	NP	NP	86.4	3.1	SP

**Project No.** 187609      **Client:** TTL  
**Project:** TTL Job No 000180200804  
 Analysis of Forty-Two Thin Wall Tube Samples  
 ● **Source of Sample:** UD-338      **Depth:** 13' - 15'      **Sample Number:** UD-338  
 ■ **Source of Sample:** UD-338      **Depth:** 28' - 30'      **Sample Number:** UD-338  
 ▲ **Source of Sample:** UD-338      **Depth:** 43' - 45'      **Sample Number:** UD-338

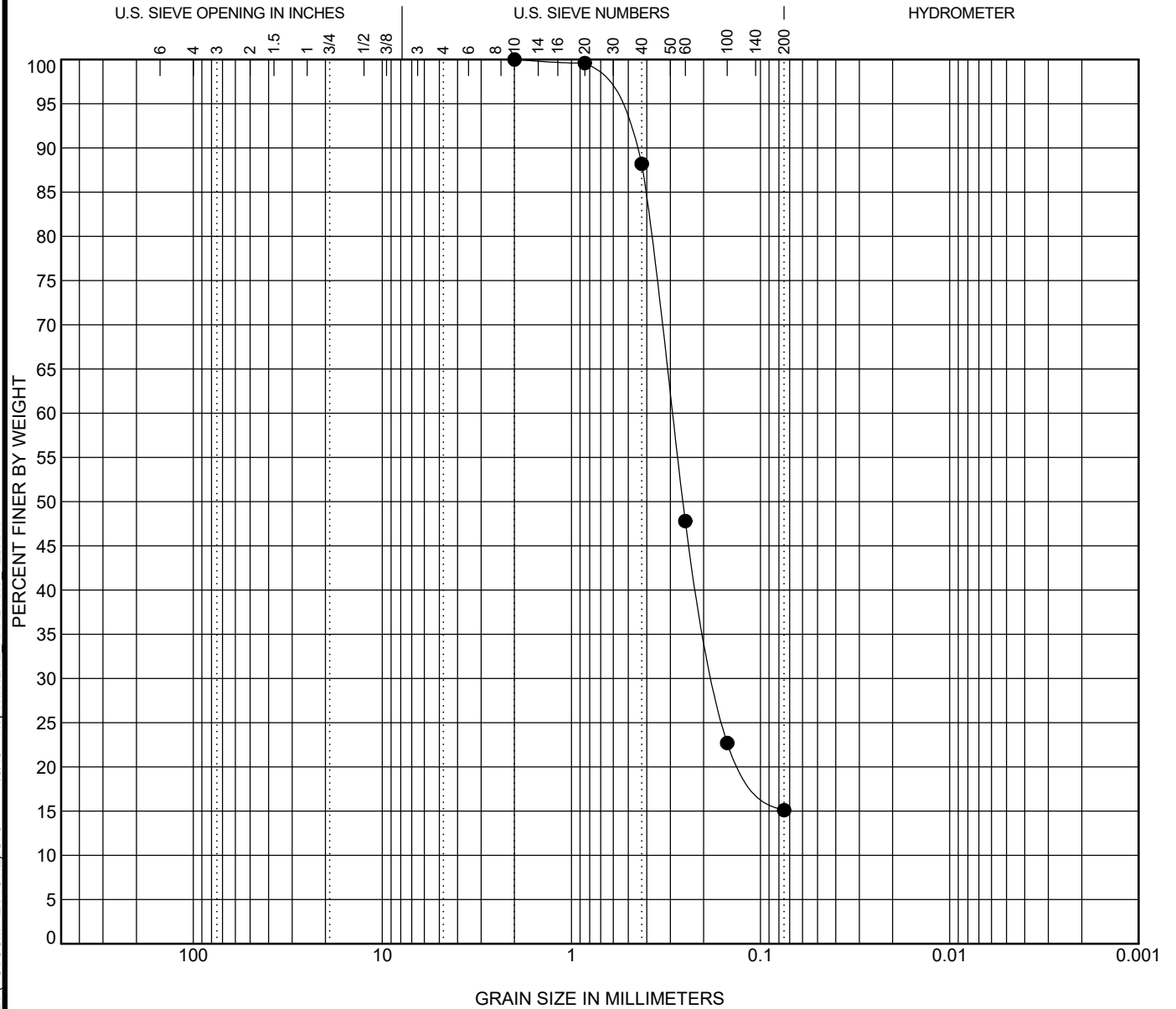
**Remarks:**

**BOWSER-MORNER, INC.**

Dayton, Ohio

# TTL LABORATORY REPORTS

# GRAIN SIZE DISTRIBUTION



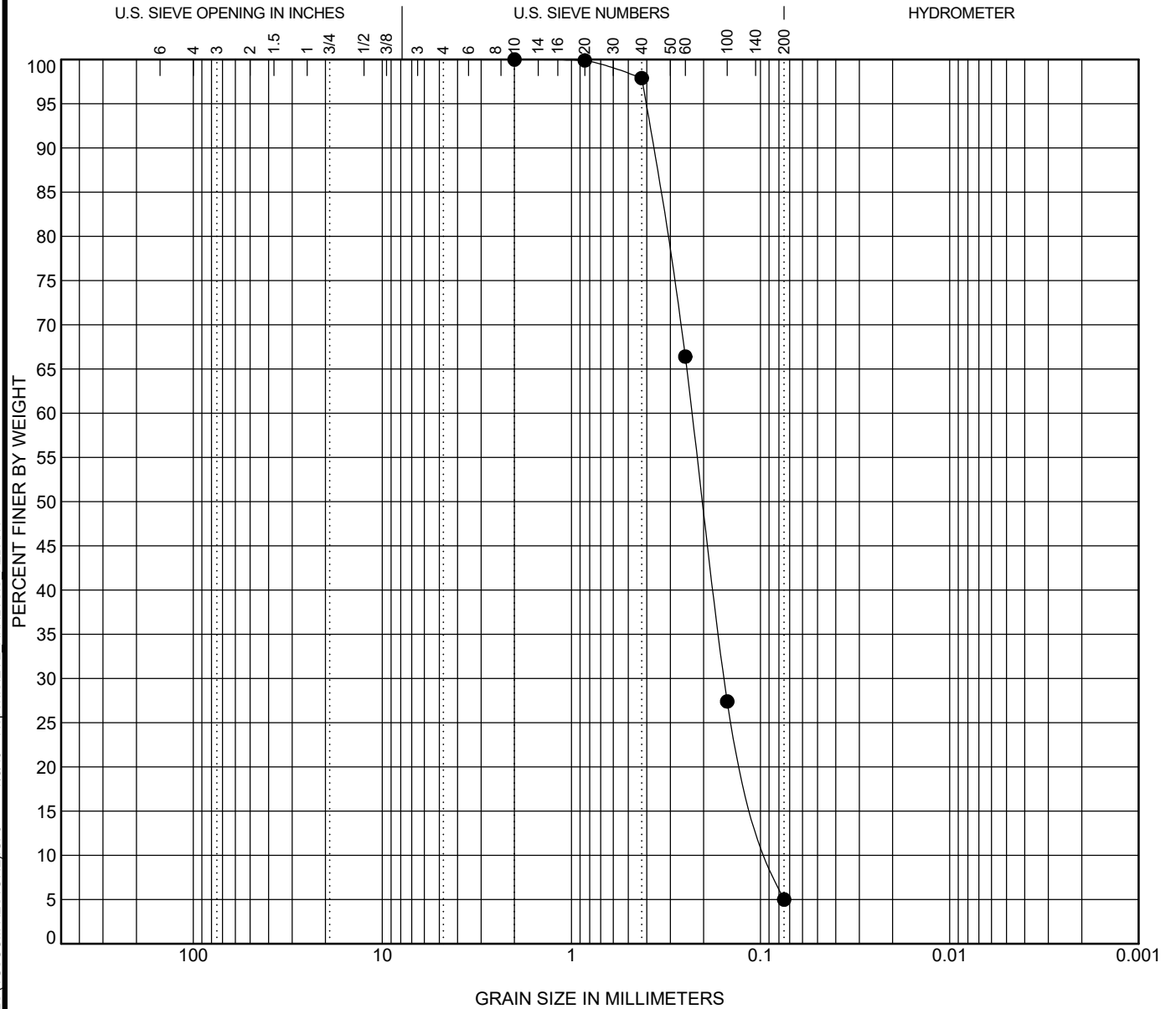
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ01S</b>													
Description	<b>6'-9'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ01S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.3	0.2		0.0	84.9	15.1		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

C:\WORK\TWIN PINES\GINT DATABASE EXCEL\FILE\GINT DUMMY\804-LOGS WITH WELLS (TUSCOM RESTORE).GPJ 7/8/19 Report: SIEVE ANALYSIS - ALBANY

# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

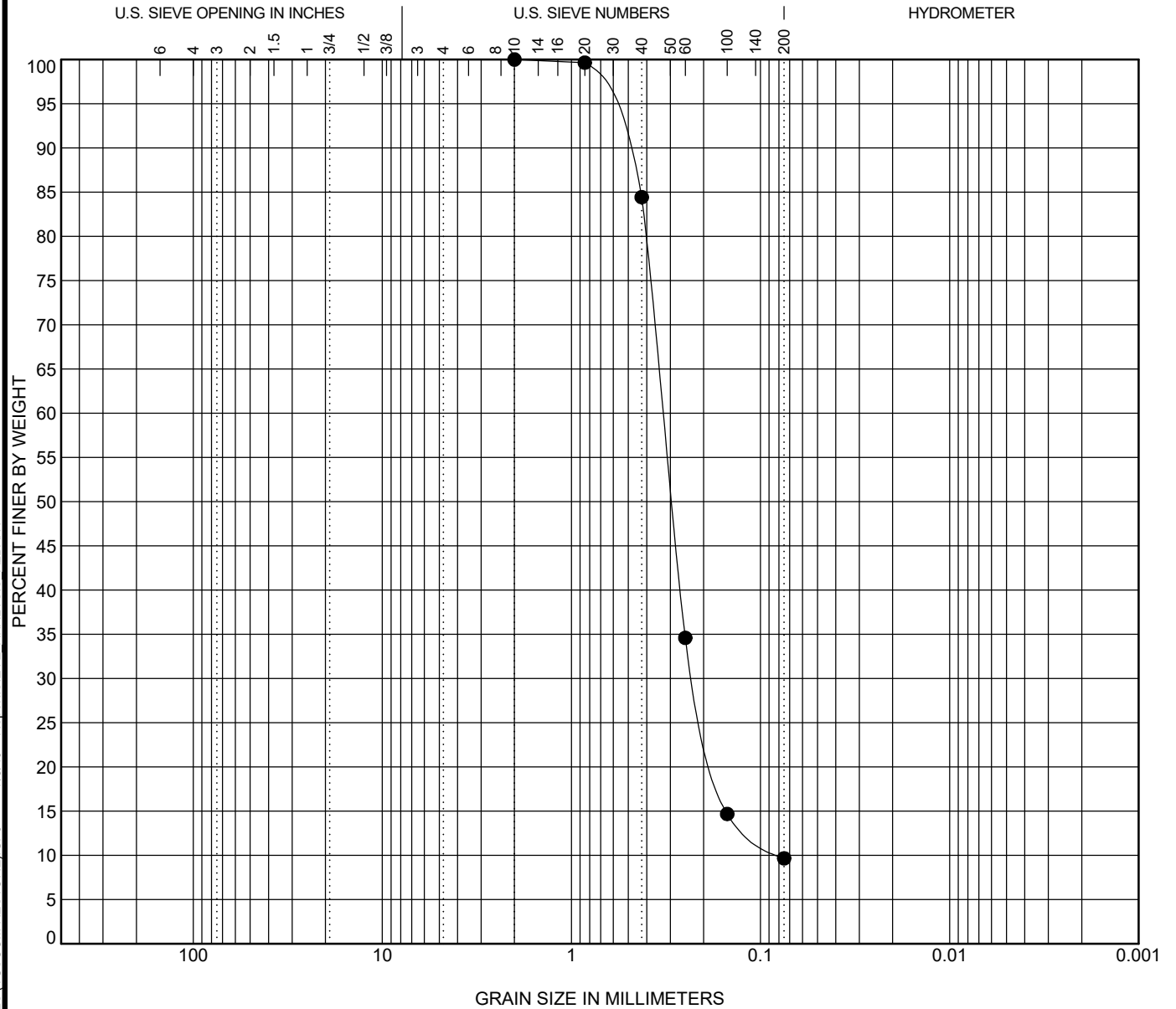
Sample ID	<b>PZ01S</b>													
Description	<b>12.5'-20.0'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ01S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.20</b>	<b>2.63</b>	<b>2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>95.0</b>	<b>5.0</b>		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	<p>Client: Twin Pines Minerals Saunders-Loncala Reserve</p> <p>Location: Saint George, Georgia</p> <p>Project Number: 000180200804.00</p>

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# GRAIN SIZE DISTRIBUTION



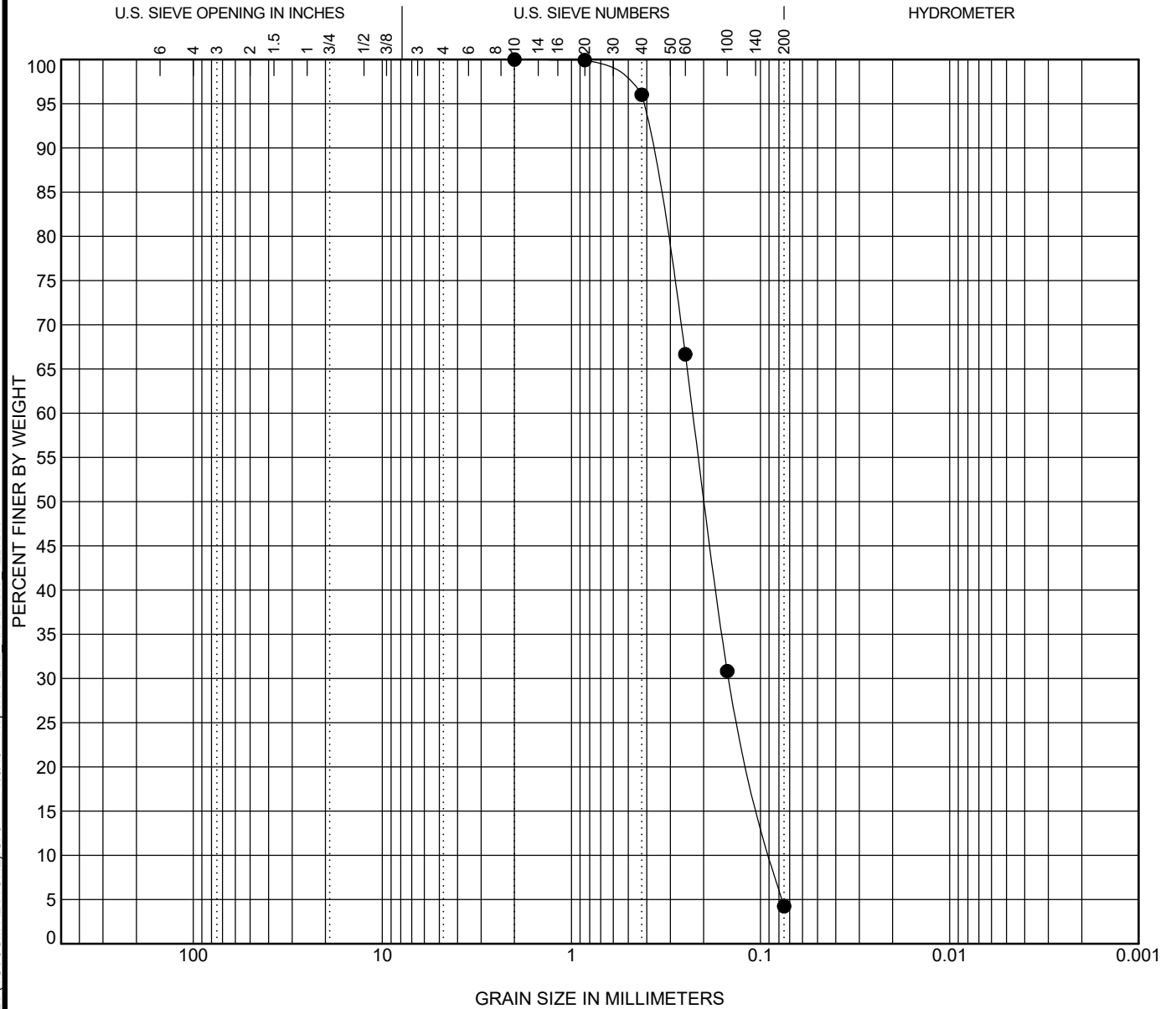
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ02</b>													
Description	<b>4'-10'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ02</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.92</b>	<b>4.17</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>90.3</b>	<b>9.7</b>		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



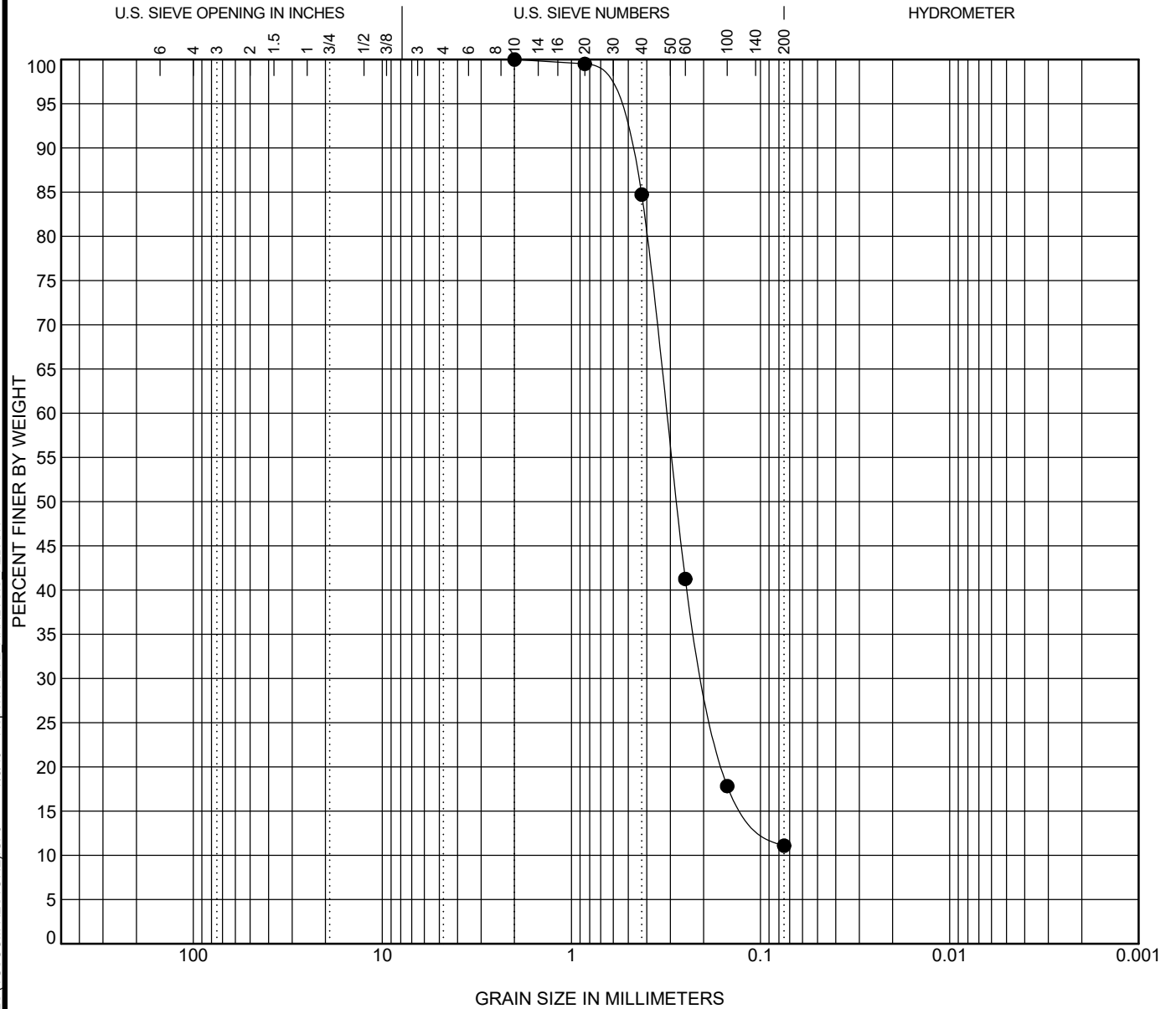
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ02</b>													
Description	<b>17.5'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ02</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.09</b>	<b>2.61</b>	<b>2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.1</b>	<b>0.0</b>	<b>95.8</b>	<b>4.2</b>		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



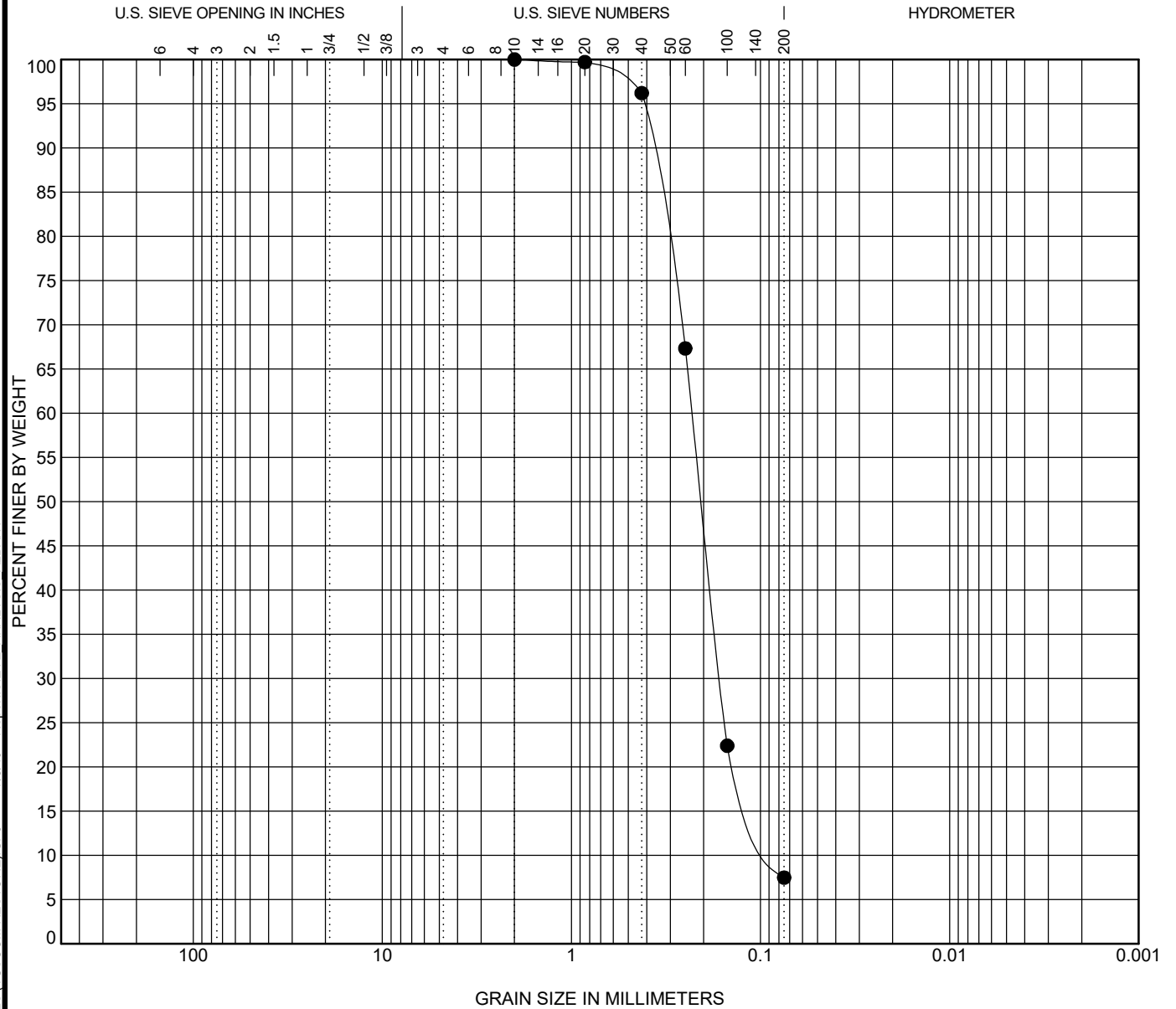
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ03S</b>													
Description	<b>3'-7'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ03S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.82</b>	<b>4.69</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>		<b>0.0</b>	<b>88.9</b>	<b>11.1</b>		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



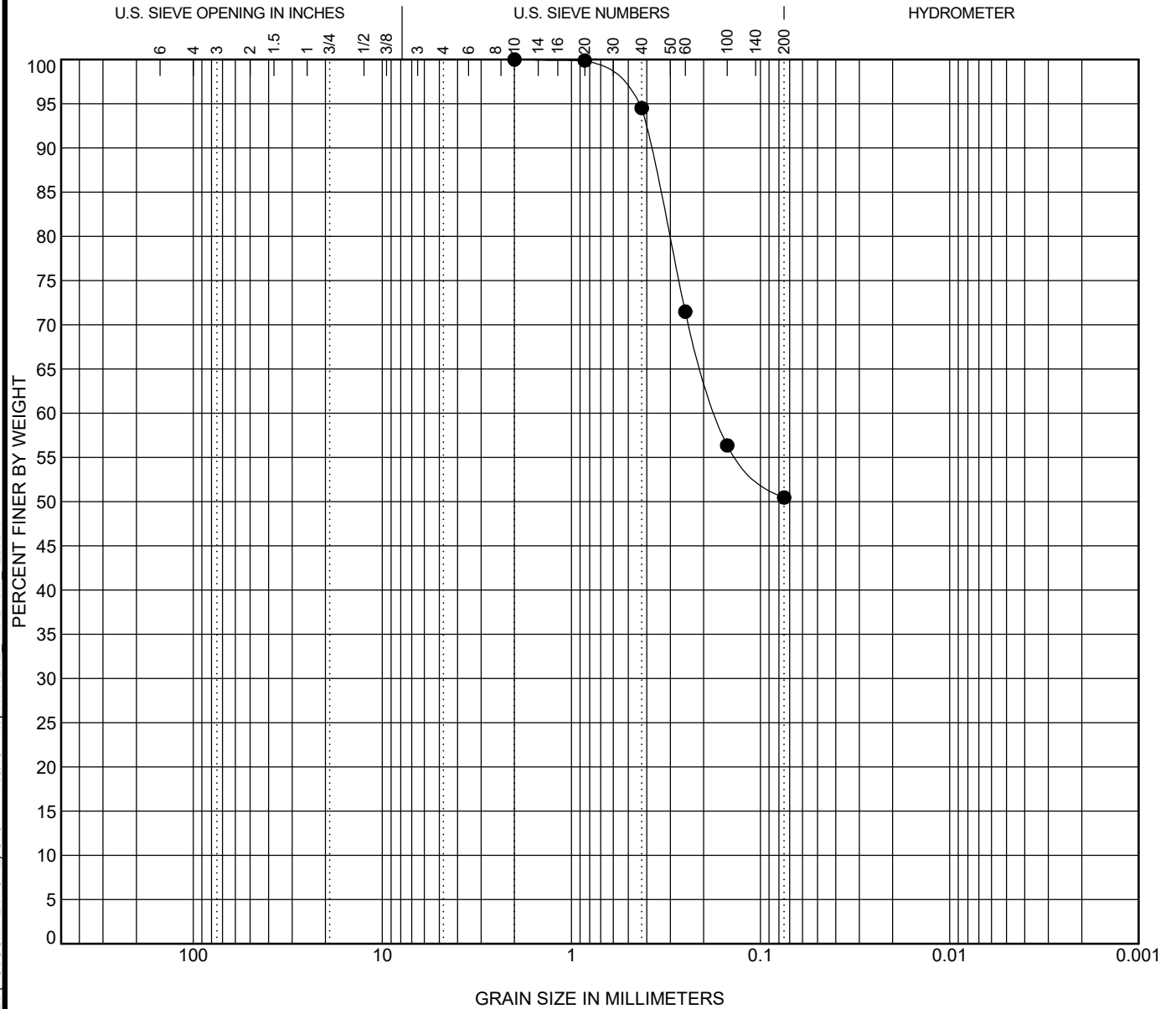
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ03S</b>													
Description	<b>18'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ03S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.38</b>	<b>2.73</b>	<b>2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>92.5</b>	<b>7.5</b>		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



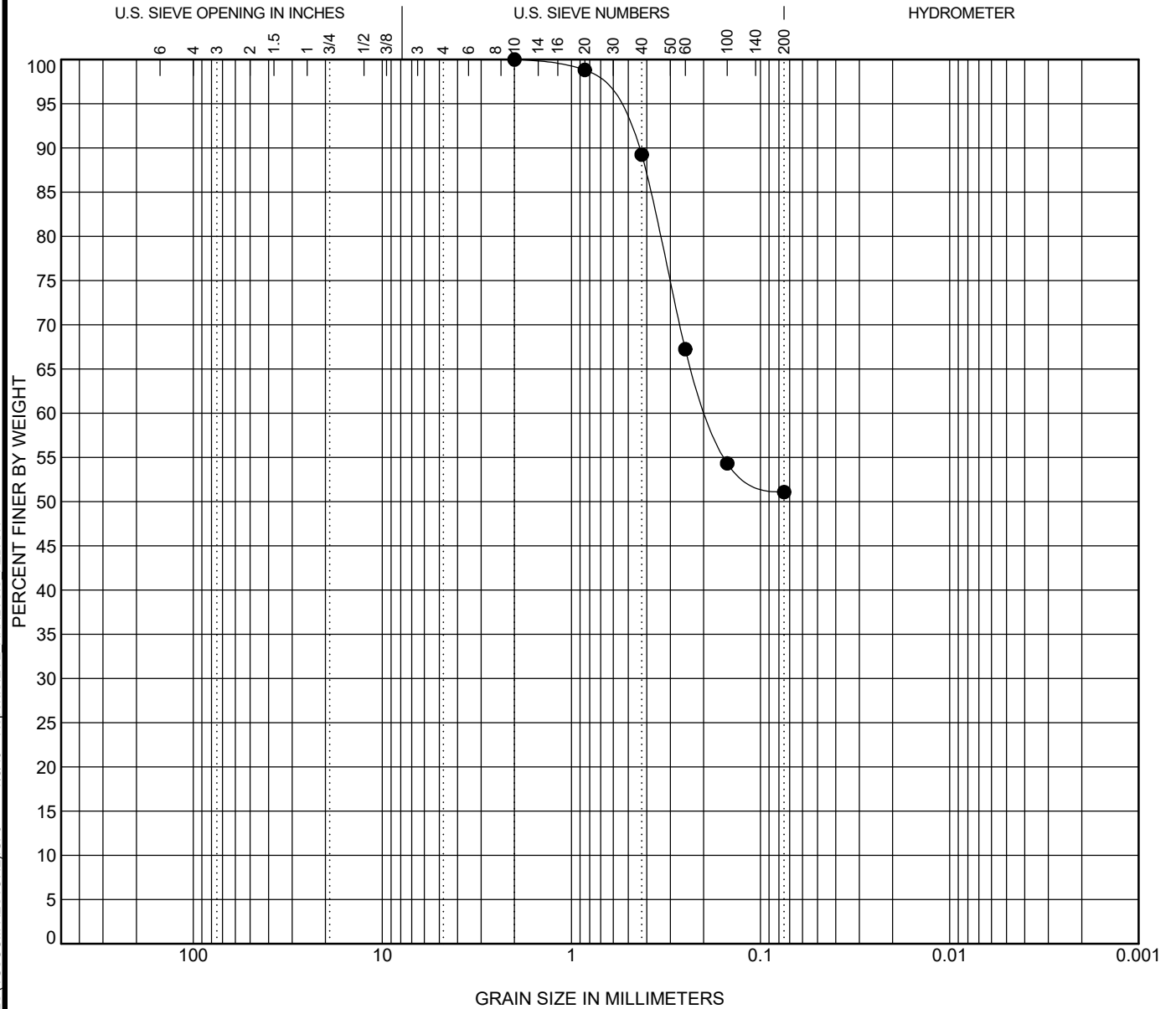
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ03D</b>													
Description	<b>7'-12'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ03D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	49.5	50.5		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



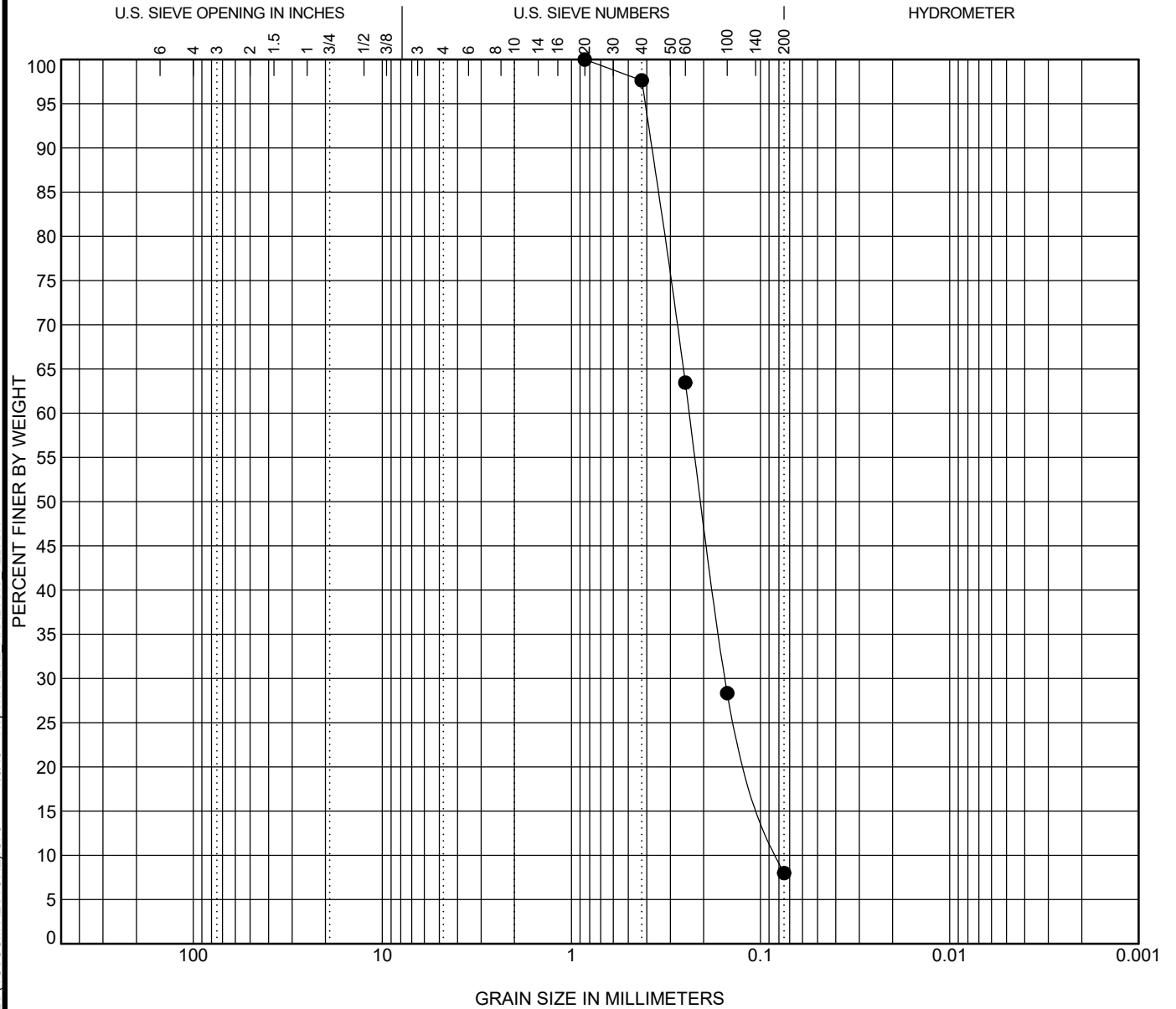
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ03D													
Description	36'-50'													
Sampled by:	TTL													
Sample Location:	PZ03D													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.9	51.1		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve Location: Saint George, Georgia Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



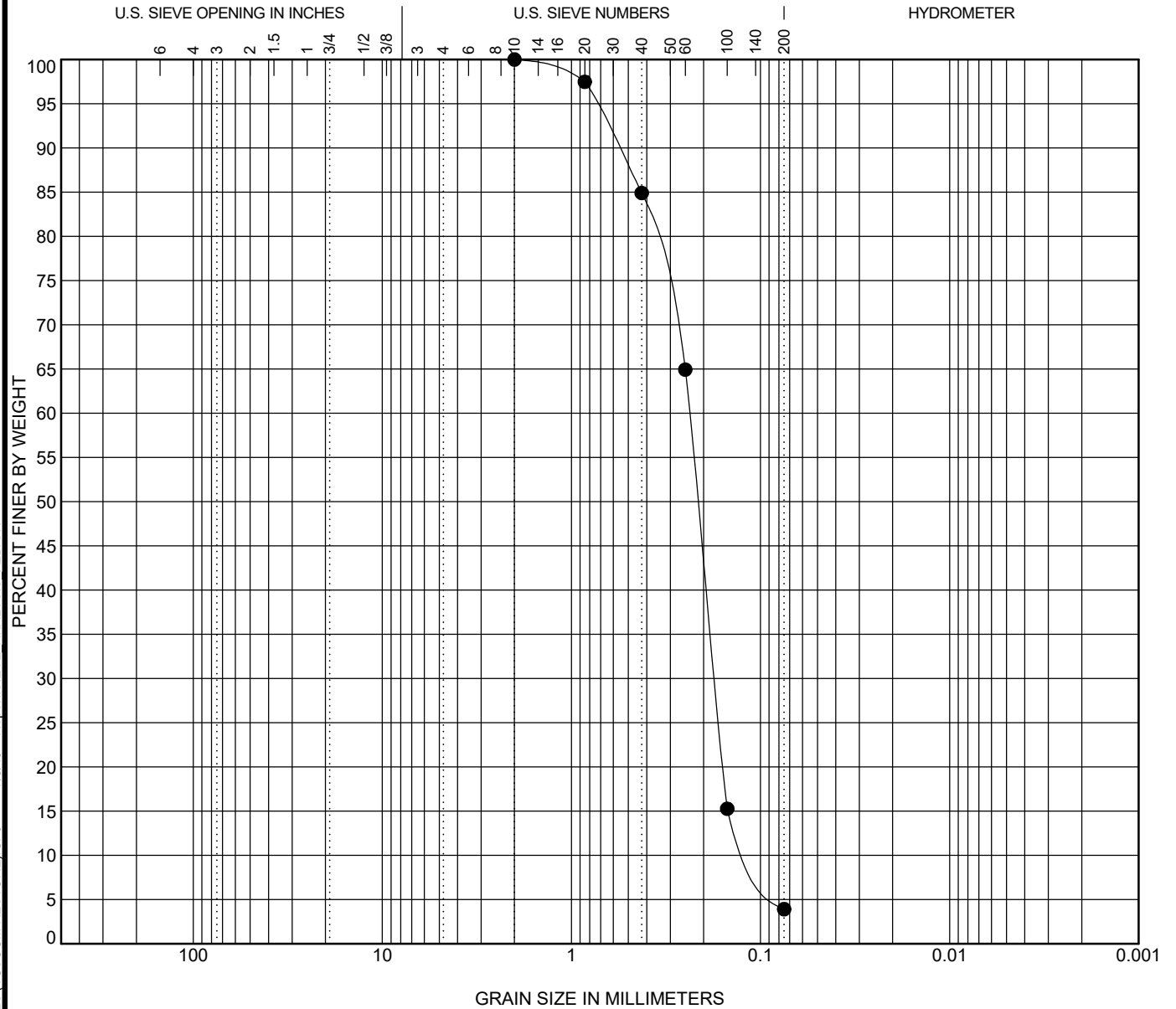
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ04</b>												
Description	<b>6'-11'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ04</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.24	2.96	0.9	0.2	0.2	0.1	0.0	92.0	8.0	

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

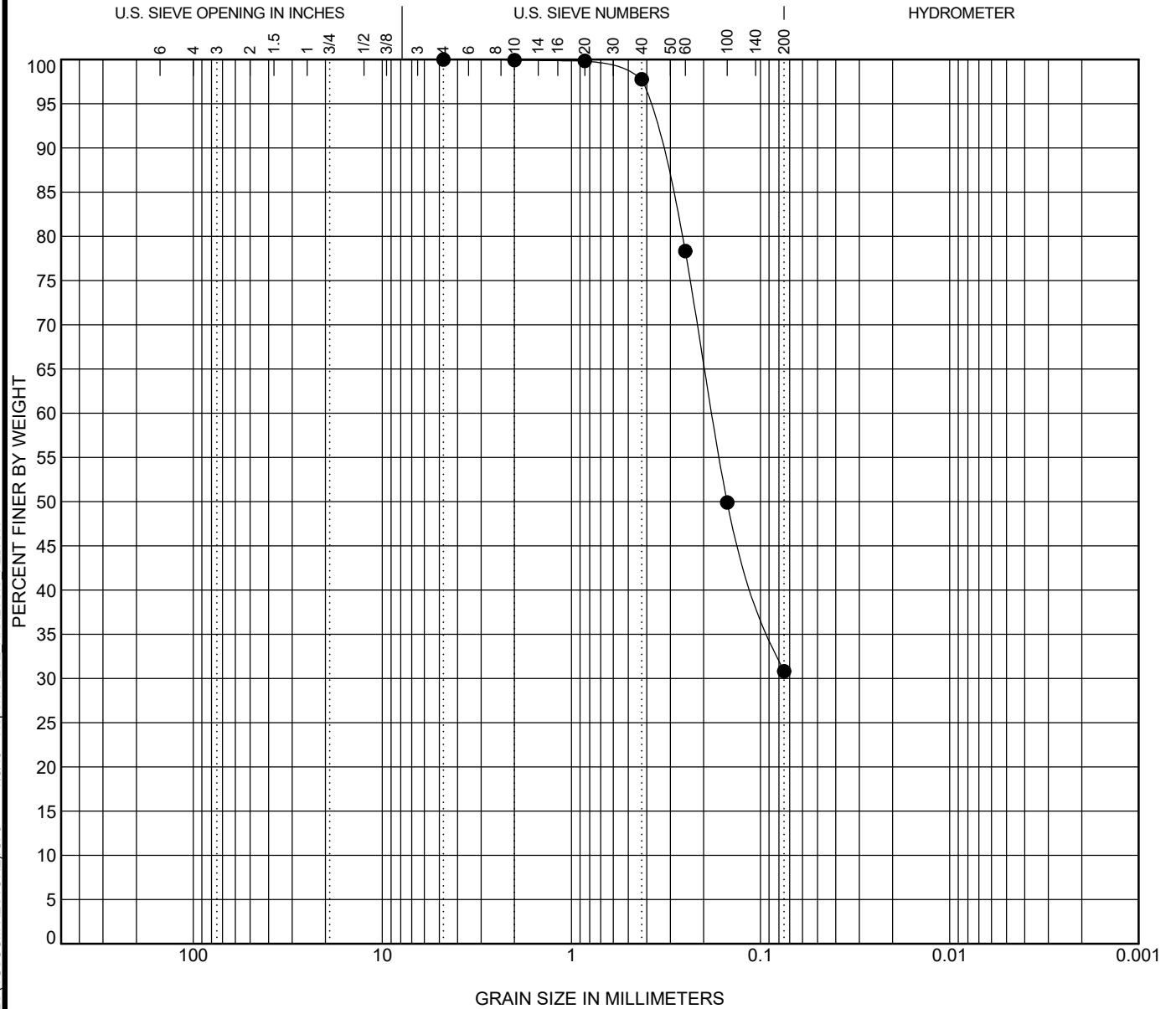
Sample ID	<b>PZ04</b>												
Description	<b>15'-20'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ04</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				<b>1.18</b>	<b>2.18</b>	<b>2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>96.1</b>	<b>3.9</b>	

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



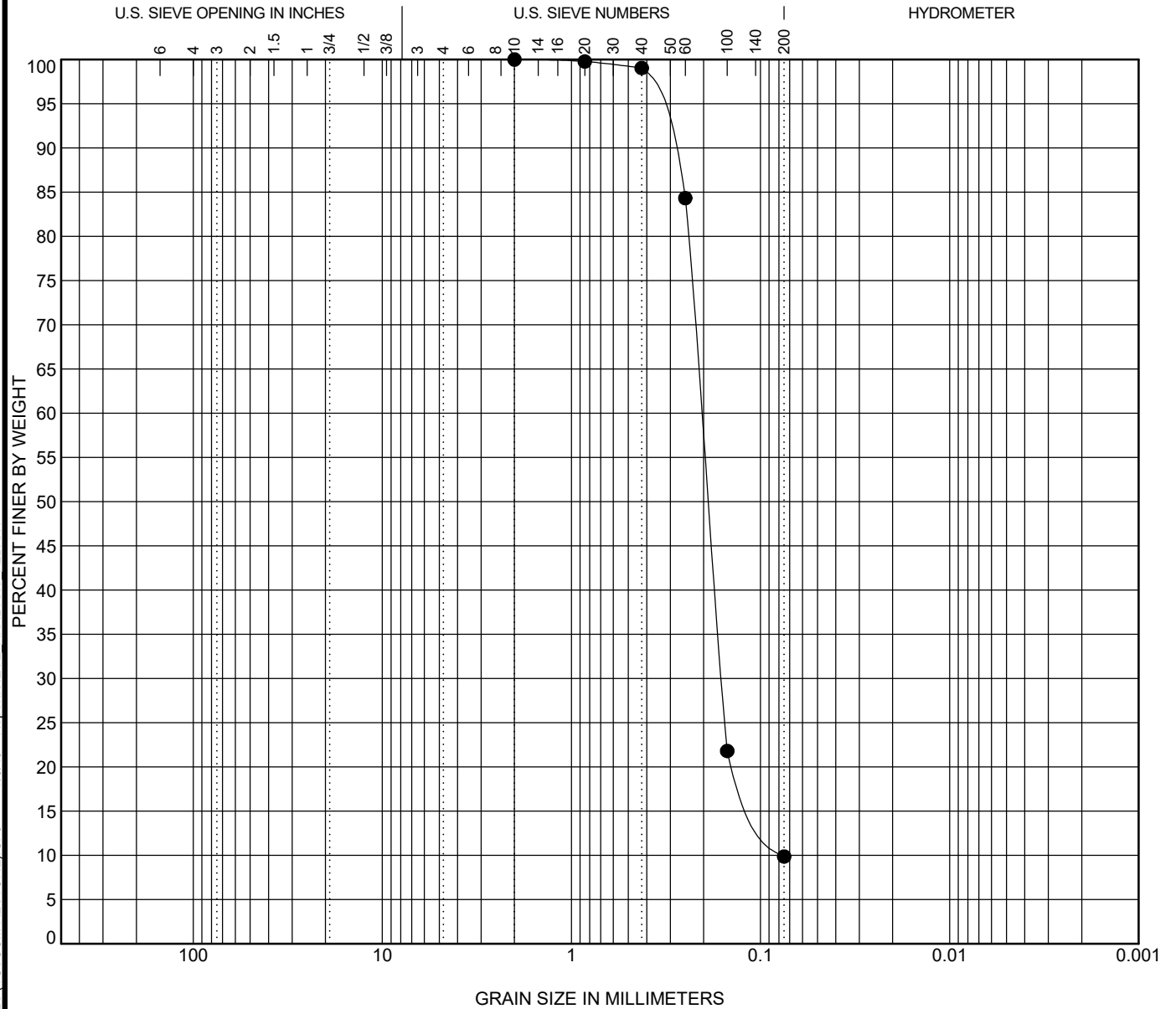
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ05</b>													
Description	<b>5'-11'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ05</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						4.8	0.2			0.0	69.2	30.8		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client: Project: Twin Pines Minerals Saunders-Loncala Reserve Location: Saint George, Georgia Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



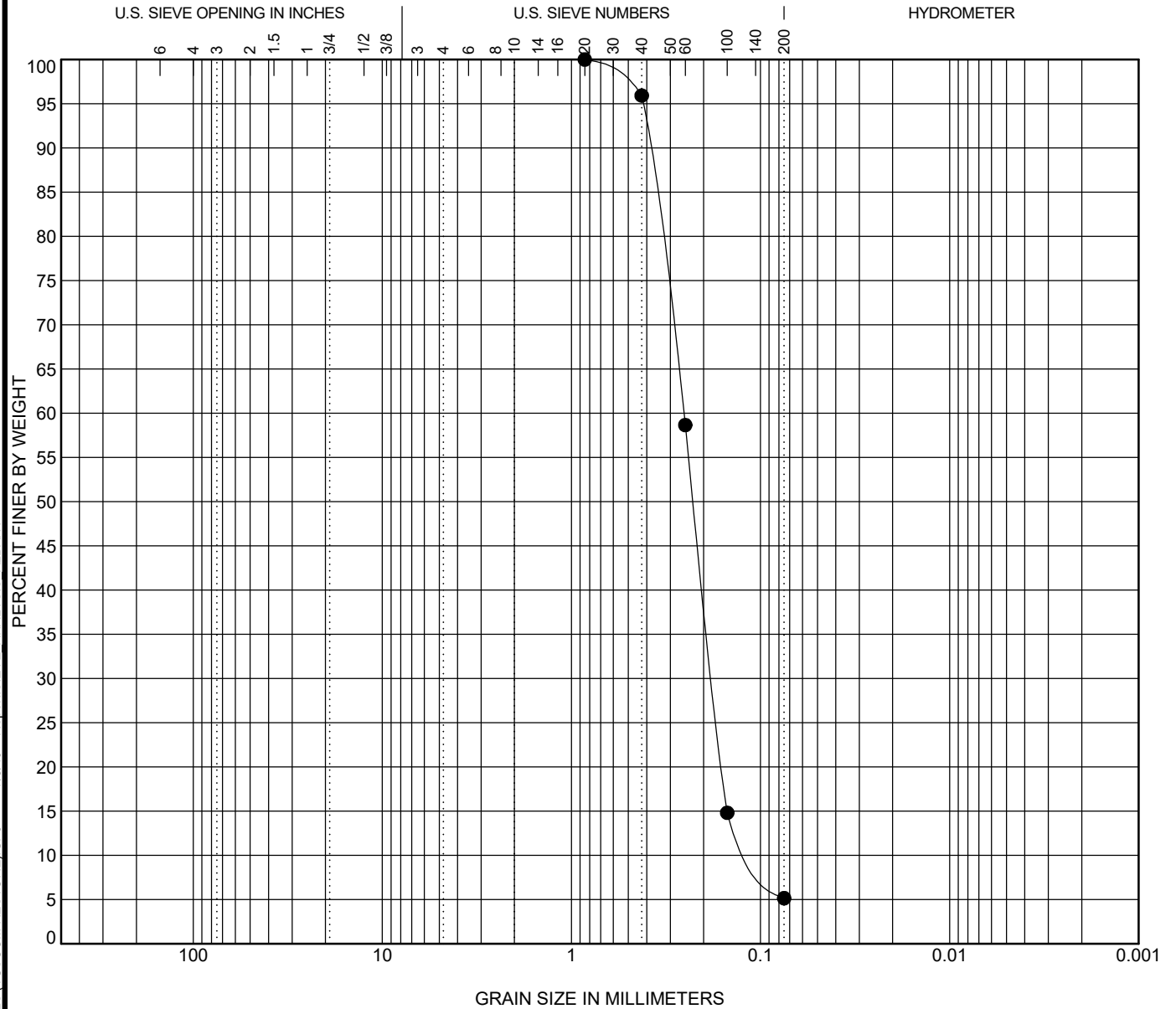
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ05</b>													
Description	<b>15'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ05</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.66</b>	<b>2.71</b>	<b>2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>90.1</b>	<b>9.9</b>		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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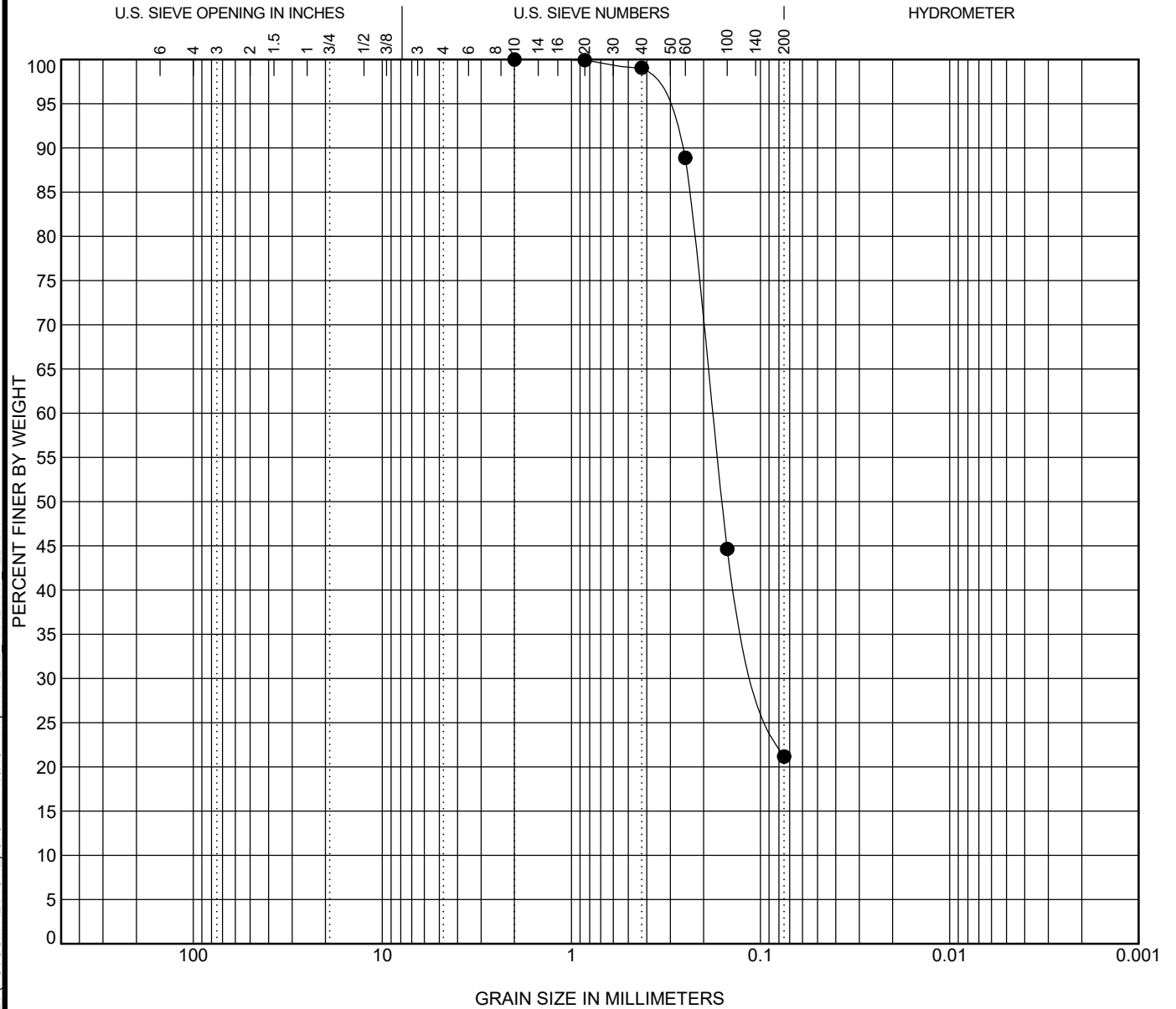
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ06</b>													
Description	<b>7.5'-8'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ06</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.18</b>	<b>2.40</b>	<b>0.9</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>94.8</b>	<b>5.2</b>		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



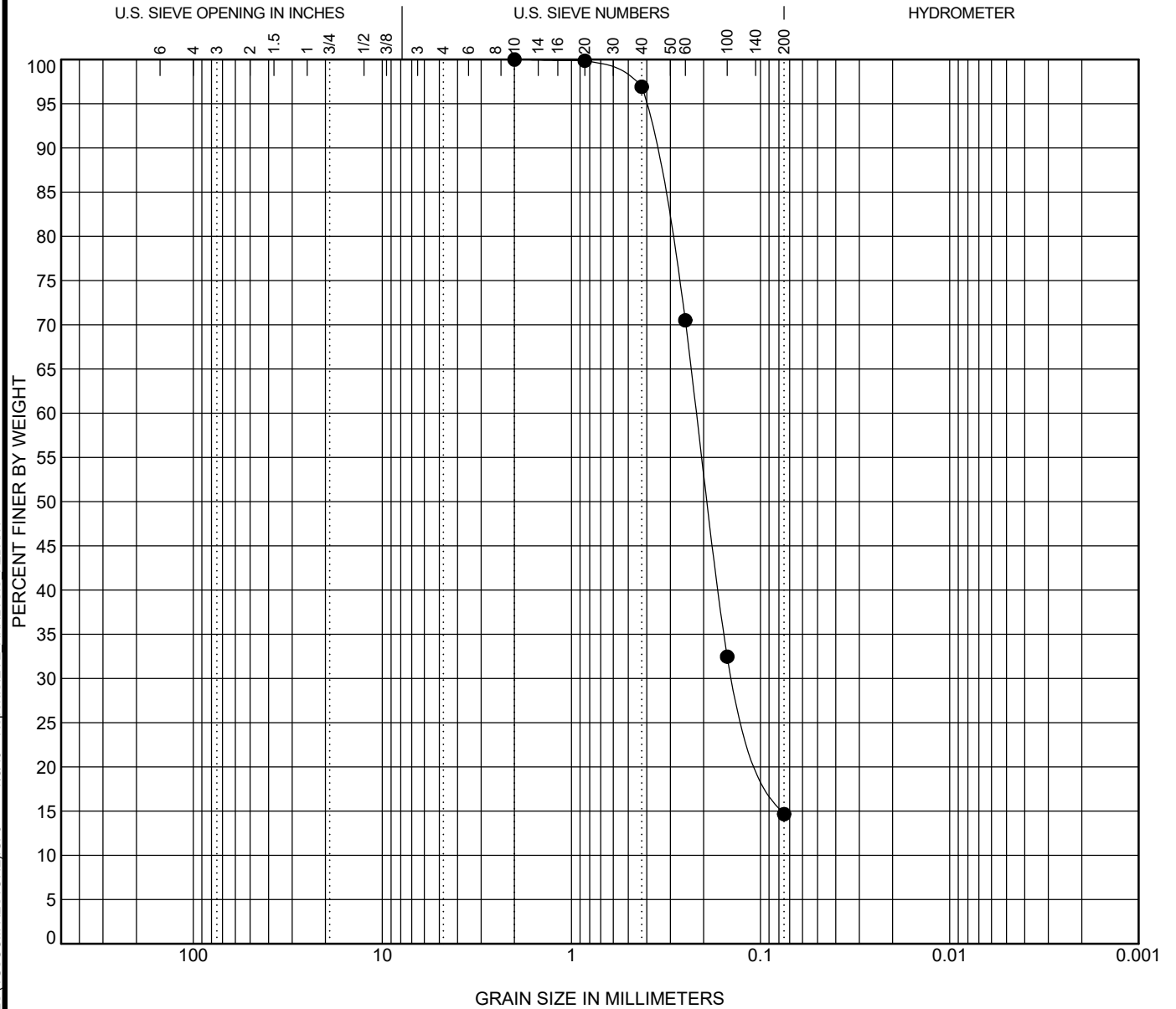
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ06</b>													
Description	<b>14'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ06</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2	0.1		0.0	78.8	21.2		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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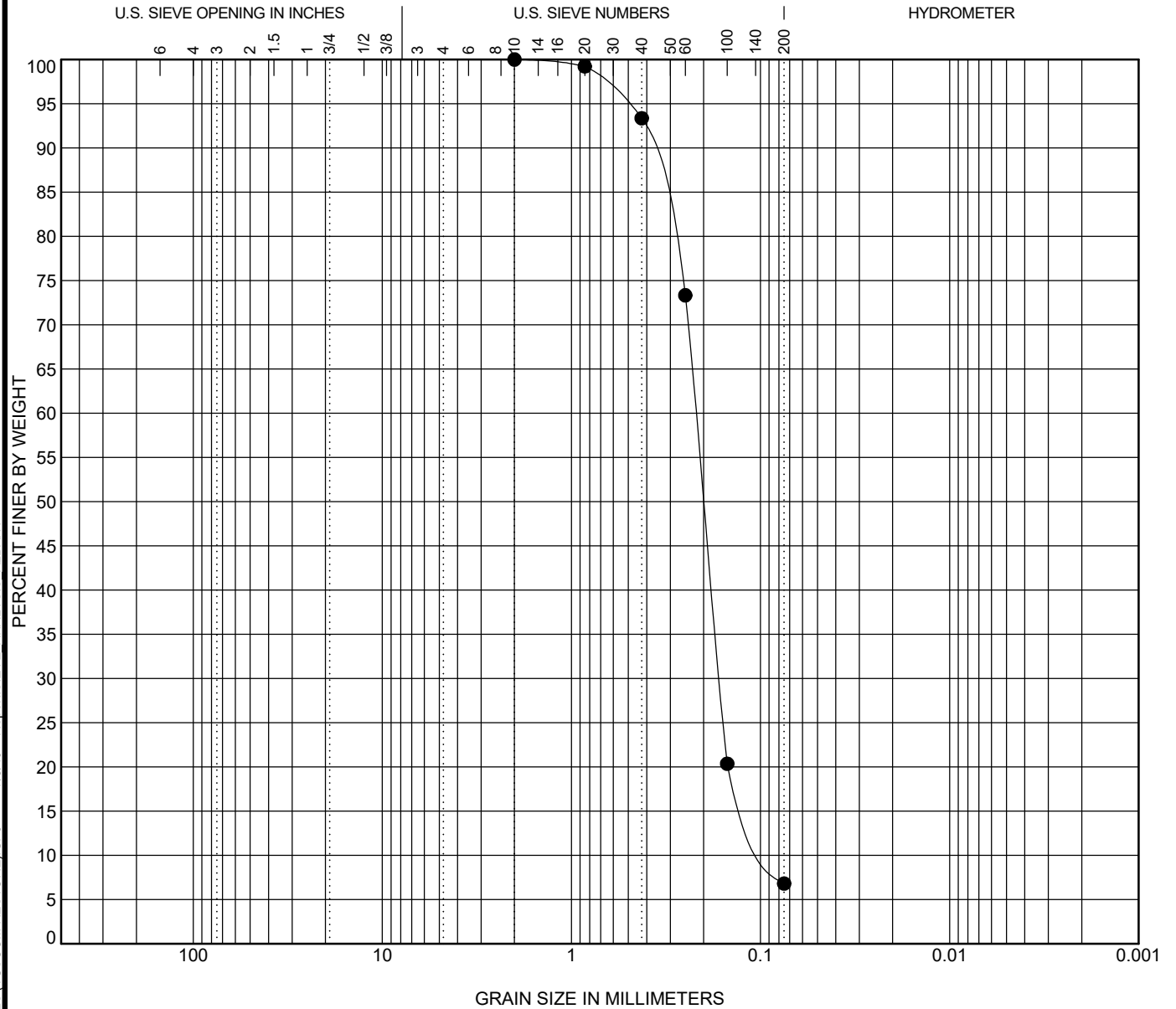
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ07</b>													
Description	<b>5'-7'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ07</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2	0.1		0.0	85.3	14.7		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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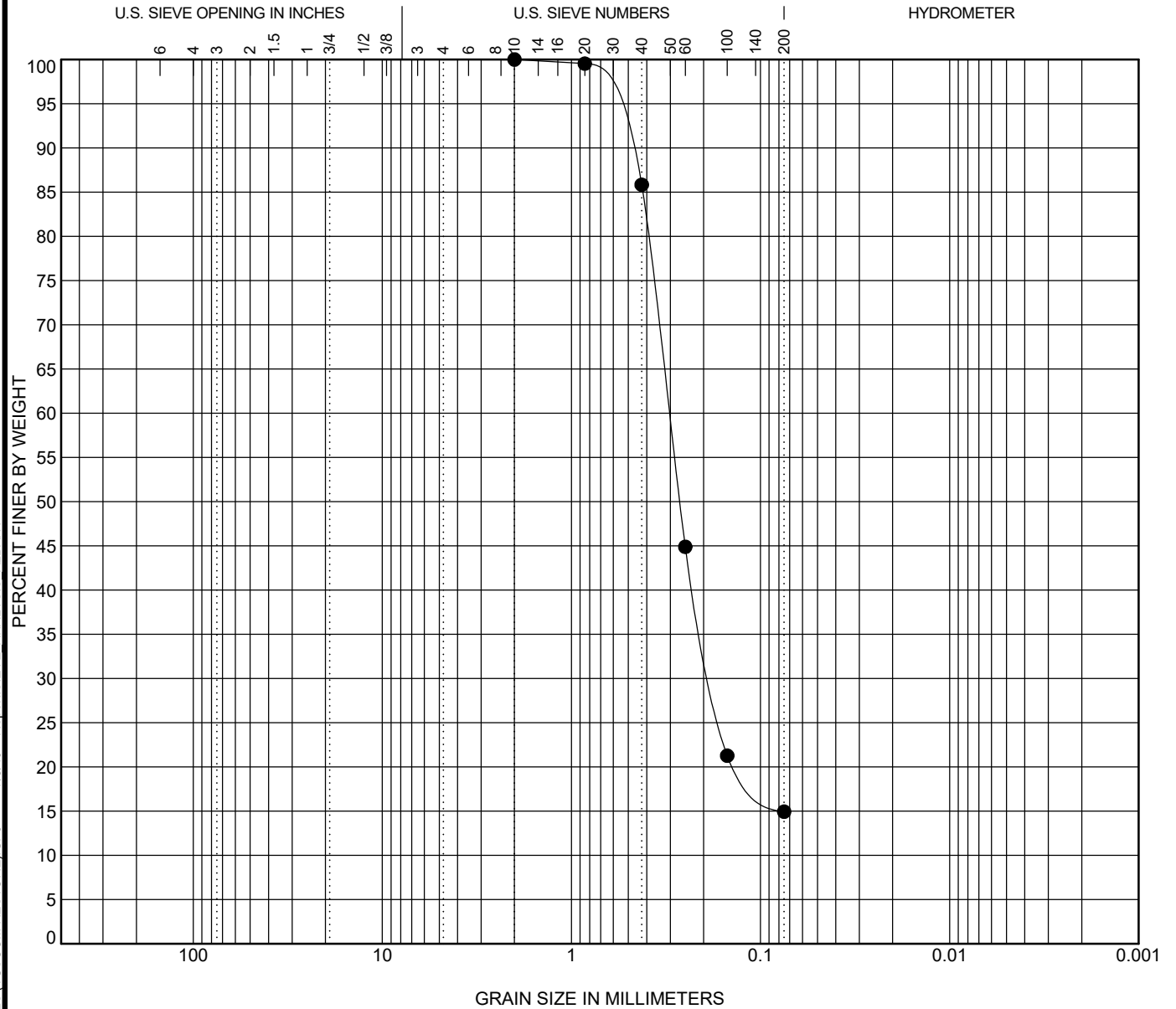
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ07</b>													
Description	<b>9'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ07</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.40</b>	<b>2.49</b>	<b>2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>93.2</b>	<b>6.8</b>		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



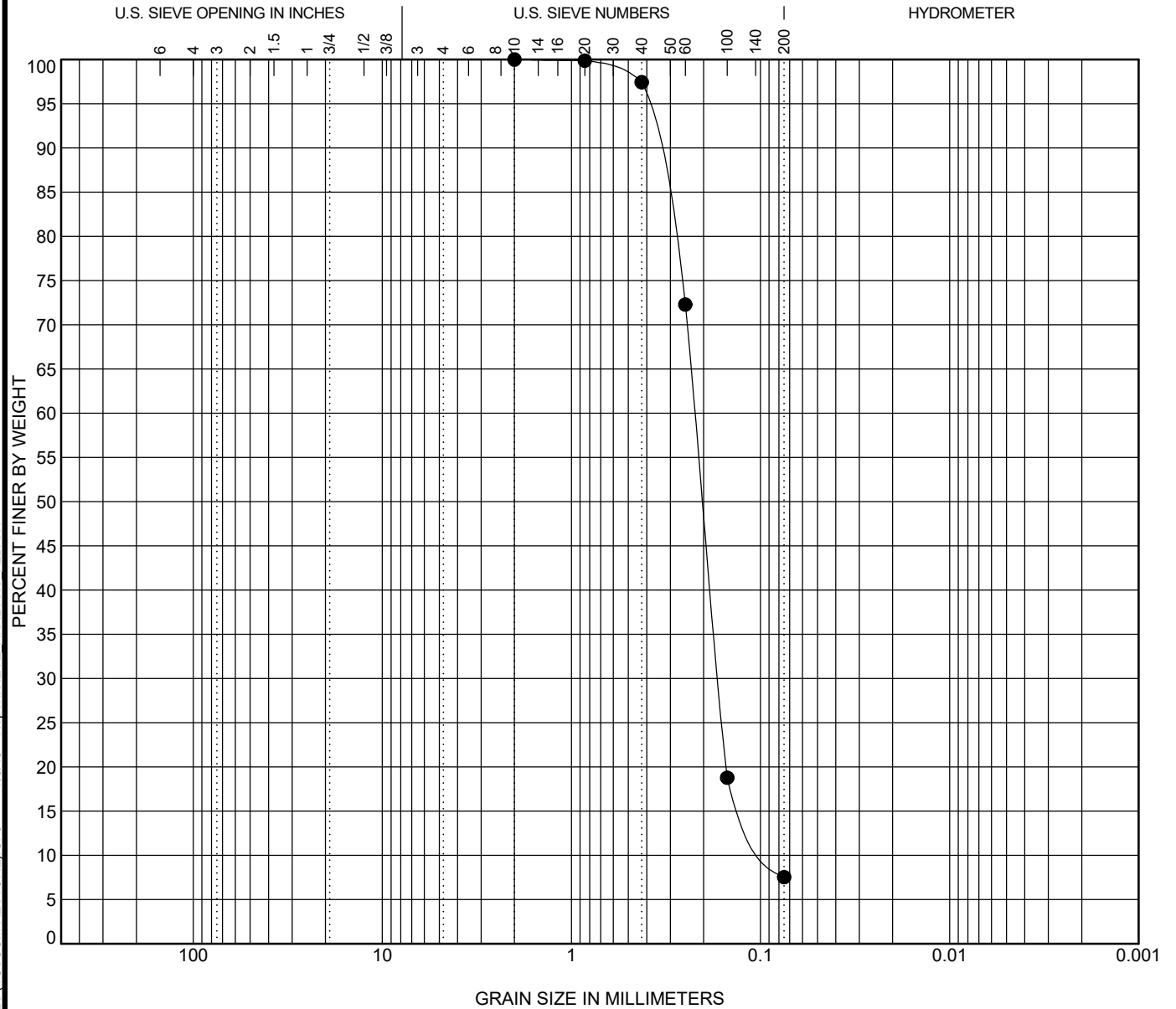
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ08</b>													
Description	<b>5'-6.5'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ08</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.3	0.2		0.0	85.1	14.9		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



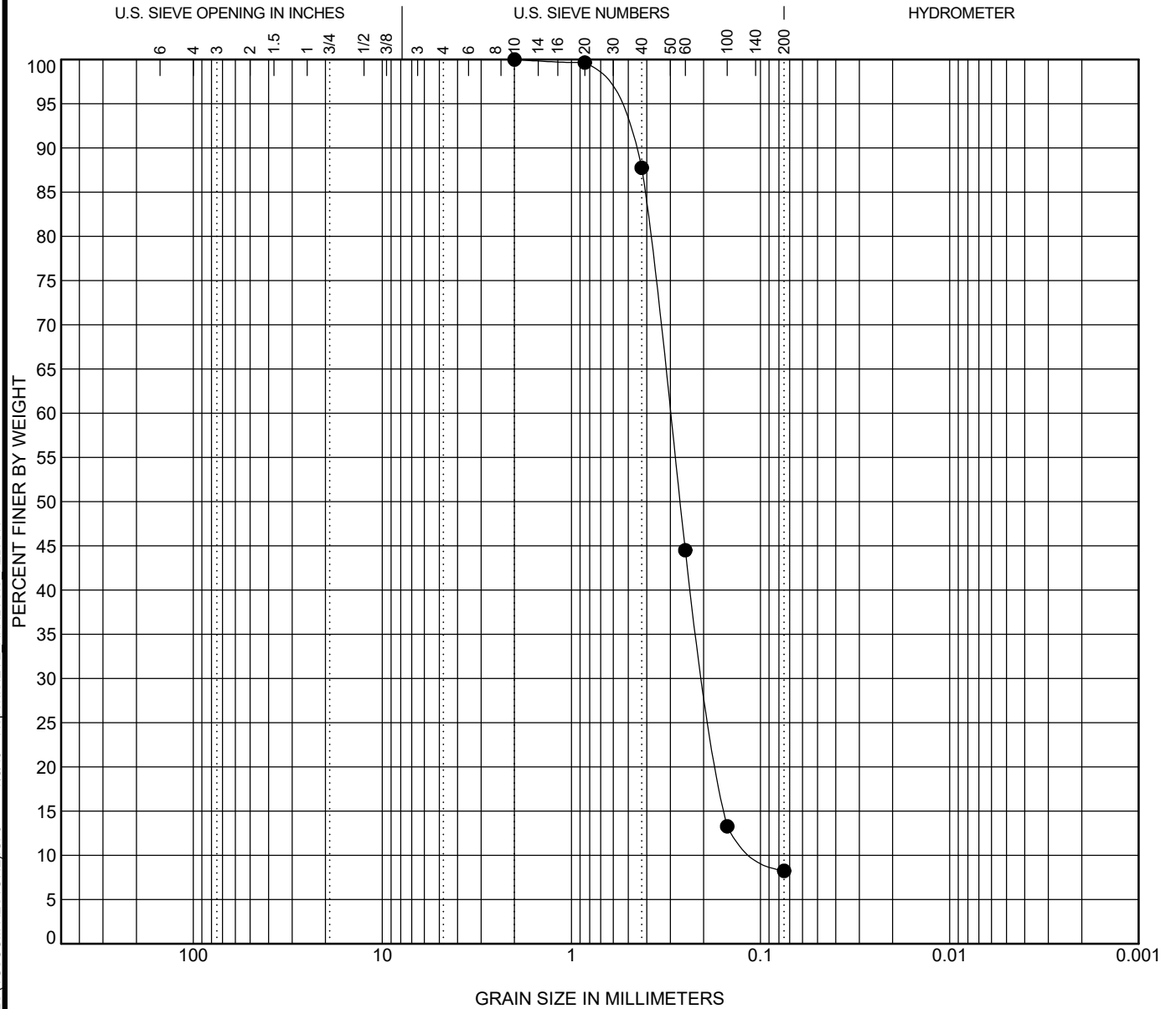
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ08</b>													
Description	<b>15'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ08</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.44	2.55	2	0.2	0.2	0.1	0.0	92.5	7.5		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00



# GRAIN SIZE DISTRIBUTION



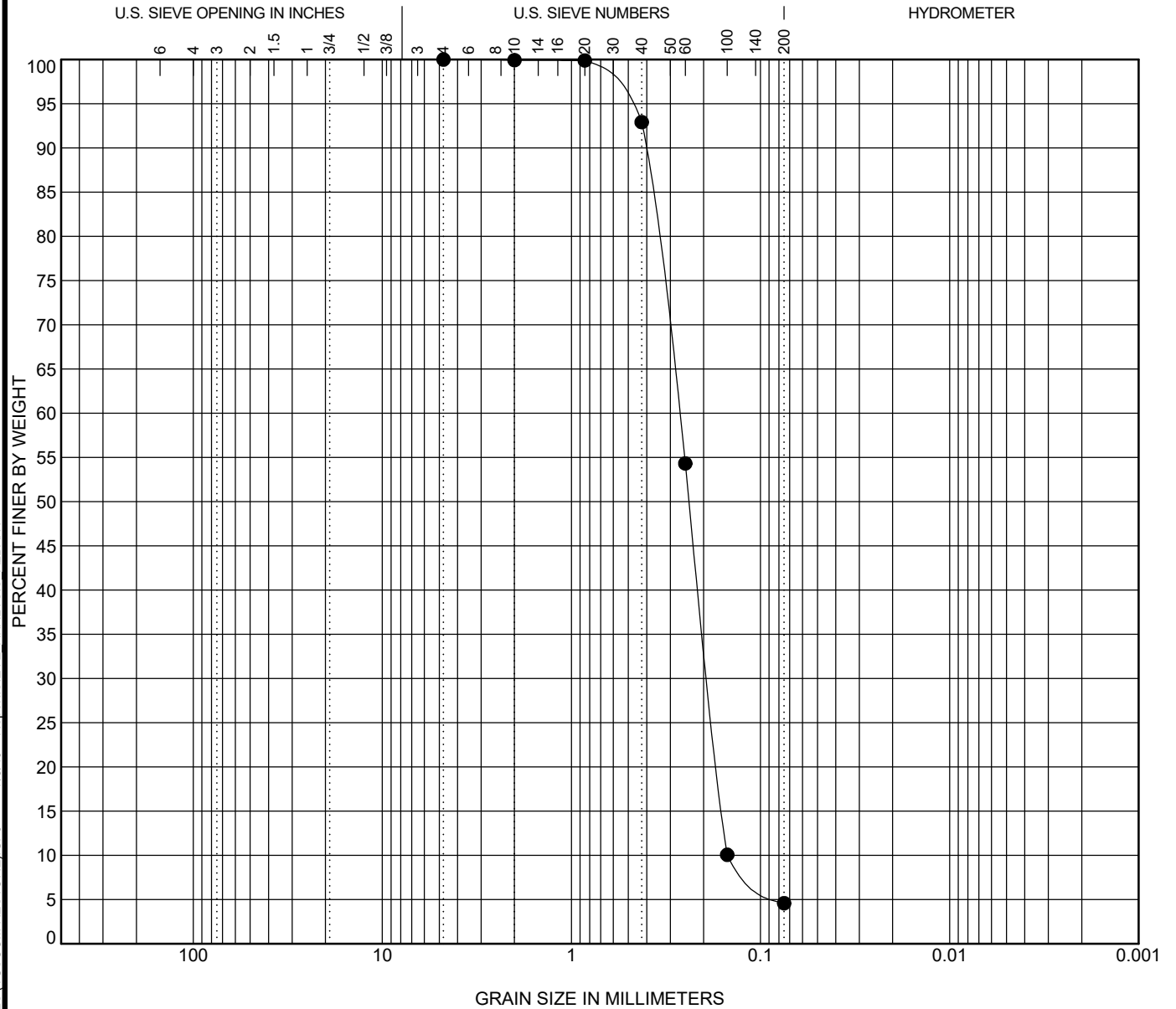
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ09</b>													
Description	<b>7'-10'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ09</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.35</b>	<b>3.16</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>91.8</b>	<b>8.2</b>		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



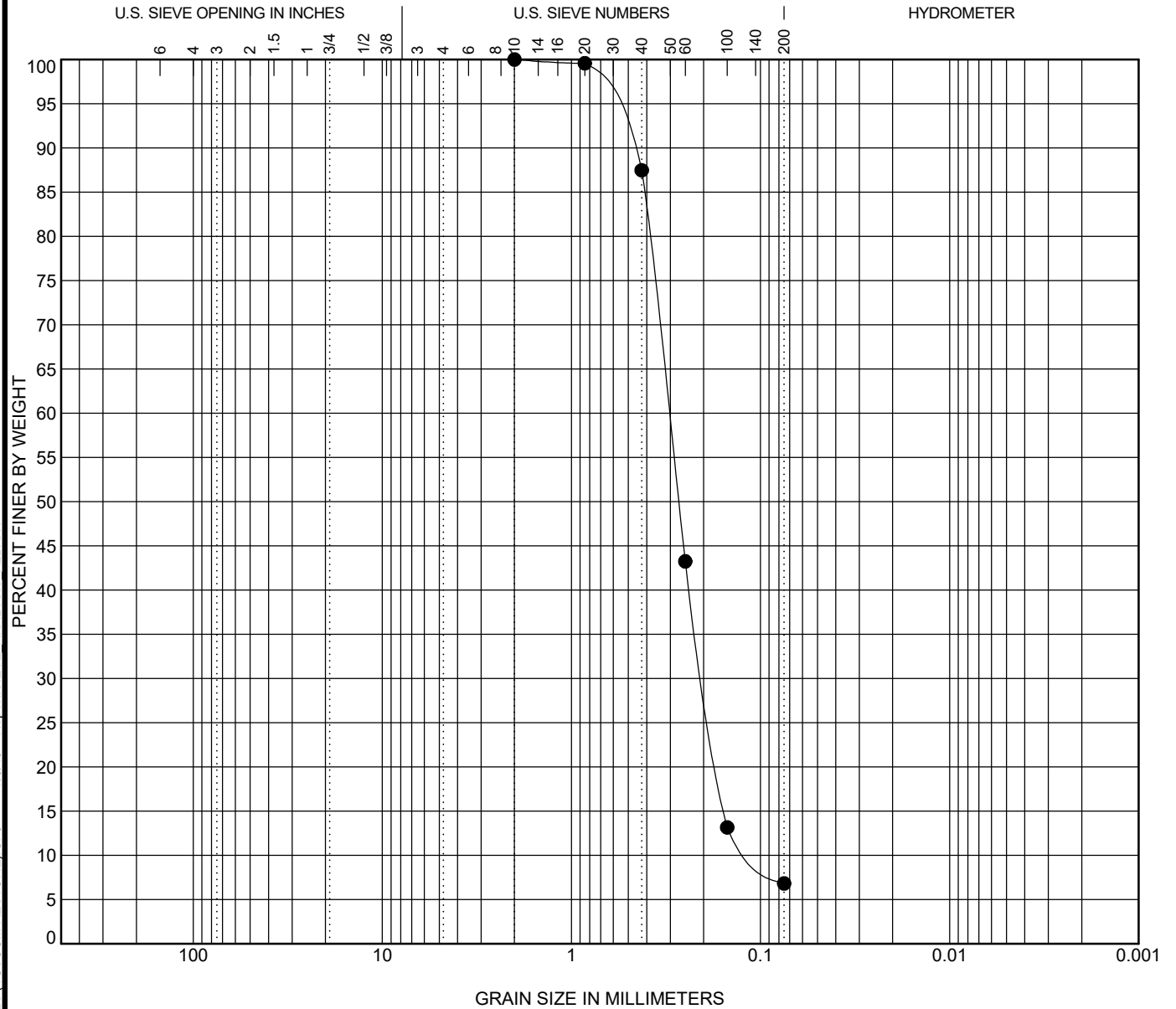
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ09</b>												
Description	<b>27'-30'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ09</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				<b>0.89</b>	<b>1.82</b>	<b>4.8</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>95.4</b>	<b>4.6</b>	

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



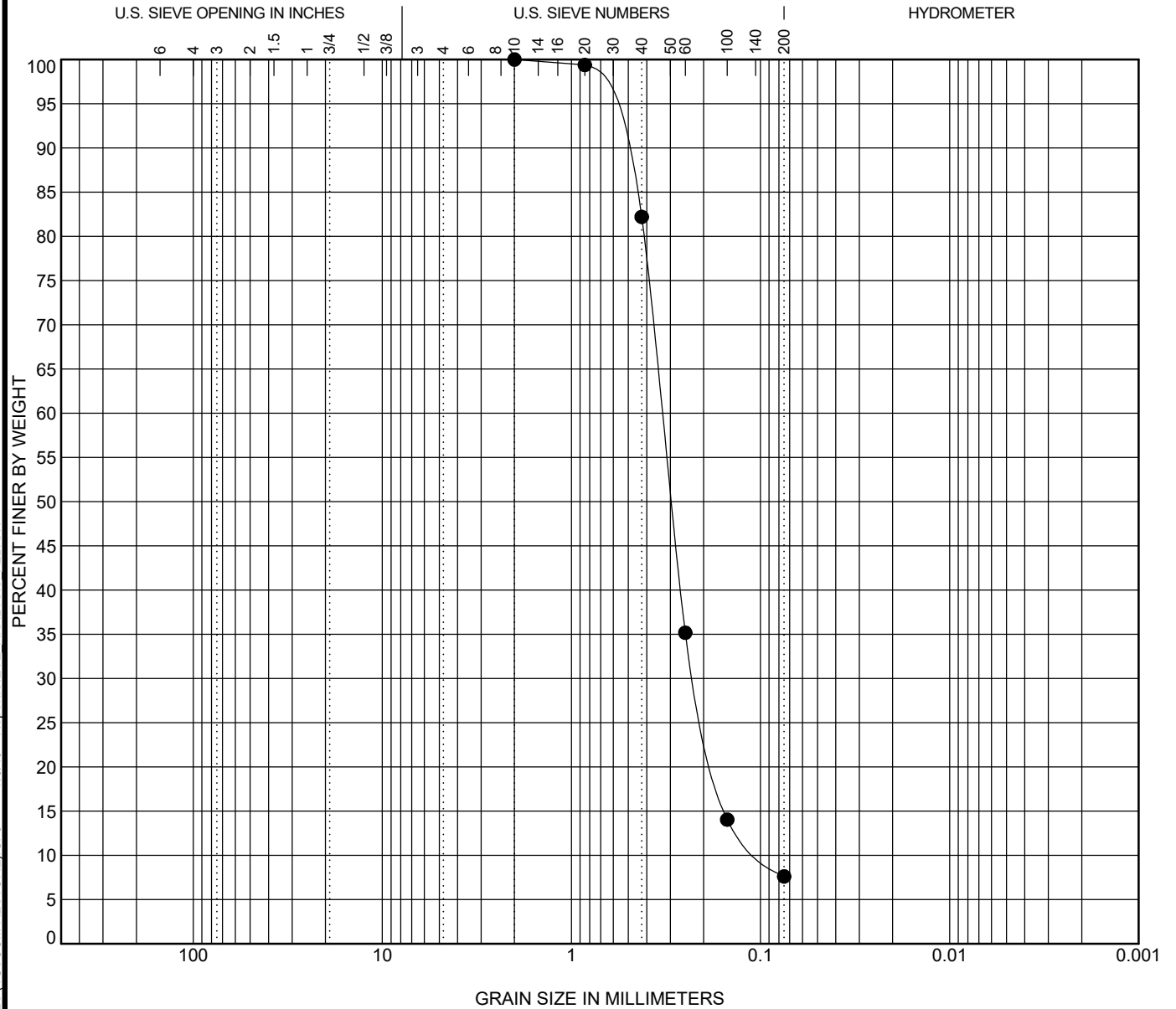
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ10</b>													
Description	<b>5'-8'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ10</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.23</b>	<b>2.88</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>93.2</b>	<b>6.8</b>		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION

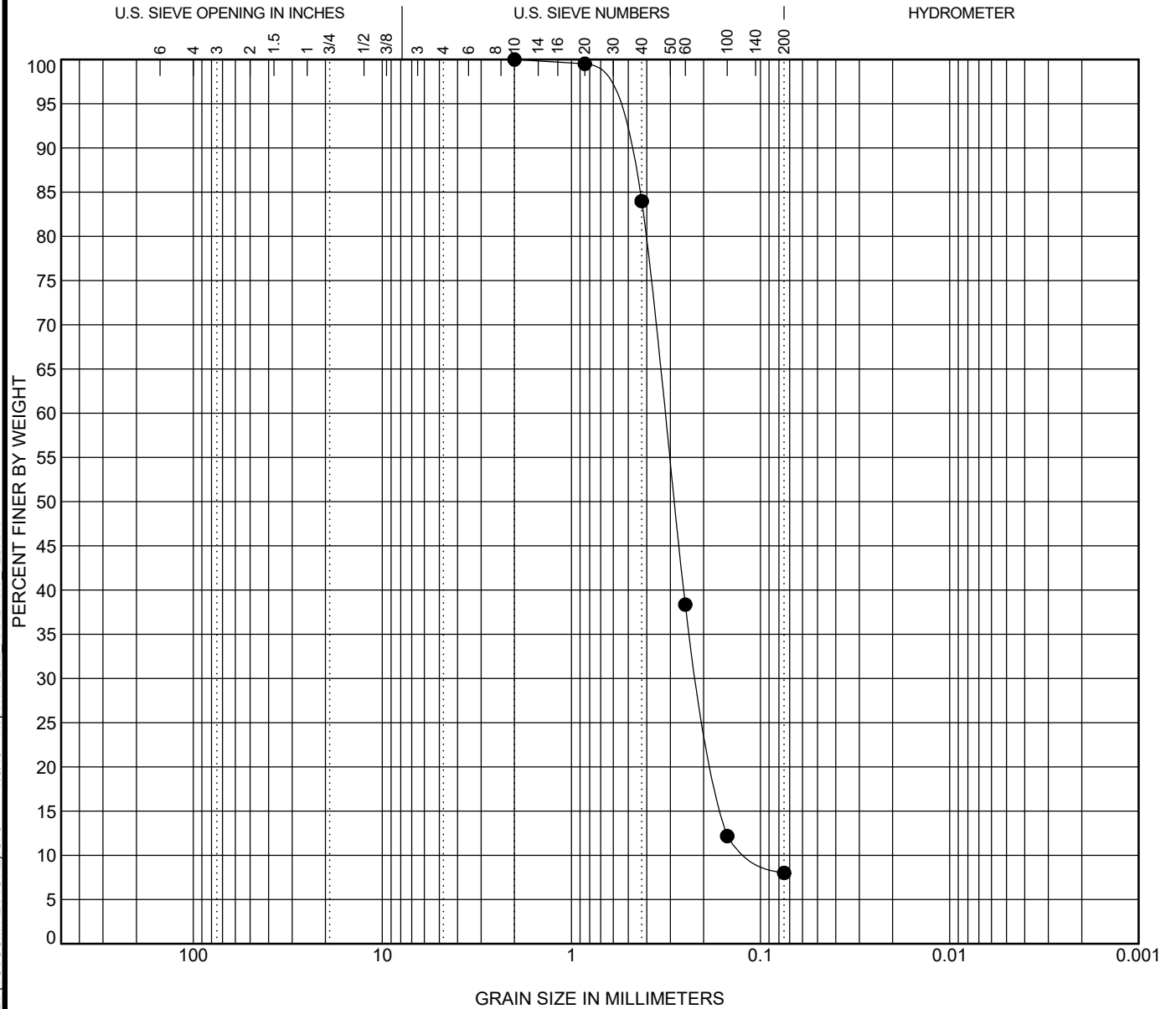


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ10</b>												
Description	<b>28'-30'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ10</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				<b>1.52</b>	<b>3.41</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>92.4</b>	<b>7.6</b>	

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	<p>Client:</p> <p>Project: Twin Pines Minerals Saunders-Loncala Reserve</p> <p>Location: Saint George, Georgia</p> <p>Project Number: 000180200804.00</p>

# GRAIN SIZE DISTRIBUTION



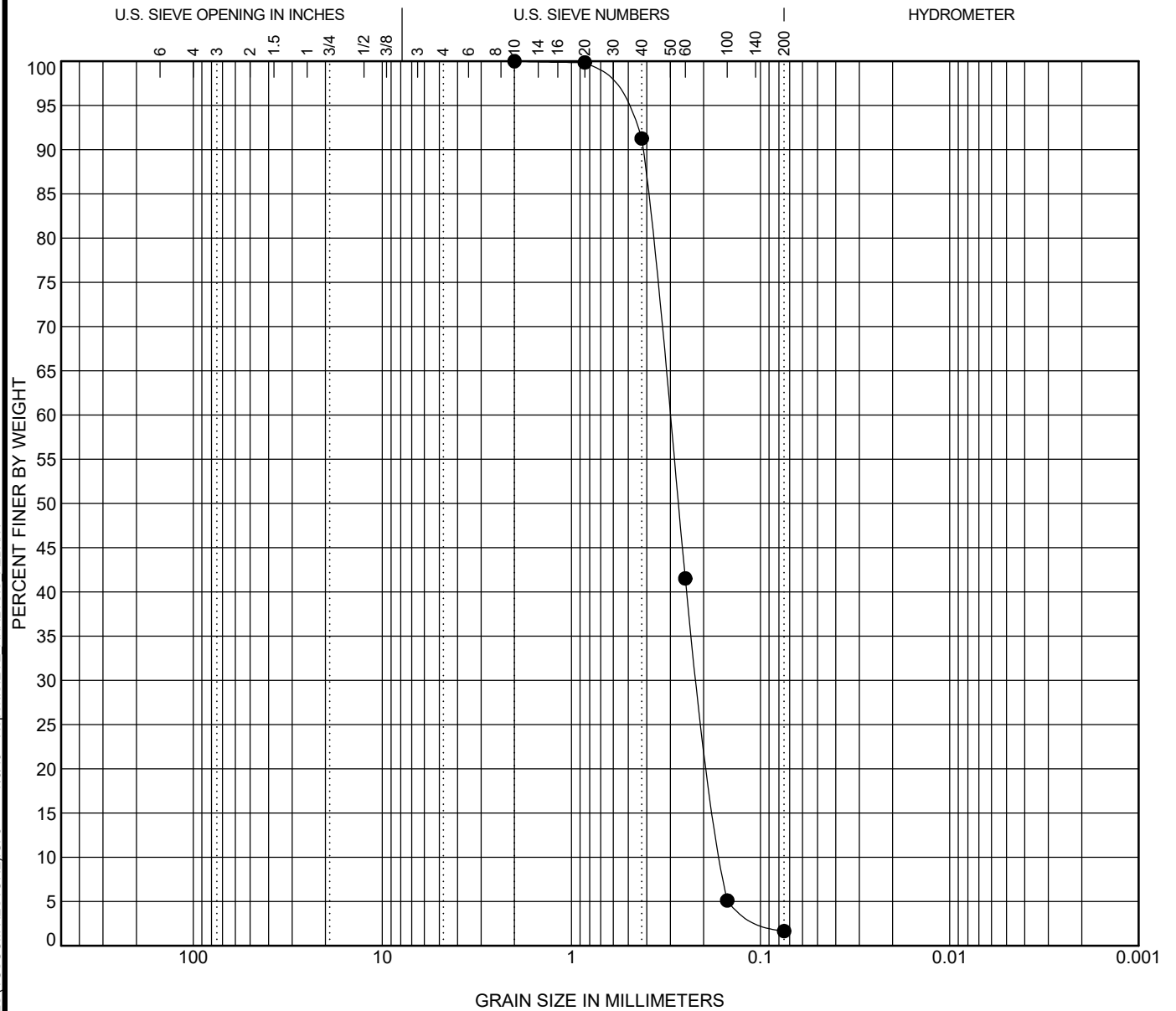
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ11												
Description	8'-13'												
Sampled by:	TTL												
Sample Location:	PZ11												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.34	3.08	2	0.3	0.2	0.1	0.0	92.0	8.0	

<p><b>TTL</b> geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve Location: Saint George, Georgia Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



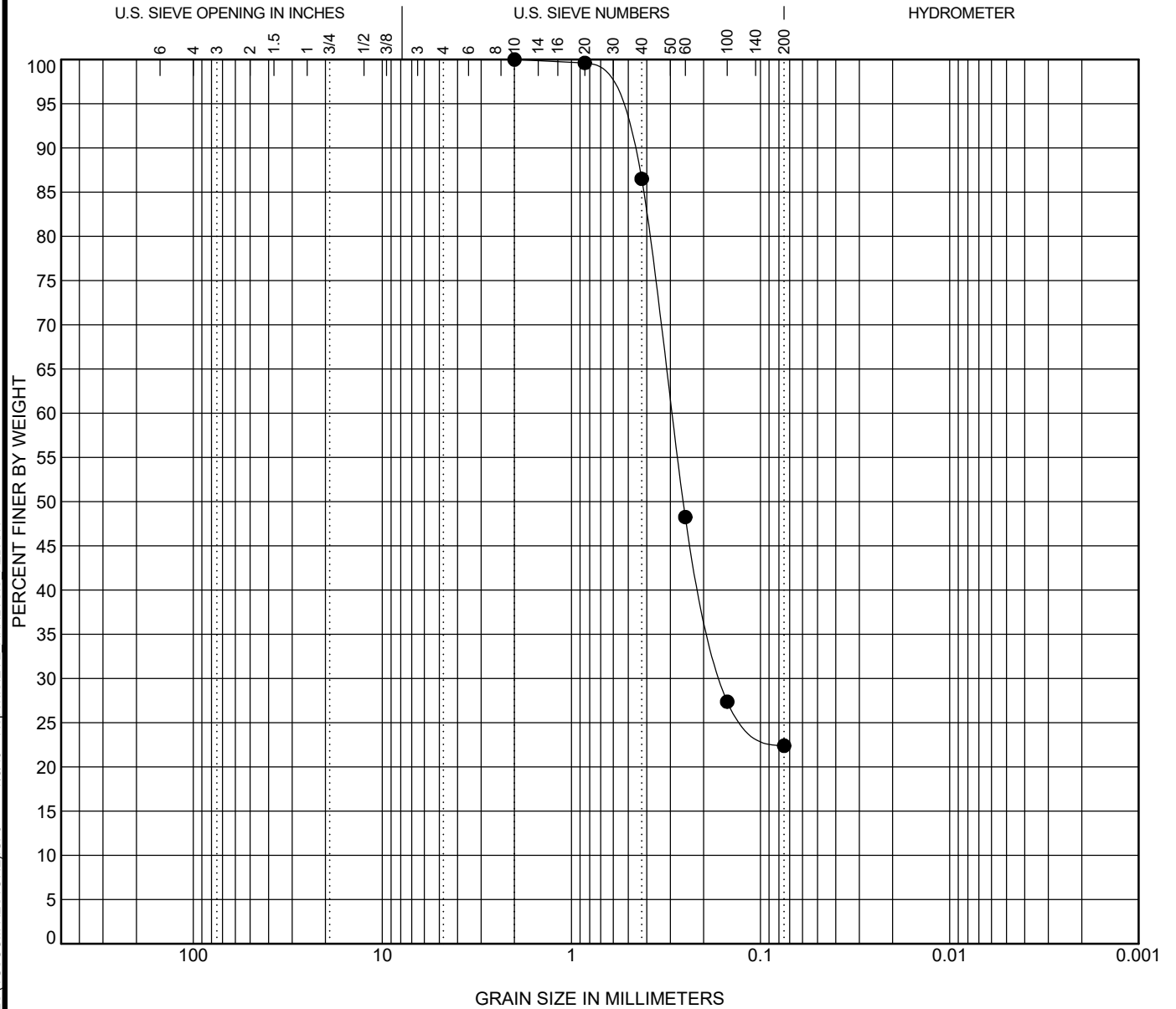
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ11												
Description	13'-19'												
Sampled by:	TTL												
Sample Location:	PZ11												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.92	1.90	2	0.3	0.2	0.2	0.0	98.3	1.7	

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ12S</b>													
Description	<b>5'-9"</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ12S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.3	0.2		0.0	77.6	22.4		

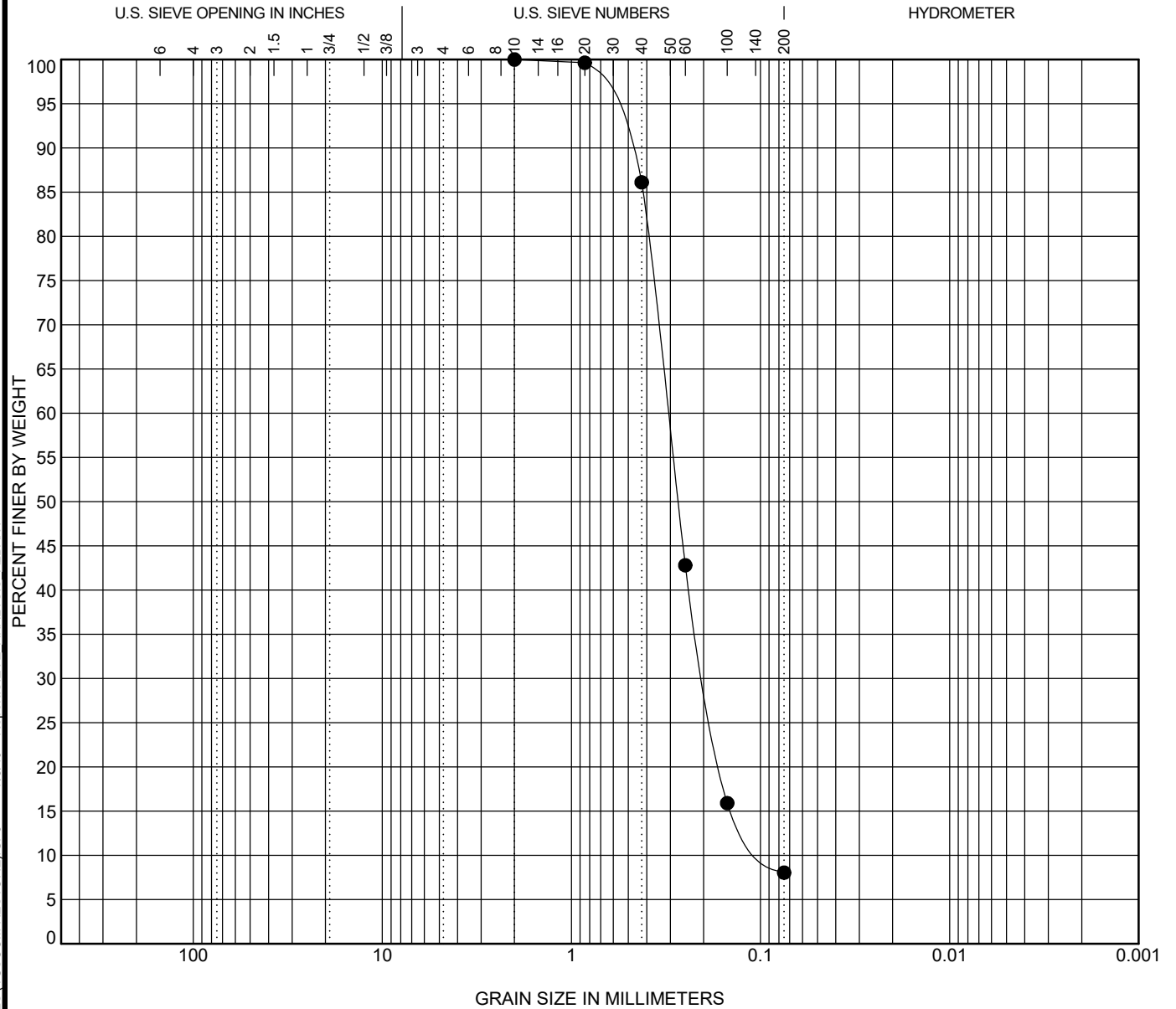


geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

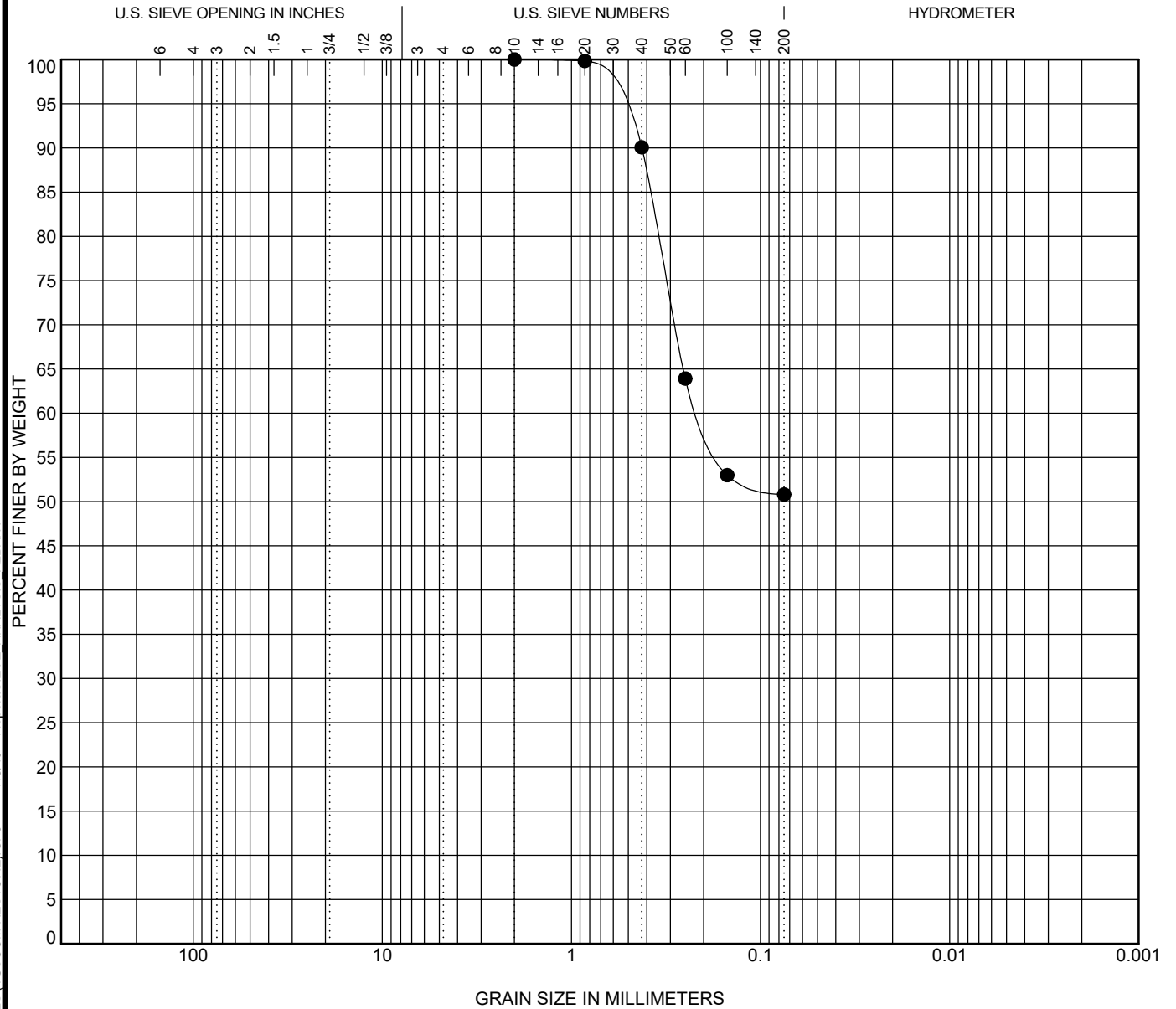
Sample ID	PZ12S													
Description	19'-20'													
Sampled by:	TTL													
Sample Location:	PZ12S													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.40	3.46	2	0.3	0.2	0.1	0.0	92.0	8.0		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ12D</b>													
Description	<b>9'-19'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ12D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	49.2	50.8		

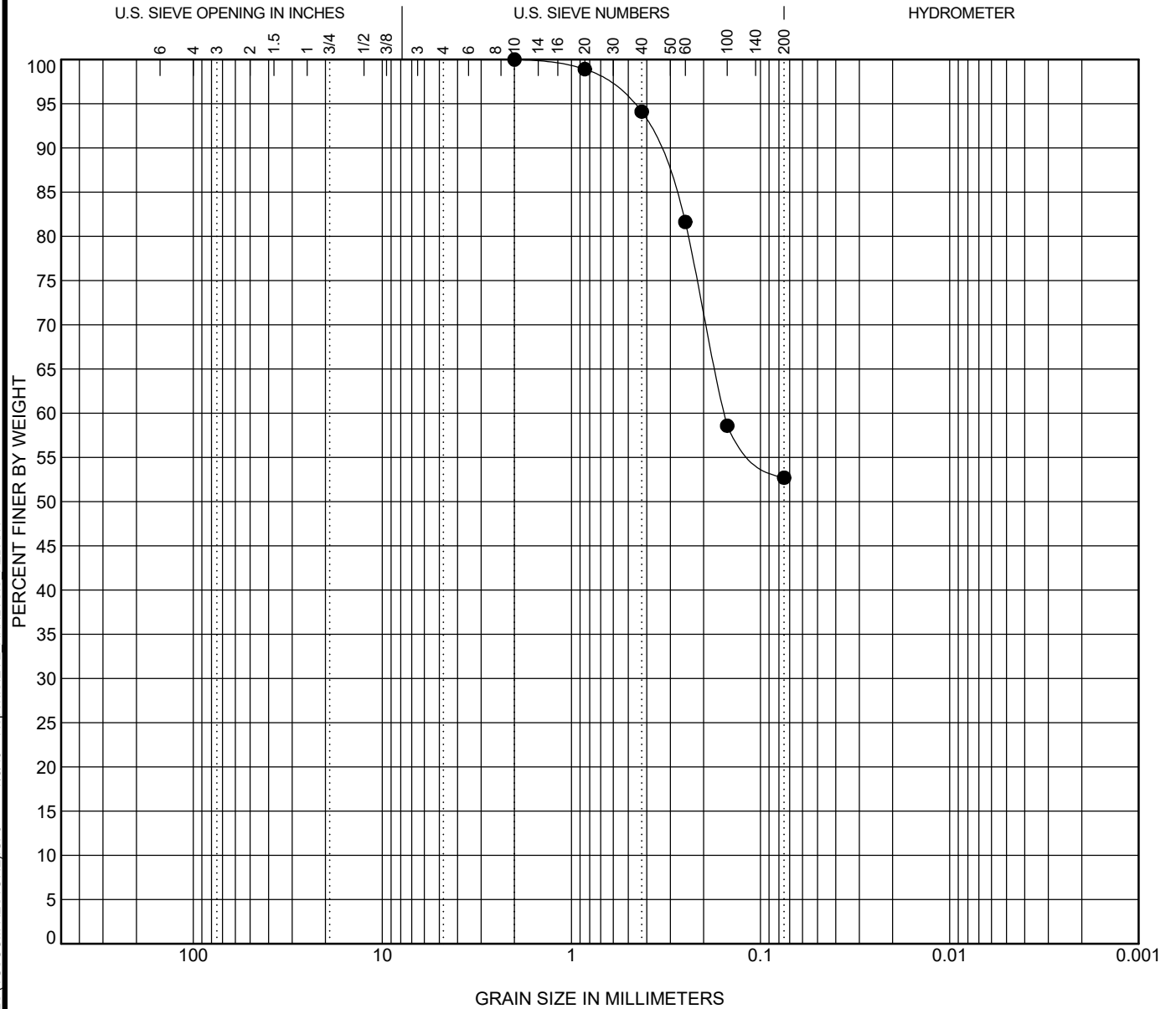


geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



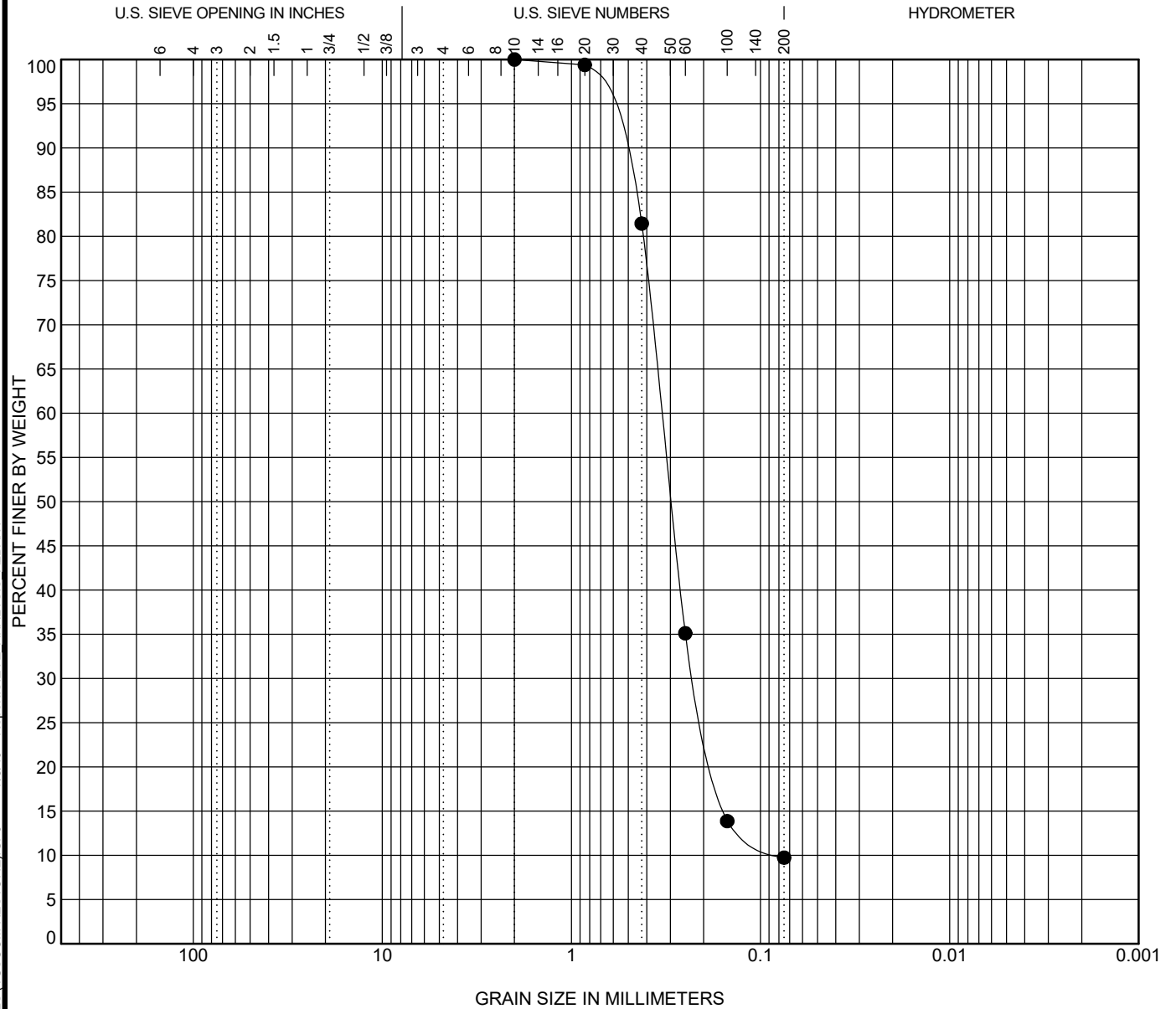
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ12D												
Description	26'-40'												
Sampled by:	TTL												
Sample Location:	PZ12D												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
						2	0.2			0.0	47.3	52.7	

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



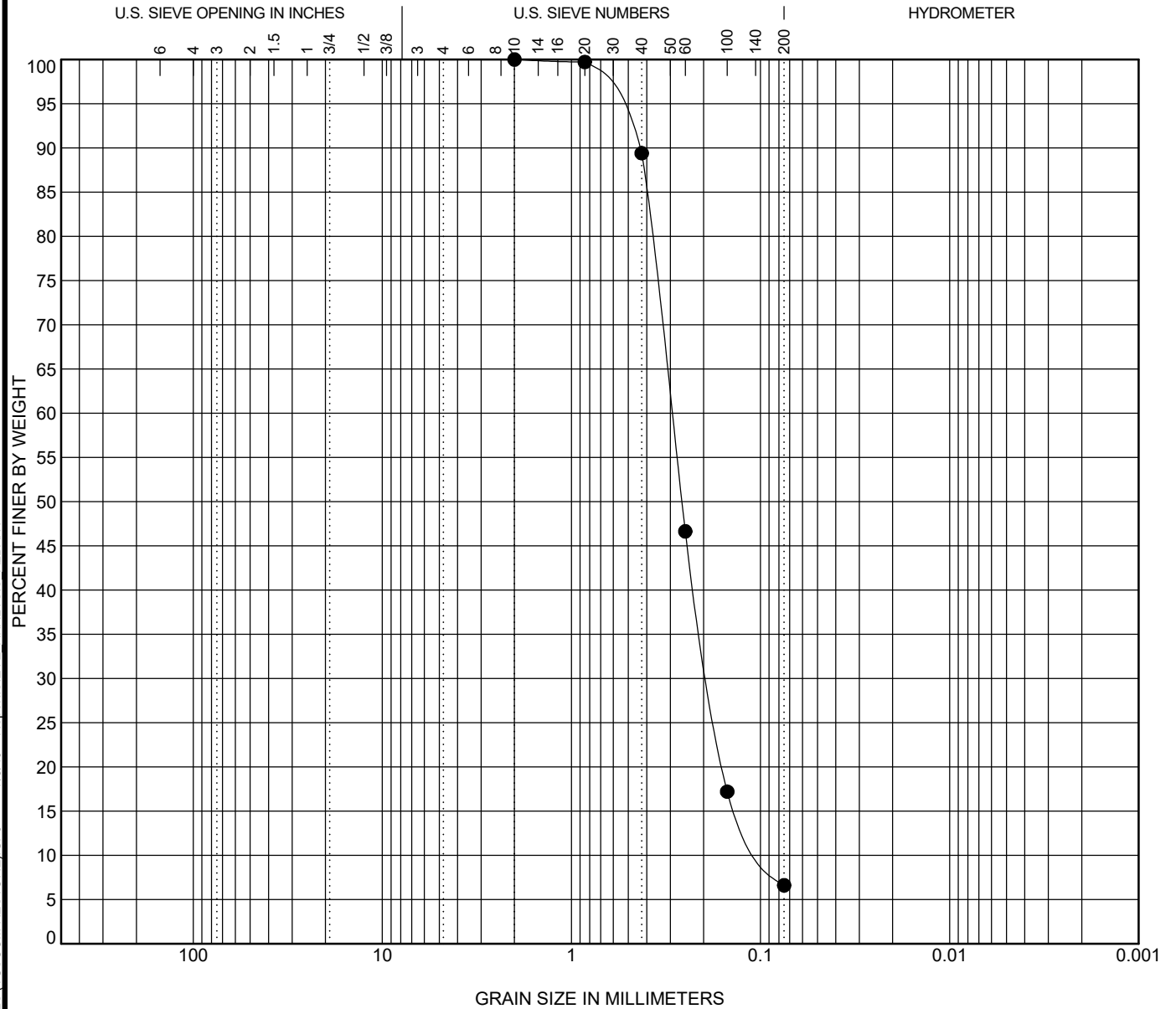
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ13</b>												
Description	<b>5'-20'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ13</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.87	4.24	2	0.3	0.2	0.1	0.0	90.3	9.7	

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



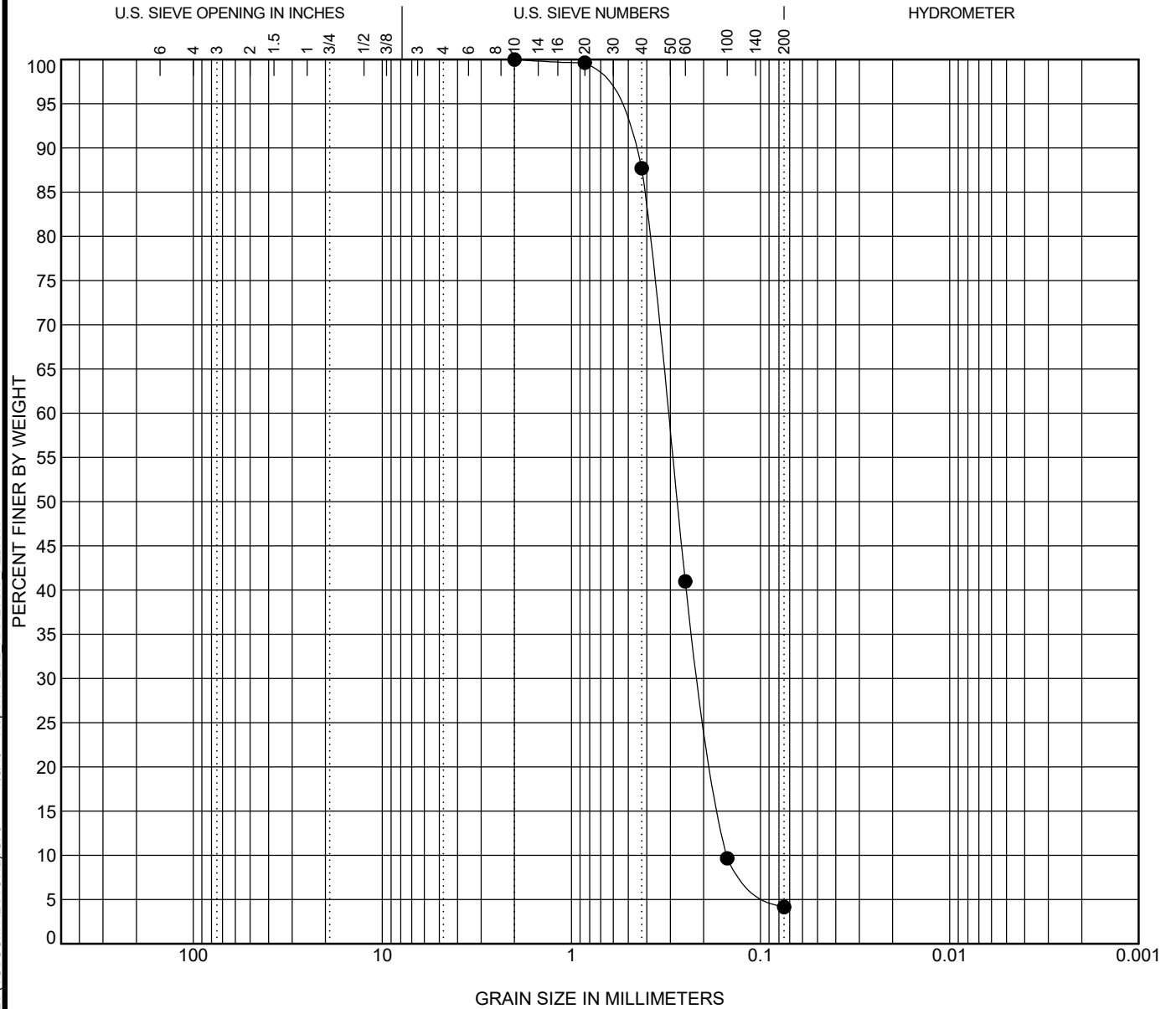
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ13</b>													
Description	<b>27'-28'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ13</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.27	3.15	2	0.3	0.2	0.1	0.0	93.4	6.6		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



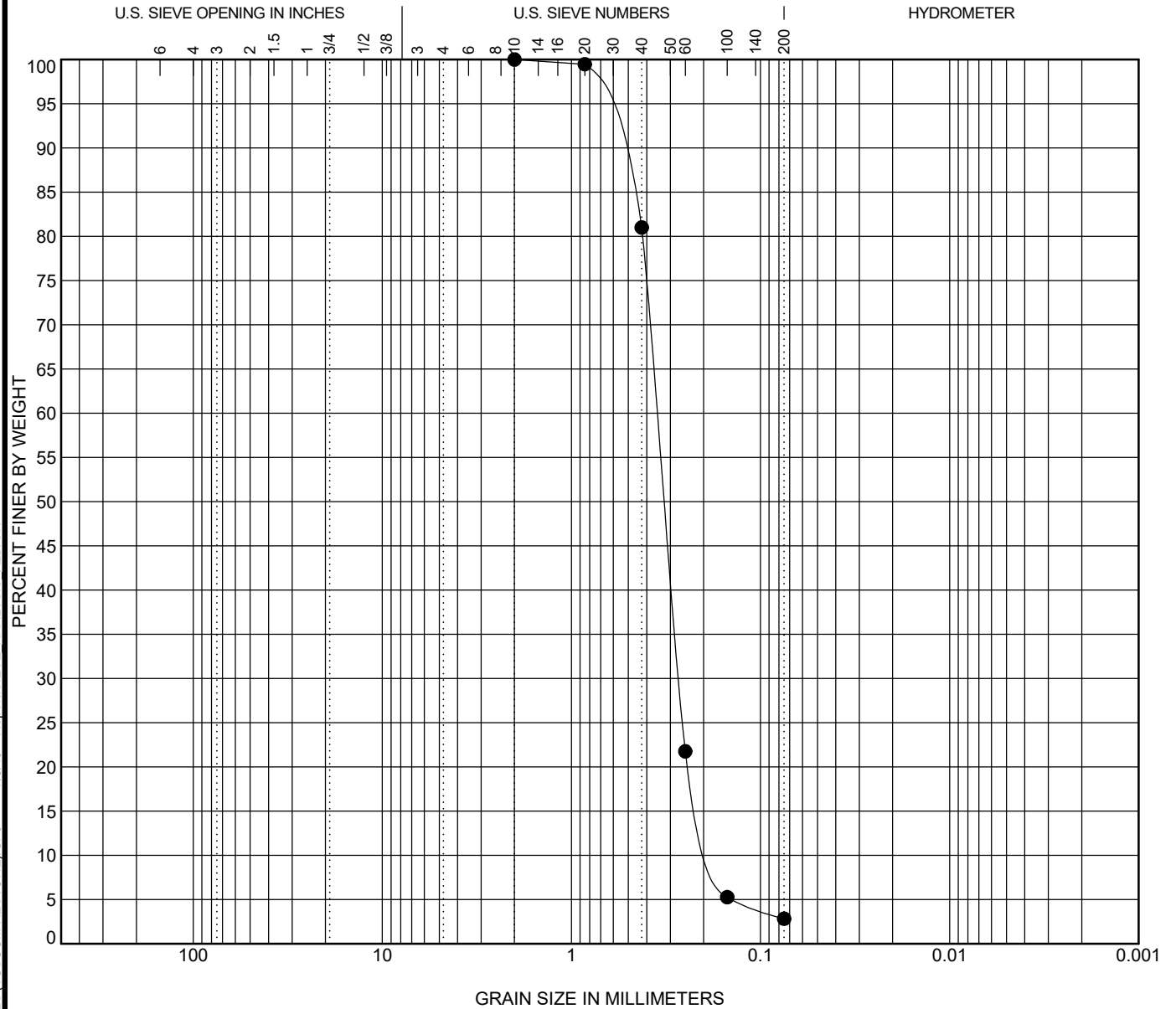
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ14													
Description	3'-9"													
Sampled by:	TTL													
Sample Location:	PZ14													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				0.93	2.06	2	0.3	0.2	0.2	0.0	95.8	4.2		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION

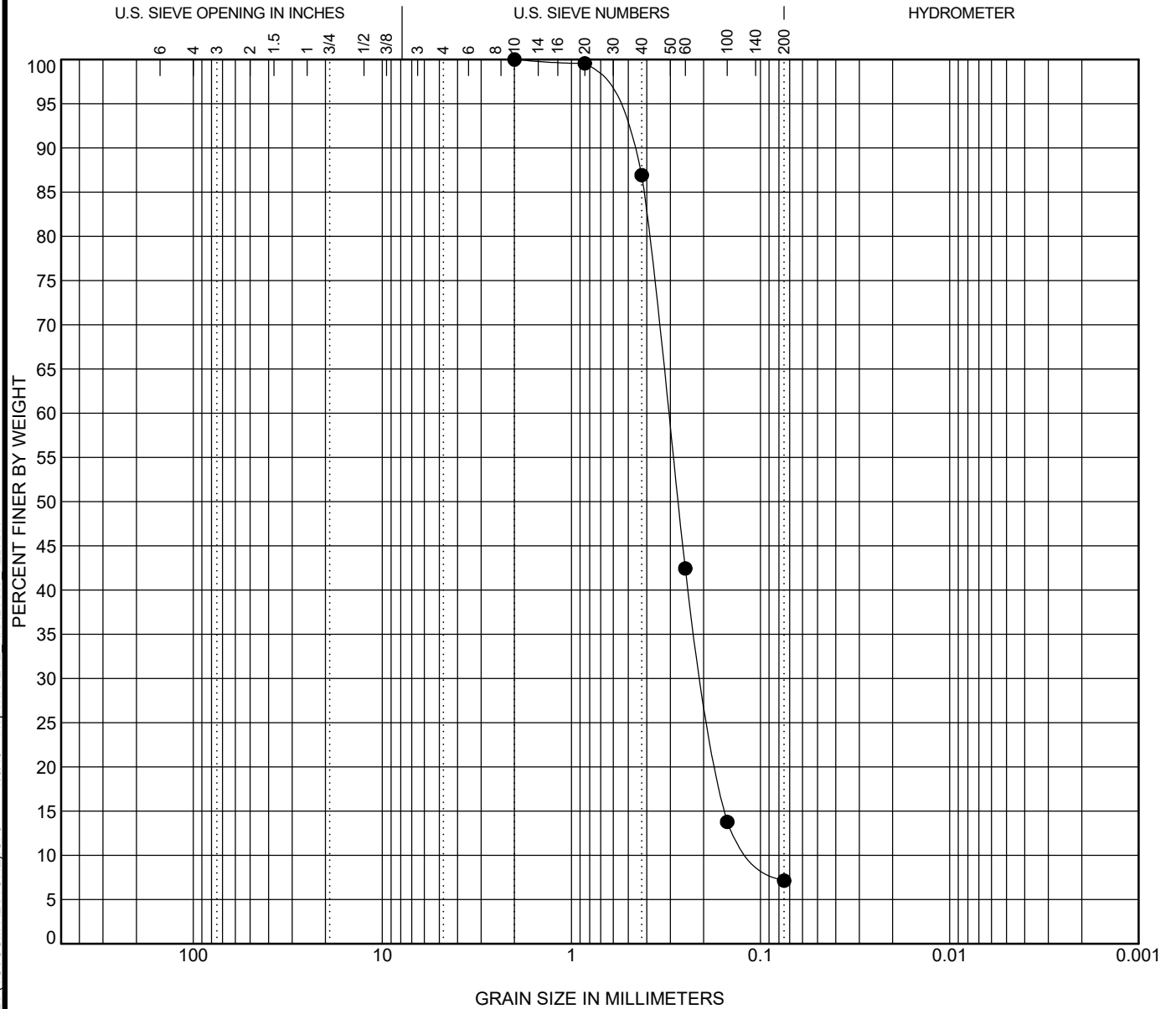


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ14</b>													
Description	<b>27'-30'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ14</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.18	2.03	2	0.4	0.3	0.2	0.0	97.2	2.8		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



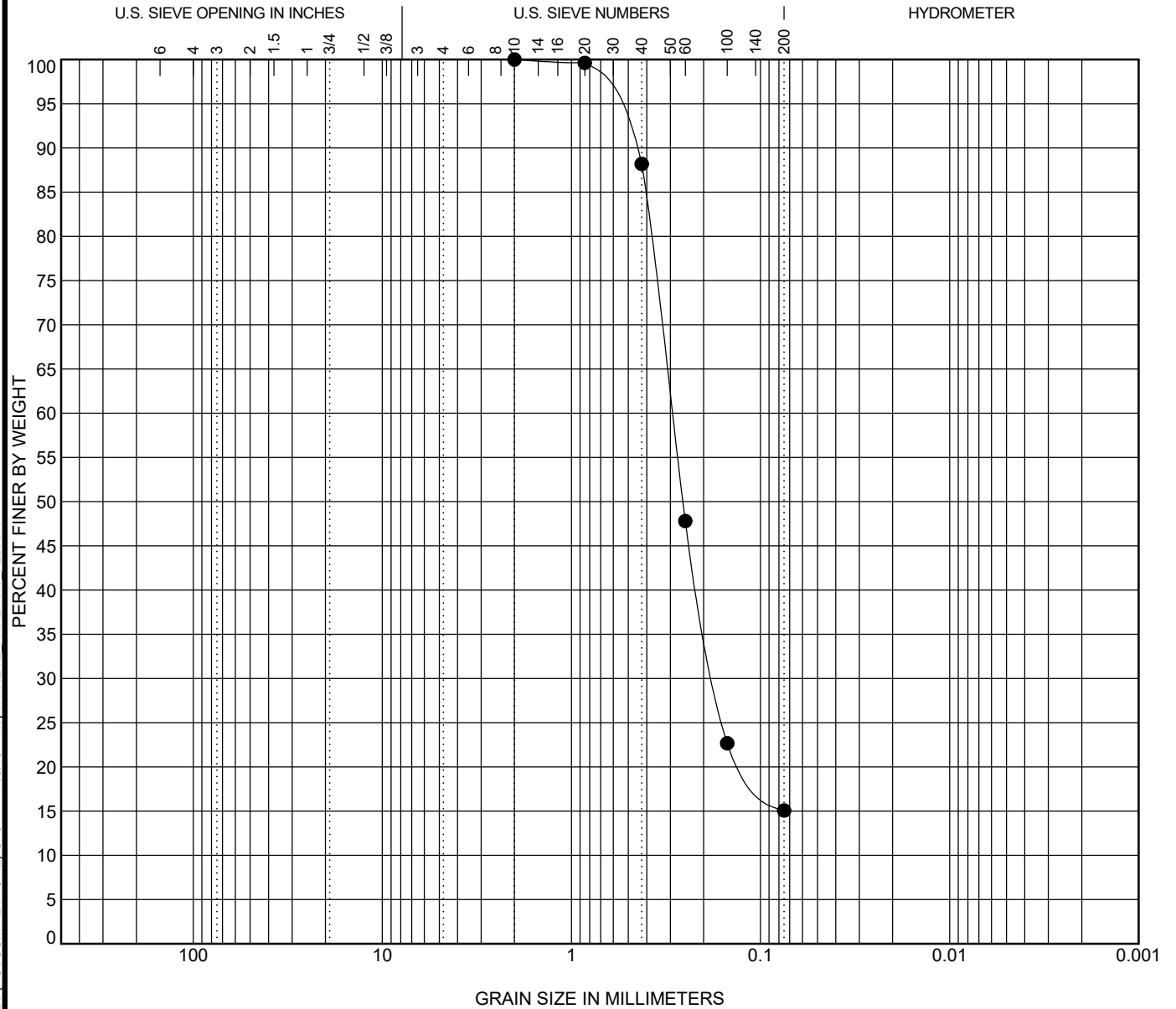
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ15</b>													
Description	<b>4'-5.5'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ15</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.29</b>	<b>3.05</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>92.9</b>	<b>7.1</b>		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

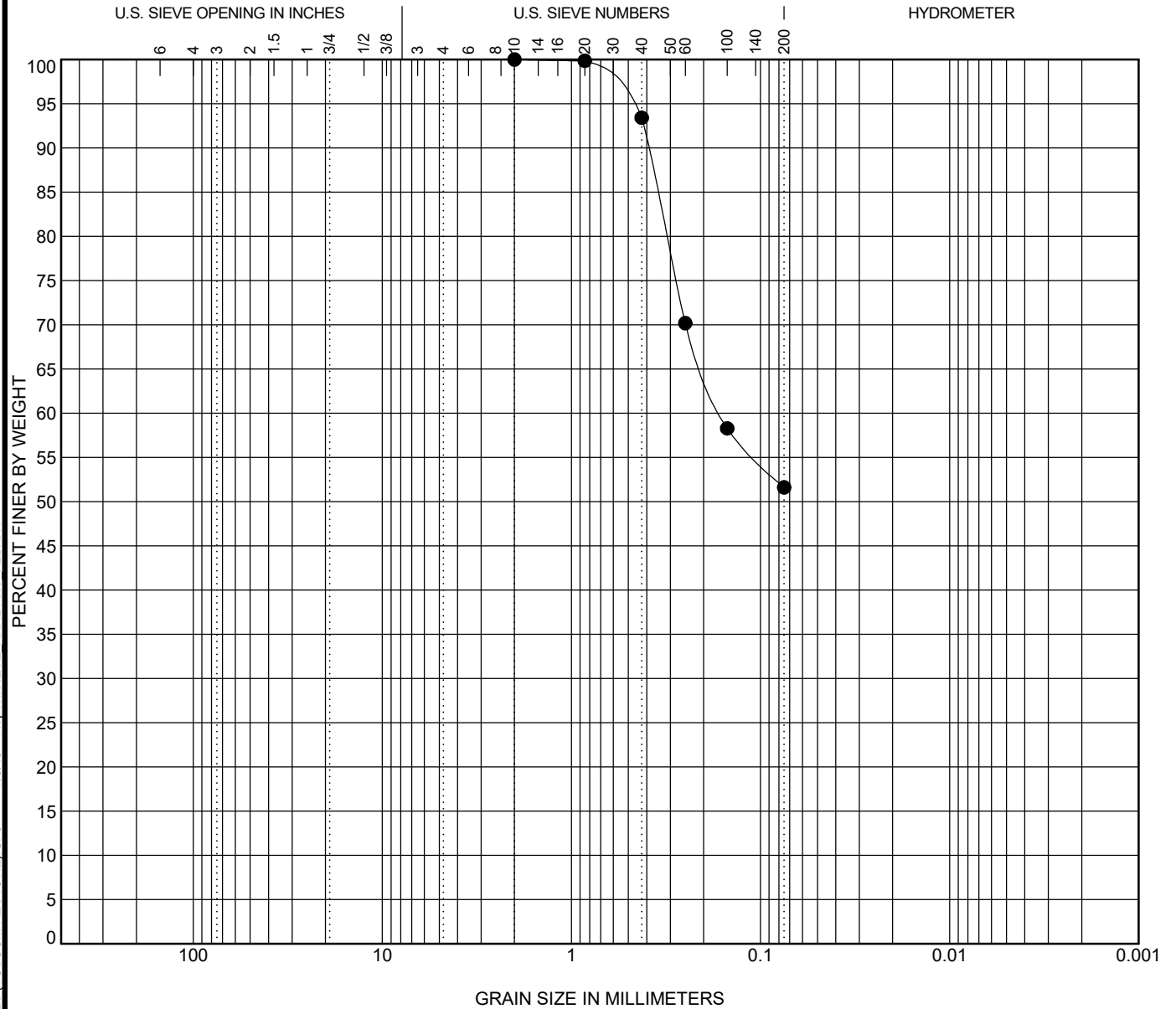
Sample ID	<b>PZ15</b>													
Description	<b>6'-9'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ15</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.3	0.2		0.0	84.9	15.1		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



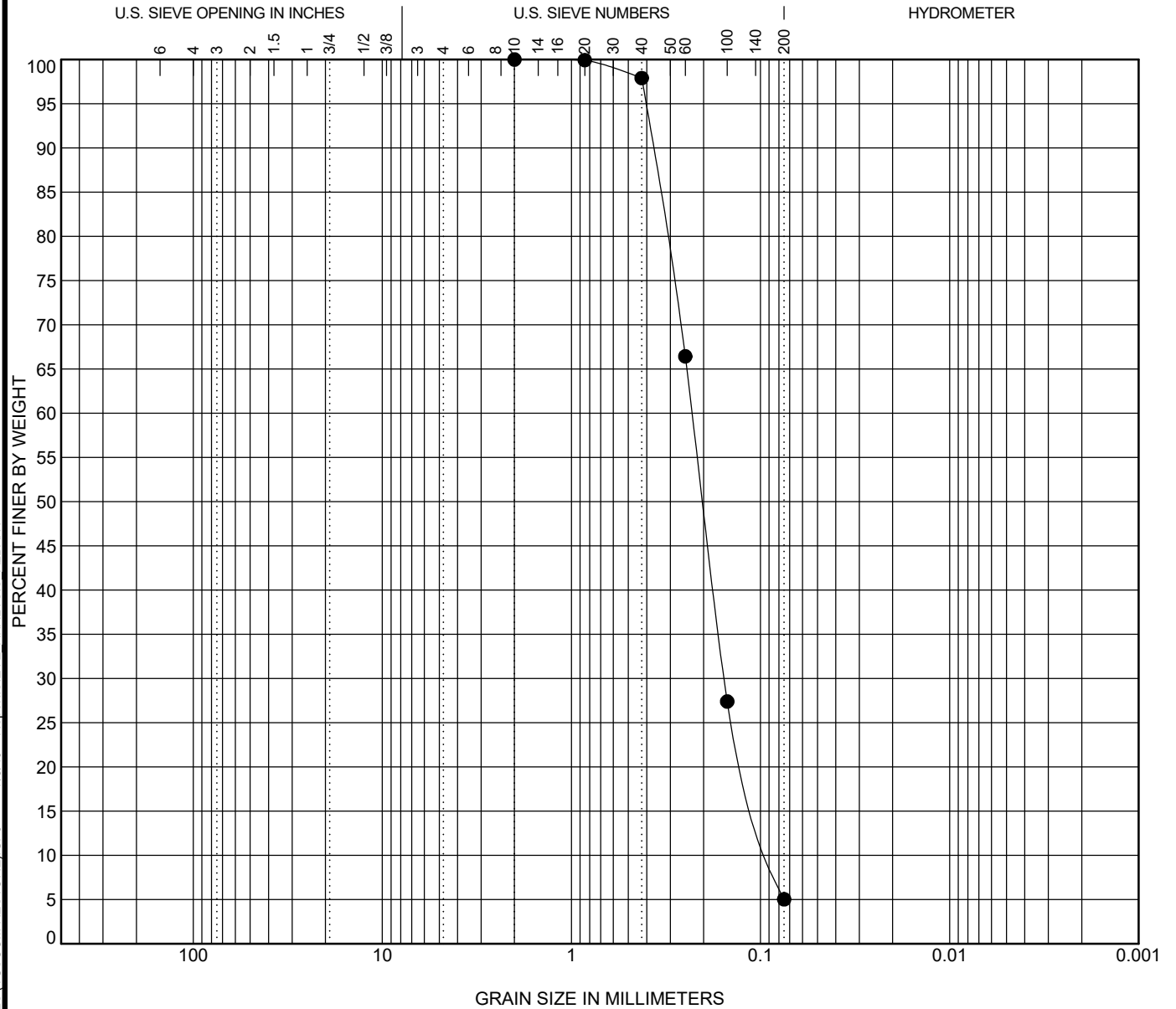
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ15</b>													
Description	<b>9'-12'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ15</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.4	51.6		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



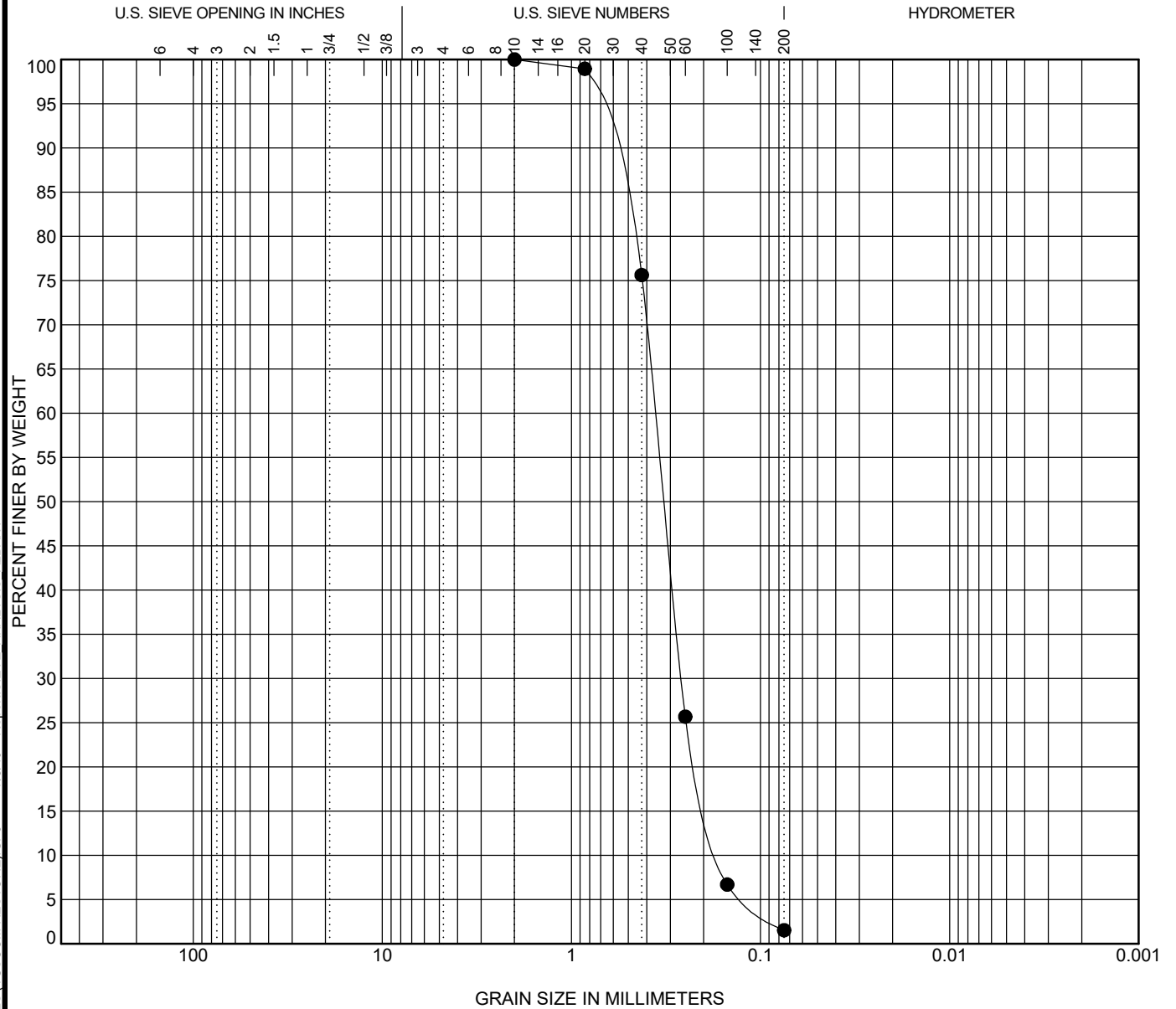
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ15</b>													
Description	<b>12.5'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ15</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.20</b>	<b>2.63</b>	<b>2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>95.0</b>	<b>5.0</b>		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



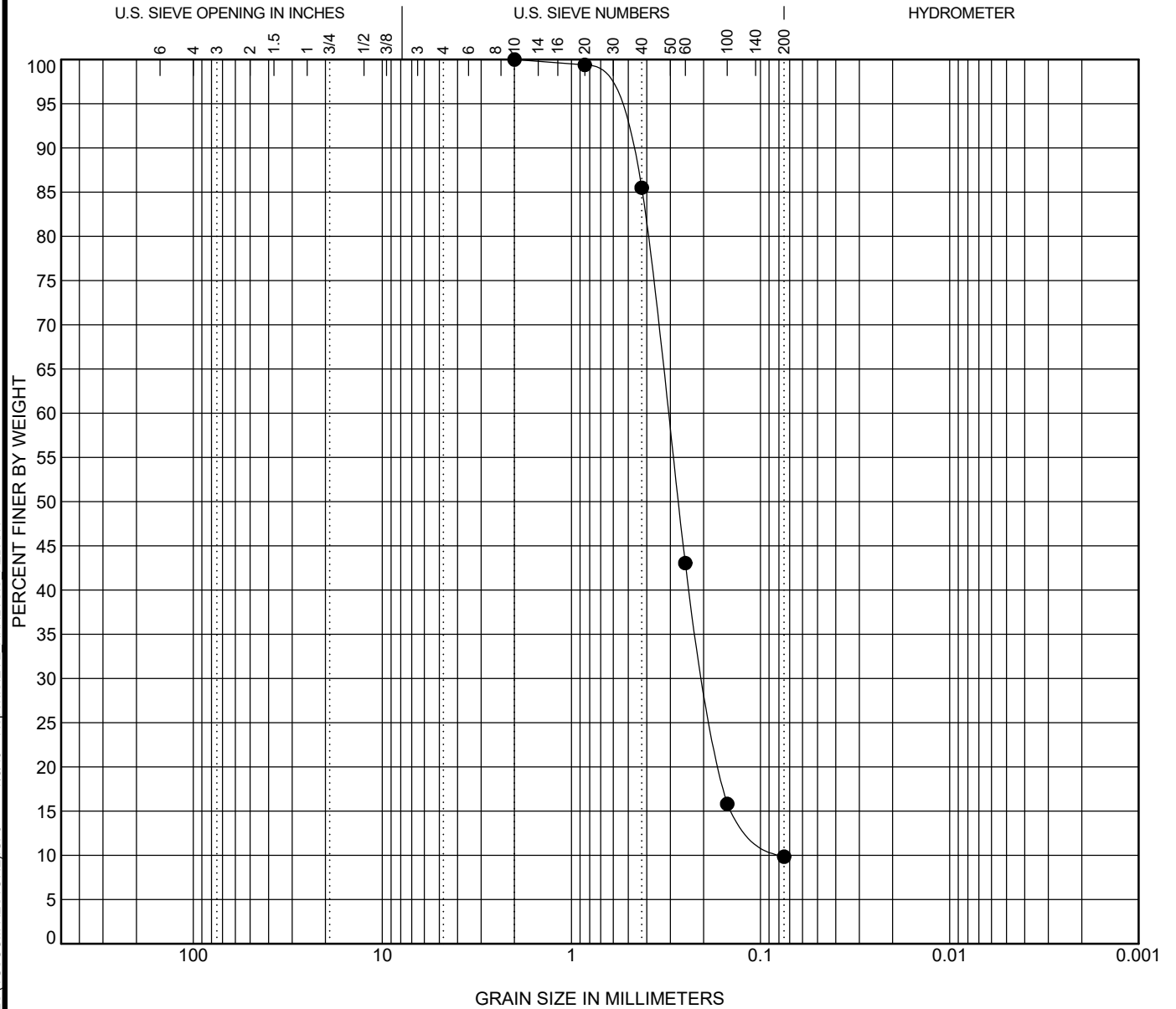
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ15</b>													
Description	<b>28'-29'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ15</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.16</b>	<b>2.20</b>	<b>2</b>	<b>0.4</b>	<b>0.3</b>	<b>0.2</b>	<b>0.0</b>	<b>98.5</b>	<b>1.5</b>		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



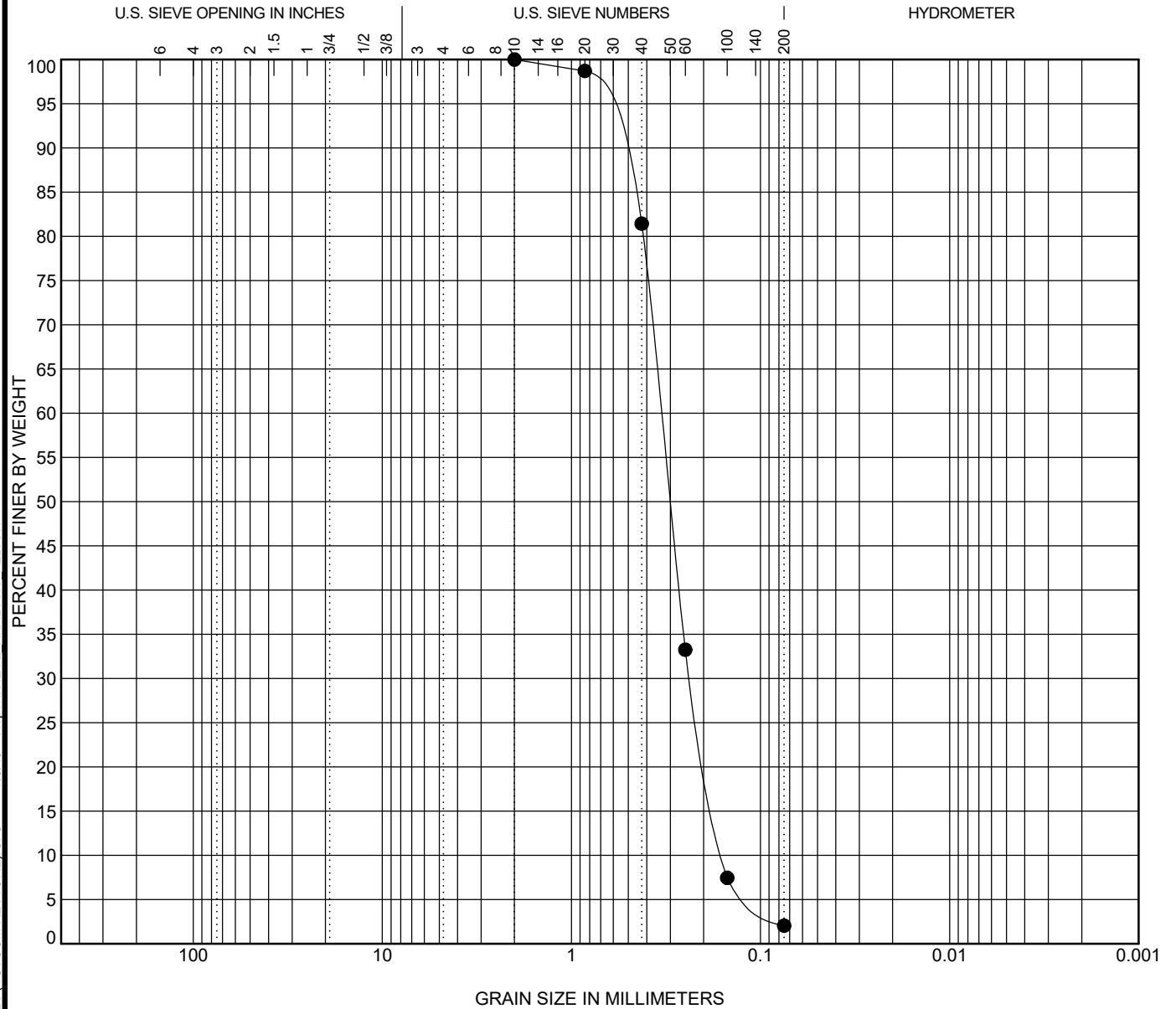
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ16S</b>												
Description	<b>5'-8'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ16S</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				<b>1.62</b>	<b>4.05</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>90.2</b>	<b>9.8</b>	

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



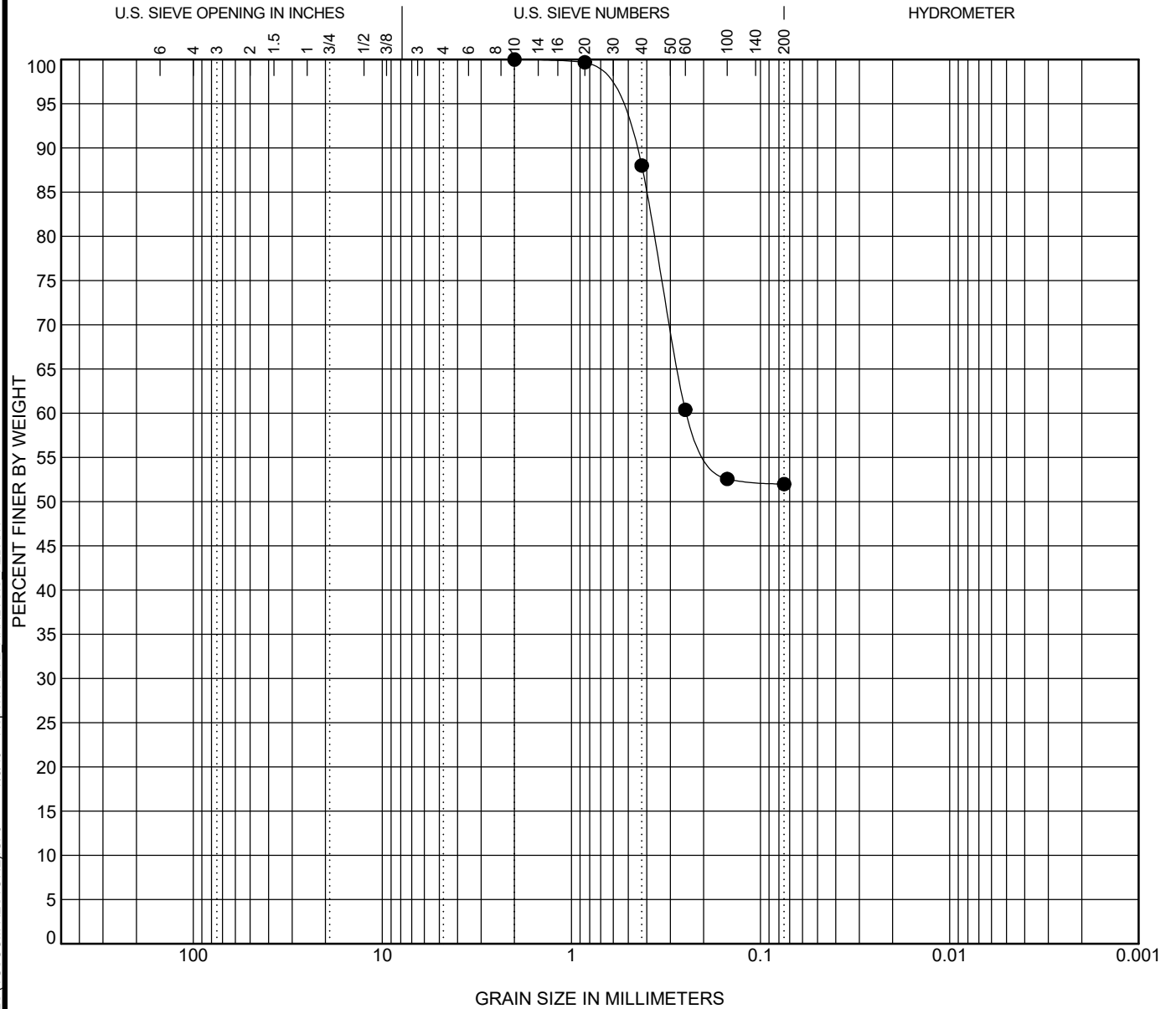
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ16S</b>													
Description	<b>18'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ16S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay
				<b>1.04</b>	<b>2.13</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.0</b>	<b>98.0</b>	<b>2.0</b>		

<p><b>TTL</b> geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve Location: Saint George, Georgia Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



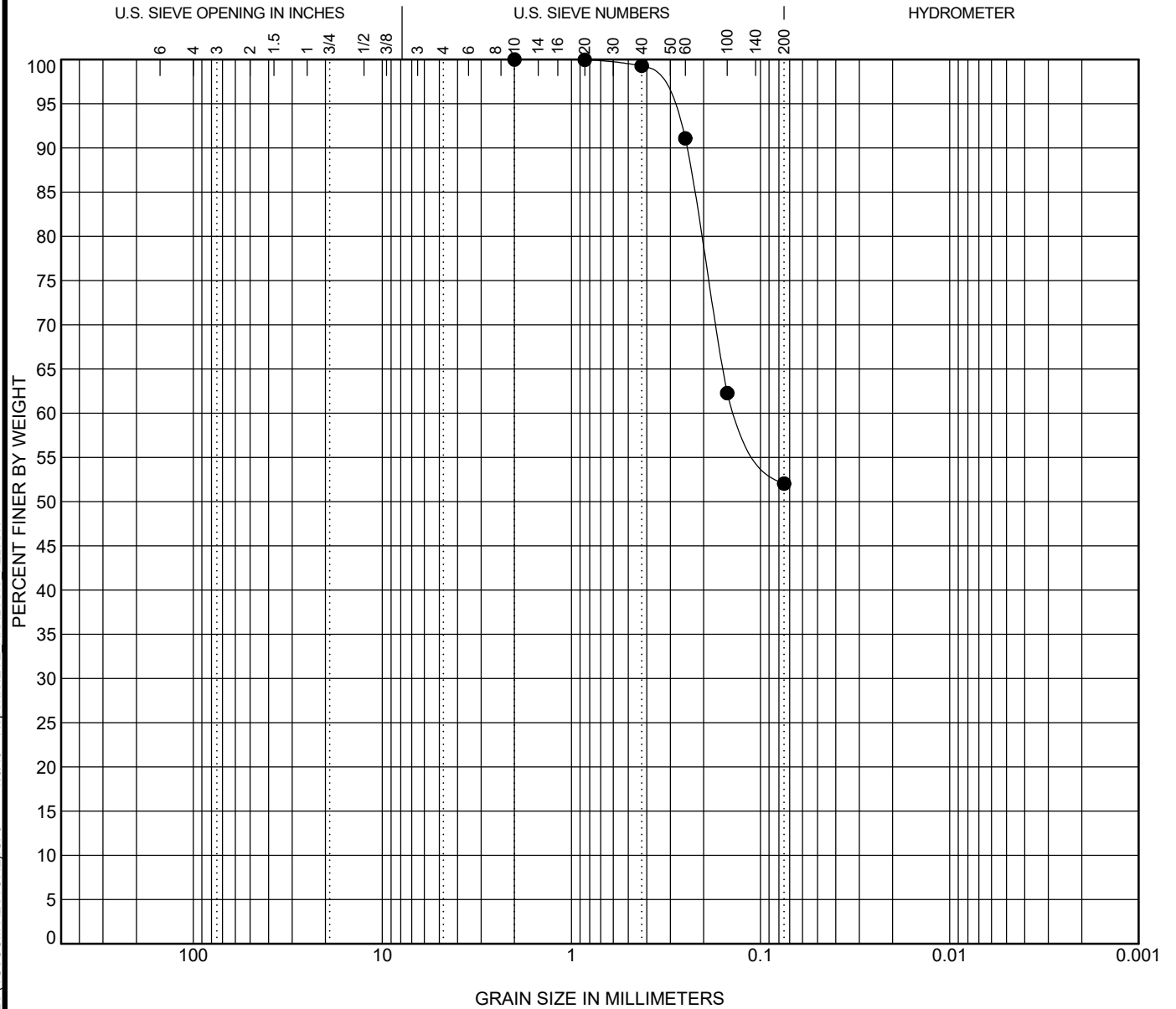
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ16D</b>													
Description	<b>10'-19'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ16D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.0	52.0		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



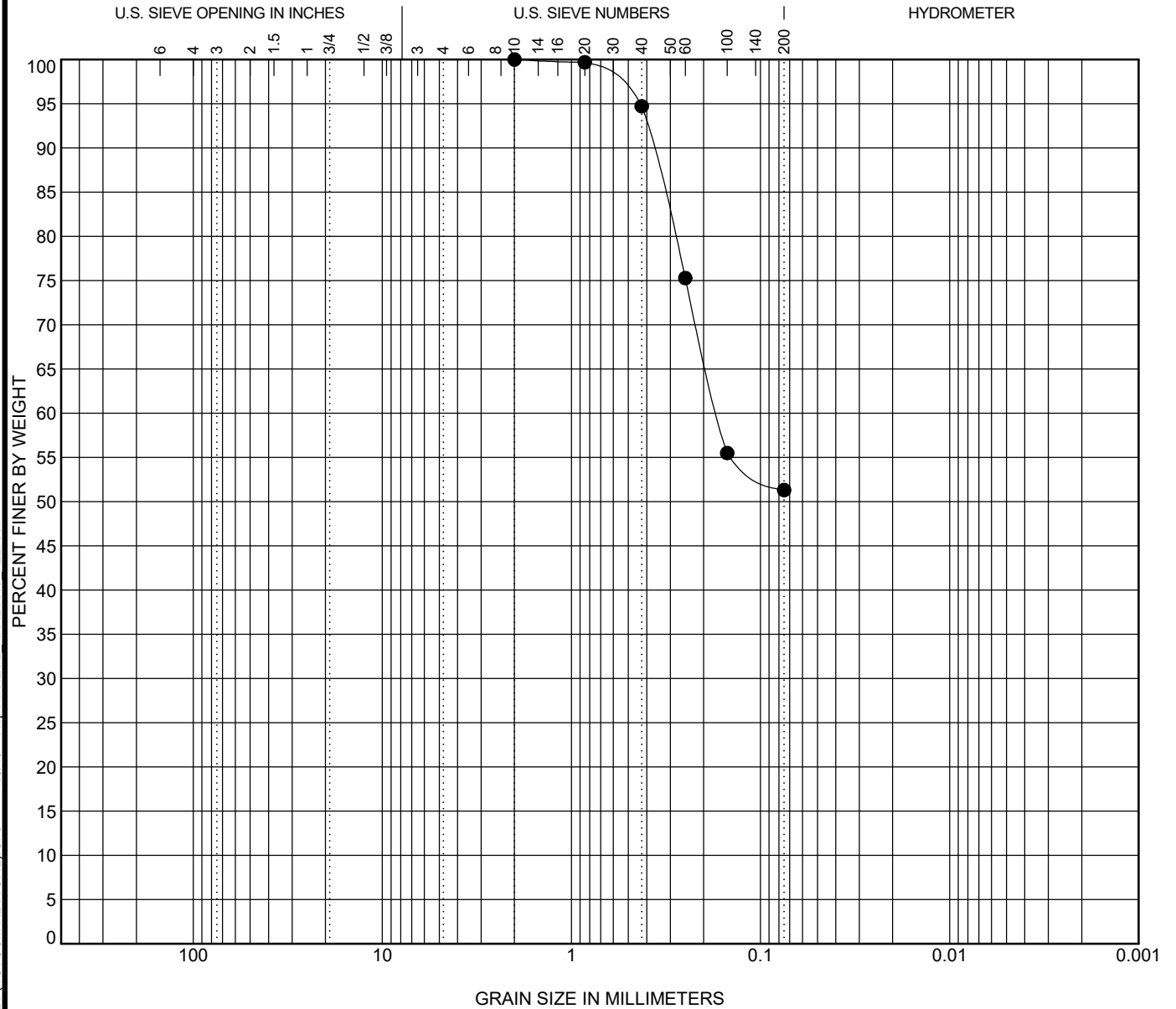
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ16D</b>													
Description	<b>41'-42.5'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ16D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.1			0.0	48.0	52.0		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ17S													
Description	9'-10'													
Sampled by:	TTL													
Sample Location:	PZ17S													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.7	51.3		



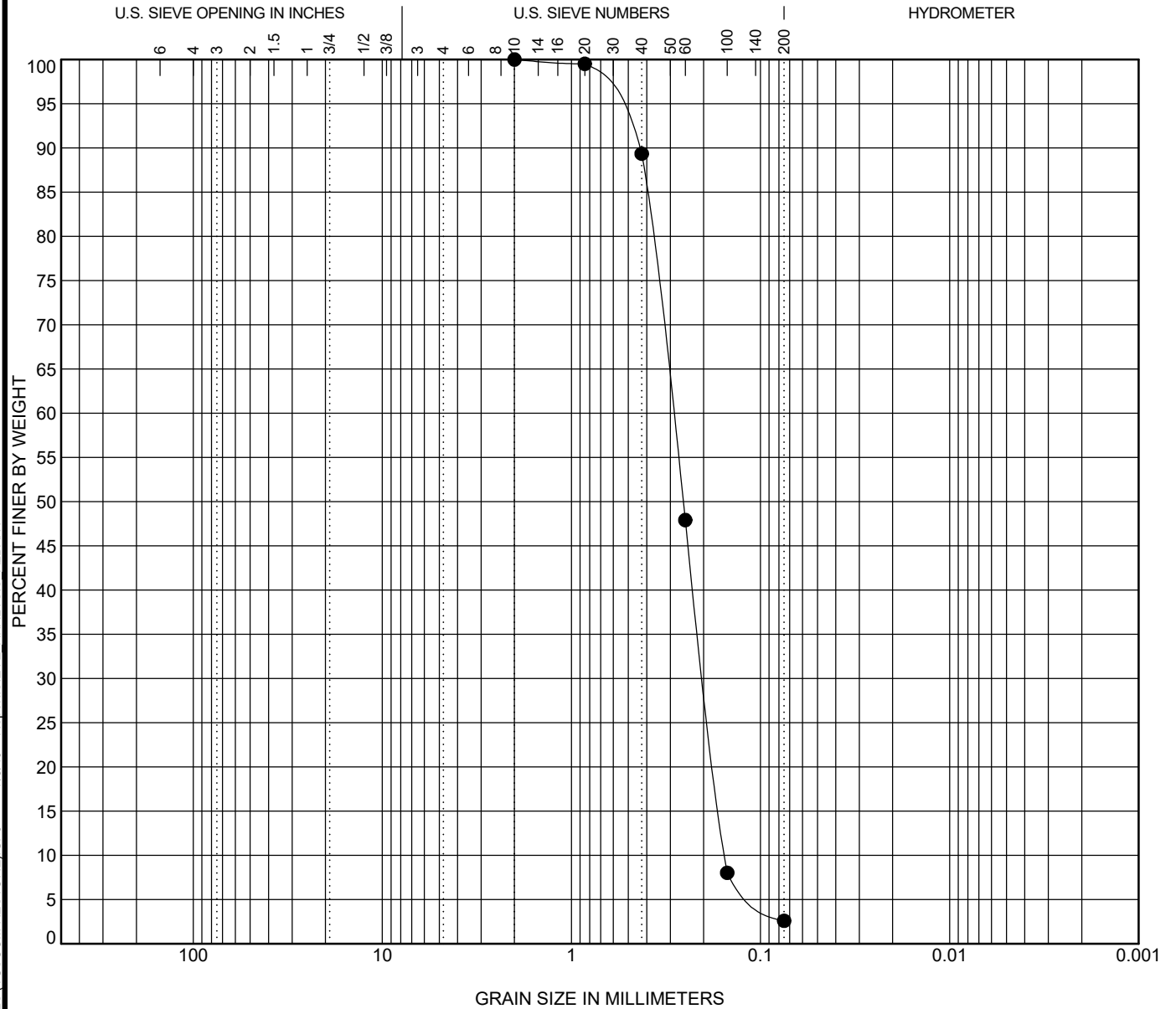
geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00



# GRAIN SIZE DISTRIBUTION



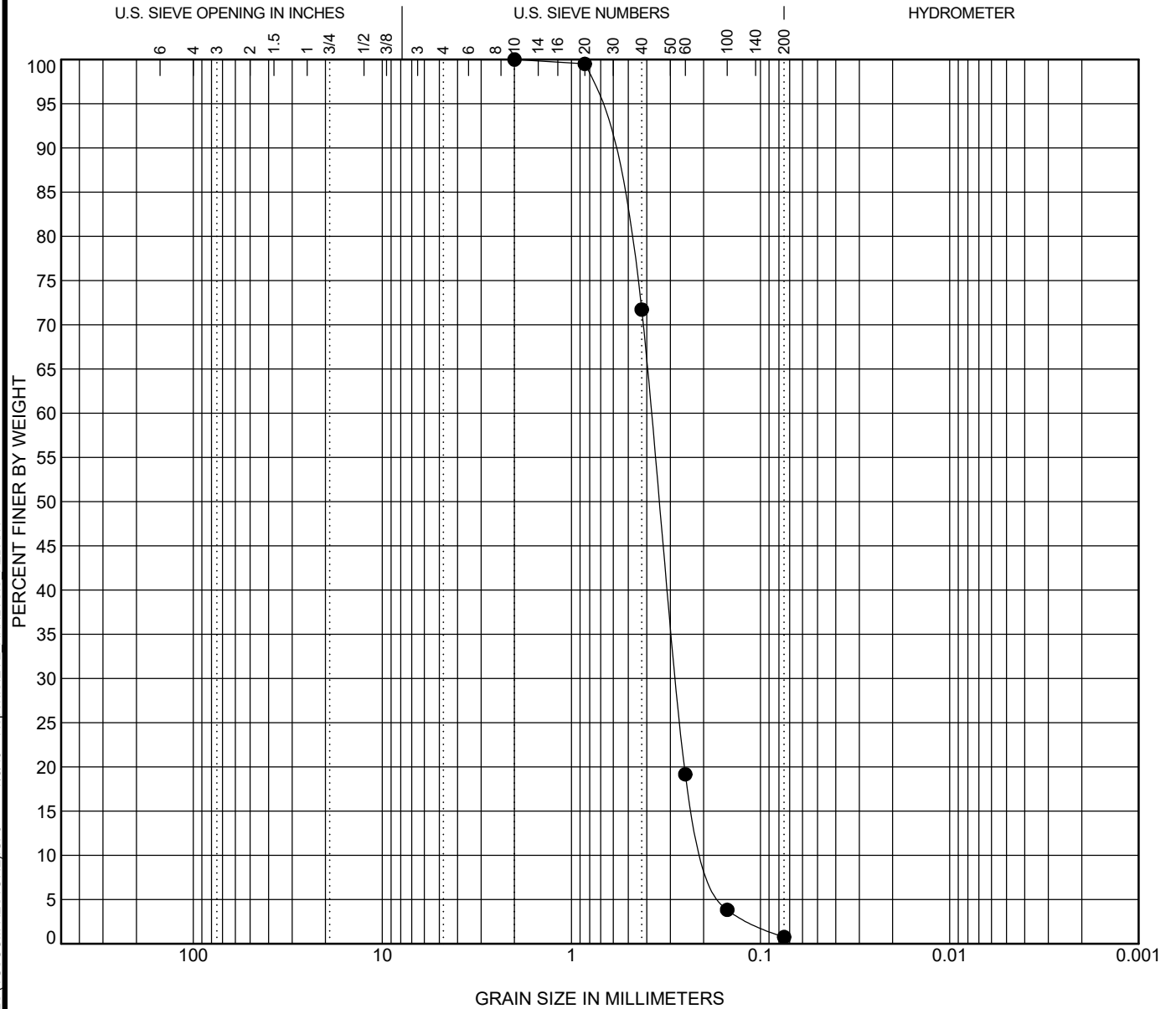
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ17D												
Description	8'-10'												
Sampled by:	TTL												
Sample Location:	PZ17D												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.88	1.90	2	0.3	0.2	0.2	0.0	97.4	2.6	

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ17D												
Description	40'-49'												
Sampled by:	TTL												
Sample Location:	PZ17D												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.12	2.05	2	0.4	0.3	0.2	0.0	99.2	0.8	

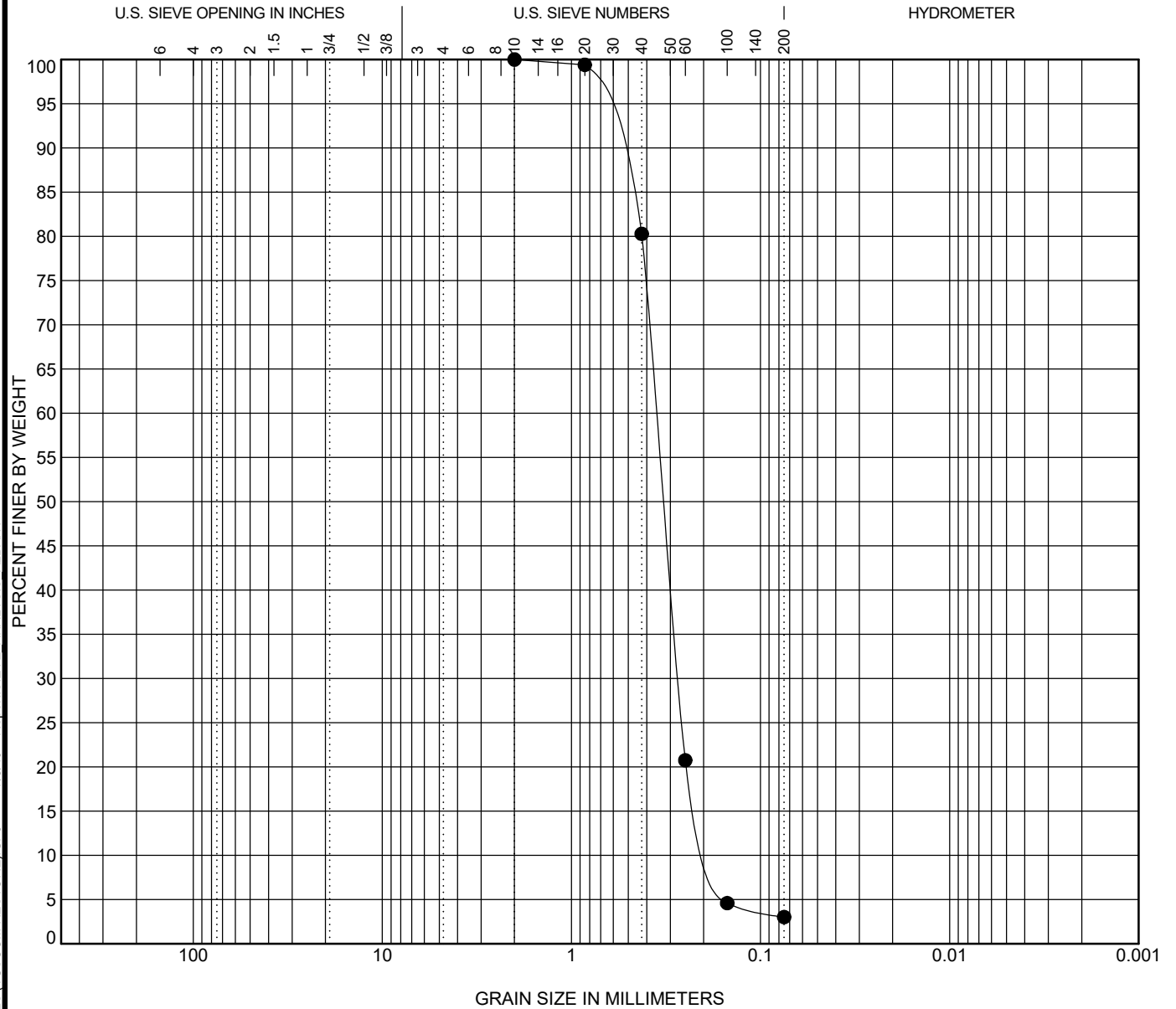


geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



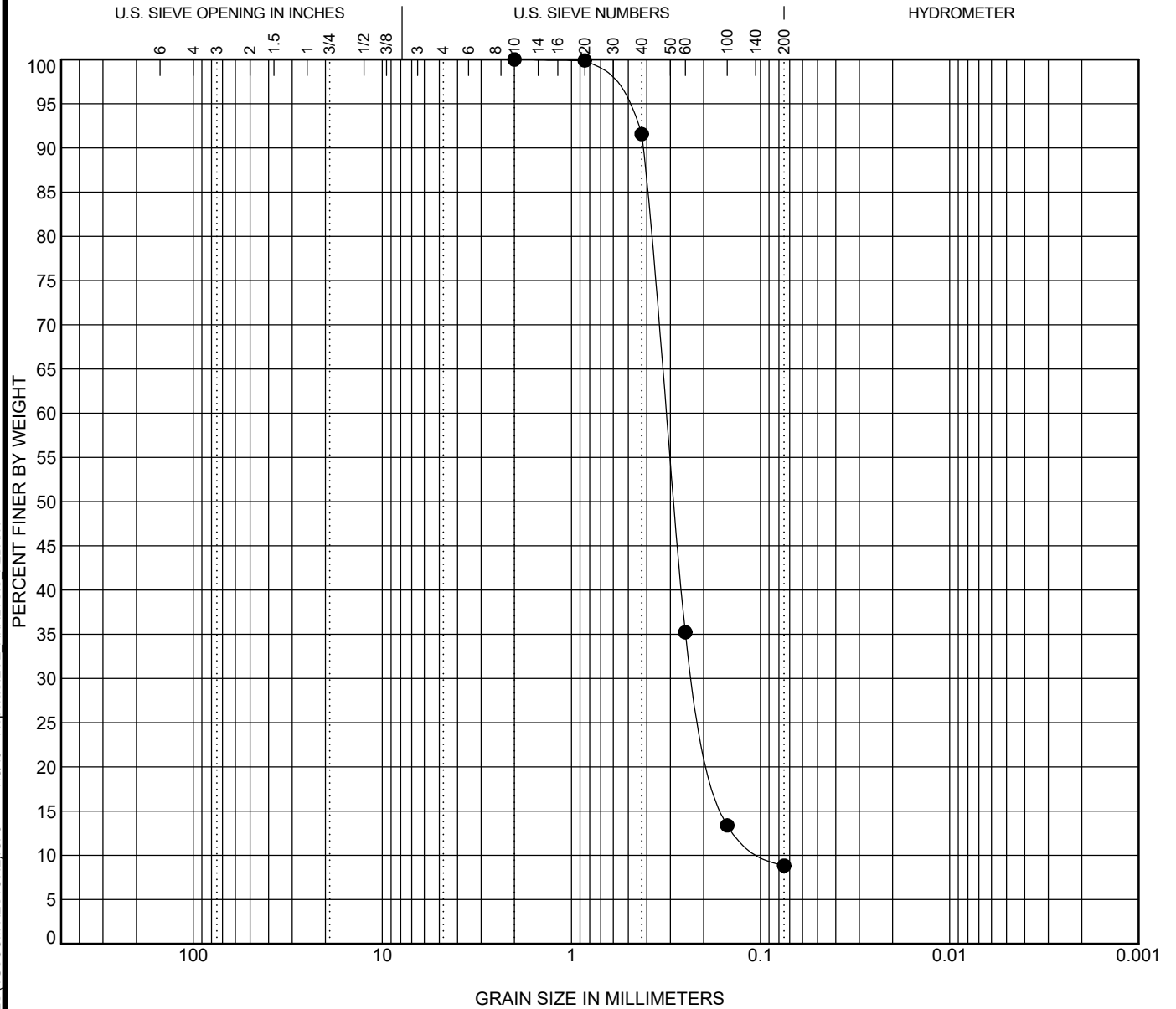
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ18</b>													
Description	<b>13'-18'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ18</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.17	1.99	2	0.4	0.3	0.2	0.0	97.0	3.0		

<p style="font-size: small; margin-top: 10px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



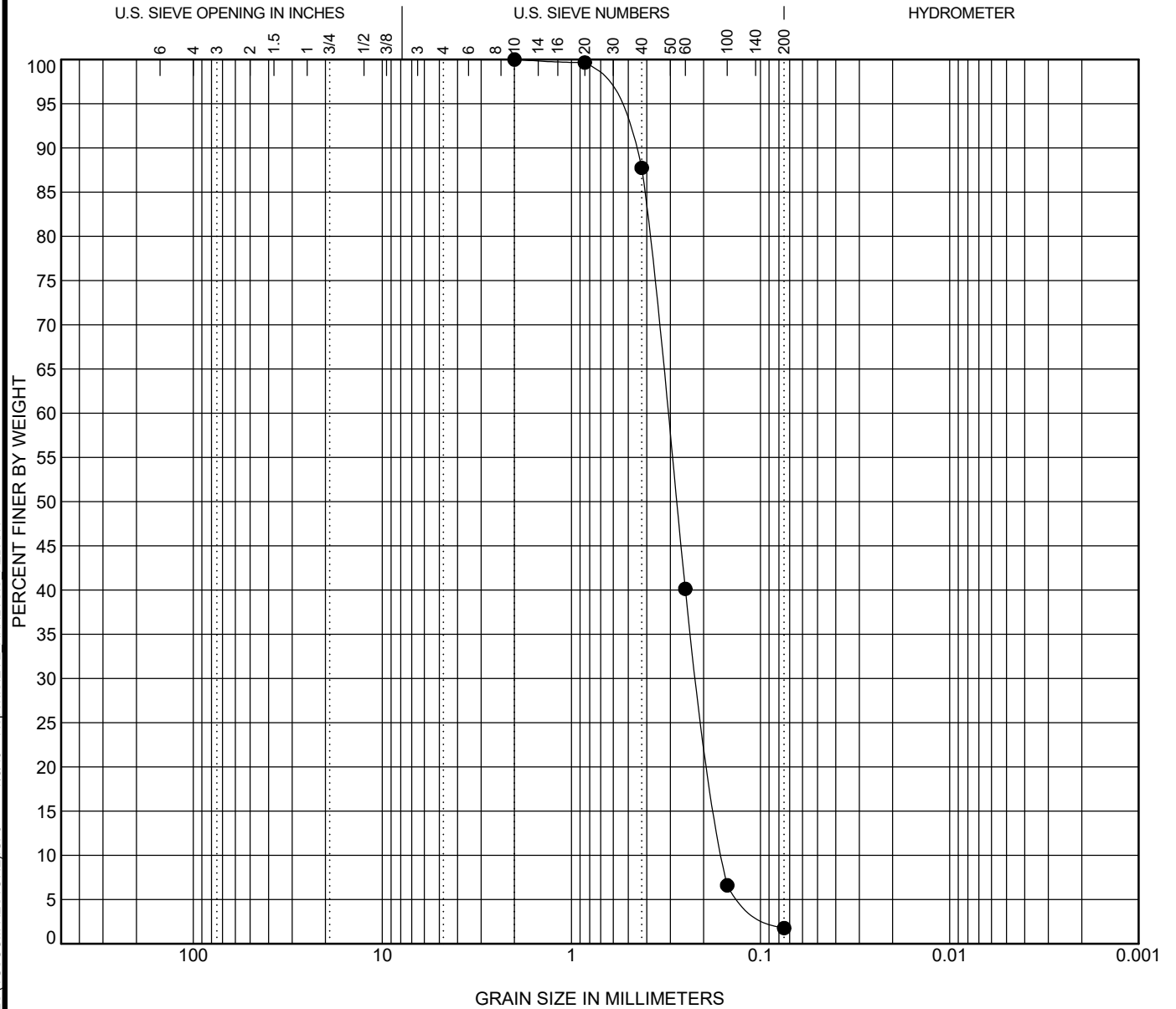
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ18</b>													
Description	<b>18'-20'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ18</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.73</b>	<b>3.52</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>91.2</b>	<b>8.8</b>		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



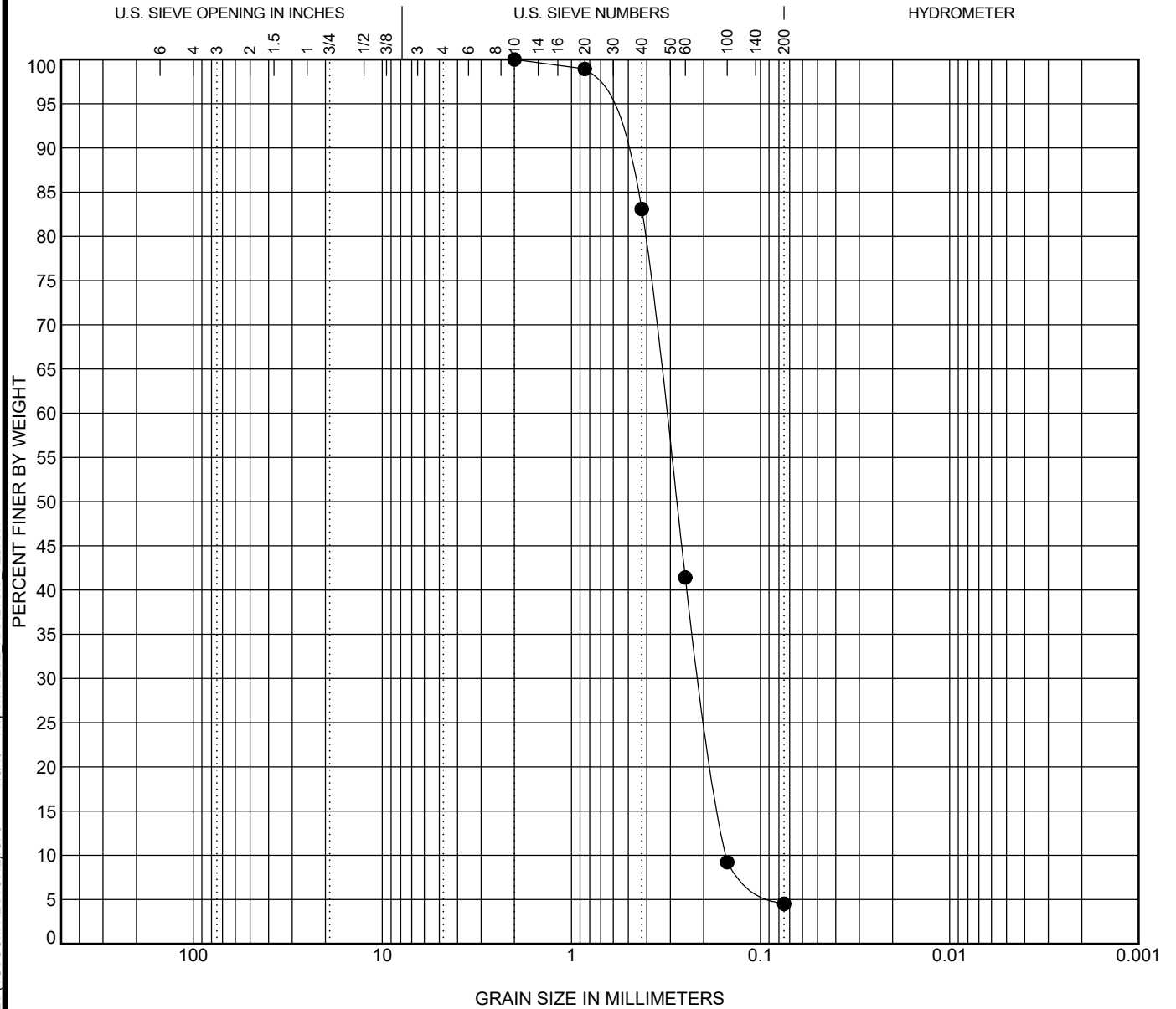
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ19</b>												
Description	<b>6'-13'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ19</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				<b>0.93</b>	<b>1.97</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.0</b>	<b>98.2</b>	<b>1.8</b>	

<p style="font-size: small; margin-top: 10px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



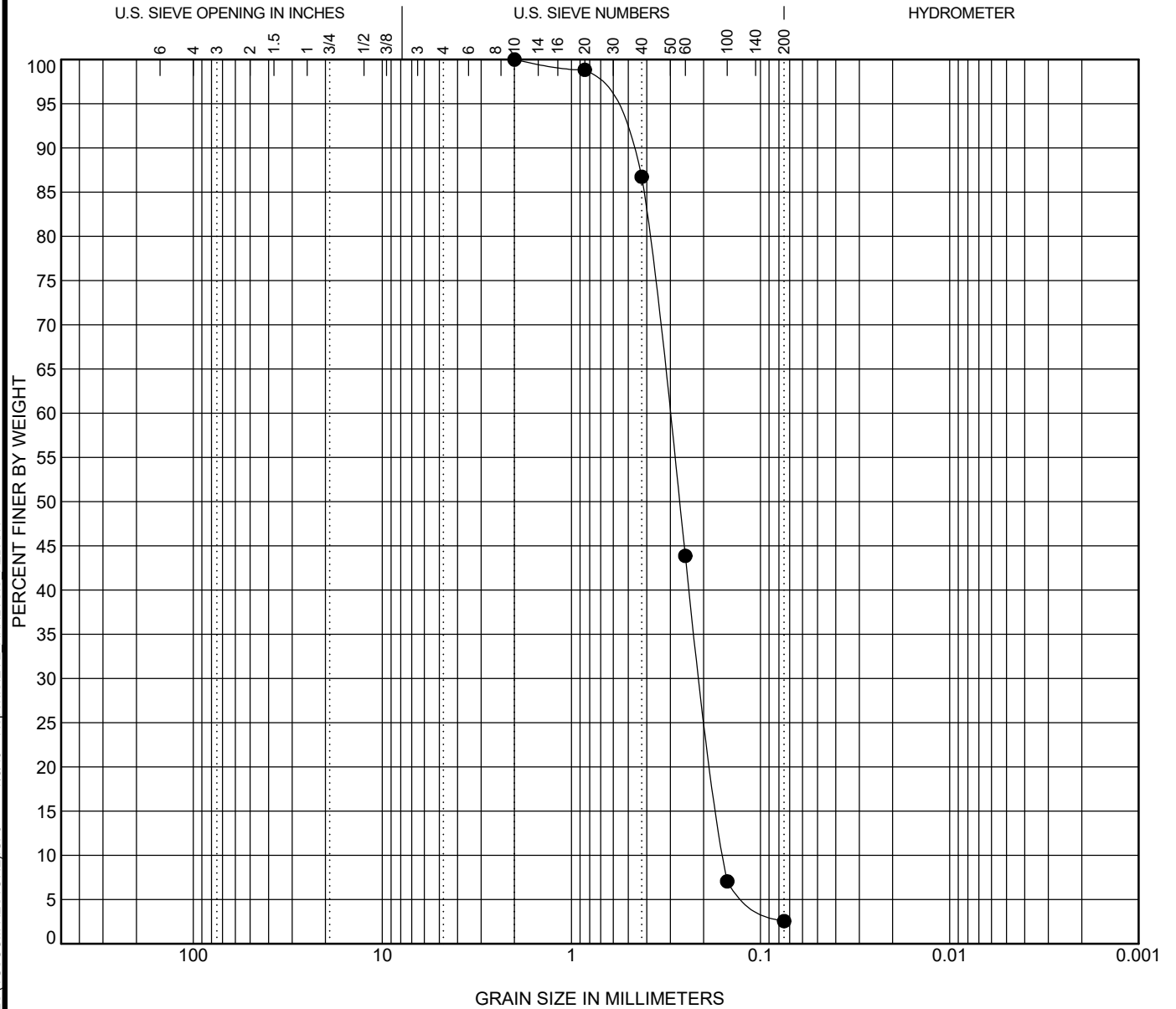
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ19</b>													
Description	<b>13'-18'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ19</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>0.90</b>	<b>2.09</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.0</b>	<b>95.5</b>	<b>4.5</b>		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



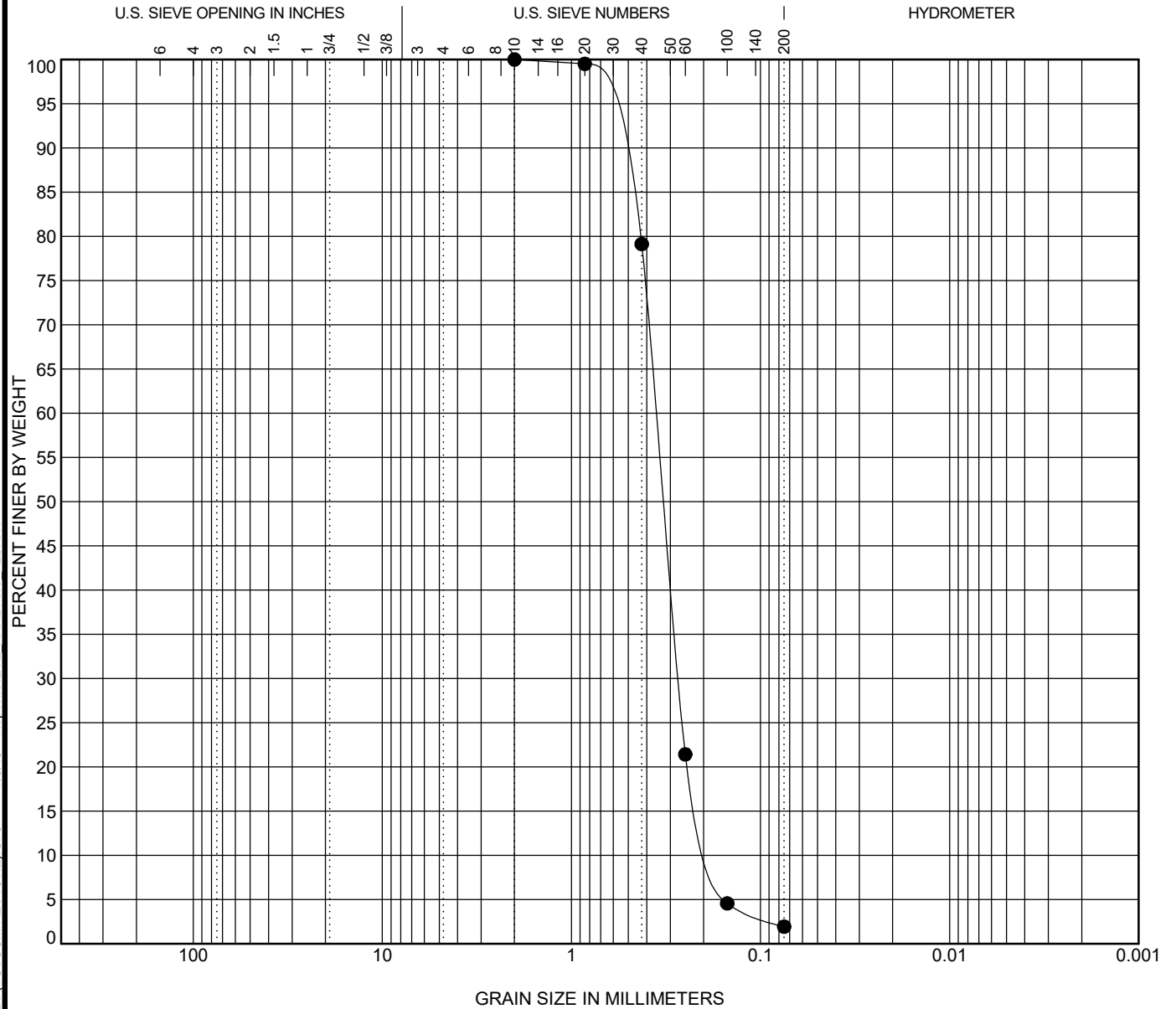
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ20D</b>													
Description	<b>7'-16'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ20D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay
				<b>0.89</b>	<b>1.95</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.0</b>	<b>97.4</b>	<b>2.6</b>		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

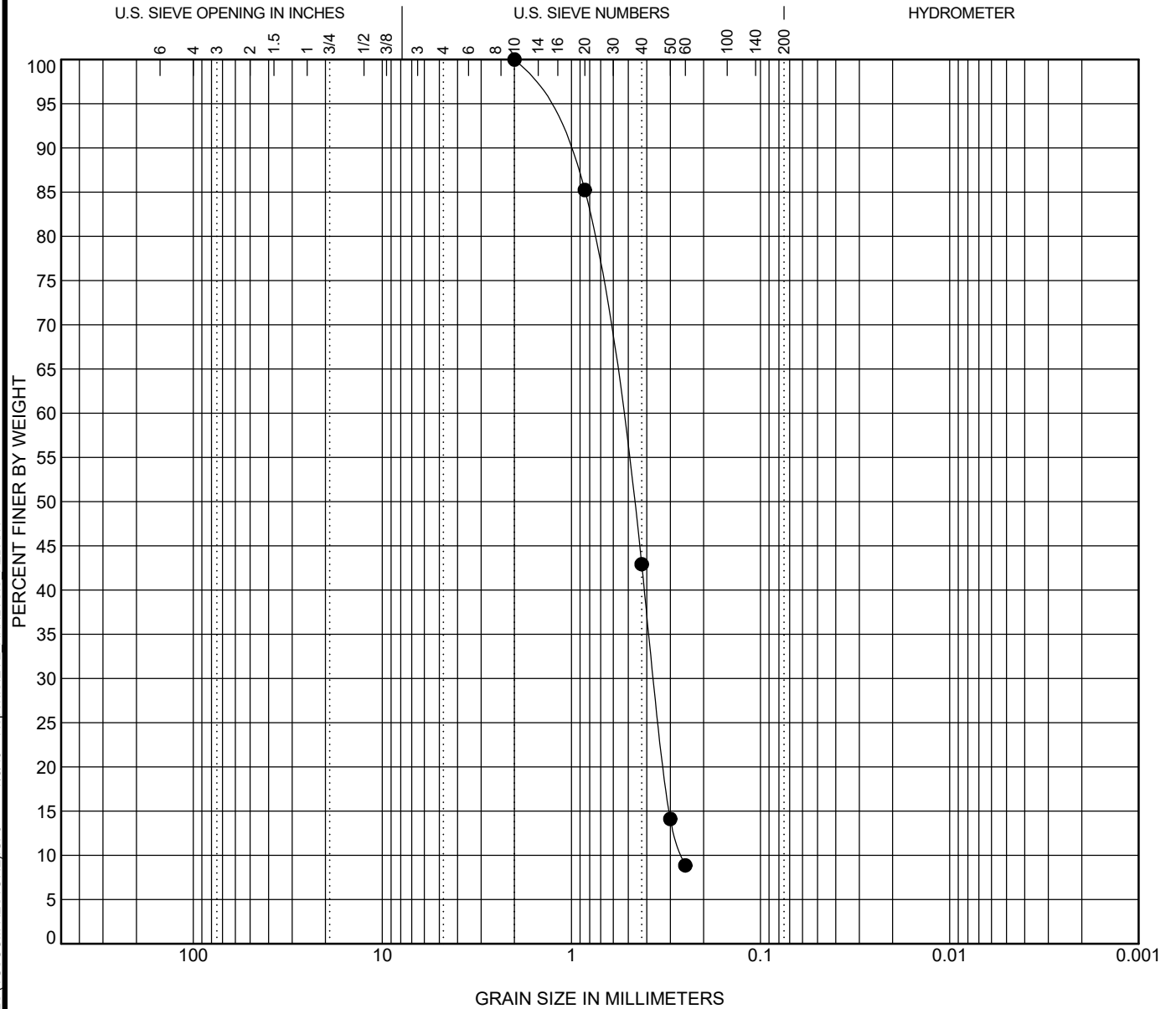
Sample ID	<b>PZ20D</b>													
Description	<b>33'-40'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ20D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.16	2.02	2	0.4	0.3	0.2	0.0	98.1	1.9		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ21												
Description	3'-5'												
Sampled by:	TTL												
Sample Location:	PZ21												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				0.90	2.16	2	0.6	0.4	0.3	0.0			

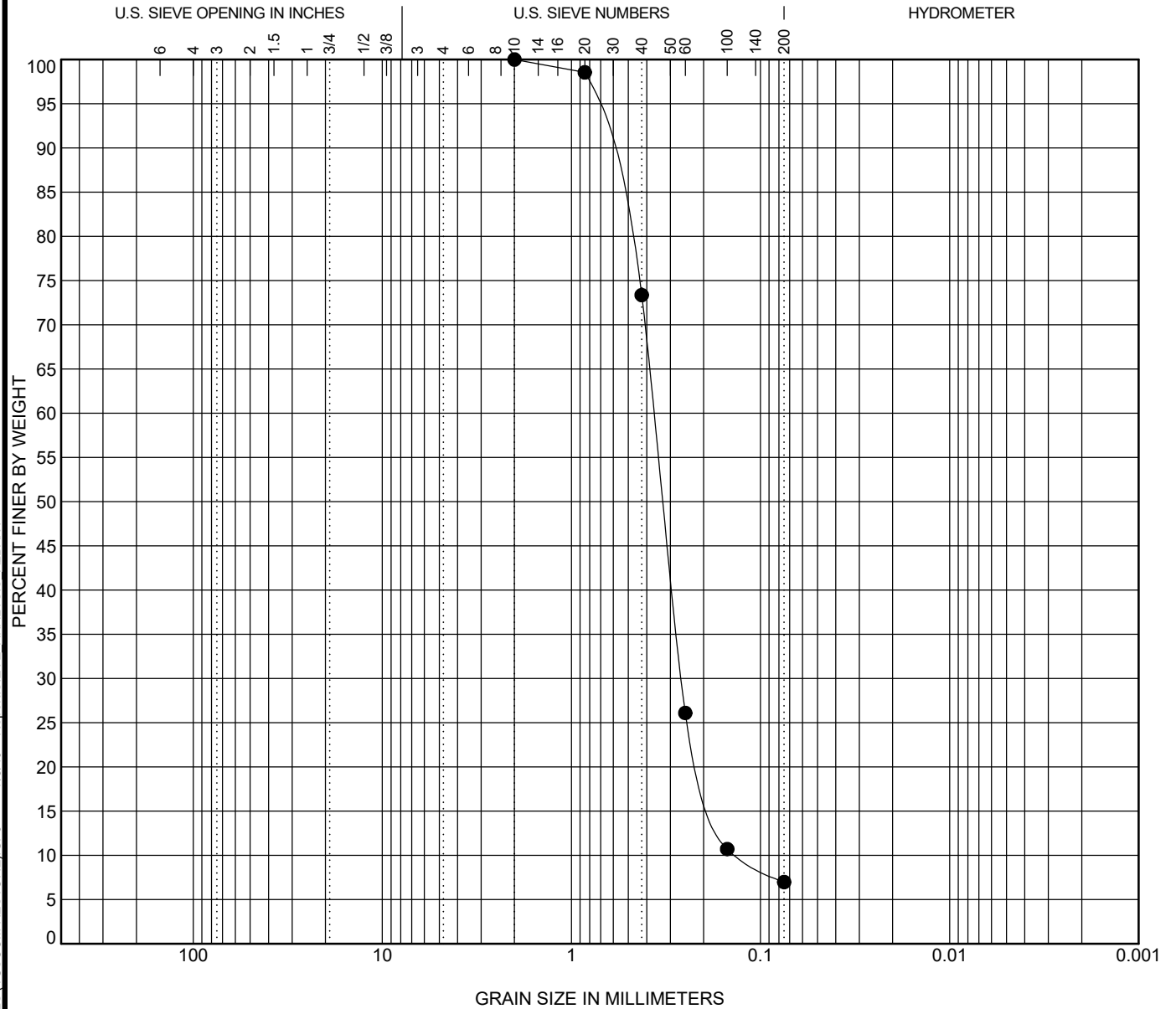


geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



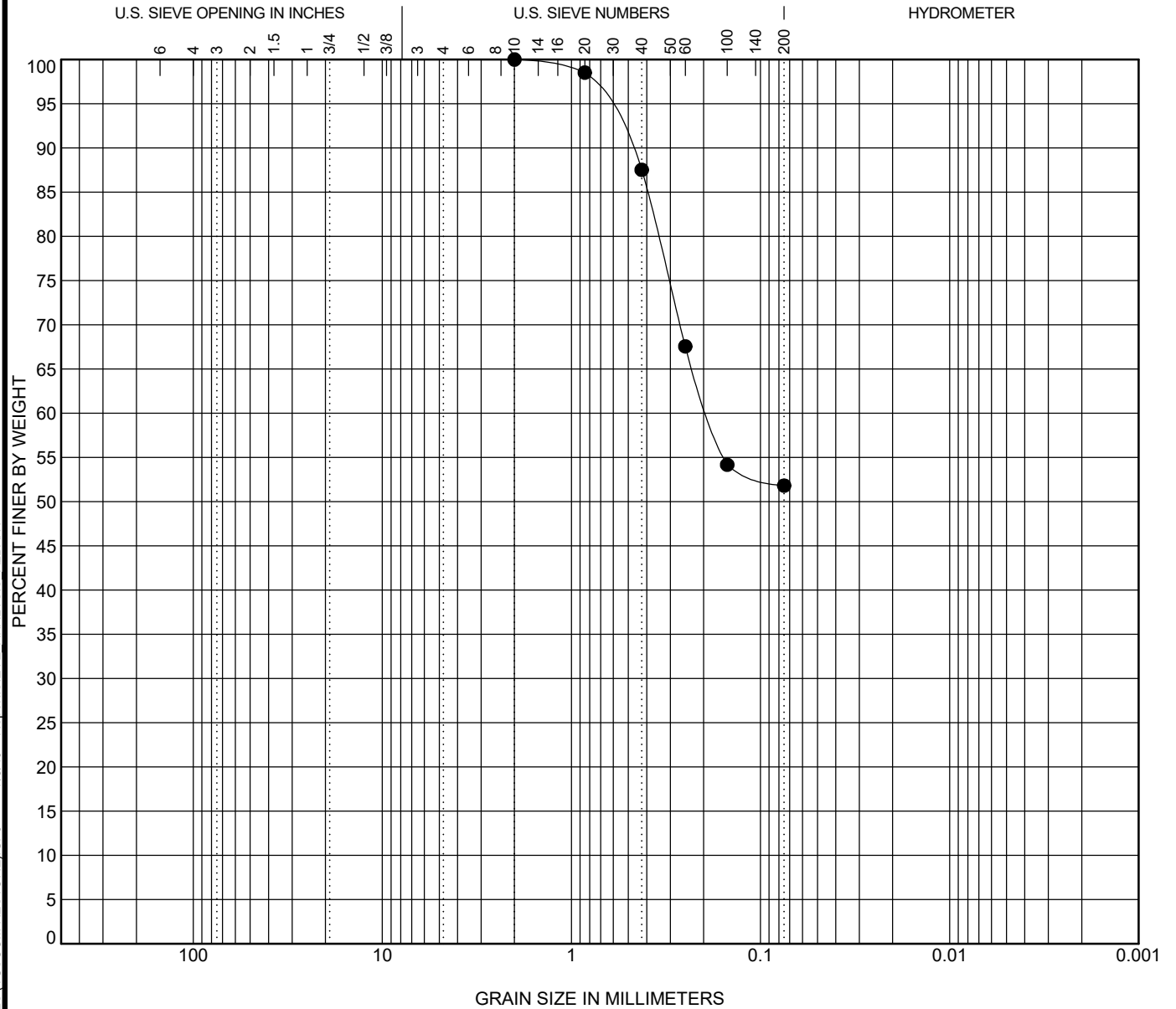
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ21</b>													
Description	<b>6'-17'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ21</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.42	2.78	2	0.4	0.3	0.1	0.0	93.0	7.0		

<p><b>TTL</b> geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve Location: Saint George, Georgia Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ22S</b>													
Description	<b>9'-10'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ22S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.2	51.8		

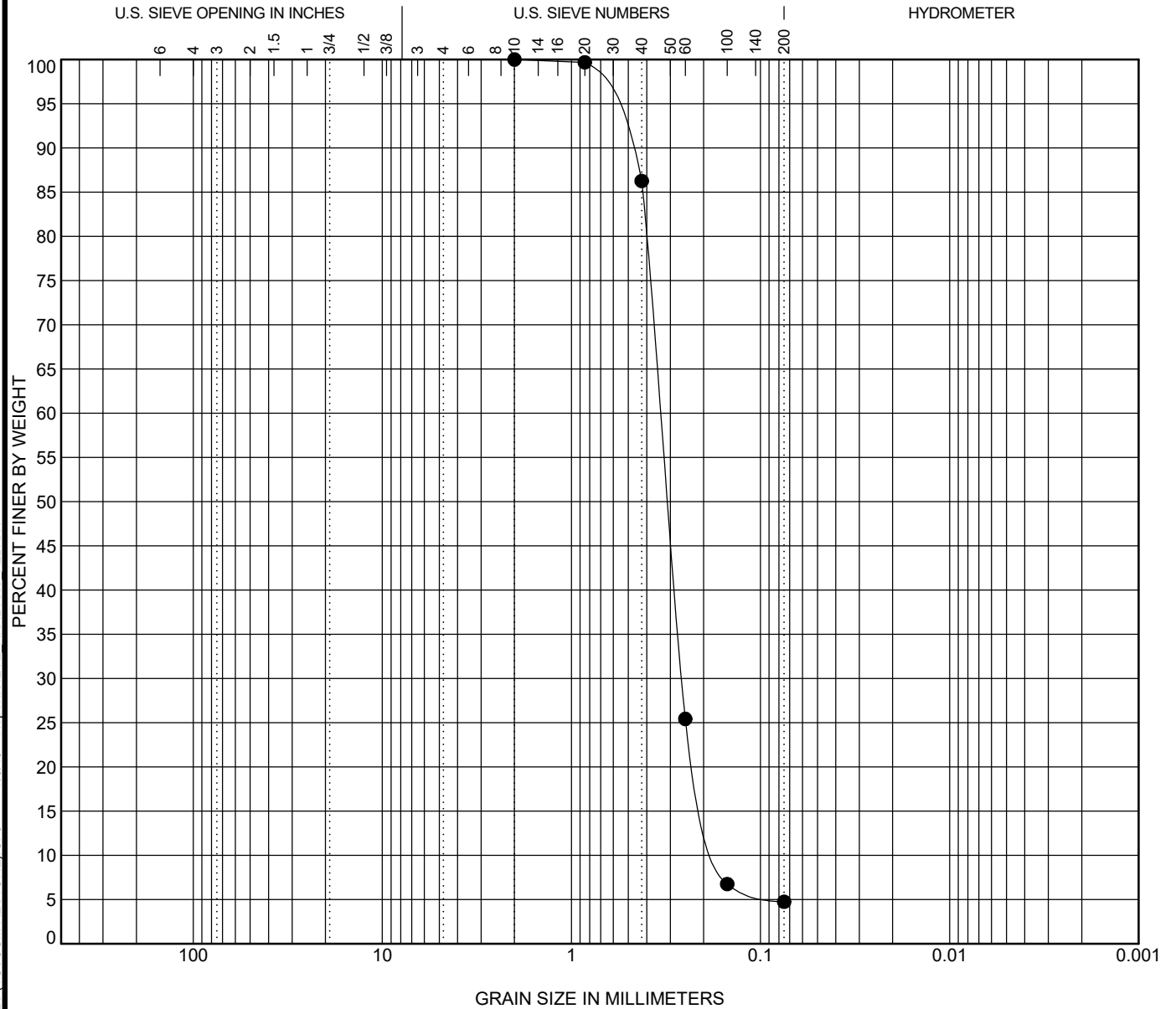


geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



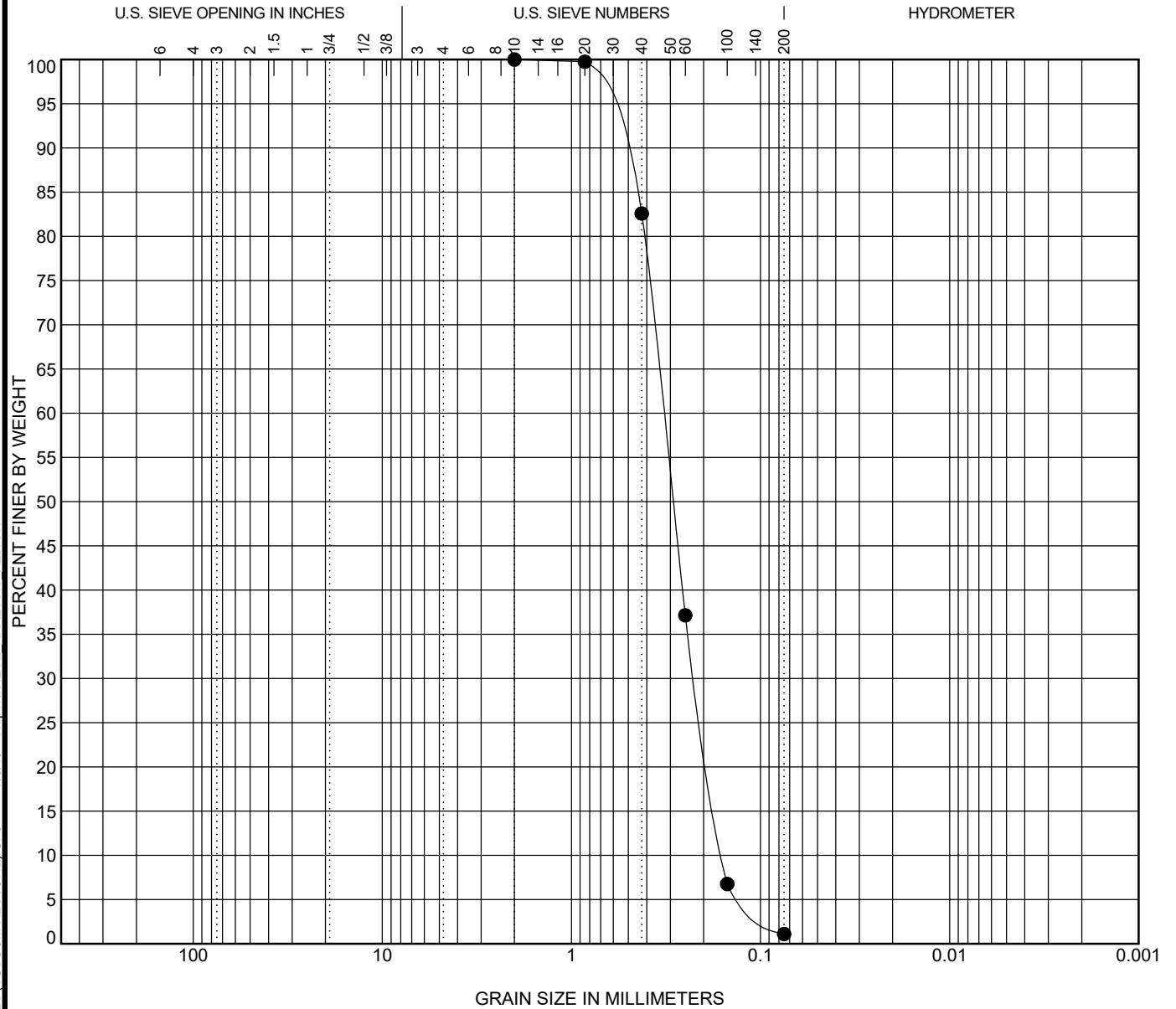
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	P222D													
Description	18'-23'													
Sampled by:	TTL													
Sample Location:	P222D													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.22	2.06	2	0.3	0.3	0.2	0.0	95.3	4.7		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



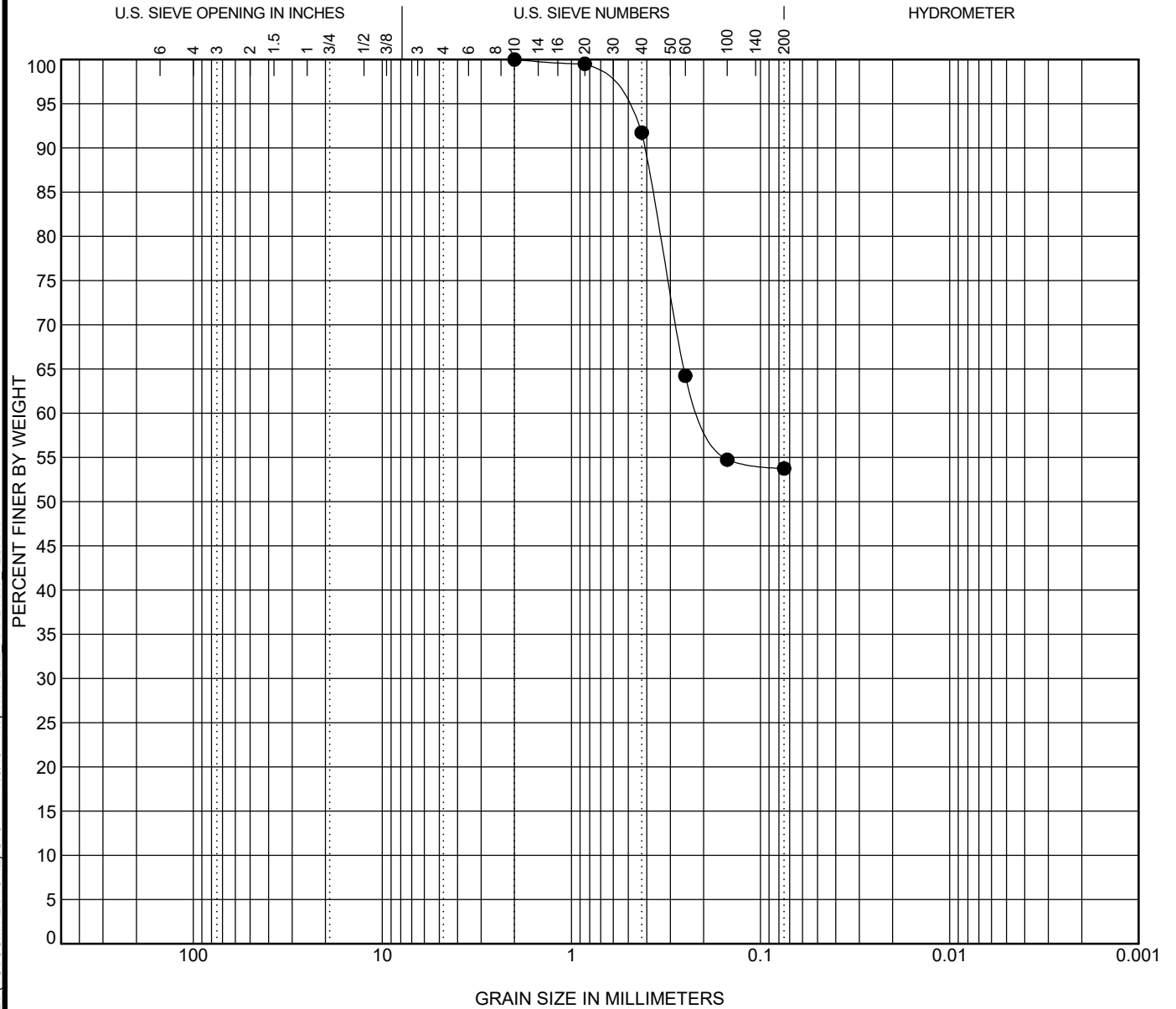
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ22D</b>													
Description	<b>35'-38'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ22D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>0.95</b>	<b>2.06</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.0</b>	<b>98.9</b>	<b>1.1</b>		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ23</b>													
Description	<b>12.5'-15'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ23</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	46.3	53.7		

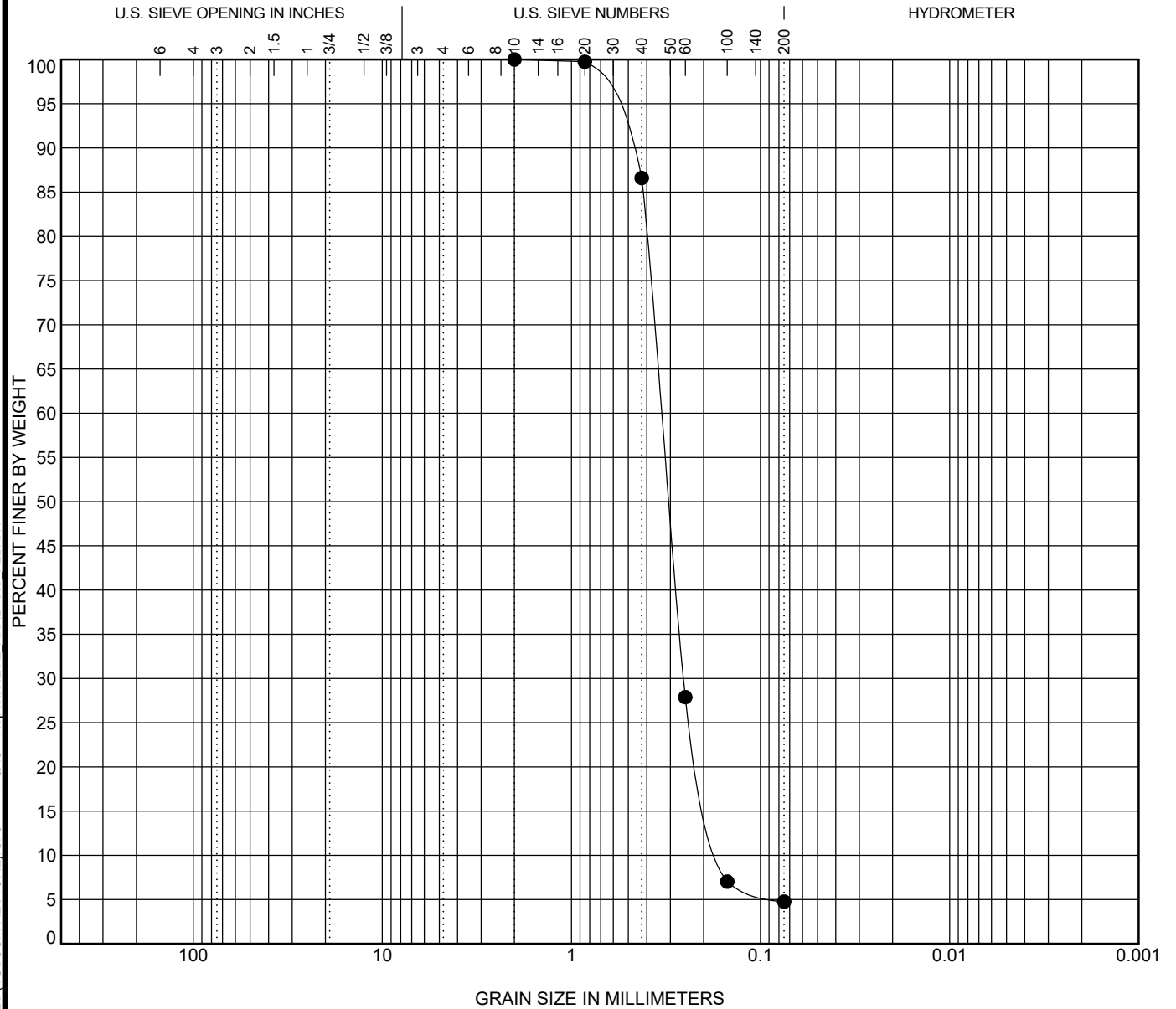


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## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ24												
Description	6'-7'												
Sampled by:	TTL												
Sample Location:	PZ24												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.20	2.07	2	0.3	0.3	0.2	0.0	95.2	4.8	

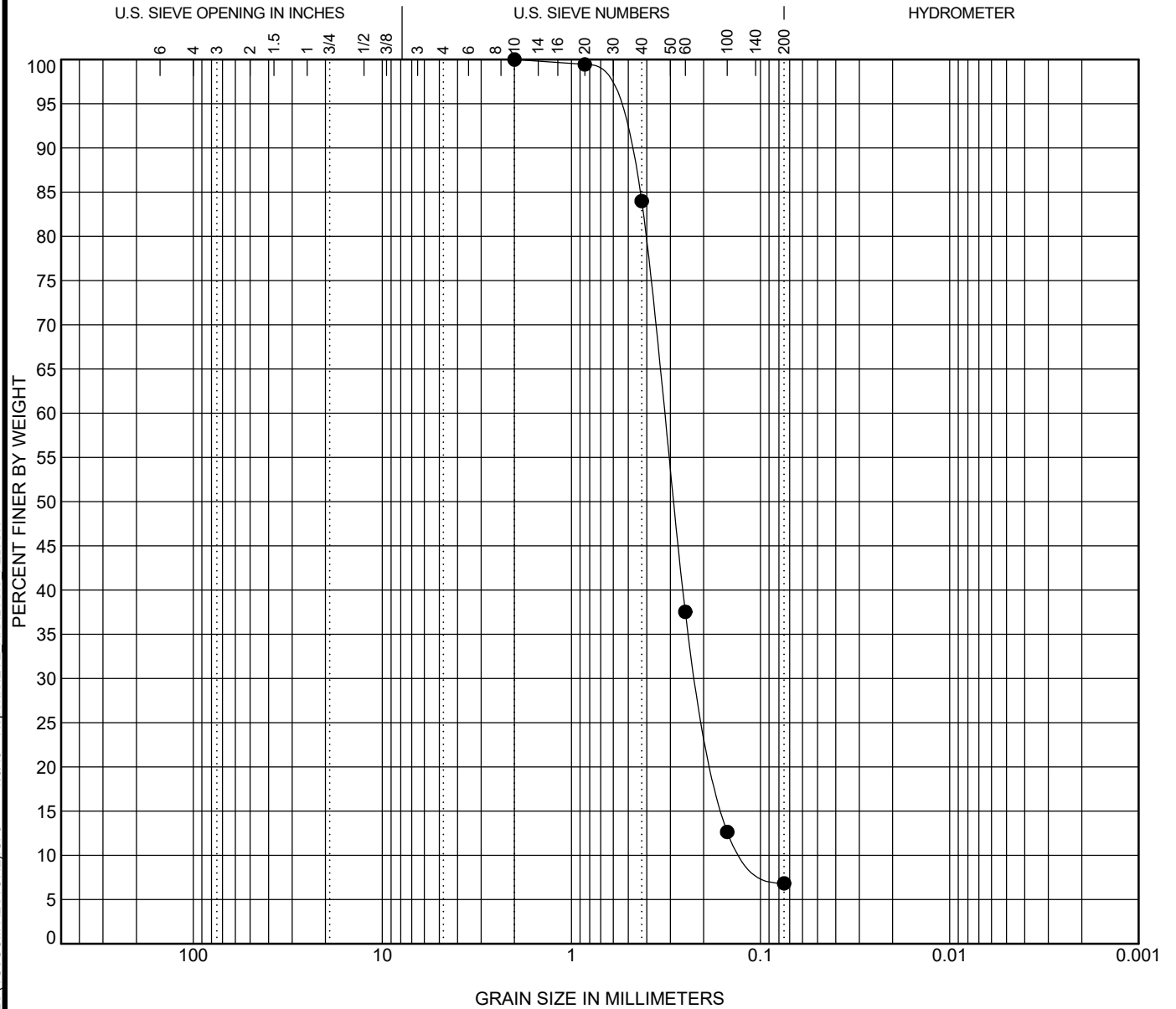


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## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

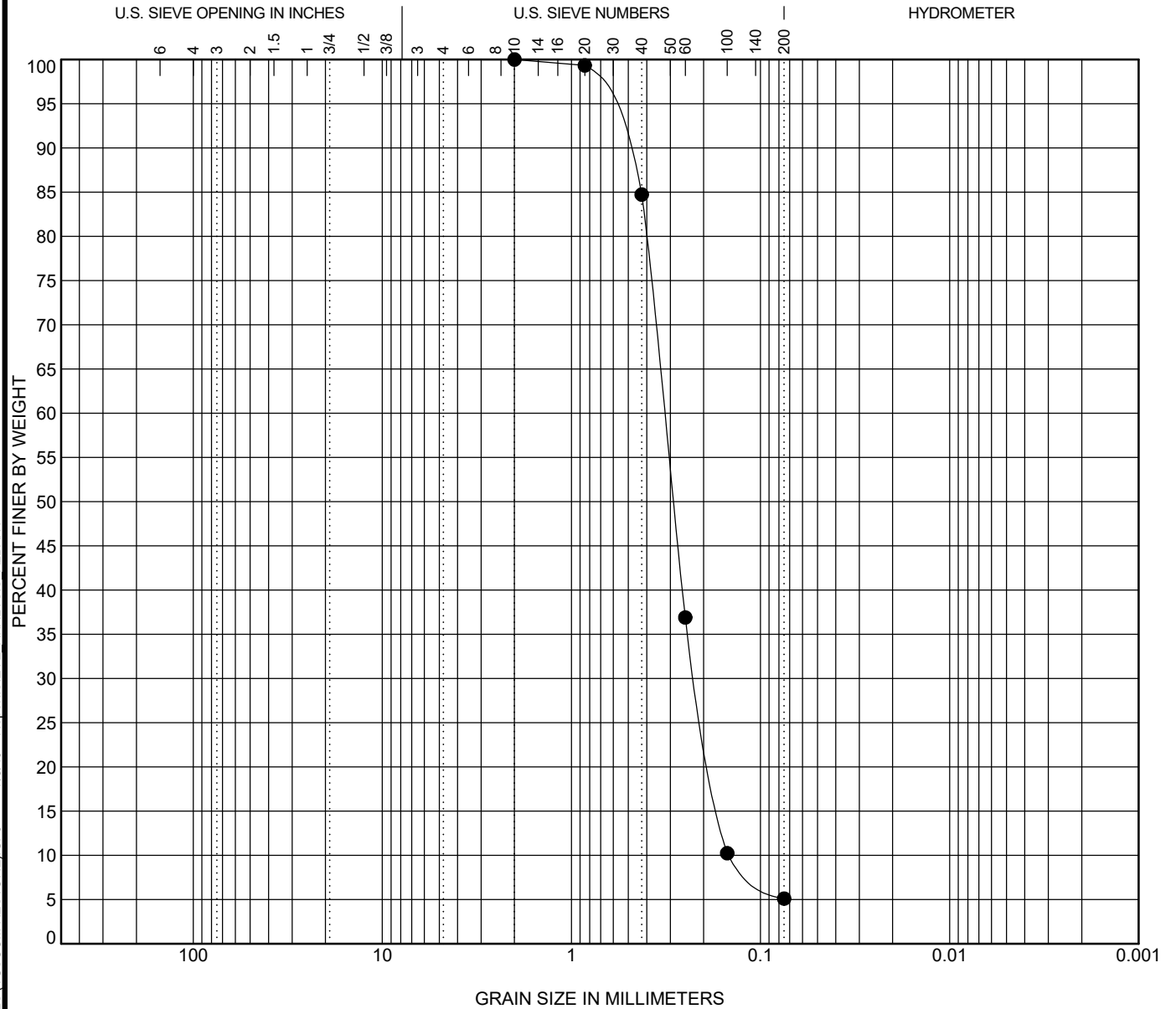
Sample ID	<b>PZ24</b>												
Description	<b>10'-18'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ24</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				<b>1.30</b>	<b>2.95</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>93.2</b>	<b>6.8</b>	

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



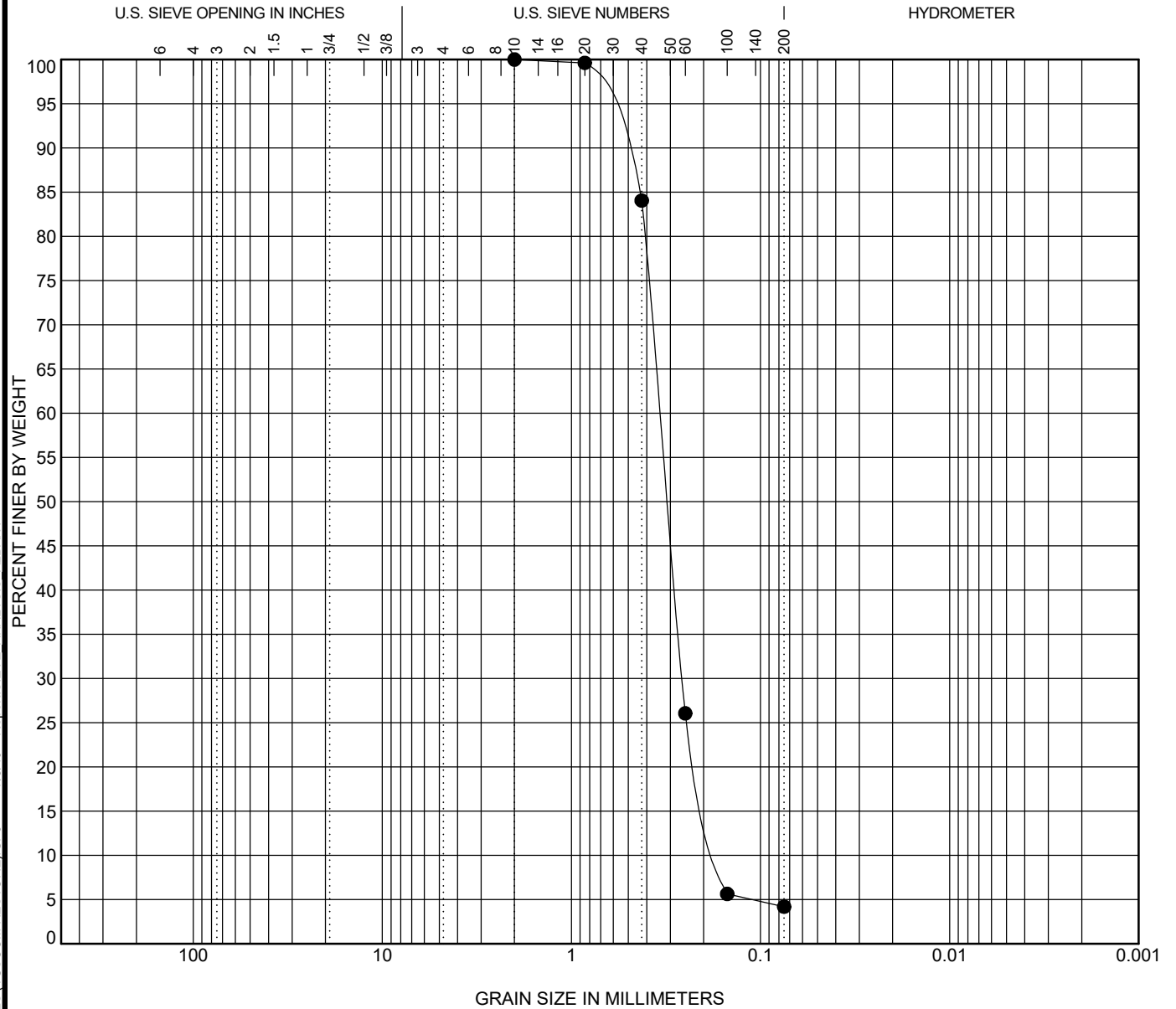
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ25S</b>													
Description	<b>3'-5'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ25S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.02</b>	<b>2.22</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>94.9</b>	<b>5.1</b>		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



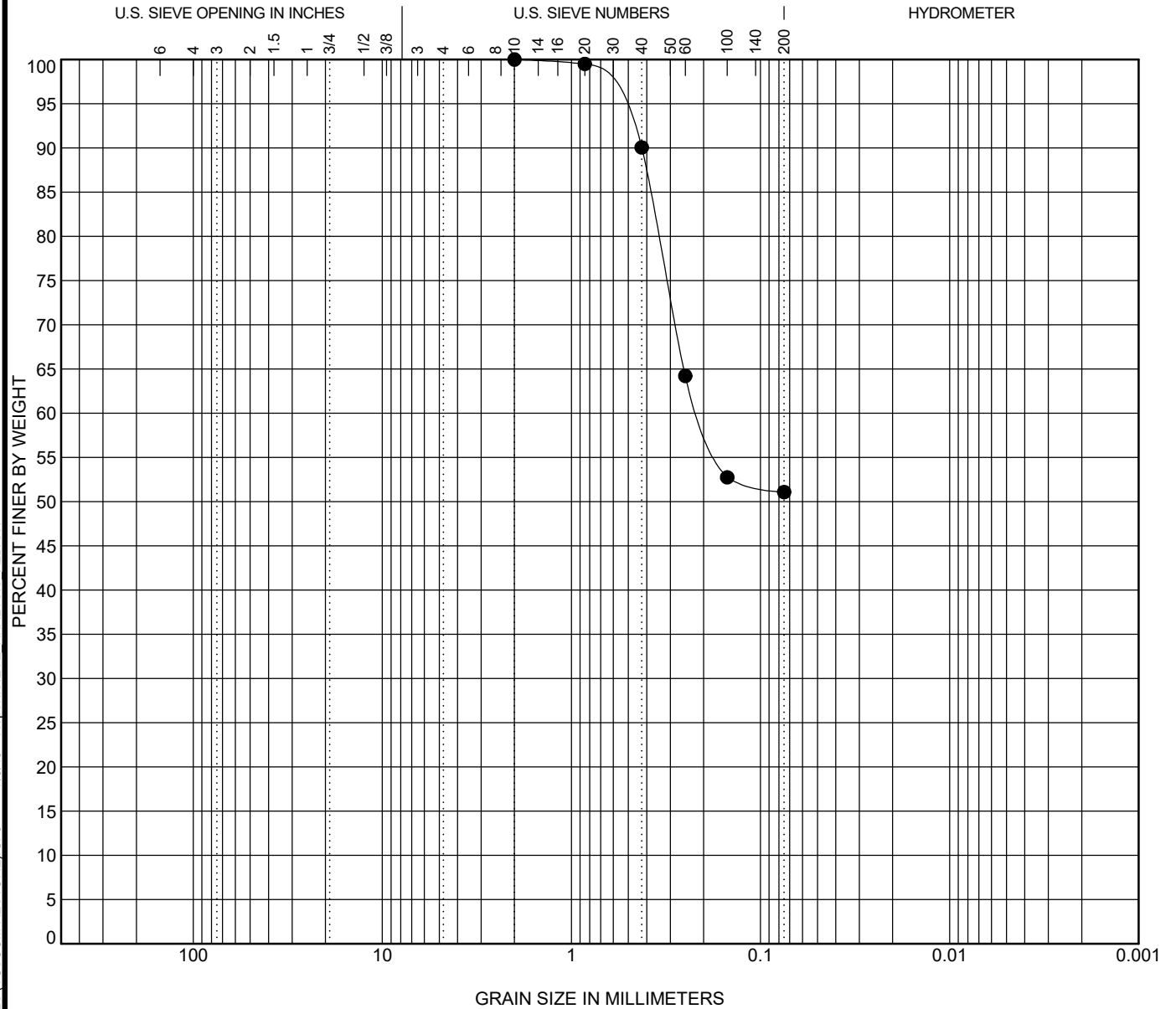
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ25S</b>													
Description	<b>13'-19'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ25S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				1.18	2.04	2	0.3	0.3	0.2	0.0	95.8	4.2		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



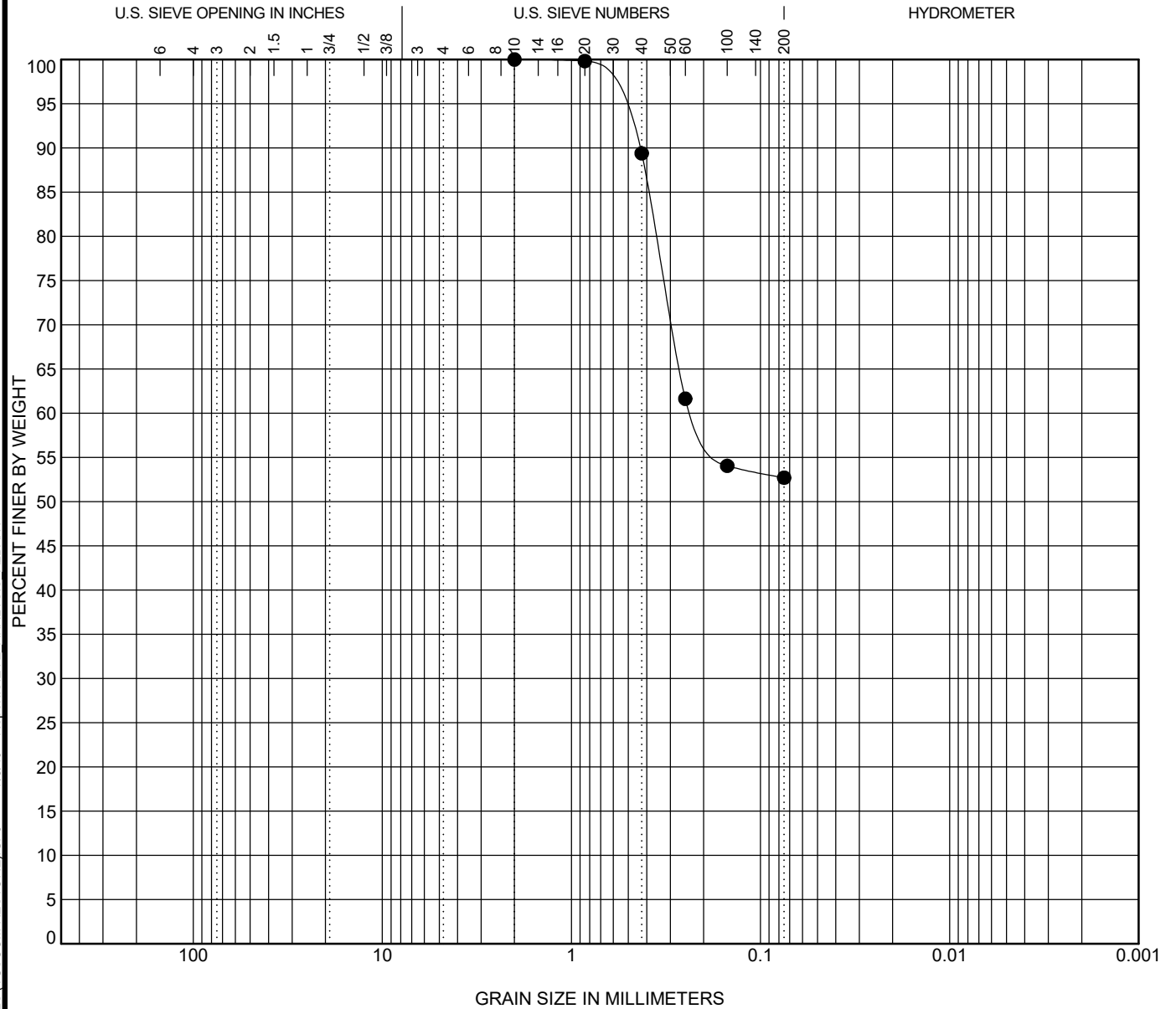
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ25D</b>													
Description	<b>9'-11'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ25D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.9	51.1		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



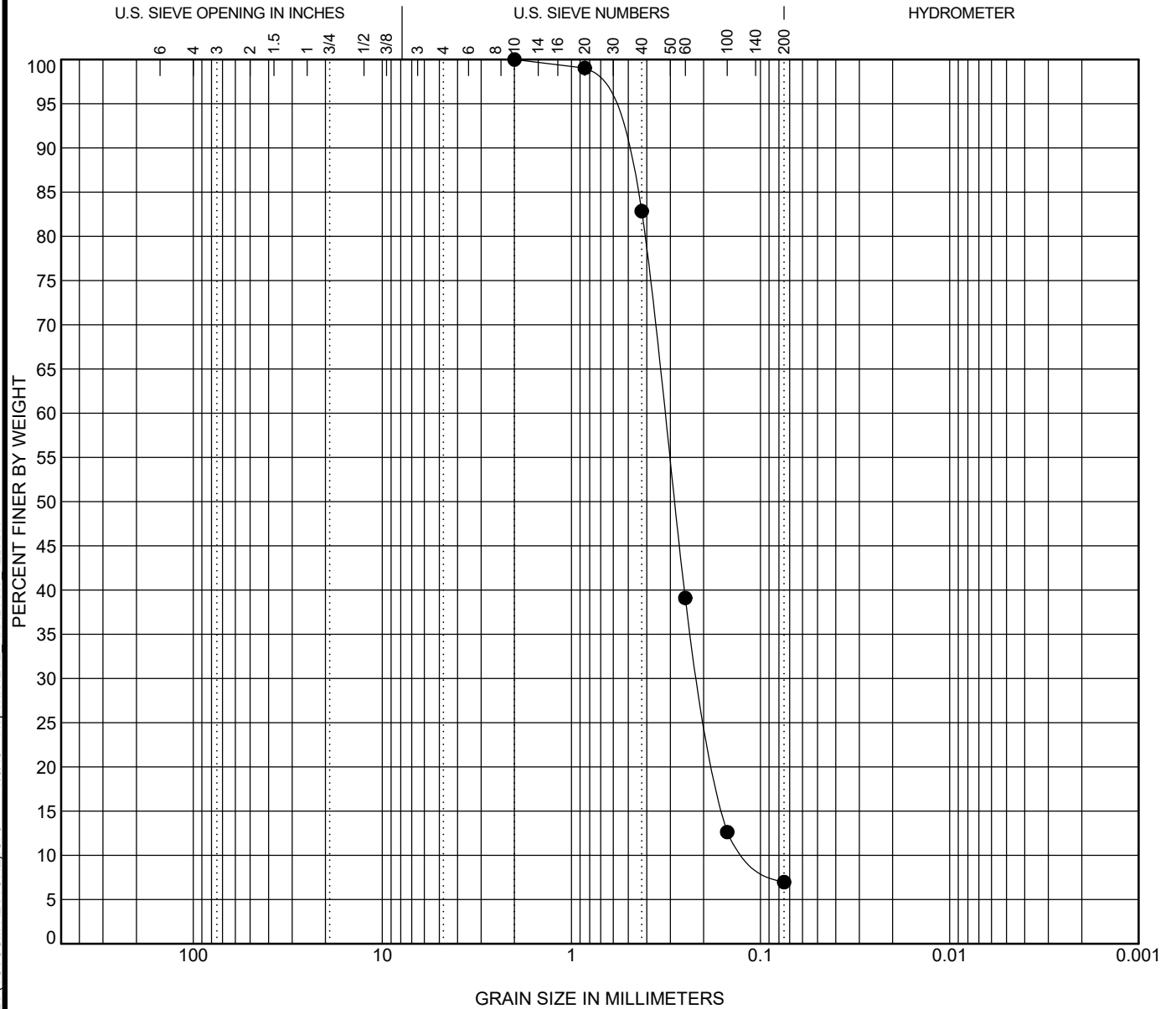
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ25D</b>													
Description	<b>28.5'-29'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ25D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	47.3	52.7		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



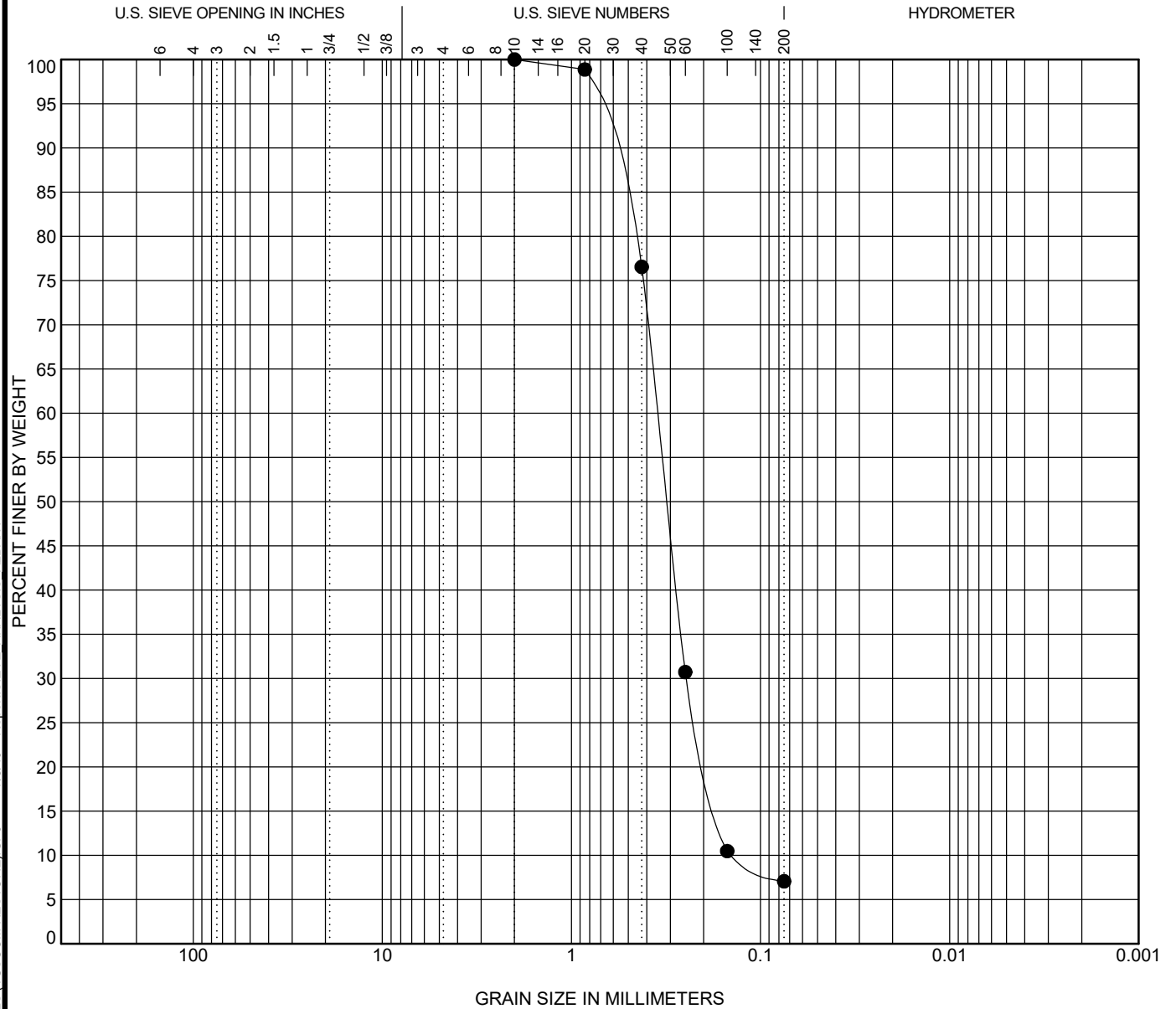
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ26</b>													
Description	<b>0'-6"</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ26</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>1.26</b>	<b>2.96</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.1</b>	<b>0.0</b>	<b>93.0</b>	<b>7.0</b>		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



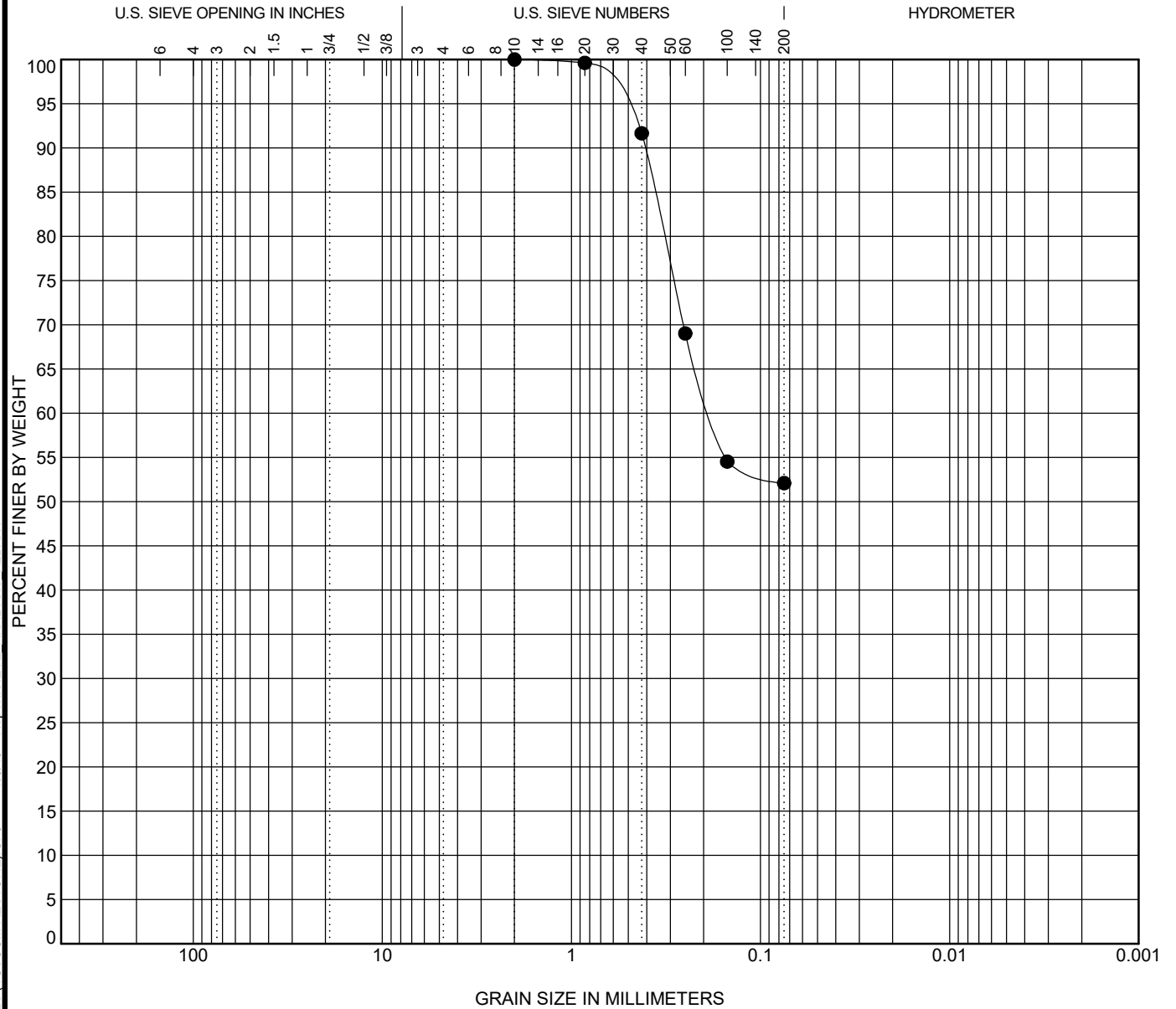
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ26</b>												
Description	<b>13.5'-20'</b>												
Sampled by:	<b>TTL</b>												
Sample Location:	<b>PZ26</b>												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.26	2.58	2	0.4	0.2	0.1	0.0	92.9		7.1

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



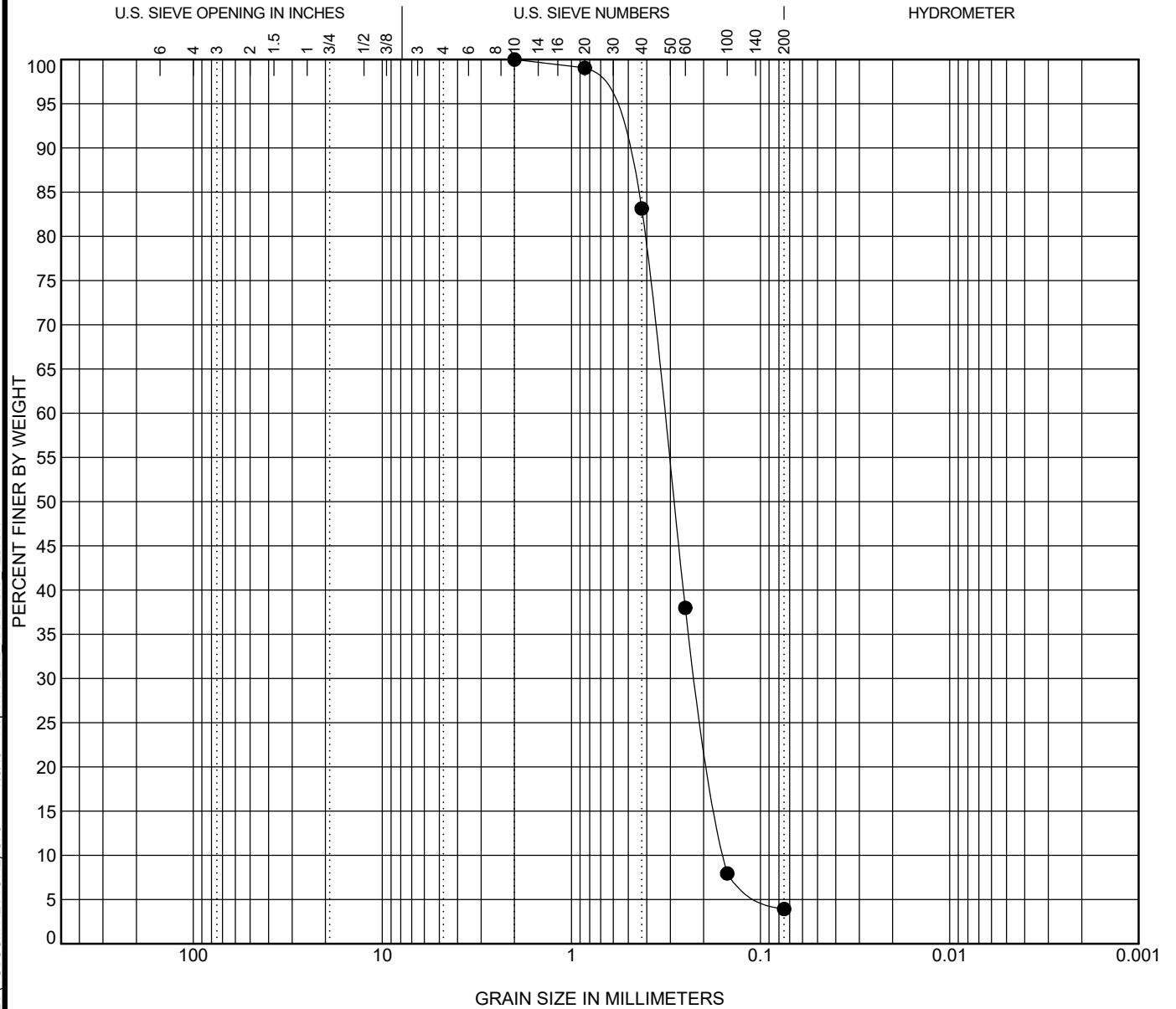
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ27S</b>													
Description	<b>9'-10'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ27S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	47.9	52.1		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	<p>Client: Twin Pines Minerals Saunders-Loncala Reserve</p> <p>Location: Saint George, Georgia</p> <p>Project Number: 000180200804.00</p>

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

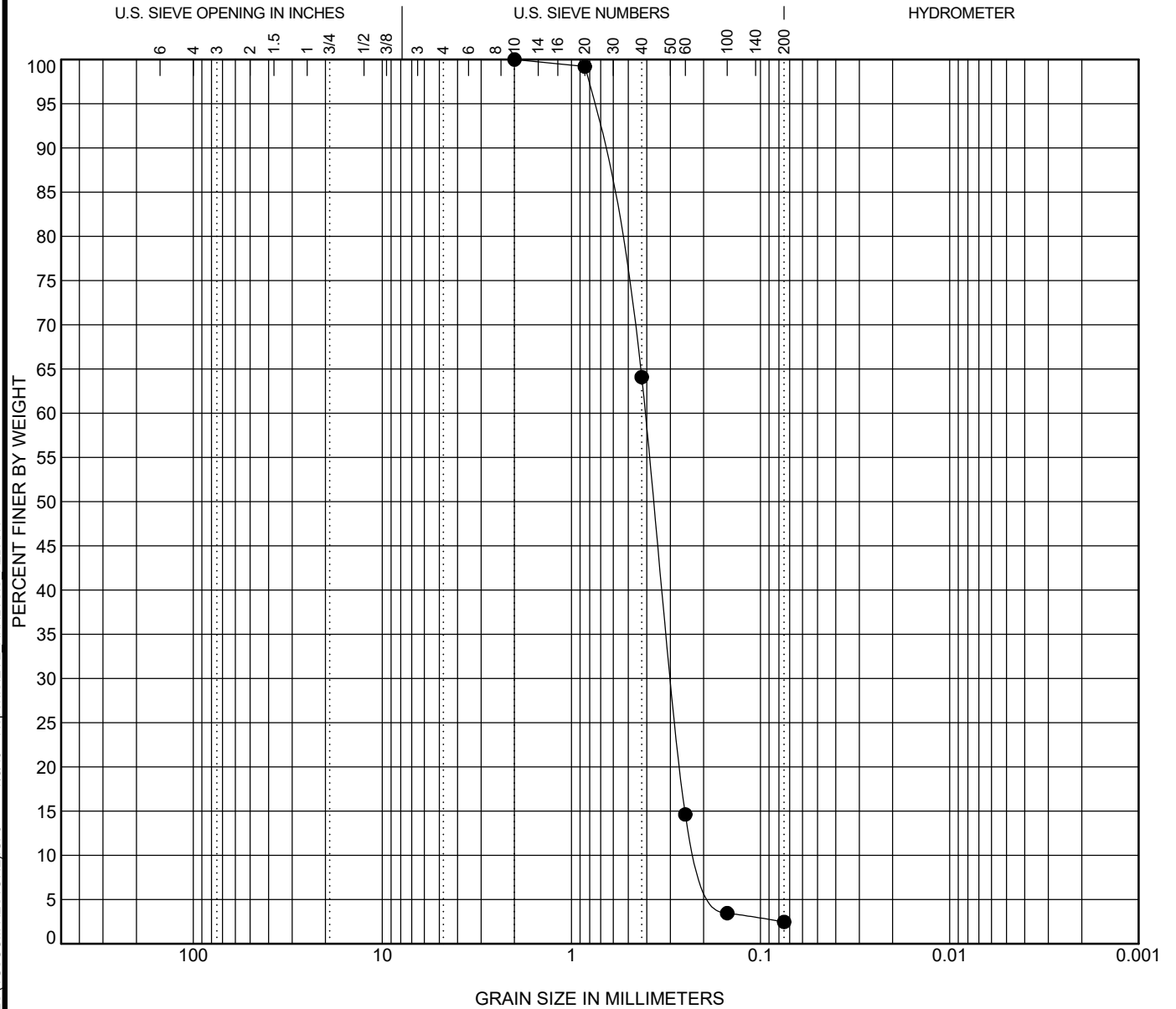
Sample ID	<b>PZ27D</b>													
Description	<b>8'-13'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ27D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>0.95</b>	<b>2.08</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.0</b>	<b>96.1</b>	<b>3.9</b>		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



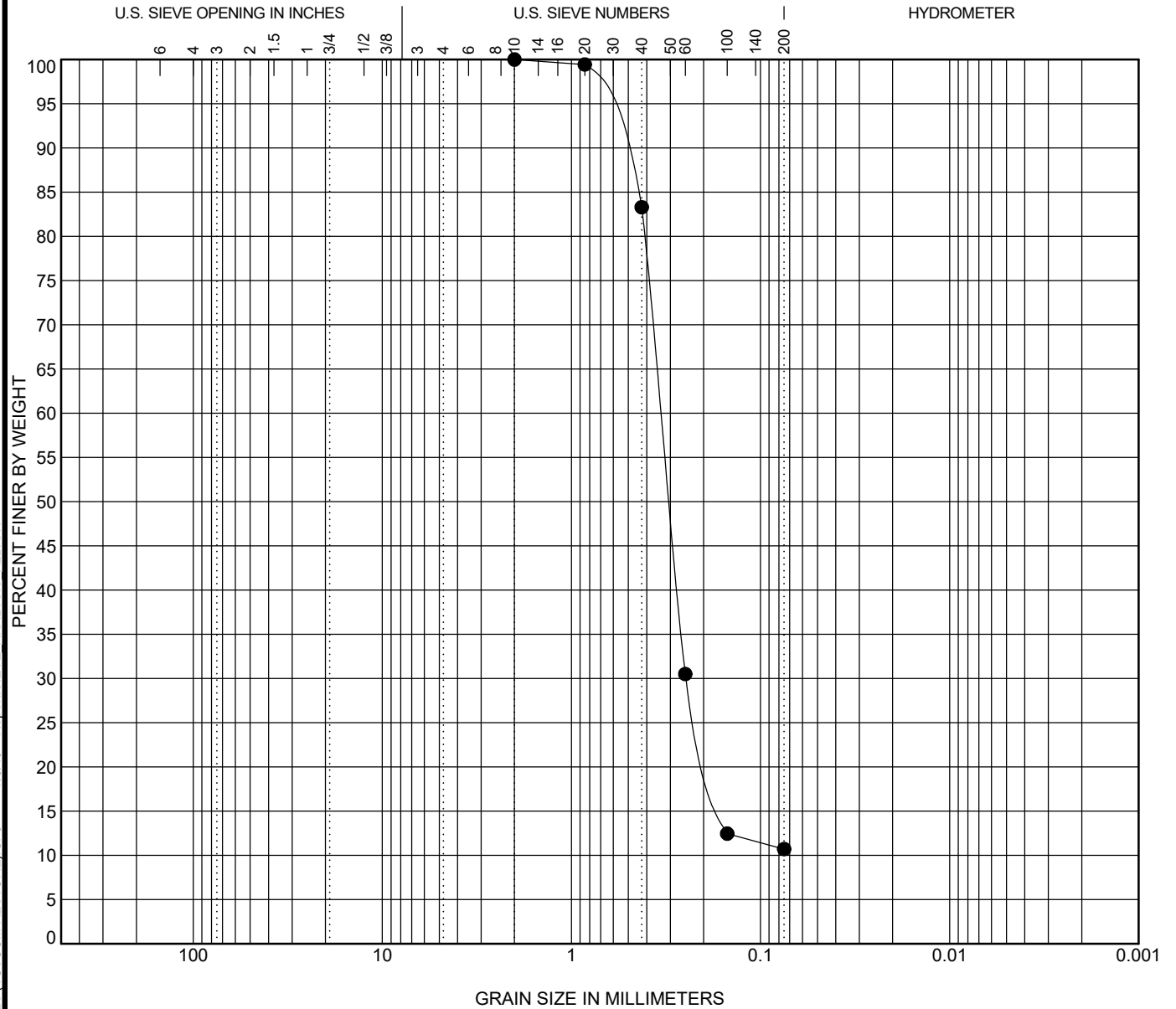
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ27D												
Description	24'-30'												
Sampled by:	TTL												
Sample Location:	PZ27D												
Date Sampled:													
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
				1.06	2.01	2	0.4	0.3	0.2	0.0	97.5	2.5	

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	<p>Client:</p> <p>Project: Twin Pines Minerals Saunders-Loncala Reserve</p> <p>Location: Saint George, Georgia</p> <p>Project Number: 000180200804.00</p>

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# GRAIN SIZE DISTRIBUTION



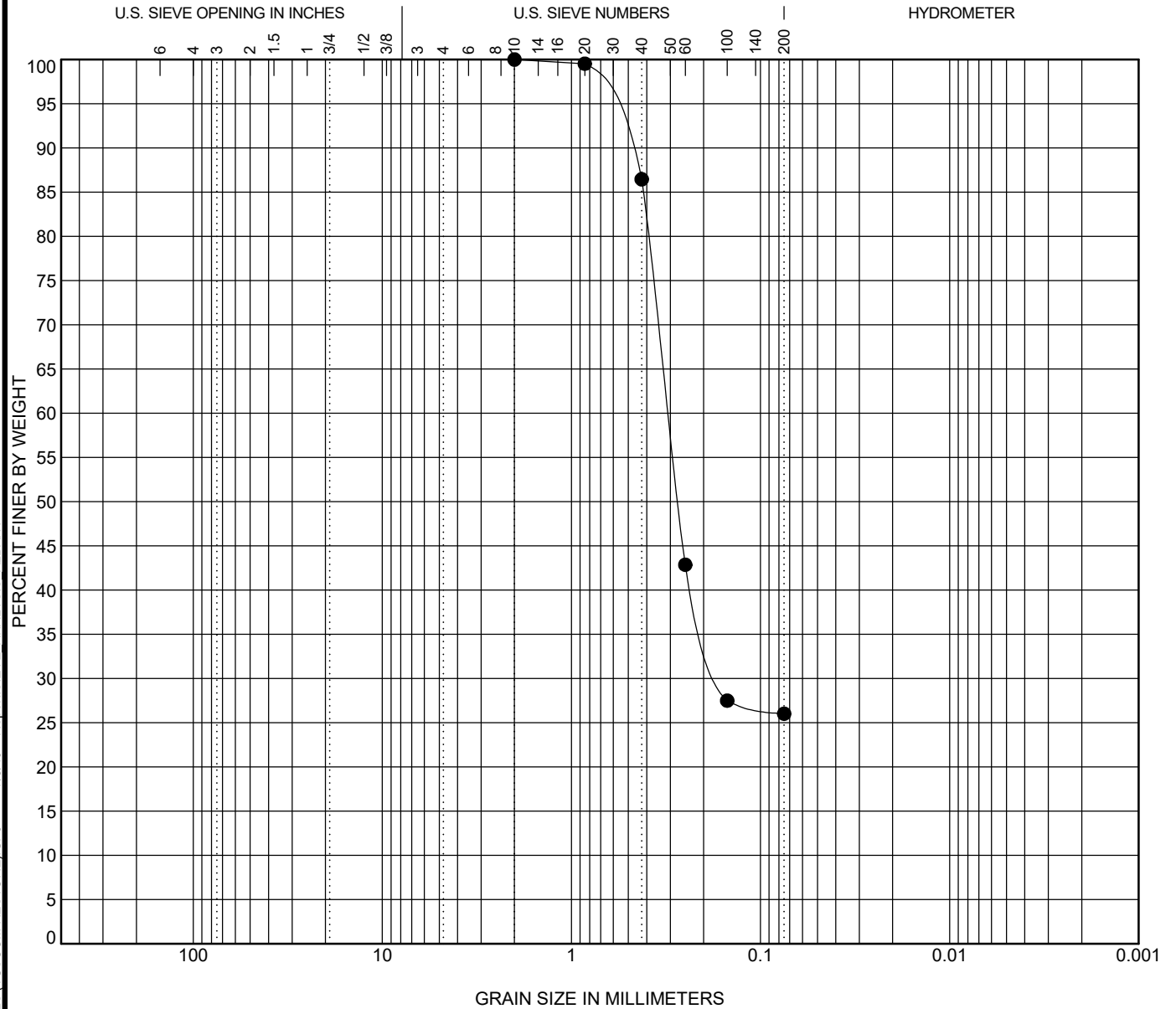
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ28D</b>													
Description	<b>9'-19'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ28D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
				<b>3.19</b>	<b>5.94</b>	<b>2</b>	<b>0.3</b>	<b>0.2</b>		<b>0.0</b>	<b>89.3</b>	<b>10.7</b>		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	<p>Client:</p> <p>Project: Twin Pines Minerals Saunders-Loncala Reserve</p> <p>Location: Saint George, Georgia</p> <p>Project Number: 000180200804.00</p>

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# GRAIN SIZE DISTRIBUTION



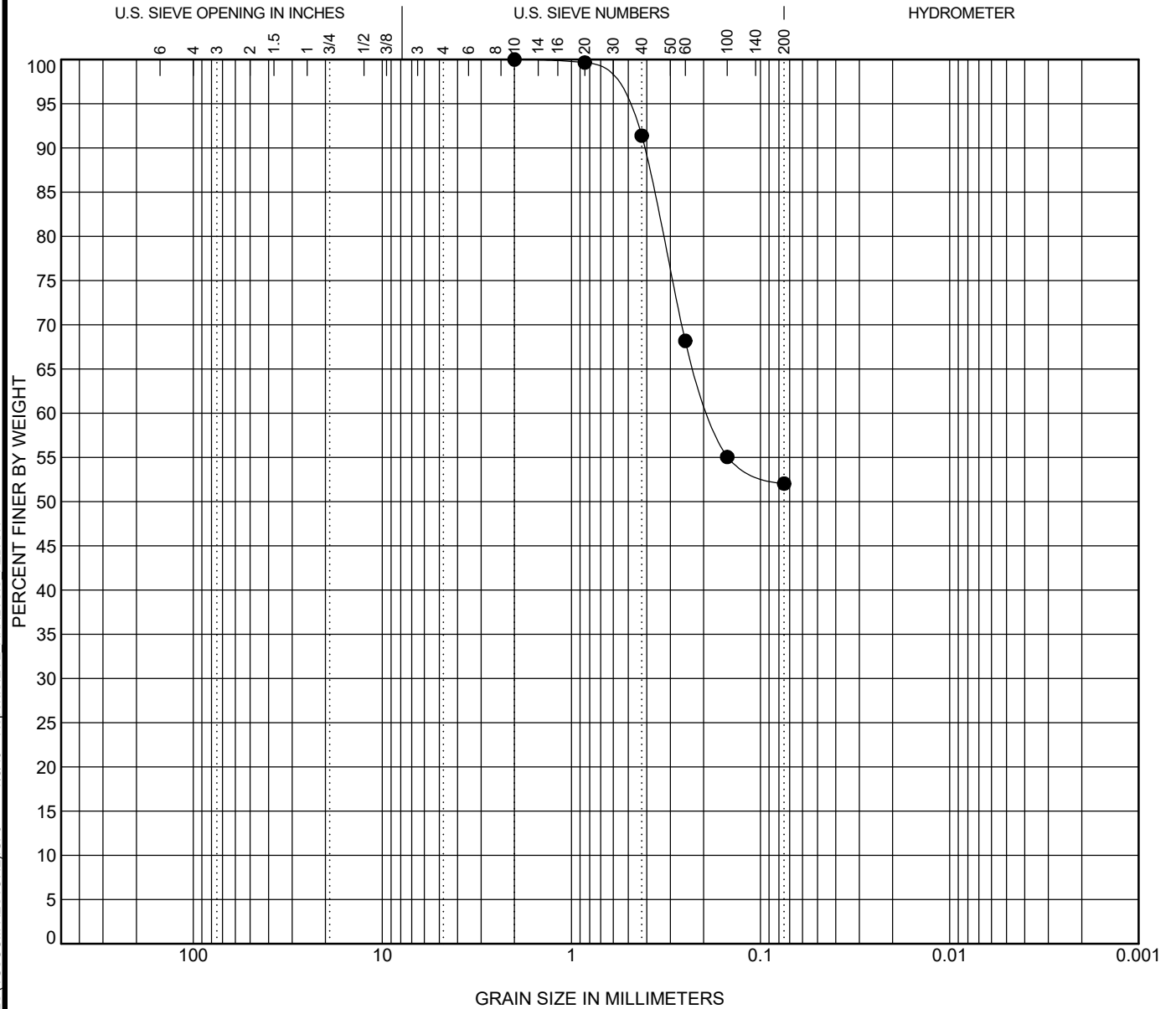
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ28D</b>													
Description	<b>27'-30'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ28D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.3	0.2		0.0	74.0	26.0		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ38</b>													
Description	<b>6'-7'</b>													
Sampled by:	<b>TT^L</b>													
Sample Location:	<b>PZ38</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.0	52.0		

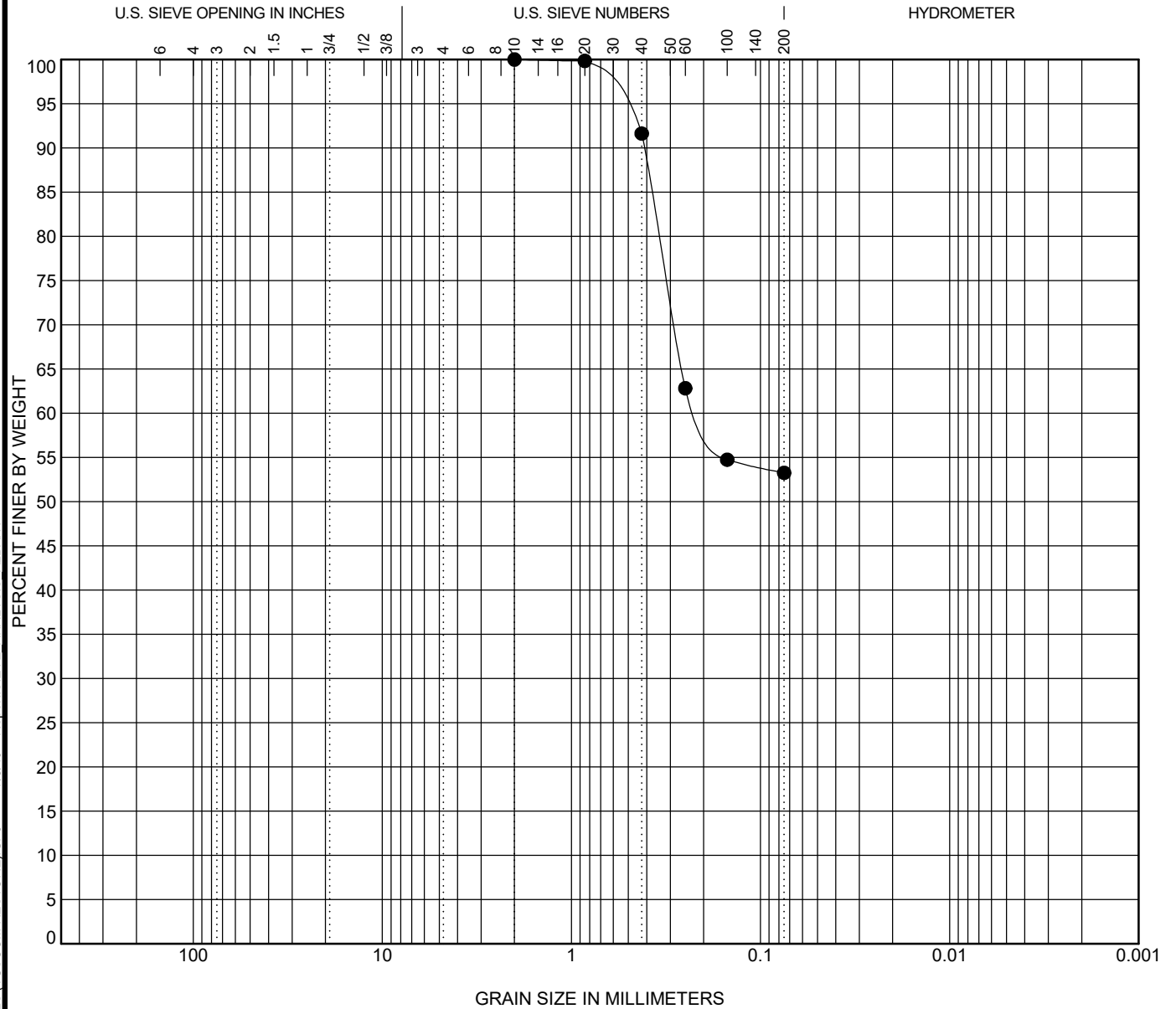


geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



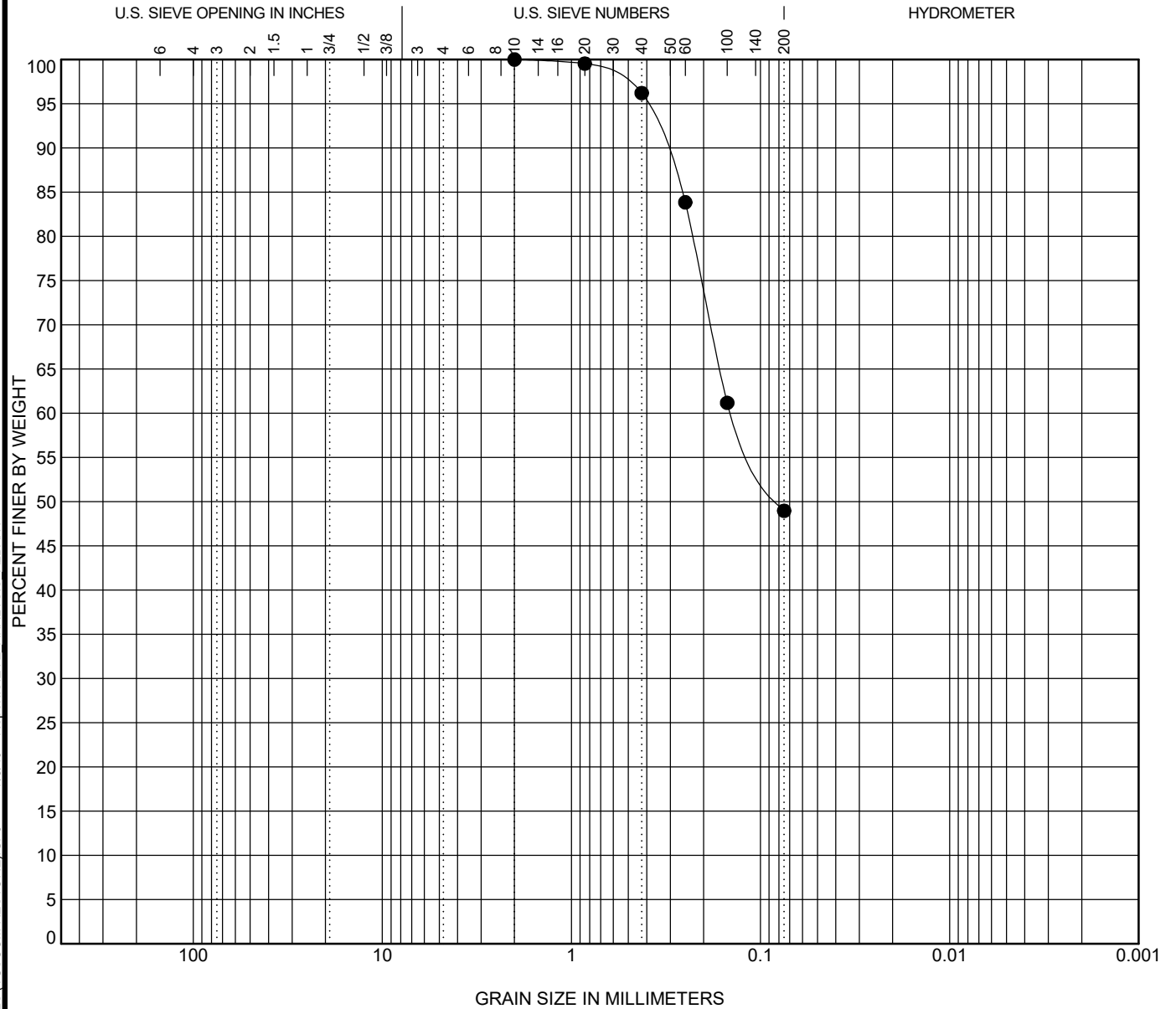
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ39D/OWA3D													
Description	19'-20'													
Sampled by:	TTL													
Sample Location:	PZ39D/OWA3D													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	46.7	53.3		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



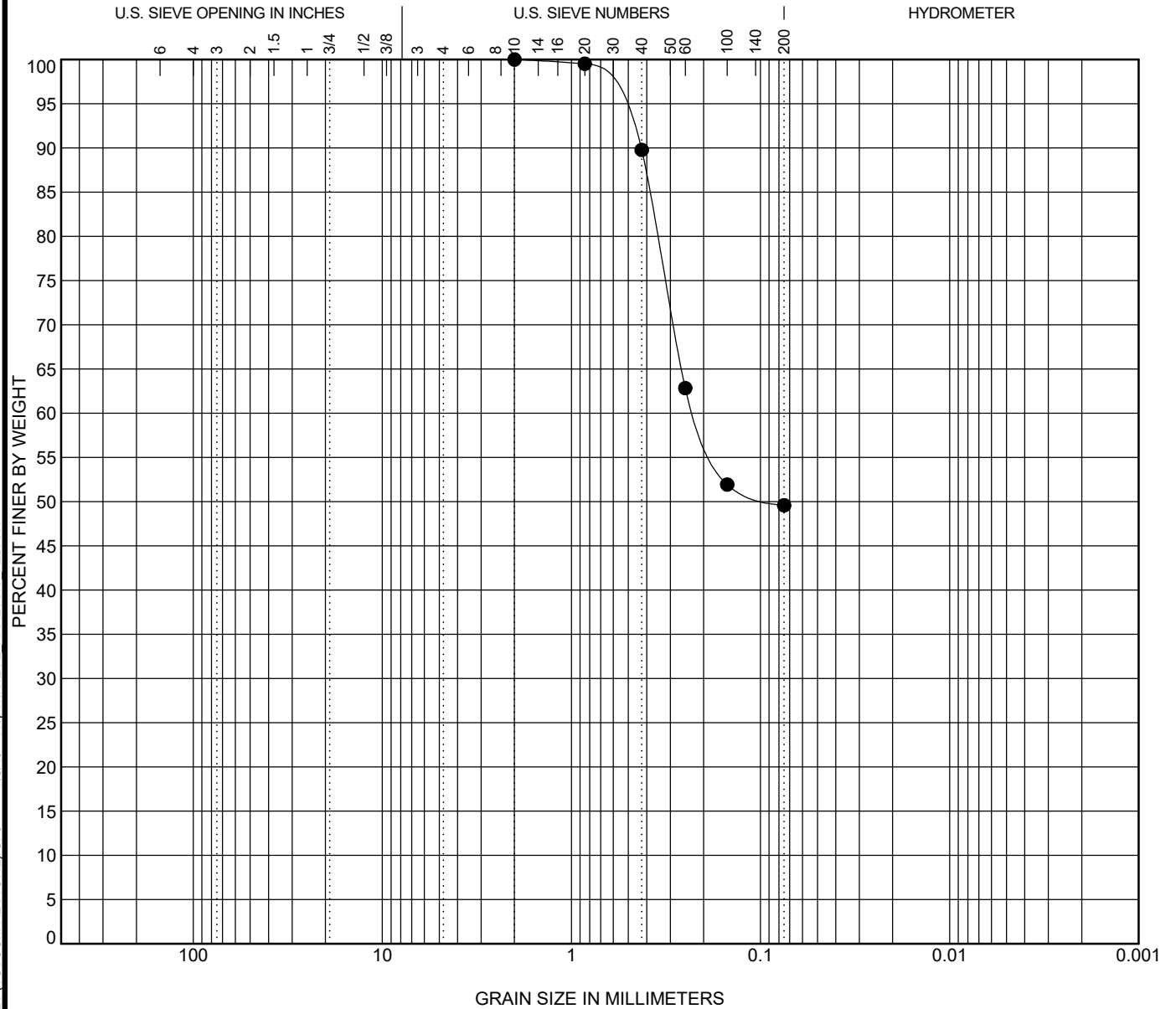
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	PZ39D/OWA3D													
Description	77'-79'													
Sampled by:	TTL													
Sample Location:	PZ39D/OWA3D													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.1			0.0	51.0	49.0		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



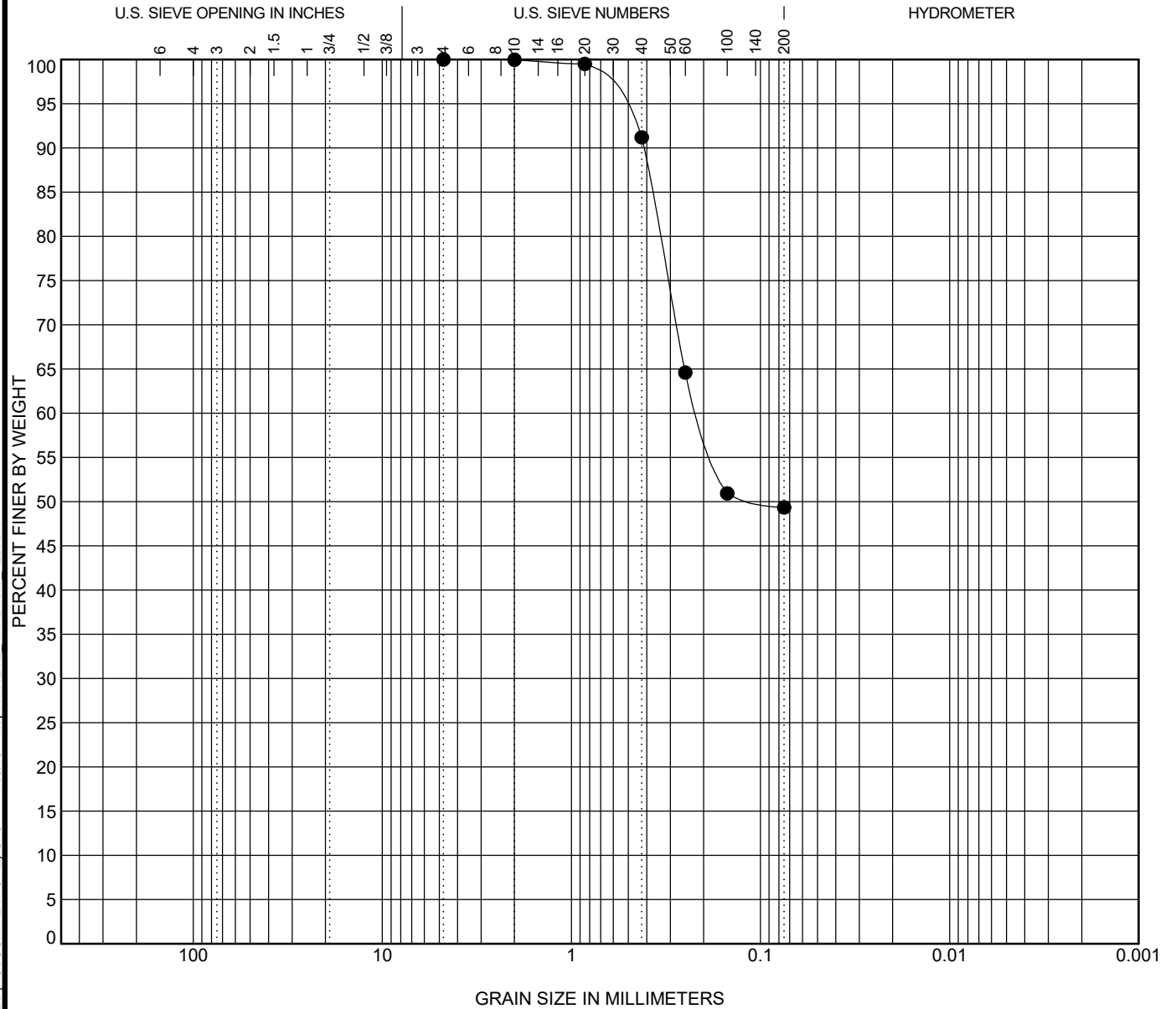
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ40</b>													
Description	<b>14'-15'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ40</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	50.4	49.6		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ43</b>													
Description	<b>5.5'-15'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ43</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						4.8	0.2			0.0	50.7	49.3		



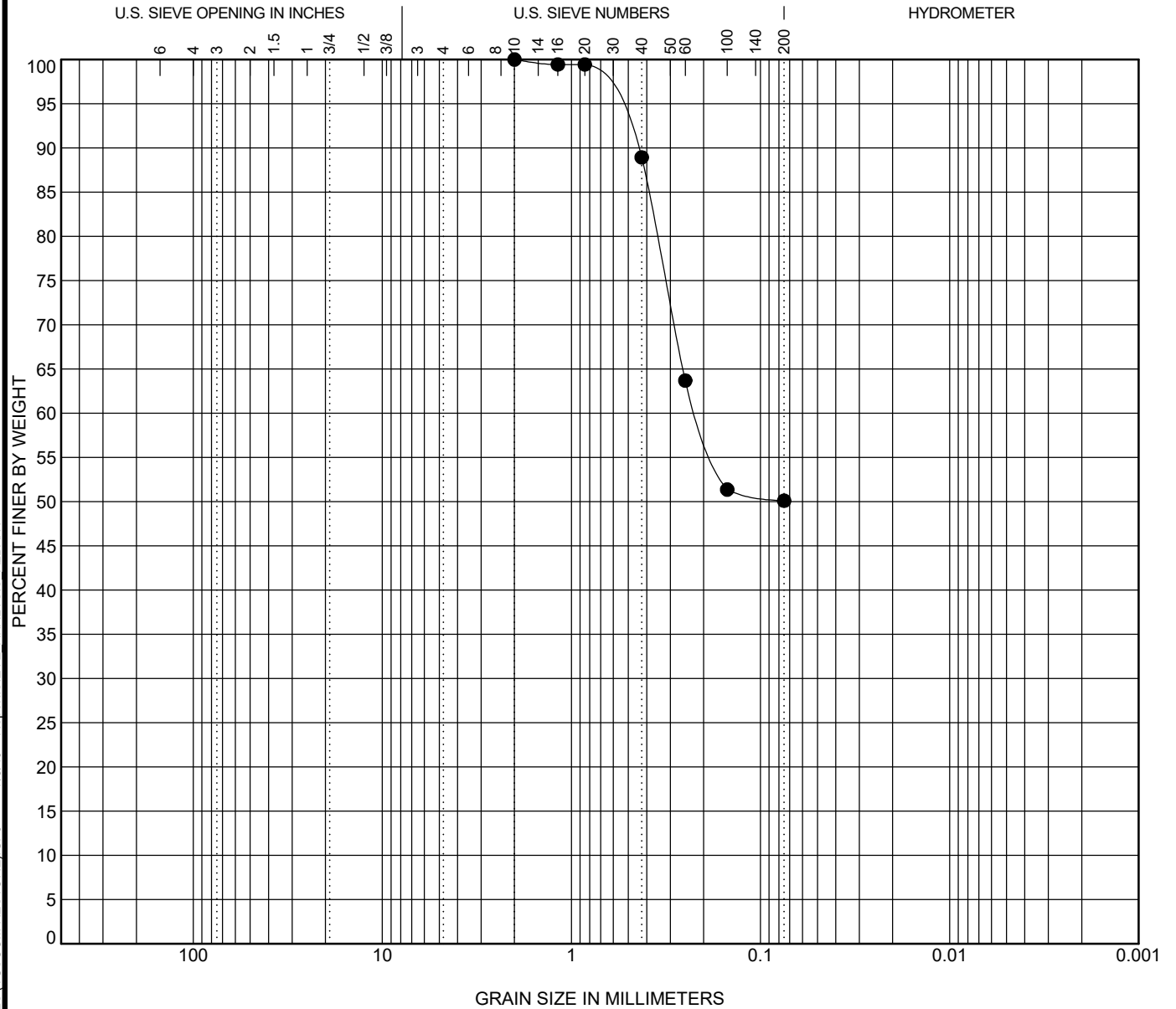
geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00



# GRAIN SIZE DISTRIBUTION



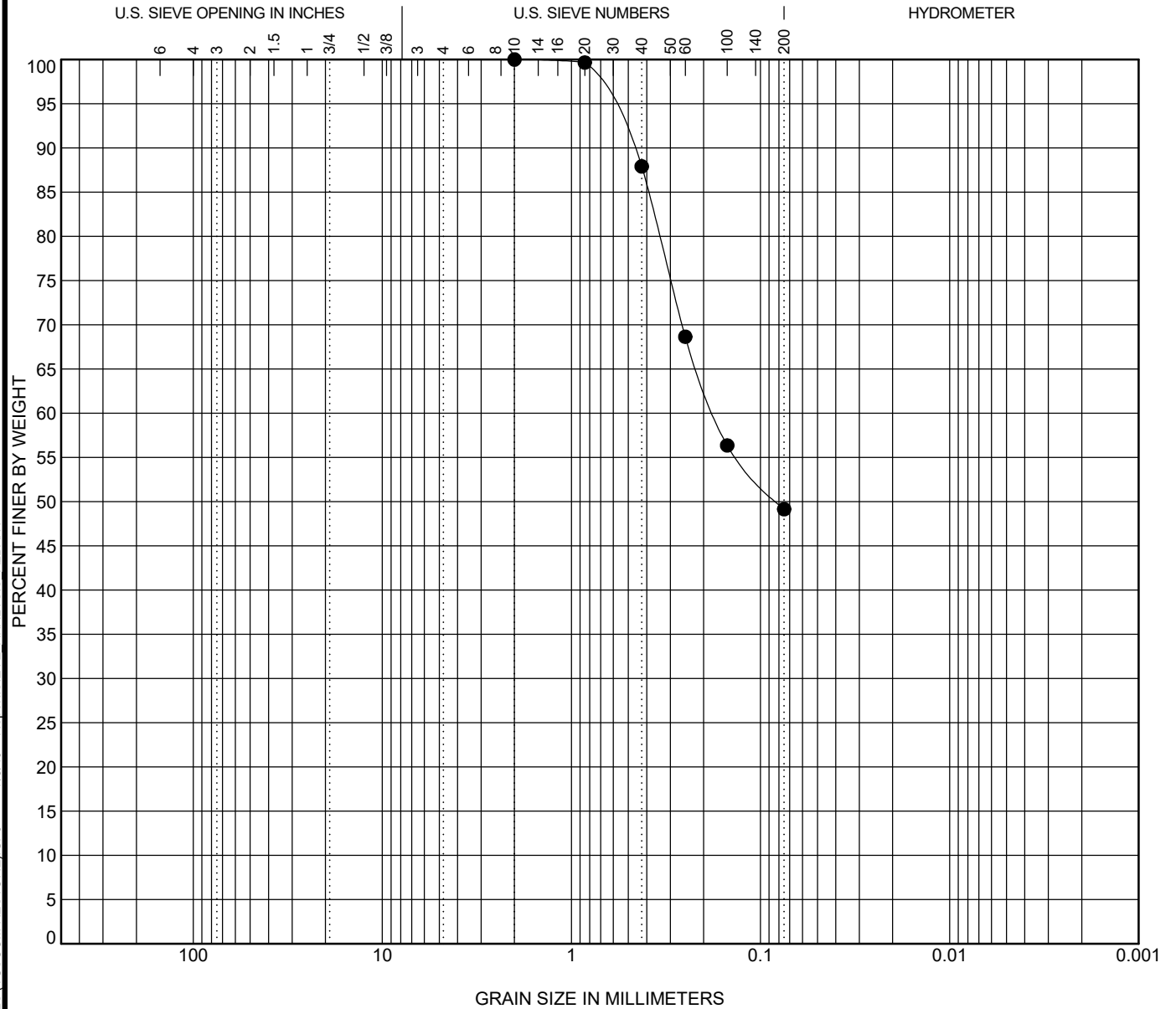
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ45D</b>													
Description	<b>18'-22'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ45D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	49.9	50.1		

<p style="font-size: 0.8em; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
	Location: Saint George, Georgia
	Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



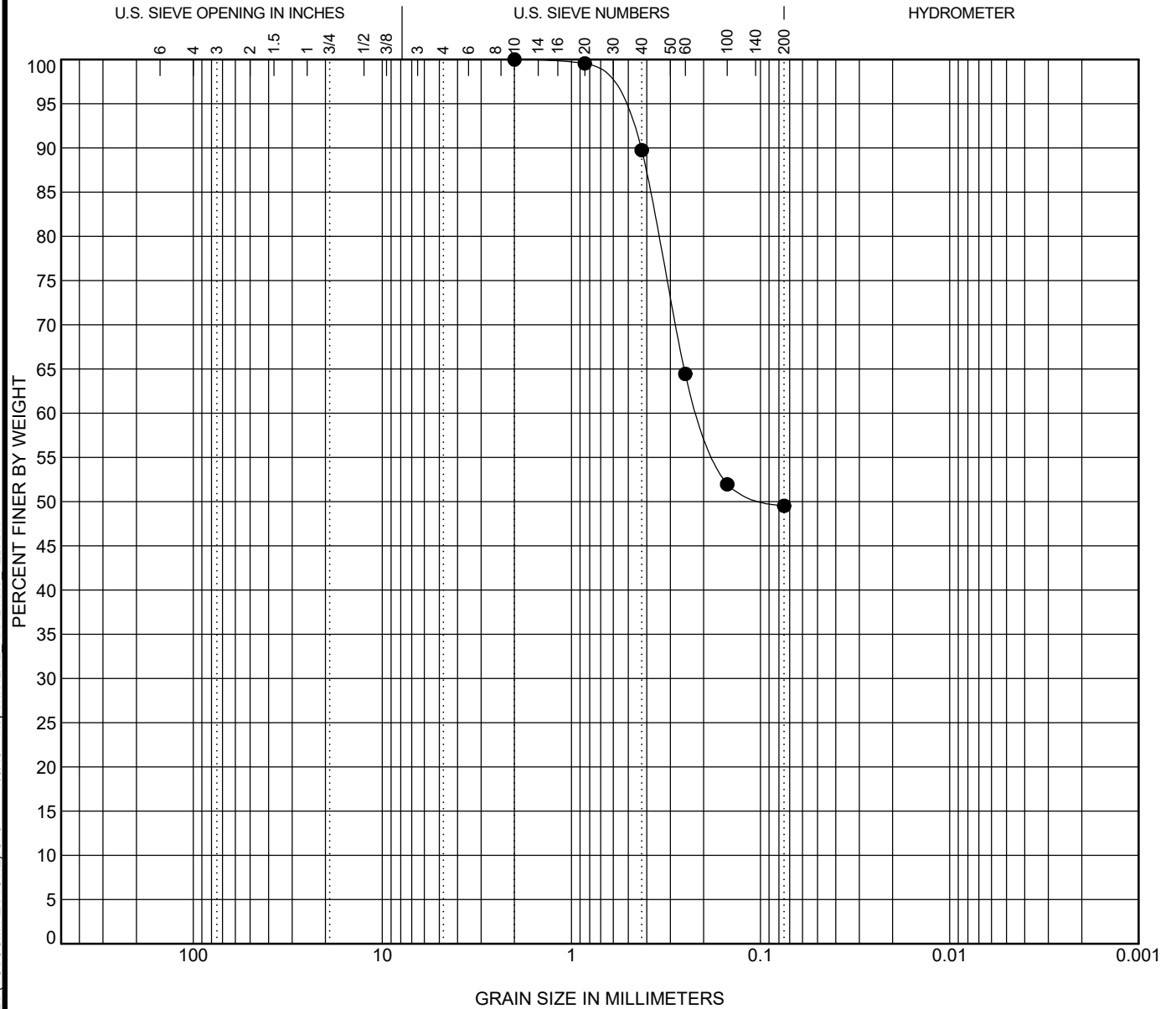
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ45D</b>													
Description	<b>49'-49.5'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ45D</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	50.9	49.1		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	<p>Client: Twin Pines Minerals Saunders-Loncala Reserve</p> <p>Location: Saint George, Georgia</p> <p>Project Number: 000180200804.00</p>

C:\WORK\TWIN PINES\GINT DATABASE EXCEL\FILE\GINT DUMMY\804-L OGS WITH WELLS (TUSCOM RESTORE).GPJ 7/8/19 Report: SIEVE ANALYSIS - ALBANY

# GRAIN SIZE DISTRIBUTION



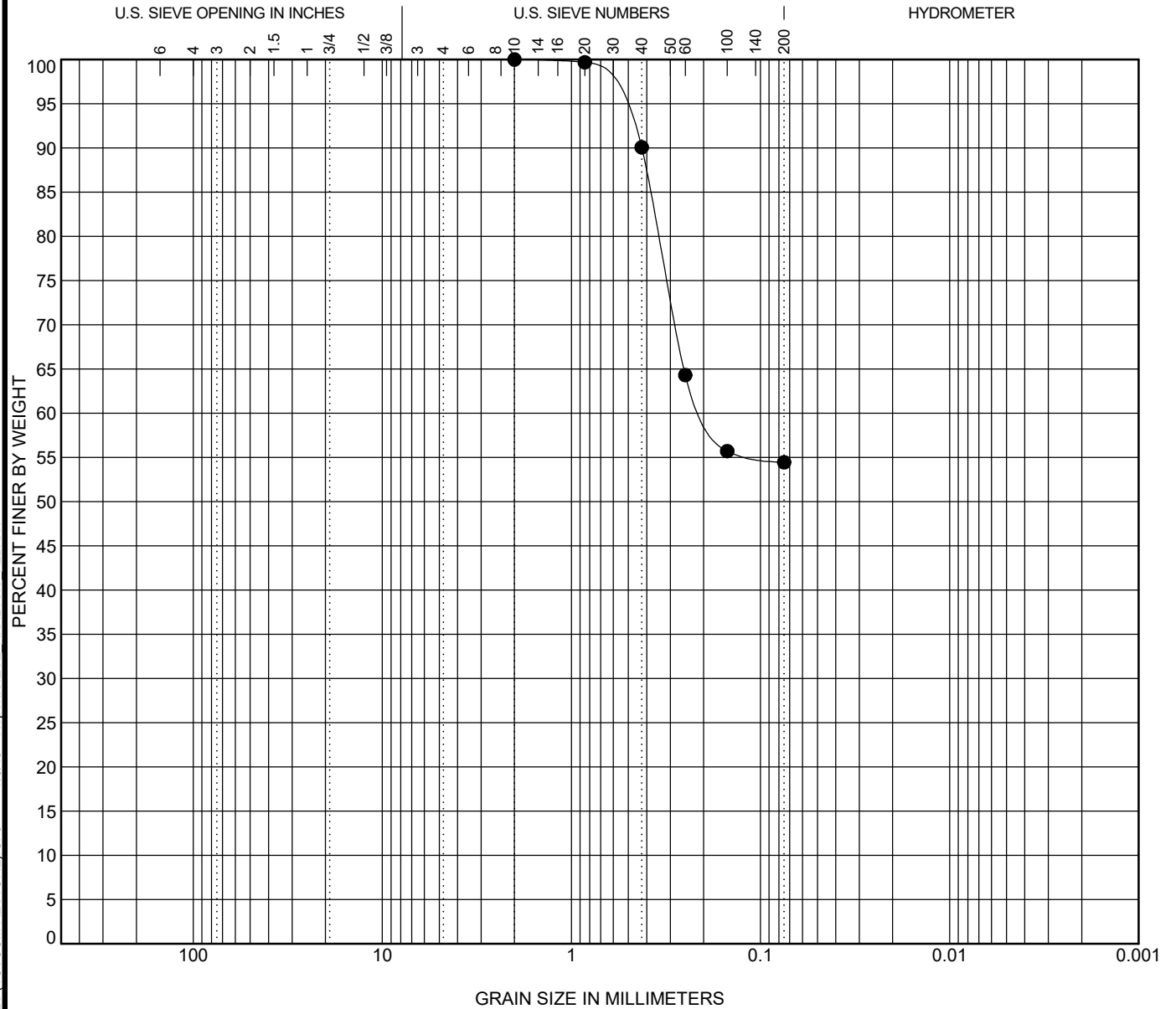
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ45S</b>													
Description	<b>6.5</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ45S</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	50.5	49.5		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	<p>Client: Twin Pines Minerals Saunders-Loncala Reserve</p> <p>Location: Saint George, Georgia</p> <p>Project Number: 000180200804.00</p>

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# GRAIN SIZE DISTRIBUTION



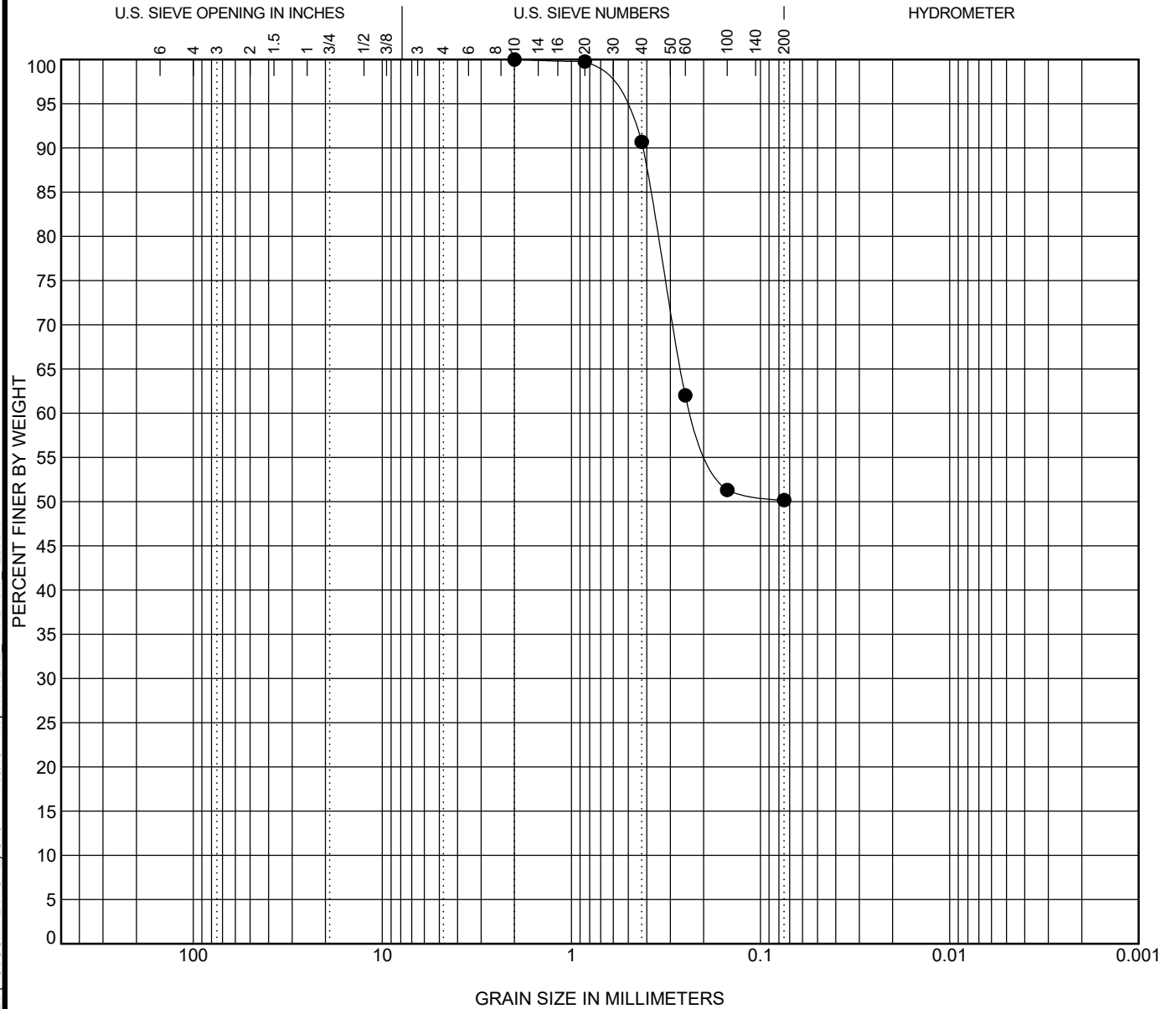
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ46</b>													
Description	<b>4'-10'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ46</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	45.5	54.5		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ47</b>													
Description	<b>13'-15'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ47</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	49.8	50.2		

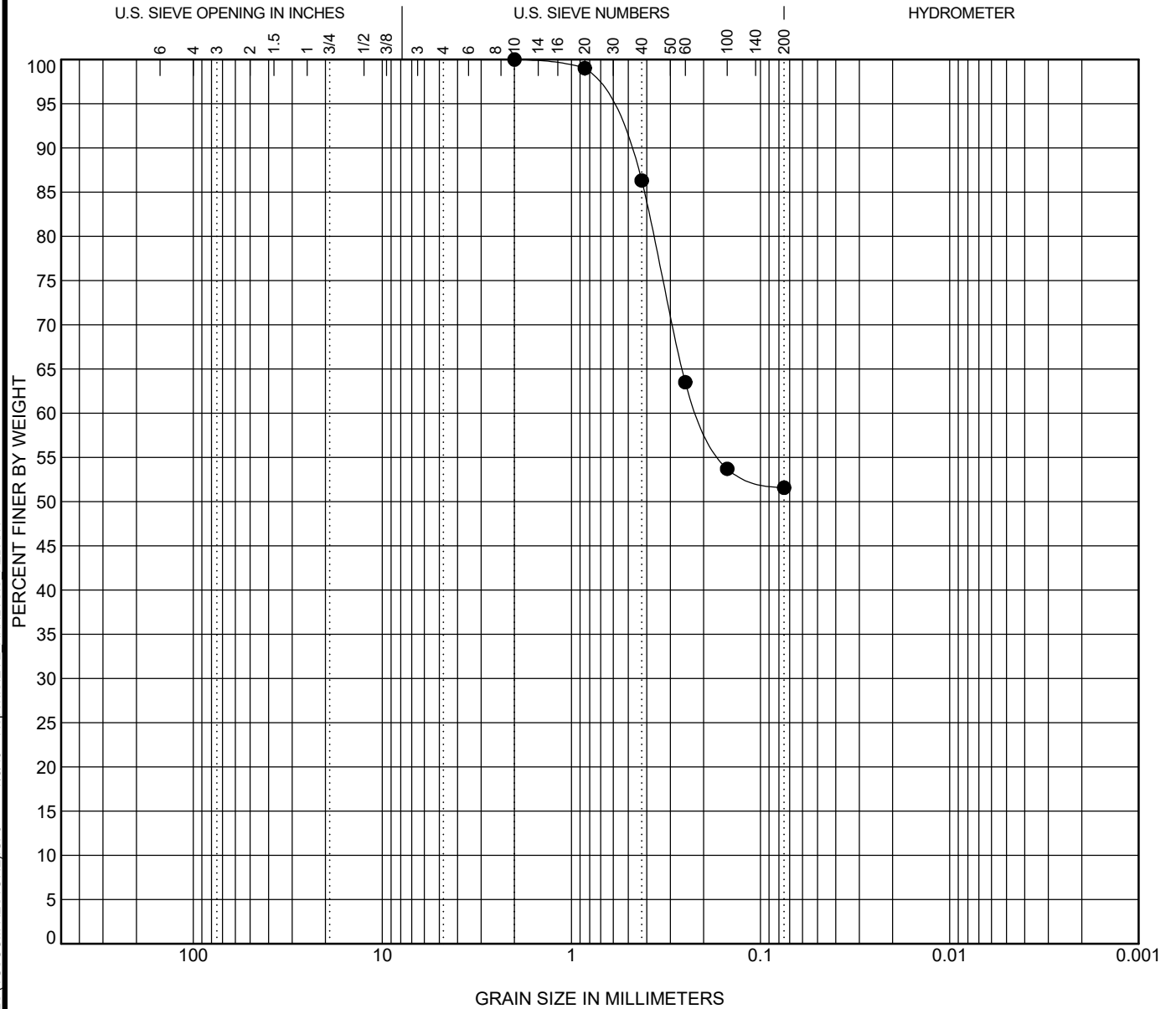


geotechnical • analytical • materials • environmental

## SIEVE ANALYSIS RESULTS

Client:  
 Project: Twin Pines Minerals Saunders-Loncala Reserve  
 Location: Saint George, Georgia  
 Project Number: 000180200804.00

# GRAIN SIZE DISTRIBUTION



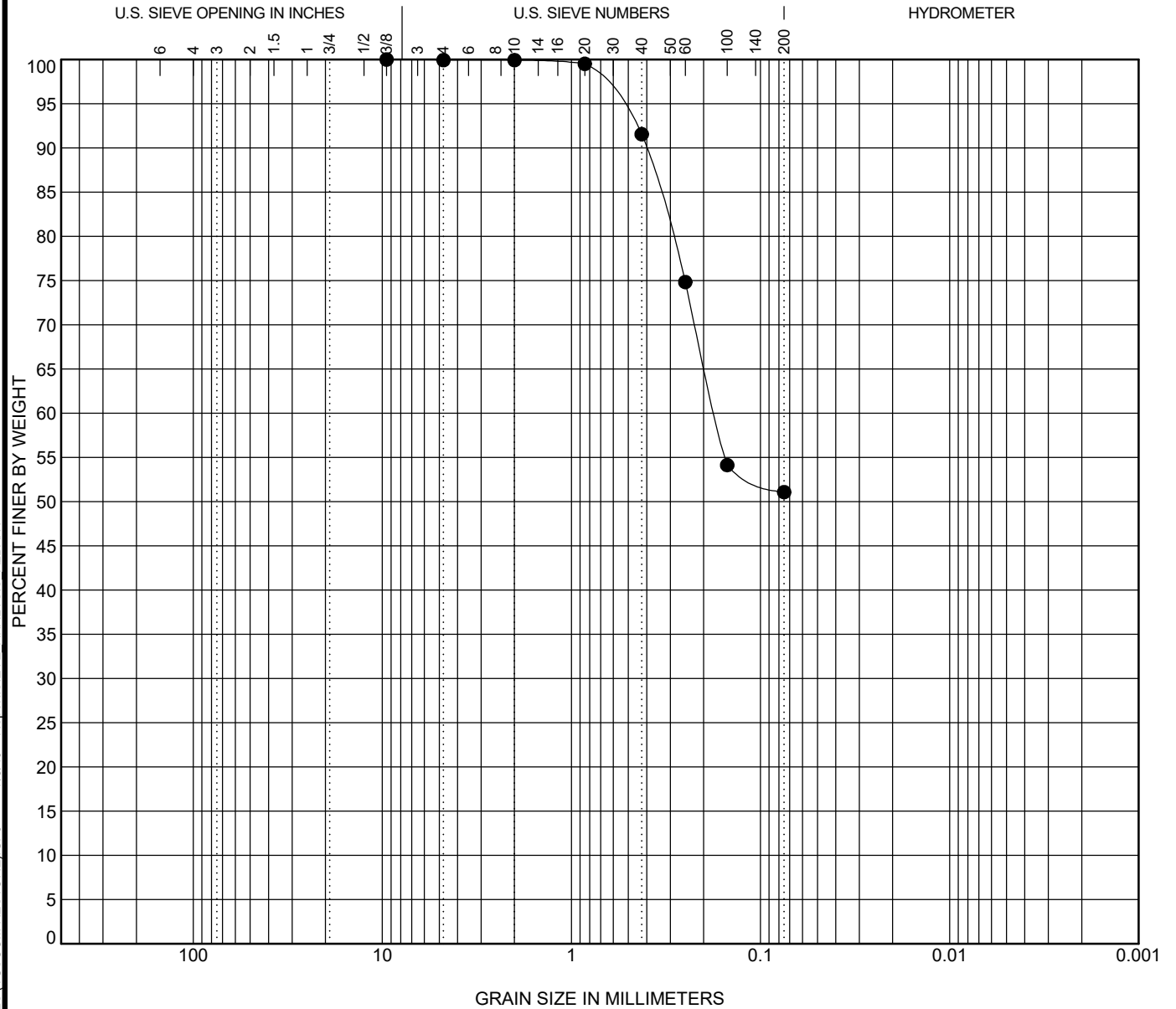
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ49</b>													
Description	<b>13.5'-15'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ49</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.4	51.6		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



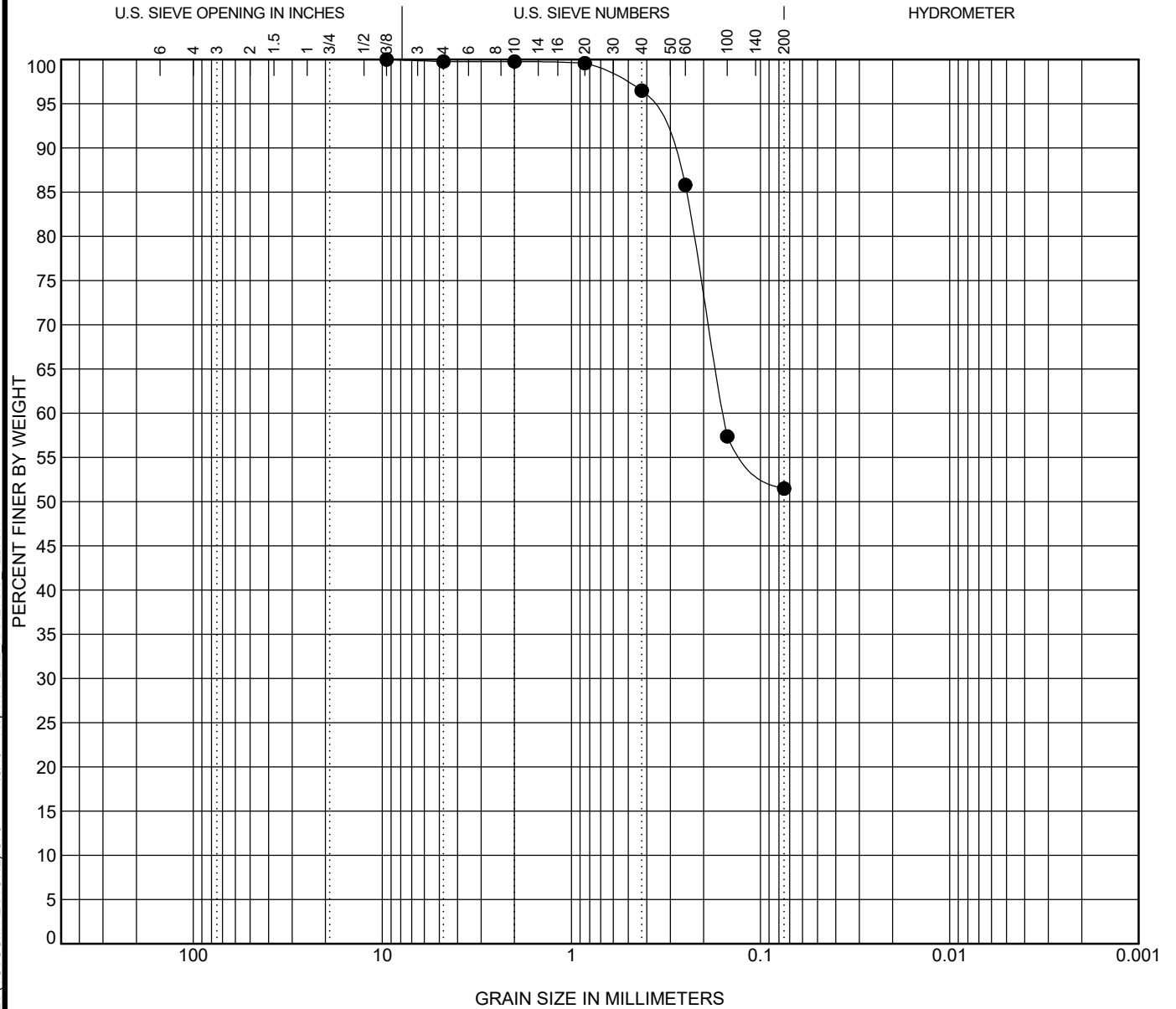
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ50</b>													
Description	<b>12'-13'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ50</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						9.5	0.2			0.1	48.9	51.1		

<p style="font-size: small; margin: 0;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client:
	Project: Twin Pines Minerals Saunders-Loncala Reserve
Location: Saint George, Georgia	
Project Number: 000180200804.00	

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

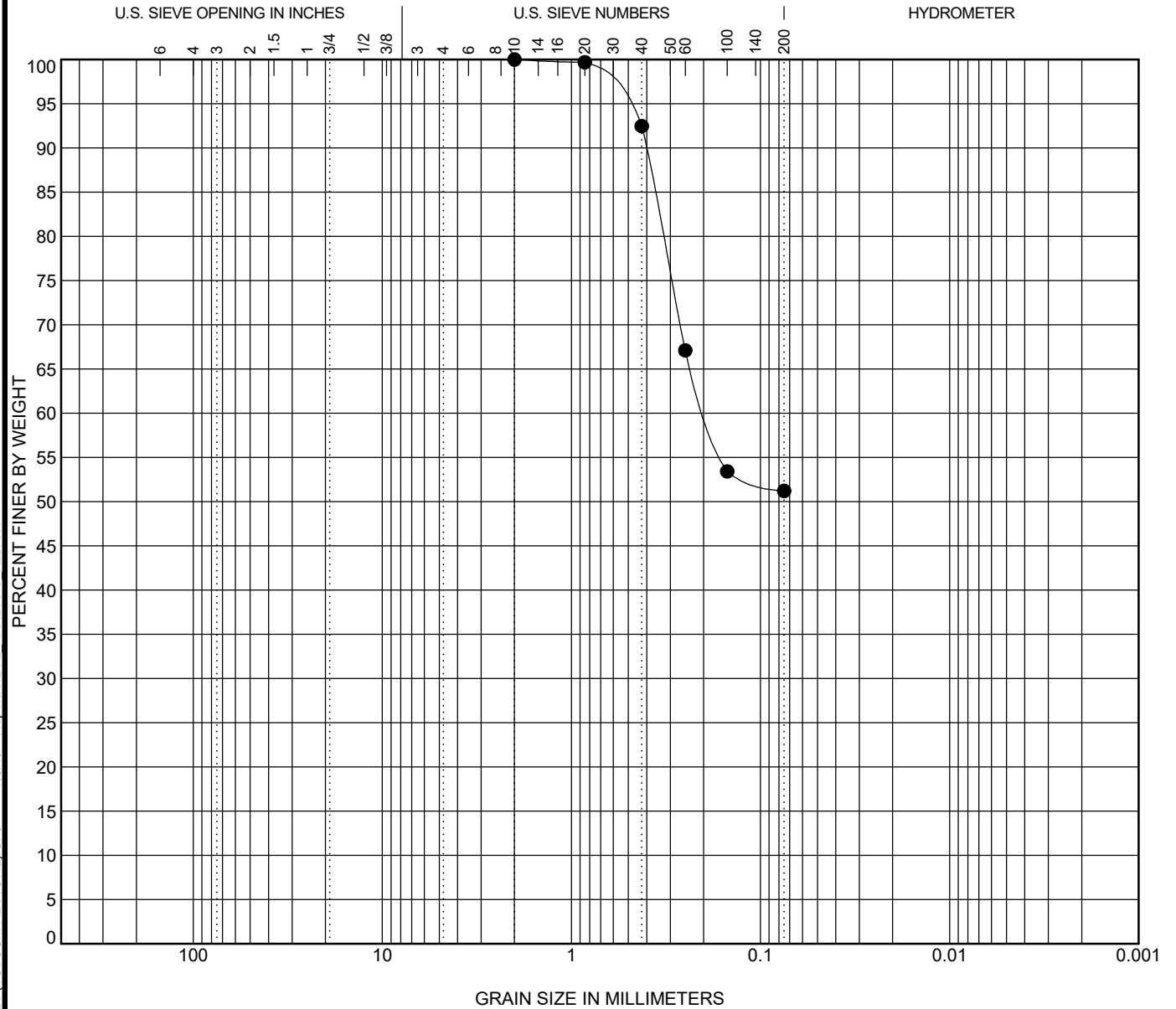
Sample ID	<b>PZ53</b>													
Description	<b>5'-8'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ53</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						9.5	0.2			0.2	48.3	51.5		

<p style="font-size: small; margin-top: 5px;">geotechnical • analytical • materials • environmental</p>	SIEVE ANALYSIS RESULTS
	Client: Project: Twin Pines Minerals Saunders-Loncala Reserve Location: Saint George, Georgia Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



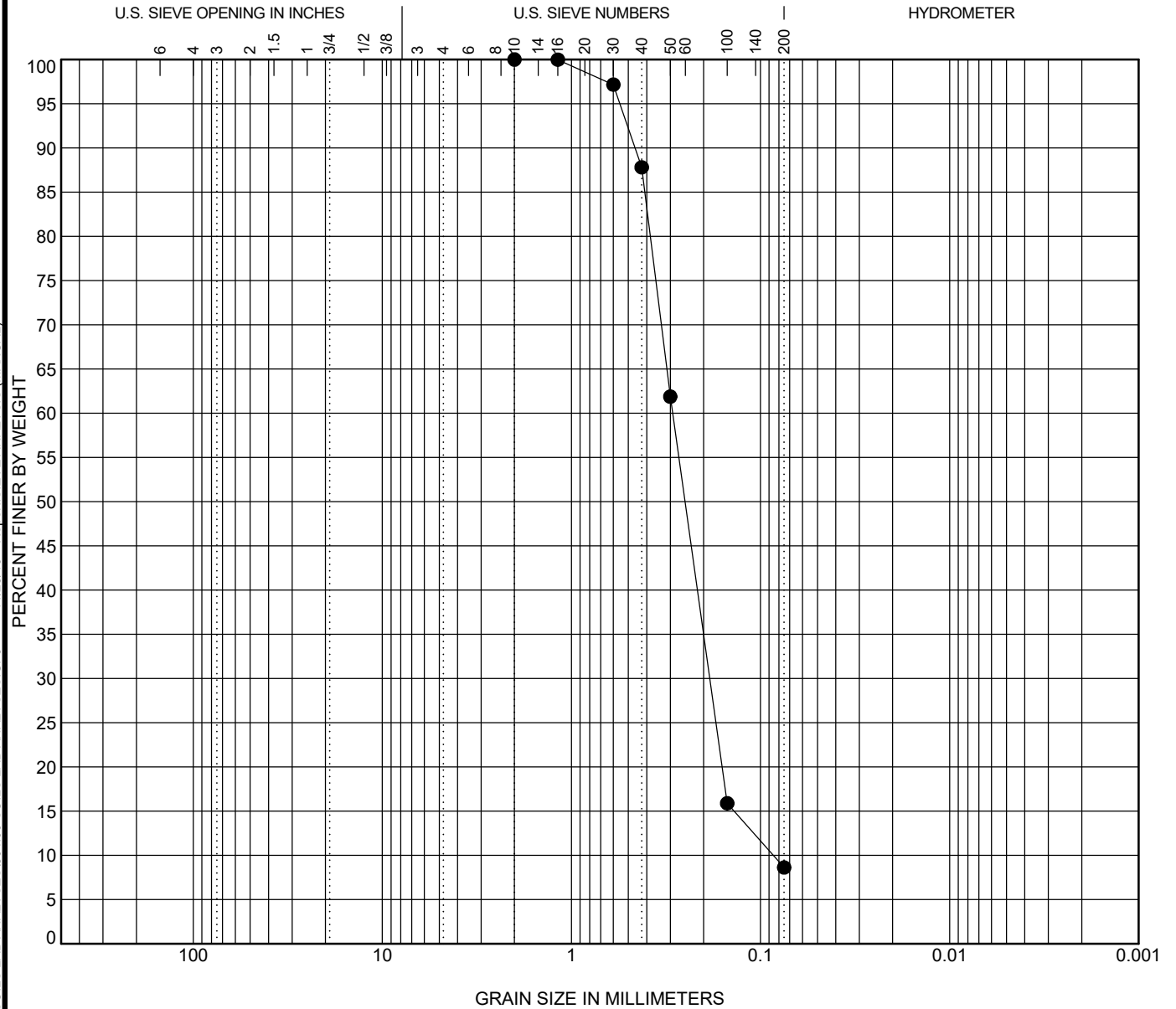
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	<b>PZ53</b>													
Description	<b>7'-10'</b>													
Sampled by:	<b>TTL</b>													
Sample Location:	<b>PZ53</b>													
Date Sampled:														
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
						2	0.2			0.0	48.8	51.2		

<p><b>TTL</b> geotechnical • analytical • materials • environmental</p>	<b>SIEVE ANALYSIS RESULTS</b>
	Client: Project: Twin Pines Minerals Saunders-Loncala Reserve Location: Saint George, Georgia Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	UD-25R												
Description	Light Brown Sand with Silt (SP-SM)												
Sampled by:	TTL, Inc.												
Sample Location:	3'-5'												
Date Sampled:	11/19/2019												
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
18	NP	NP	NP	1.4	3.4	2	0.29	0.19	0.086	0.0	91.4	8.6	

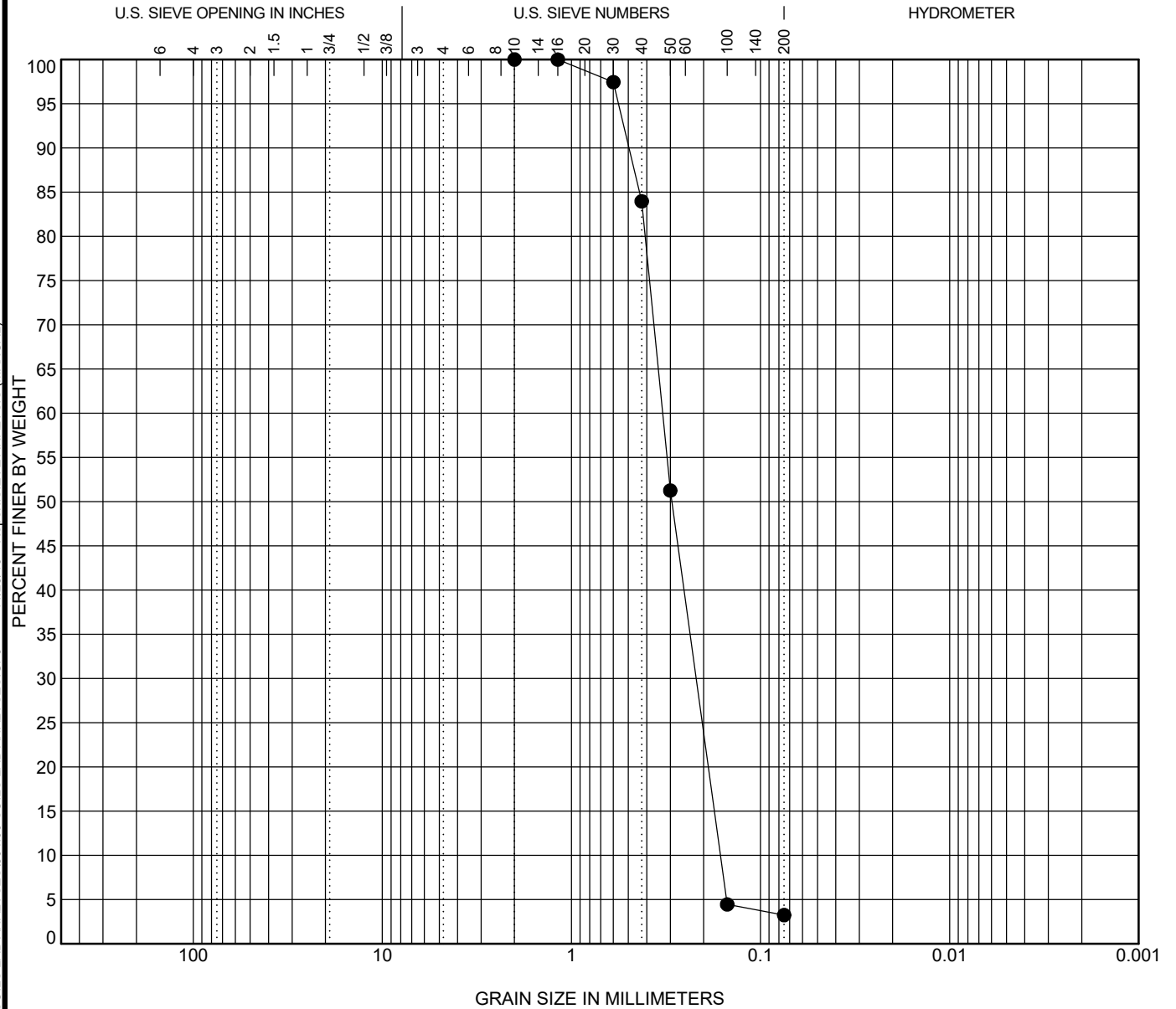


## SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC  
 Project: Twin Pines Minerals Permitting Services  
 Location: Charlton County, Georgia  
 Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	UD-25R												
Description	Black/Brown Sand (SP)												
Sampled by:	TTL, Inc.												
Sample Location:	10'-12'												
Date Sampled:	11/19/2019												
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
24	NP	NP	NP	0.9	2.0	2	0.33	0.22	0.163	0.0	96.8	3.2	

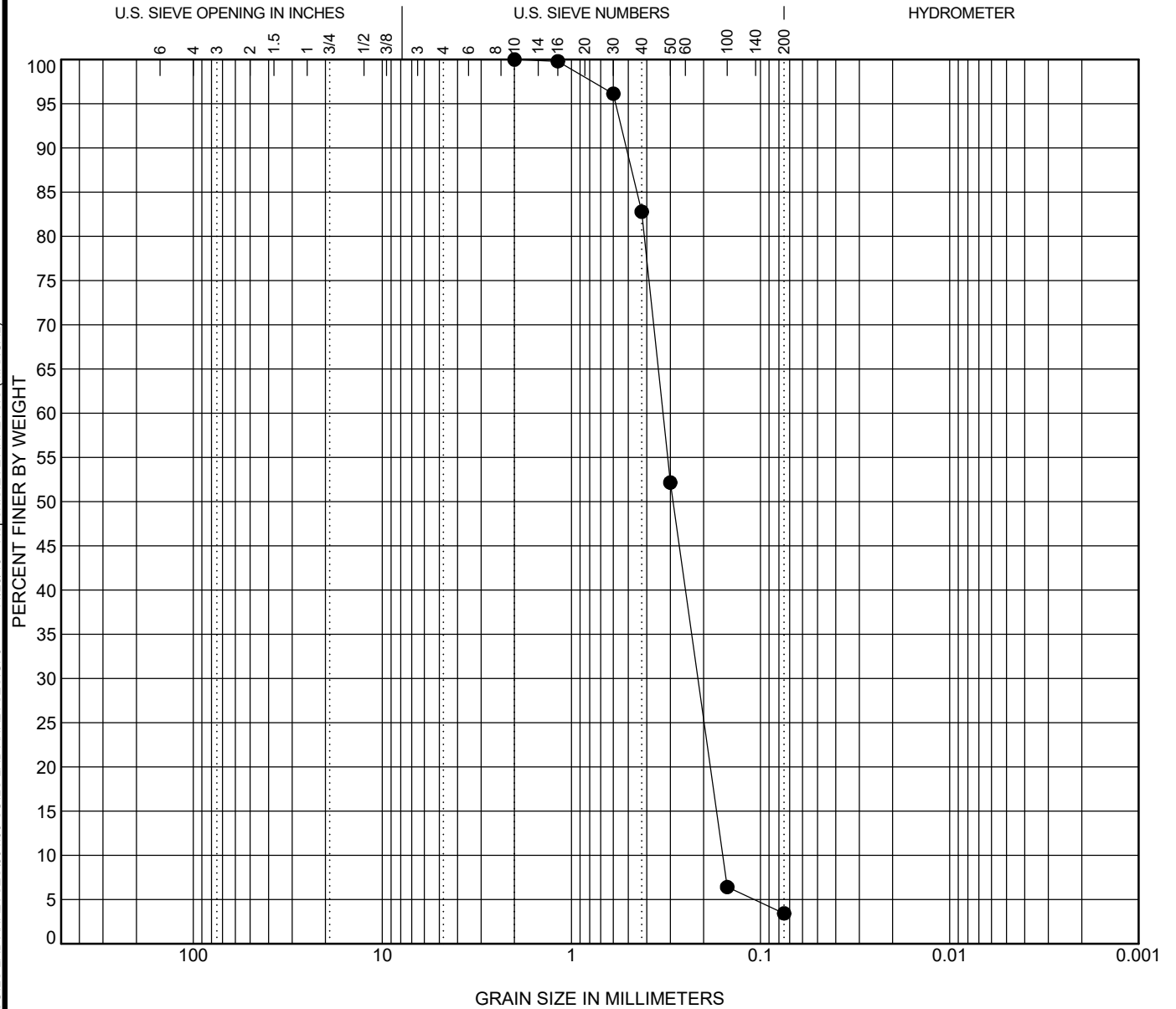


## SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC  
 Project: Twin Pines Minerals Permitting Services  
 Location: Charlton County, Georgia  
 Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	UD-43R												
Description	Black/Brown Sand (SP)												
Sampled by:	TTL, Inc.												
Sample Location:	5'-7'												
Date Sampled:	11/19/2019												
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	NP	NP	NP	0.9	2.1	2	0.33	0.21	0.158	0.0	96.6	3.4	

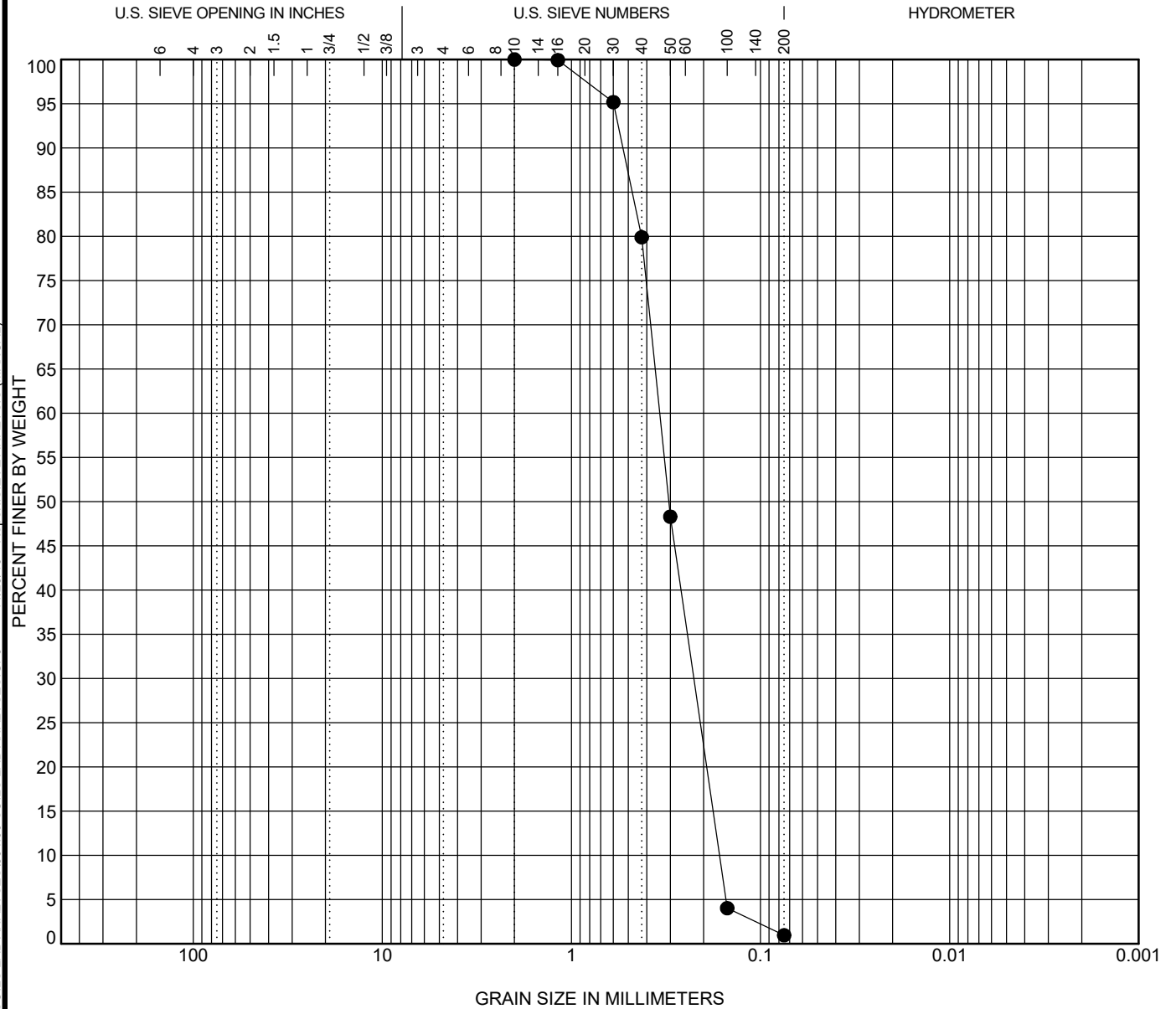


## SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC  
 Project: Twin Pines Minerals Permitting Services  
 Location: Charlton County, Georgia  
 Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	UD-43R												
Description	Black/Brown Sand (SP)												
Sampled by:	TTL, Inc.												
Sample Location:	10'-12'												
Date Sampled:	11/19/2019												
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	---	---	---	0.9	2.1	2	0.34	0.23	0.165	0.0	99.0	1.0	

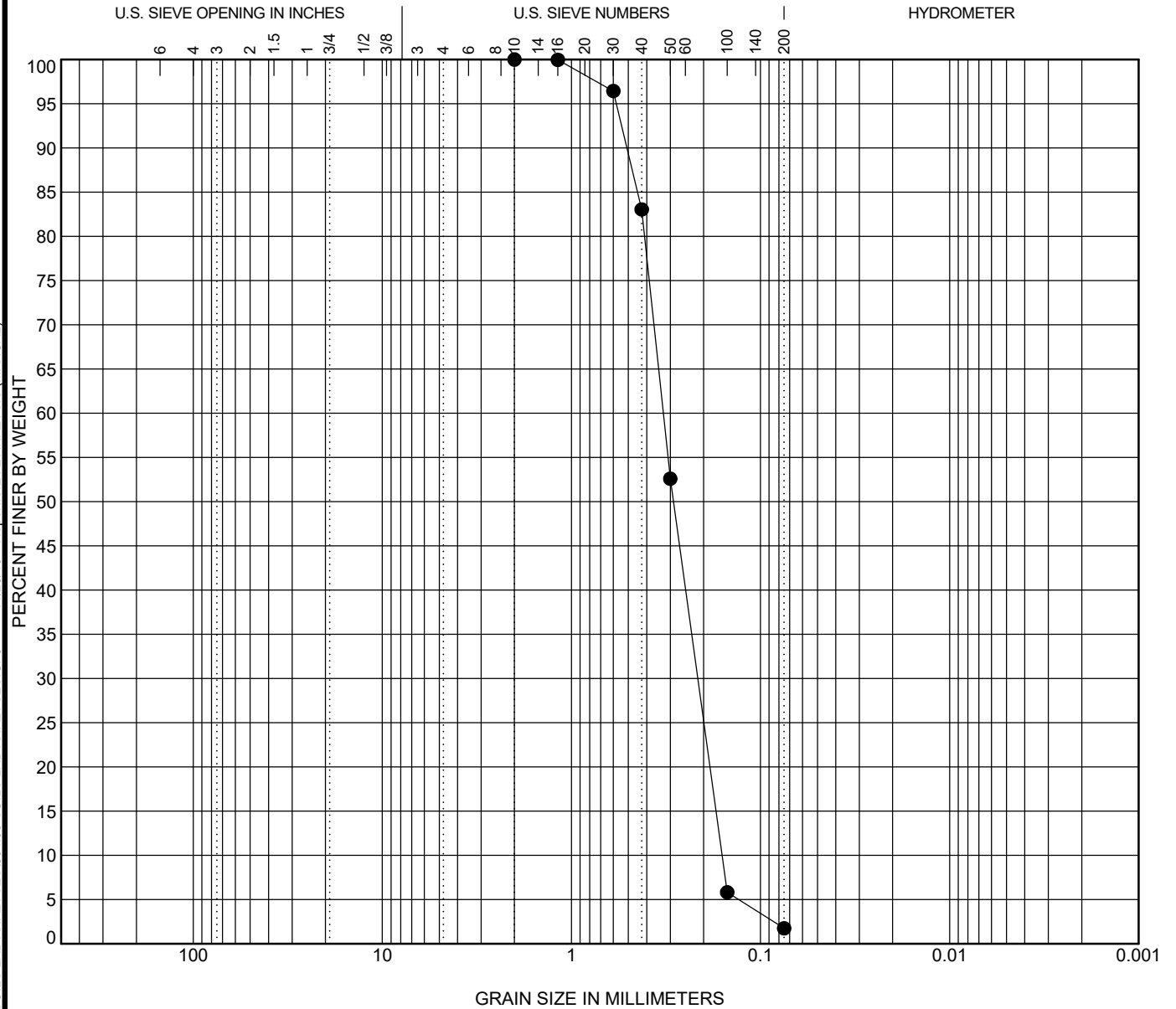


## SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC  
 Project: Twin Pines Minerals Permitting Services  
 Location: Charlton County, Georgia  
 Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	UD-238R												
Description	Black/Brown Sand (SP)												
Sampled by:	TTL, Inc.												
Sample Location:	6'-8'												
Date Sampled:	11/19/2019												
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	---	---	---	0.9	2.0	2	0.33	0.21	0.16	0.0	98.3	1.7	

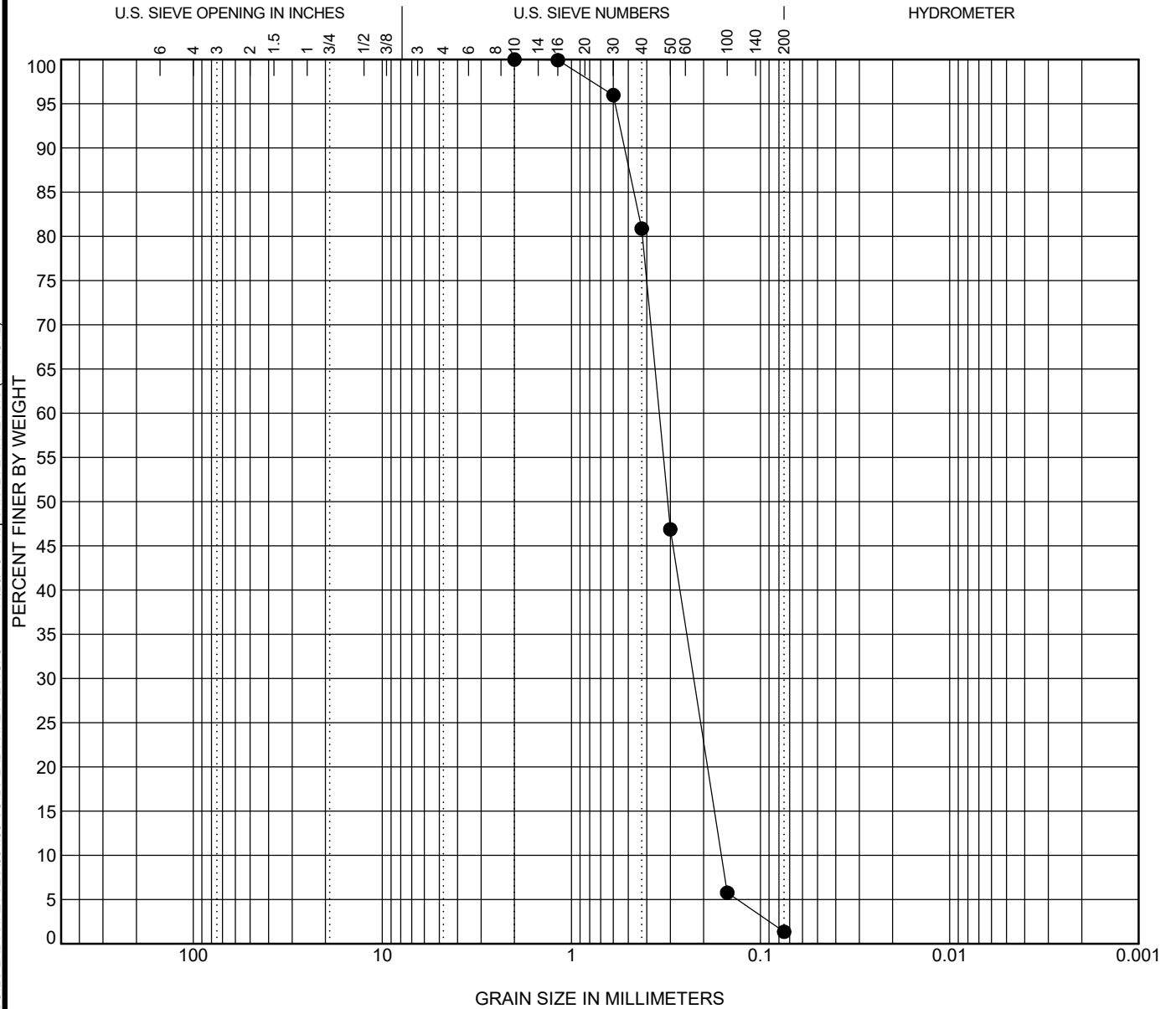


## SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC  
 Project: Twin Pines Minerals Permitting Services  
 Location: Charlton County, Georgia  
 Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	UD-238R												
Description	Black/Brown Sand (SP)												
Sampled by:	TTL, Inc.												
Sample Location:	10'-12'												
Date Sampled:	11/19/2019												
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
17	---	---	---	0.9	2.1	2	0.34	0.23	0.161	0.0	98.7	1.4	

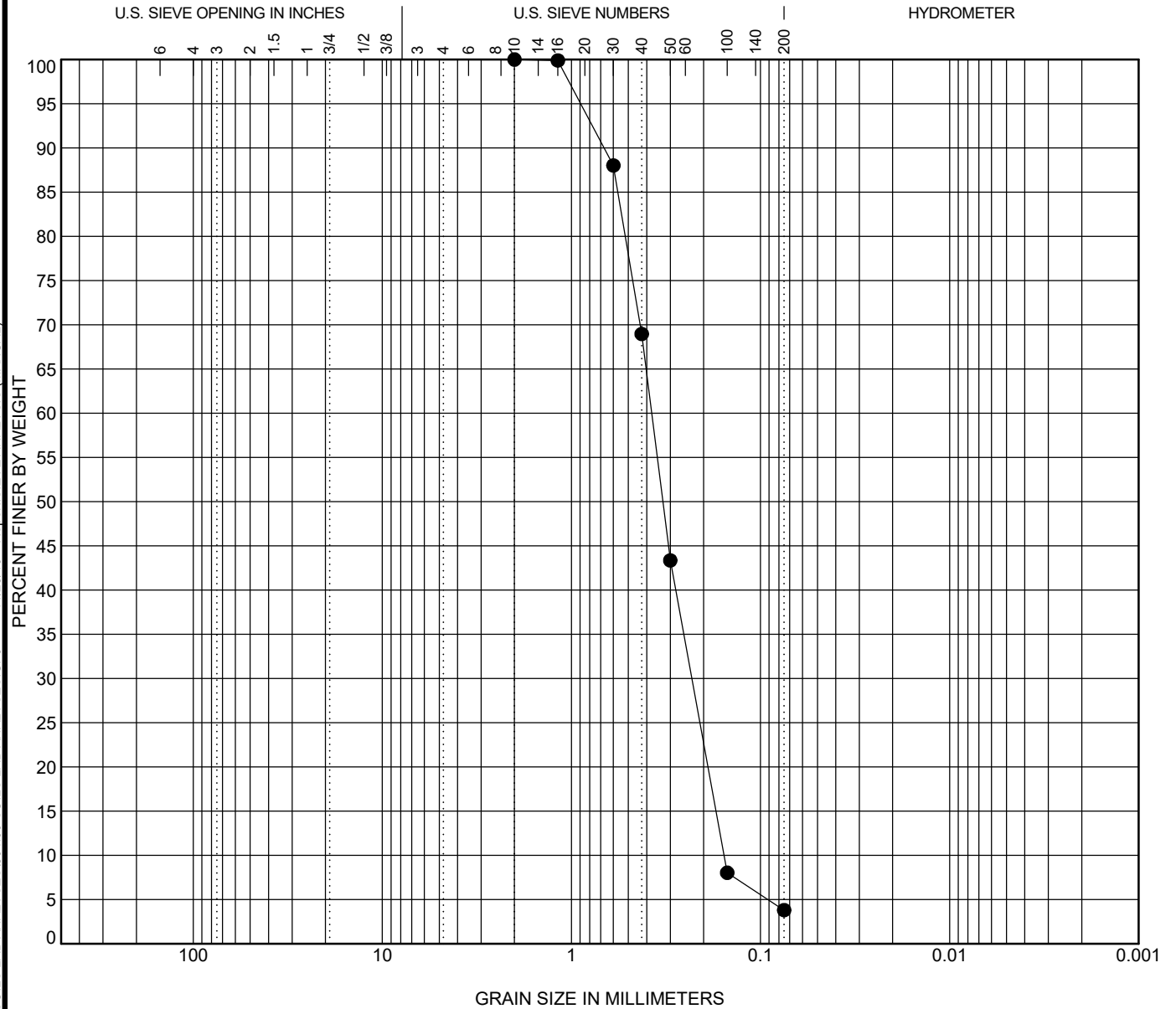


## SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC  
 Project: Twin Pines Minerals Permitting Services  
 Location: Charlton County, Georgia  
 Project Number: 000180200804.00

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# GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	UD-338R												
Description	Black/Brown Sand (SP)												
Sampled by:	TTL, Inc.												
Sample Location:	9'-11'												
Date Sampled:	11/19/2019												
wc (%)	LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
19	---	---	---	0.9	2.4	2	0.38	0.23	0.156	0.0	96.2	3.8	



## SIEVE ANALYSIS RESULTS

Client: Twin Pines Minerals, LLC  
 Project: Twin Pines Minerals Permitting Services  
 Location: Charlton County, Georgia  
 Project Number: 000180200804.00

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## **ATTACHMENT C**

**Daniel B. Stephens & Associates, Inc  
Soil Moisture Retention Curve Test Report**

# Laboratory Report for TTL, Inc.

Project: Twin Pines, 000180200804.00

October 7, 2019



*Daniel B. Stephens & Associates, Inc.*

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113



October 7, 2019

Jim Smith  
TTL, Inc.  
4589 Val North Drive  
Valdosta, GA 31602  
(727) 490-0858

Re: DBS&A Laboratory Report for the TTL, Inc. Twin Pines Project

Dear Mr. Smith:

Enclosed is the report for the TTL Inc. Twin Pines project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to TTL, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.  
SOIL TESTING & RESEARCH LABORATORY

Adam Bland  
Laboratory Operations Manager

Enclosure

*Daniel B. Stephens & Associates, Inc.*  
*Soil Testing & Research Laboratory*

4400 Alameda Blvd. NE, Suite C  
Albuquerque, NM 87113

505-889-7752  
FAX 505-889-0258

## **Summaries**





## Notes

### **Sample Receipt:**

Three samples were received on March 25, 2019. Each sample was received as two 3" x 3" stainless steel sleeves sealed with endcaps and duct tape (labeled as samples 'A' and 'B'), and one full 1-gallon bag of loose material (labeled as sample 'C'). All samples were packaged together with packing material in a 5-gallon bucket, and all were received in good order.

### **Sample Preparation and Testing Notes:**

The entire 'B' sleeve was used for the 'undisturbed' sample testing. The loose material 'C' was used for remolded sample testing. Each of the samples was subjected to initial properties analysis, saturated hydraulic conductivity testing, and the hanging column and pressure chamber portions of the moisture retention testing. The (Undisturbed) label and dry bulk densities achieved (in g/cc) were added to the sub-sample ID's.

Adjacent sample trimmings were used for the dewpoint potentiometer and relative humidity chamber portions of the moisture retention testing.

Porosity calculations are based on the use of an assumed specific gravity value of 2.65.

Volumetric water contents were adjusted for changes in volume, where applicable. Due to the irregularities formed on the sample surfaces during settling, volume measurements obtained after the initial reading should be considered estimates.



### Summary of Sample Preparation/Volume Changes

Sample Number	Initial Sample Data <sup>1</sup>		Volume Change Post Saturation <sup>2</sup>			Volume Change Post Drying Curve <sup>3</sup>		
	Moisture Content (% g/g)	Dry Bulk Density (g/cm <sup>3</sup> )	Dry Bulk Density (g/cm <sup>3</sup> )	% Volume Change (%)	% of Initial Density (%)	Dry Bulk Density (g/cm <sup>3</sup> )	% Volume Change (%)	% of Initial Density (%)
SS-ADK-01 (Undisturbed) (1.46 g/cc)	2.7	1.46	1.46	---	100.0%	1.52	-4.0%	104.2%
SS-ADK-01 (1.60 g/cc)	4.4	1.60	1.60	---	100.0%	1.60	---	100.0%
SS-KEY-01 (Undisturbed) (1.63 g/cc)	17.8	1.63	1.63	---	100.0%	1.63	---	100.0%
SS-KEY-01 (1.59 g/cc)	20.3	1.59	1.59	---	100.0%	1.59	---	100.0%
SS-T1A-01 (Undisturbed) (1.54 g/cc)	25.3	1.54	1.54	---	100.0%	1.54	---	100.0%
SS-T1A-01 (1.59 g/cc)	21.1	1.59	1.59	---	100.0%	1.59	---	100.0%

<sup>1</sup>Initial Sample Data: The 'as received' dry bulk density and moisture content.

<sup>2</sup>Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

<sup>3</sup>Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
SS-ADK-01 (Undisturbed) (1.46 g/cc)	2.7	3.9	---	---	1.46	1.50	44.8
SS-ADK-01 (1.60 g/cc)	NA	NA	4.4	6.9	1.60	1.66	39.8
SS-KEY-01 (Undisturbed) (1.63 g/cc)	17.8	29.0	---	---	1.63	1.92	38.5
SS-KEY-01 (1.59 g/cc)	NA	NA	20.3	32.4	1.59	1.92	39.9
SS-T1A-01 (Undisturbed) (1.54 g/cc)	25.3	38.9	---	---	1.54	1.93	42.0
SS-T1A-01 (1.59 g/cc)	NA	NA	21.1	33.5	1.59	1.92	40.1

NA = Not analyzed

--- = This sample was not remolded





### Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K <sub>sat</sub> (cm/sec)	Oversize Corrected K <sub>sat</sub> (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
SS-ADK-01 (Undisturbed) (1.46 g/cc)	1.6E-02	NA	X	
SS-ADK-01 (1.60 g/cc)	1.1E-02	NA	X	
SS-KEY-01 (Undisturbed) (1.63 g/cc)	2.0E-03	NA	X	
SS-KEY-01 (1.59 g/cc)	1.9E-03	NA	X	
SS-T1A-01 (Undisturbed) (1.54 g/cc)	2.4E-03	NA	X	
SS-T1A-01 (1.59 g/cc)	3.2E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass  
 NR = Not requested  
 NA = Not applicable



### Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
SS-ADK-01 (Undisturbed) (1.46 g/cc)	0	44.0
	6	42.1 #
	19	40.9 #
	49	14.4 #
	186	10.0 #
	4283	3.3 #
	18866	2.0 #
	366414	1.2 #
	852439	0.7 #
SS-ADK-01 (1.60 g/cc)	0	40.4
	5	39.9
	13	39.6
	52	10.8
	197	8.2
	9280	1.6
	34265	0.9
	265760	0.7
	846993	0.4
SS-KEY-01 (Undisturbed) (1.63 g/cc)	0	36.9
	6	36.1
	19	35.3
	49	23.0
	186	17.7
	3773	3.3
	37733	1.2
	267901	0.9
	852439	0.6

# Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics  
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
SS-KEY-01 (1.59 g/cc)	0	39.8
	4	39.8
	25	36.4
	337	12.7
	9178	2.6
	39568	1.2
	303492	0.8
	846993	0.4
SS-T1A-01 (Undisturbed) (1.54 g/cc)	0	40.1
	6	39.7
	19	39.3
	49	27.4
	186	19.5
	4079	10.5
	37631	3.3
	173162	1.7
	852439	0.6
SS-T1A-01 (1.59 g/cc)	0	38.1
	11	37.7
	32	35.5
	99	21.6
	337	18.4
	2448	6.0
	37325	1.4
	251381	1.0
	846993	0.7

## Volume adjustments are applicable at this matric potential (see data sheet for this sample).



### Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	$\alpha$ (cm <sup>-1</sup> )	N (dimensionless)	$\theta_r$ (% vol)	$\theta_s$ (% vol)	Oversize Corrected	
					$\theta_r$ (% vol)	$\theta_s$ (% vol)
SS-ADK-01 (Undisturbed) (1.46 g/cc)	0.0305	3.6589	3.28	43.45	NA	NA
SS-ADK-01 (1.60 g/cc)	0.0370	2.9456	2.02	40.86	NA	NA
SS-KEY-01 (Undisturbed) (1.63 g/cc)	0.0357	1.4480	0.00	37.56	NA	NA
SS-KEY-01 (1.59 g/cc)	0.0188	1.6228	0.61	39.97	NA	NA
SS-T1A-01 (Undisturbed) (1.54 g/cc)	0.0450	1.3213	0.00	41.31	NA	NA
SS-T1A-01 (1.59 g/cc)	0.0236	1.4332	0.00	39.00	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass  
 NR = Not requested  
 NA = Not applicable

## **Initial Properties**



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
SS-ADK-01 (Undisturbed) (1.46 g/cc)	2.7	3.9	---	---	1.46	1.50	44.8
SS-ADK-01 (1.60 g/cc)	NA	NA	4.4	6.9	1.60	1.66	39.8
SS-KEY-01 (Undisturbed) (1.63 g/cc)	17.8	29.0	---	---	1.63	1.92	38.5
SS-KEY-01 (1.59 g/cc)	NA	NA	20.3	32.4	1.59	1.92	39.9
SS-T1A-01 (Undisturbed) (1.54 g/cc)	25.3	38.9	---	---	1.54	1.93	42.0
SS-T1A-01 (1.59 g/cc)	NA	NA	21.1	33.5	1.59	1.92	40.1

NA = Not analyzed

--- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property and Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-ADK-01 (1.60 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	14-Aug-19
Field weight* of sample (g):		515.39
Tare weight, ring (g):		140.92
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		358.85
Sample volume (cm <sup>3</sup> ):		224.93
Assumed particle density (g/cm <sup>3</sup> ):		2.65
<hr/>		
Gravimetric Moisture Content (% g/g):		4.4
Volumetric Moisture Content (% vol):		6.9
Dry bulk density (g/cm <sup>3</sup> ):		1.60
Wet bulk density (g/cm <sup>3</sup> ):		1.66
Calculated Porosity (% vol):		39.8
Percent Saturation:		17.4
<hr/>		
Laboratory analysis by:		D. O'Dowd
Data entered by:		D. O'Dowd
Checked by:		J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded





Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: TTL, Inc.
Job Number: DB19.1098.00
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)
Project Name: Twin Pines
Project Number: 000180200804.00

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: TTL, Inc.  
Job Number: DB19.1098.00  
Sample Number: SS-KEY-01 (1.59 g/cc)  
Project Name: Twin Pines  
Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	14-Aug-19
Field weight* of sample (g):		559.42
Tare weight, ring (g):		137.30
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		350.79
Sample volume (cm <sup>3</sup> ):		220.36
Assumed particle density (g/cm <sup>3</sup> ):		2.65
<hr/>		
Gravimetric Moisture Content (% g/g):		20.3
Volumetric Moisture Content (% vol):		32.4
Dry bulk density (g/cm <sup>3</sup> ):		1.59
Wet bulk density (g/cm <sup>3</sup> ):		1.92
Calculated Porosity (% vol):		39.9
Percent Saturation:		81.1
<hr/>		
Laboratory analysis by:		D. O'Dowd
Data entered by:		D. O'Dowd
Checked by:		J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: TTL, Inc.  
Job Number: DB19.1098.00  
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)  
Project Name: Twin Pines  
Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	4-Apr-19	---
Field weight* of sample (g):	795.02	
Tare weight, ring (g):	245.30	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	438.64	
Sample volume (cm <sup>3</sup> ):	285.39	
Assumed particle density (g/cm <sup>3</sup> ):	2.65	

---

Gravimetric Moisture Content (% g/g):	25.3
Volumetric Moisture Content (% vol):	38.9
Dry bulk density (g/cm <sup>3</sup> ):	1.54
Wet bulk density (g/cm <sup>3</sup> ):	1.93
Calculated Porosity (% vol):	42.0
Percent Saturation:	92.7

---

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-T1A-01 (1.59 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	14-Aug-19
Field weight* of sample (g):		570.50
Tare weight, ring (g):		140.50
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		354.98
Sample volume (cm <sup>3</sup> ):		223.74
Assumed particle density (g/cm <sup>3</sup> ):		2.65
<hr/>		
Gravimetric Moisture Content (% g/g):		21.1
Volumetric Moisture Content (% vol):		33.5
Dry bulk density (g/cm <sup>3</sup> ):		1.59
Wet bulk density (g/cm <sup>3</sup> ):		1.92
Calculated Porosity (% vol):		40.1
Percent Saturation:		83.6
<hr/>		
Laboratory analysis by:		D. O'Dowd
Data entered by:		D. O'Dowd
Checked by:		J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded

## **Saturated Hydraulic Conductivity**



### Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K <sub>sat</sub> (cm/sec)	Oversize Corrected K <sub>sat</sub> (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
SS-ADK-01 (Undisturbed) (1.46 g/cc)	1.6E-02	NA	X	
SS-ADK-01 (1.60 g/cc)	1.1E-02	NA	X	
SS-KEY-01 (Undisturbed) (1.63 g/cc)	2.0E-03	NA	X	
SS-KEY-01 (1.59 g/cc)	1.9E-03	NA	X	
SS-T1A-01 (Undisturbed) (1.54 g/cc)	2.4E-03	NA	X	
SS-T1A-01 (1.59 g/cc)	3.2E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass  
 NR = Not requested  
 NA = Not applicable



### Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

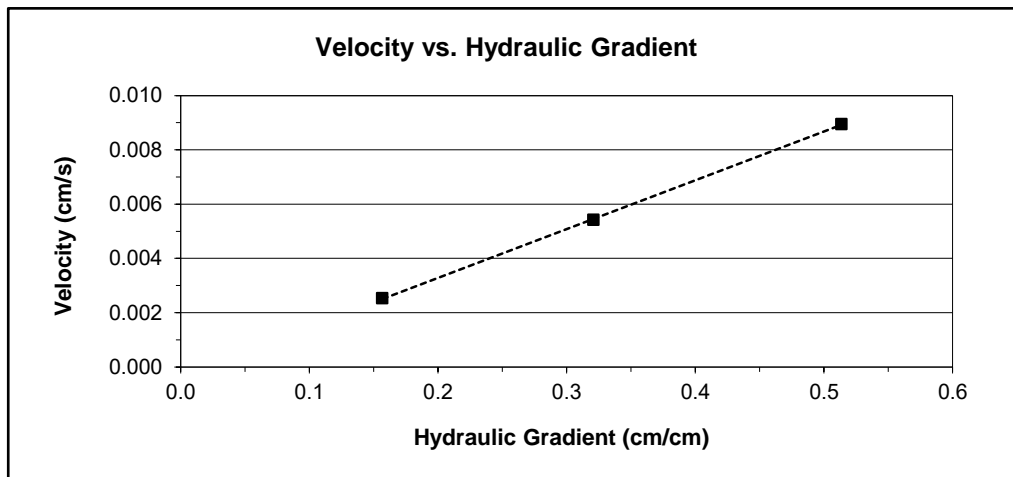
Type of water used: TAP  
 Collection vessel tare (g): 66.44  
 Sample length (cm): 7.01  
 Sample diameter (cm): 7.21  
 Sample x-sectional area (cm<sup>2</sup>): 40.84

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
5-Apr-19	12:32:00	21.0	3.6	132.17	65.7	180	1.7E-02	1.7E-02
5-Apr-19	12:35:00							
Test # 2:								
5-Apr-19	12:52:00	21.0	2.25	106.23	39.8	180	1.7E-02	1.7E-02
5-Apr-19	12:55:00							
Test # 3:								
5-Apr-19	13:12:00	21.0	1.1	85.00	18.6	180	1.6E-02	1.6E-02
5-Apr-19	13:15:00							

Average Ksat (cm/sec): 1.6E-02  
 Oversize Corrected Ksat (cm/sec): NA

Comments:

- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
- NA = Not applicable



Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



### Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-ADK-01 (1.60 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

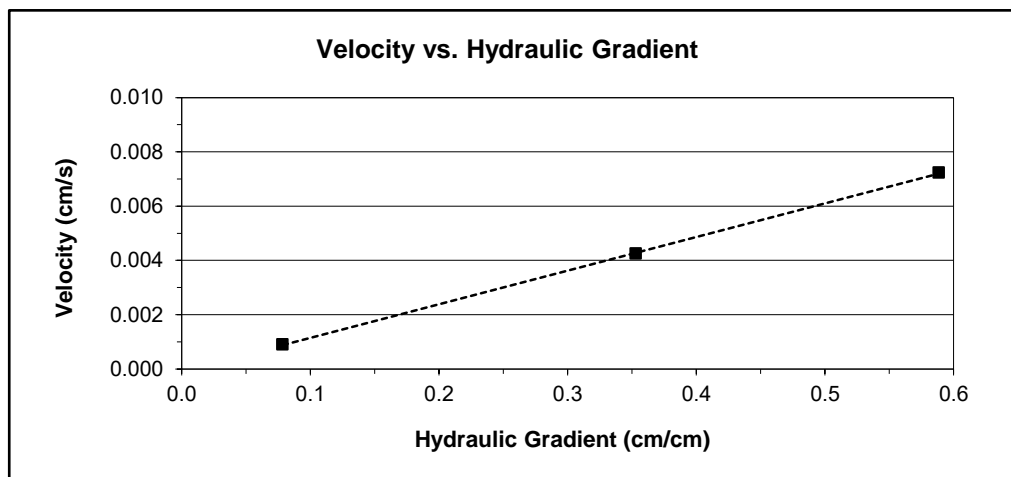
Type of water used: TAP  
 Collection vessel tare (g): 29.47  
 Sample length (cm): 7.64  
 Sample diameter (cm): 6.12  
 Sample x-sectional area (cm<sup>2</sup>): 29.43

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
20-Aug-19	10:05:30	22.5	4.5	67.76	38.3	180	1.2E-02	1.2E-02
20-Aug-19	10:08:30							
Test # 2:								
20-Aug-19	10:18:30	22.5	2.7	51.94	22.5	180	1.2E-02	1.1E-02
20-Aug-19	10:21:30							
Test # 3:								
20-Aug-19	10:31:30	22.5	0.6	34.23	4.8	180	1.1E-02	1.1E-02
20-Aug-19	10:34:30							

Average Ksat (cm/sec): 1.1E-02  
 Oversize Corrected Ksat (cm/sec): NA

Comments:

- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
- NA = Not applicable



Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines





### Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

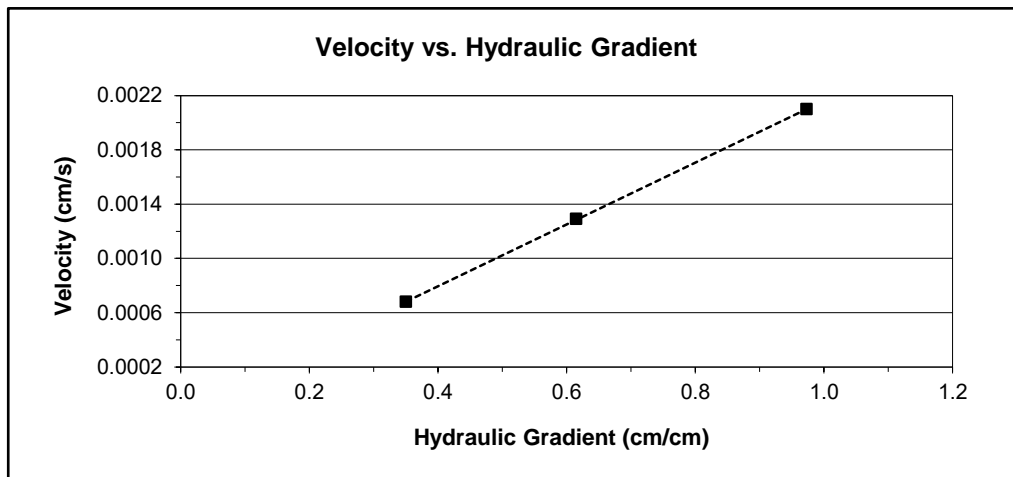
Type of water used: TAP  
 Collection vessel tare (g): 68.01  
 Sample length (cm): 6.99  
 Sample diameter (cm): 7.21  
 Sample x-sectional area (cm<sup>2</sup>): 40.85

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
5-Apr-19	12:30:00	21.0	6.8	83.44	15.4	180	2.2E-03	2.1E-03
5-Apr-19	12:33:00							
Test # 2:								
5-Apr-19	12:50:00	21.0	4.3	77.49	9.5	180	2.1E-03	2.1E-03
5-Apr-19	12:53:00							
Test # 3:								
5-Apr-19	13:10:00	21.0	2.45	73.01	5.0	180	1.9E-03	1.9E-03
5-Apr-19	13:13:00							

**Average Ksat (cm/sec): 2.0E-03**  
**Upsize Corrected Ksat (cm/sec): NA**

**Comments:**

- = Upsize correction is unnecessary since coarse fraction < 5% of composite mass
- NA = Not applicable



Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



### Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-KEY-01 (1.59 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

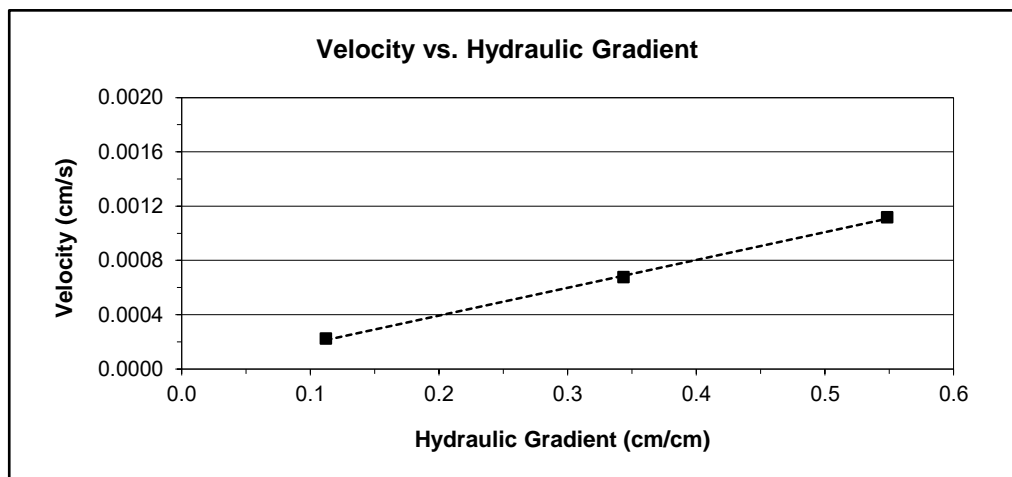
Type of water used: TAP  
 Collection vessel tare (g): 29.36  
 Sample length (cm): 7.57  
 Sample diameter (cm): 6.09  
 Sample x-sectional area (cm<sup>2</sup>): 29.13

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
20-Aug-19	10:06:00	22.5	4.15	35.21	5.9	180	2.0E-03	1.9E-03
20-Aug-19	10:09:00							
Test # 2:								
20-Aug-19	10:19:00	22.5	2.6	32.90	3.5	180	2.0E-03	1.9E-03
20-Aug-19	10:22:00							
Test # 3:								
20-Aug-19	10:32:00	22.5	0.85	30.52	1.2	180	2.0E-03	1.9E-03
20-Aug-19	10:35:00							

Average Ksat (cm/sec): 1.9E-03  
 Oversize Corrected Ksat (cm/sec): NA

Comments:

- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
- NA = Not applicable



Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



**Saturated Hydraulic Conductivity  
Constant Head Method**

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

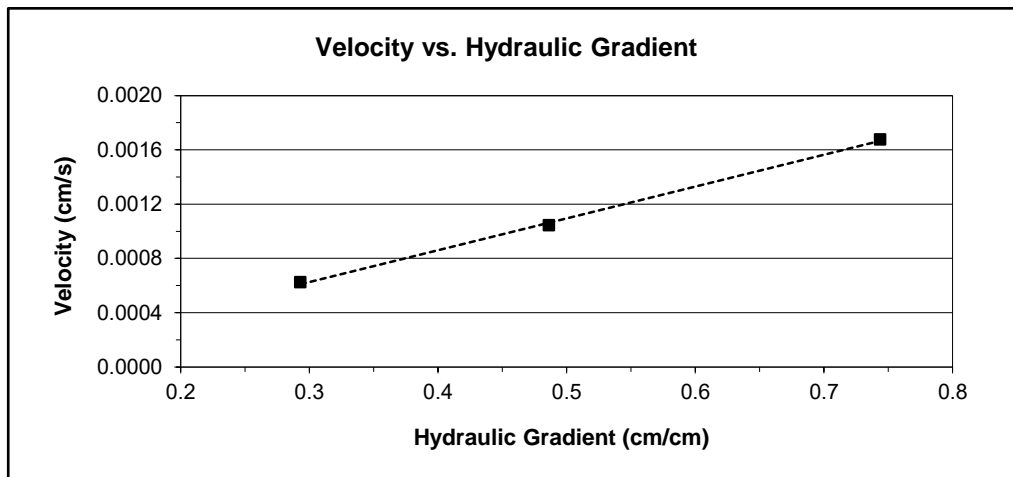
Type of water used: TAP  
 Collection vessel tare (g): 67.96  
 Sample length (cm): 6.99  
 Sample diameter (cm): 7.21  
 Sample x-sectional area (cm<sup>2</sup>): 40.83

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
5-Apr-19	12:31:00	21.0	4.85	80.27	12.3	180	2.4E-03	2.4E-03
5-Apr-19	12:34:00							
Test # 2:								
5-Apr-19	12:51:00	21.0	3.05	76.14	8.2	192	2.4E-03	2.3E-03
5-Apr-19	12:54:12							
Test # 3:								
5-Apr-19	13:11:00	21.0	1.7	72.53	4.6	180	2.6E-03	2.5E-03
5-Apr-19	13:14:00							

**Average Ksat (cm/sec): 2.4E-03**  
**Oversize Corrected Ksat (cm/sec): NA**

**Comments:**

- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
- NA = Not applicable



Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



### Saturated Hydraulic Conductivity Constant Head Method

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-T1A-01 (1.59 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

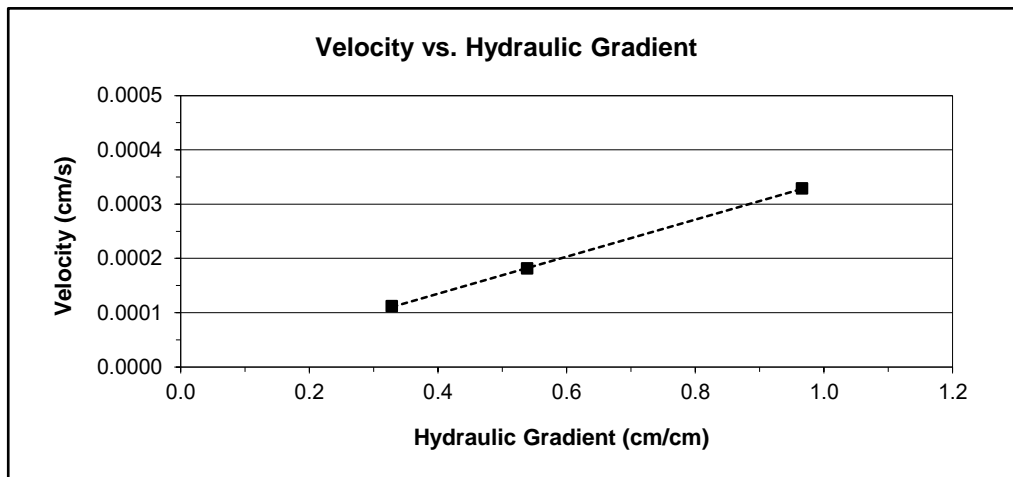
Type of water used: TAP  
 Collection vessel tare (g): 29.37  
 Sample length (cm): 7.61  
 Sample diameter (cm): 6.12  
 Sample x-sectional area (cm<sup>2</sup>): 29.42

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
20-Aug-19	10:05:00	22.5	7.35	31.11	1.7	180	3.4E-04	3.2E-04
20-Aug-19	10:08:00							
Test # 2:								
20-Aug-19	10:18:00	22.5	4.1	30.33	1.0	180	3.4E-04	3.2E-04
20-Aug-19	10:21:00							
Test # 3:								
20-Aug-19	10:31:00	22.5	2.5	29.96	0.6	180	3.4E-04	3.2E-04
20-Aug-19	10:34:00							

Average Ksat (cm/sec): 3.2E-04  
 Oversize Corrected Ksat (cm/sec): NA

Comments:

- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
- NA = Not applicable



Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines

## **Moisture Retention Characteristics**



### Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
SS-ADK-01 (Undisturbed) (1.46 g/cc)	0	44.0
	6	42.1 ††
	19	40.9 ††
	49	14.4 ††
	186	10.0 ††
	4283	3.3 ††
	18866	2.0 ††
	366414	1.2 ††
	852439	0.7 ††
SS-ADK-01 (1.60 g/cc)	0	40.4
	5	39.9
	13	39.6
	52	10.8
	197	8.2
	9280	1.6
	34265	0.9
	265760	0.7
	846993	0.4
SS-KEY-01 (Undisturbed) (1.63 g/cc)	0	36.9
	6	36.1
	19	35.3
	49	23.0
	186	17.7
	3773	3.3
	37733	1.2
	267901	0.9
	852439	0.6

---

†† Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics  
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
SS-KEY-01 (1.59 g/cc)	0	39.8
	4	39.8
	25	36.4
	337	12.7
	9178	2.6
	39568	1.2
	303492	0.8
	846993	0.4
SS-T1A-01 (Undisturbed) (1.54 g/cc)	0	40.1
	6	39.7
	19	39.3
	49	27.4
	186	19.5
	4079	10.5
	37631	3.3
	173162	1.7
	852439	0.6
SS-T1A-01 (1.59 g/cc)	0	38.1
	11	37.7
	32	35.5
	99	21.6
	337	18.4
	2448	6.0
	37325	1.4
	251381	1.0
	846993	0.7

## Volume adjustments are applicable at this matric potential (see data sheet for this sample).



### Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	$\alpha$ ( $\text{cm}^{-1}$ )	<b>N</b> (dimensionless)	$\theta_r$ (% vol)	$\theta_s$ (% vol)	Oversize Corrected	
					$\theta_r$ (% vol)	$\theta_s$ (% vol)
SS-ADK-01 (Undisturbed) (1.46 g/cc)	0.0305	3.6589	3.28	43.45	NA	NA
SS-ADK-01 (1.60 g/cc)	0.0370	2.9456	2.02	40.86	NA	NA
SS-KEY-01 (Undisturbed) (1.63 g/cc)	0.0357	1.4480	0.00	37.56	NA	NA
SS-KEY-01 (1.59 g/cc)	0.0188	1.6228	0.61	39.97	NA	NA
SS-T1A-01 (Undisturbed) (1.54 g/cc)	0.0450	1.3213	0.00	41.31	NA	NA
SS-T1A-01 (1.59 g/cc)	0.0236	1.4332	0.00	39.00	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable





**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

Dry wt. of sample (g): 418.99  
 Tare wt., ring (g): 254.90  
 Tare wt., screen & clamp (g): 26.68  
 Initial sample volume (cm<sup>3</sup>): 286.20  
 Initial dry bulk density (g/cm<sup>3</sup>): 1.46  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Initial calculated total porosity (%): 44.76

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)	
Hanging column:	5-Apr-19	15:00	826.47	0	43.99	
	15-Apr-19	17:00	816.19	6.0	42.08	##
	22-Apr-19	16:00	812.97	18.5	40.91	##
	29-Apr-19	13:55	740.23	49.0	14.43	##
	7-May-19	14:40	728.16	186.0	10.04	##

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	6.0	274.77	-4.00%	1.52	42.46
	18.5	274.77	-4.00%	1.52	42.46
	49.0	274.77	-4.00%	1.52	42.46
	186.0	274.77	-4.00%	1.52	42.46

**Comments:**

- <sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.
- <sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.
- \* Weight including tares
- † Assumed density of water is 1.0 g/cm<sup>3</sup>
- ## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

Laboratory analysis by: D. O'Dowd/A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines



**Moisture Retention Data**

**Dew Point Potentiometer / Relative Humidity Box**  
(Soil-Water Characteristic Curve)

Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)

Initial sample bulk density (g/cm<sup>3</sup>): 1.46

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight\* of dew point potentiometer sample (g): 164.88

Tare weight, jar (g): 112.64

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Dew point potentiometer:	26-Apr-19	10:31	166.02	4283	3.33	##
	18-Apr-19	9:05	165.56	18866	1.97	##
	10-Apr-19	15:27	165.30	366414	1.22	##

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	4283	274.77	-4.00%	1.52	42.46
	18866	274.77	-4.00%	1.52	42.46
	366414	274.77	-4.00%	1.52	42.46

Dry weight\* of relative humidity box sample (g): 75.67

Tare weight (g): 39.42

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Relative humidity box:	23-Apr-19	9:40	75.84	852439	0.71	##

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	852439	274.77	-4.00%	1.52	42.46

Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: C. Krous/D. O'Dowd

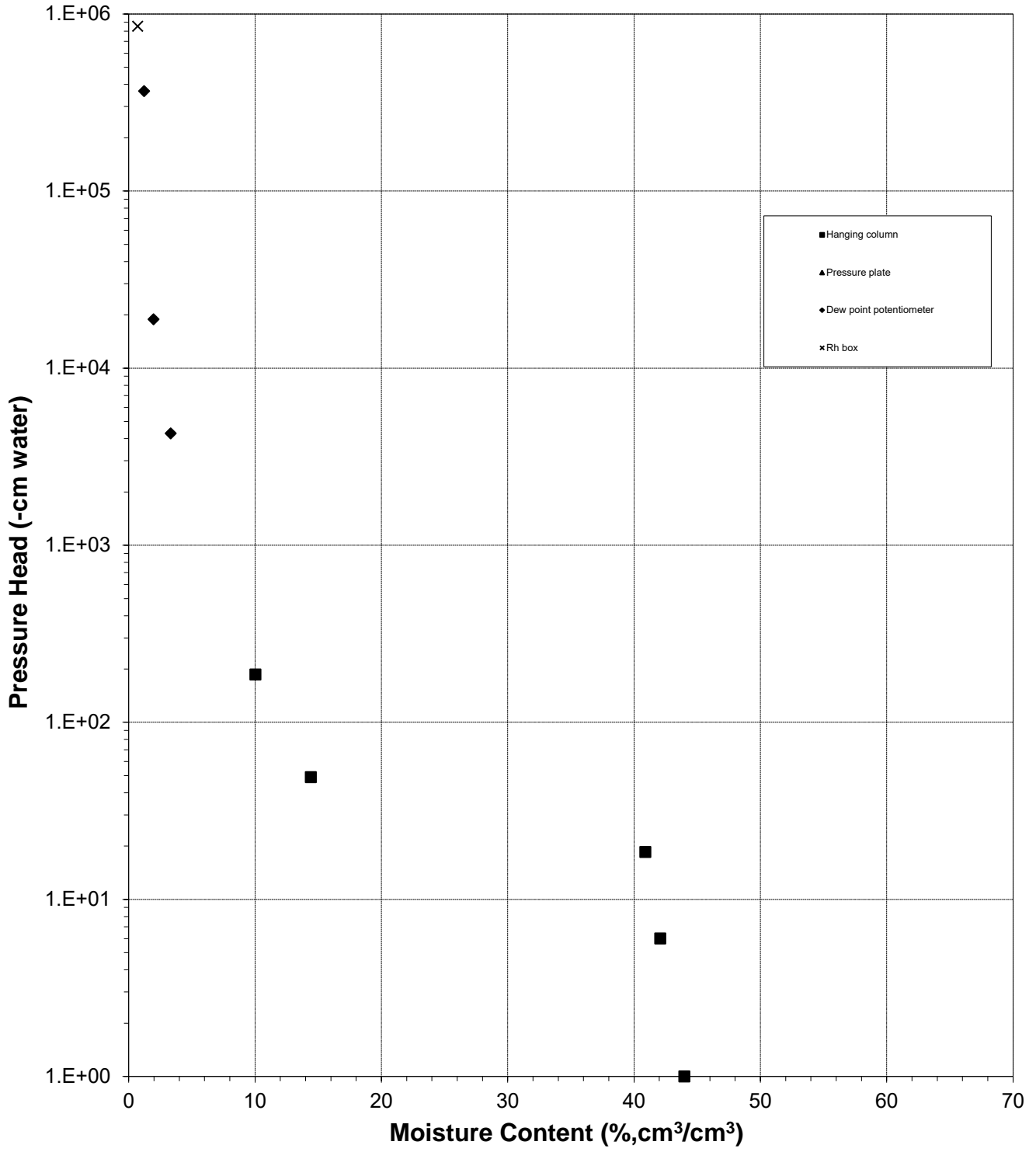
Data entered by: C. Krous

Checked by: J. Hines



### Water Retention Data Points

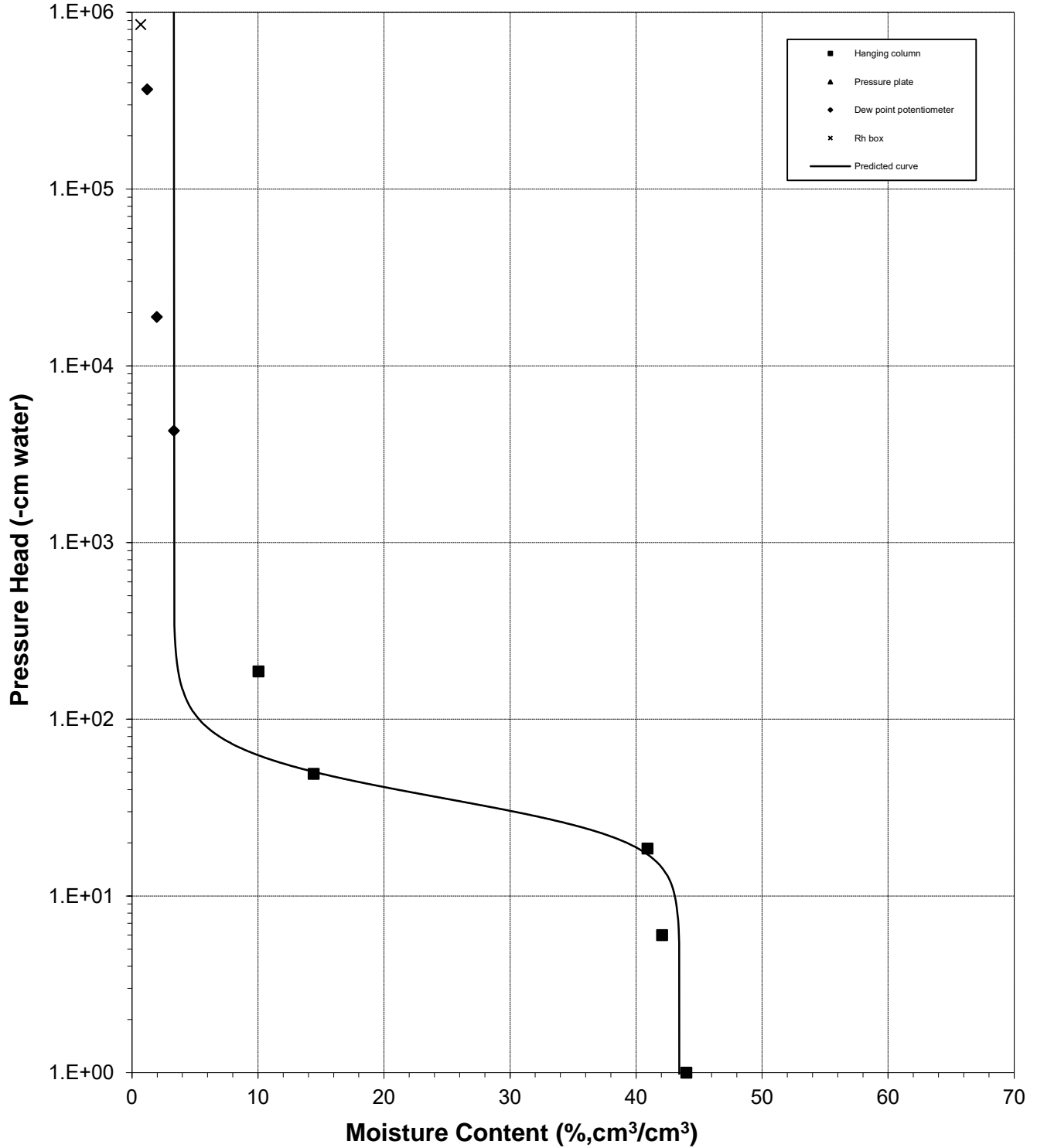
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





### Predicted Calibration Curve and Data Points

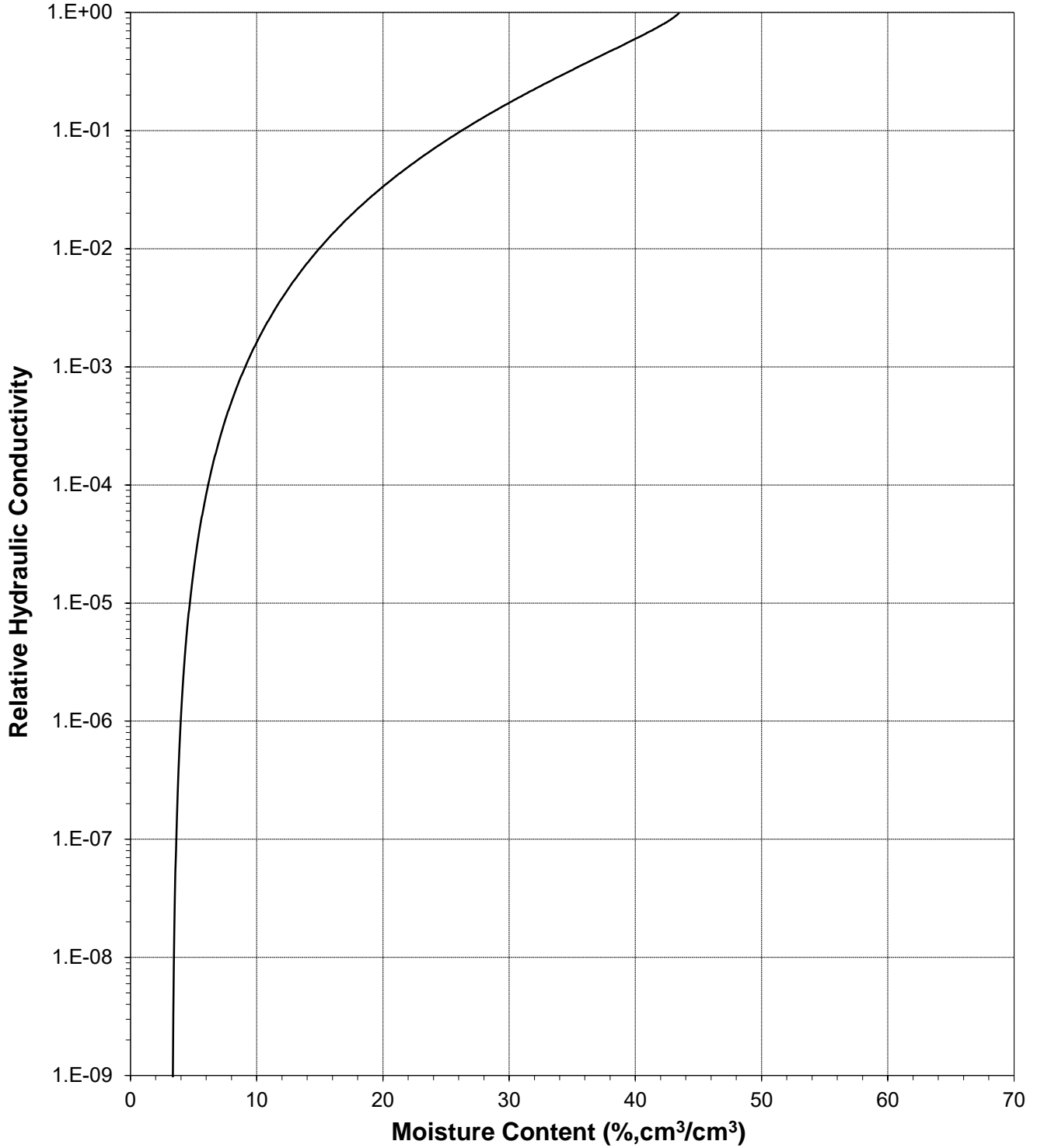
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

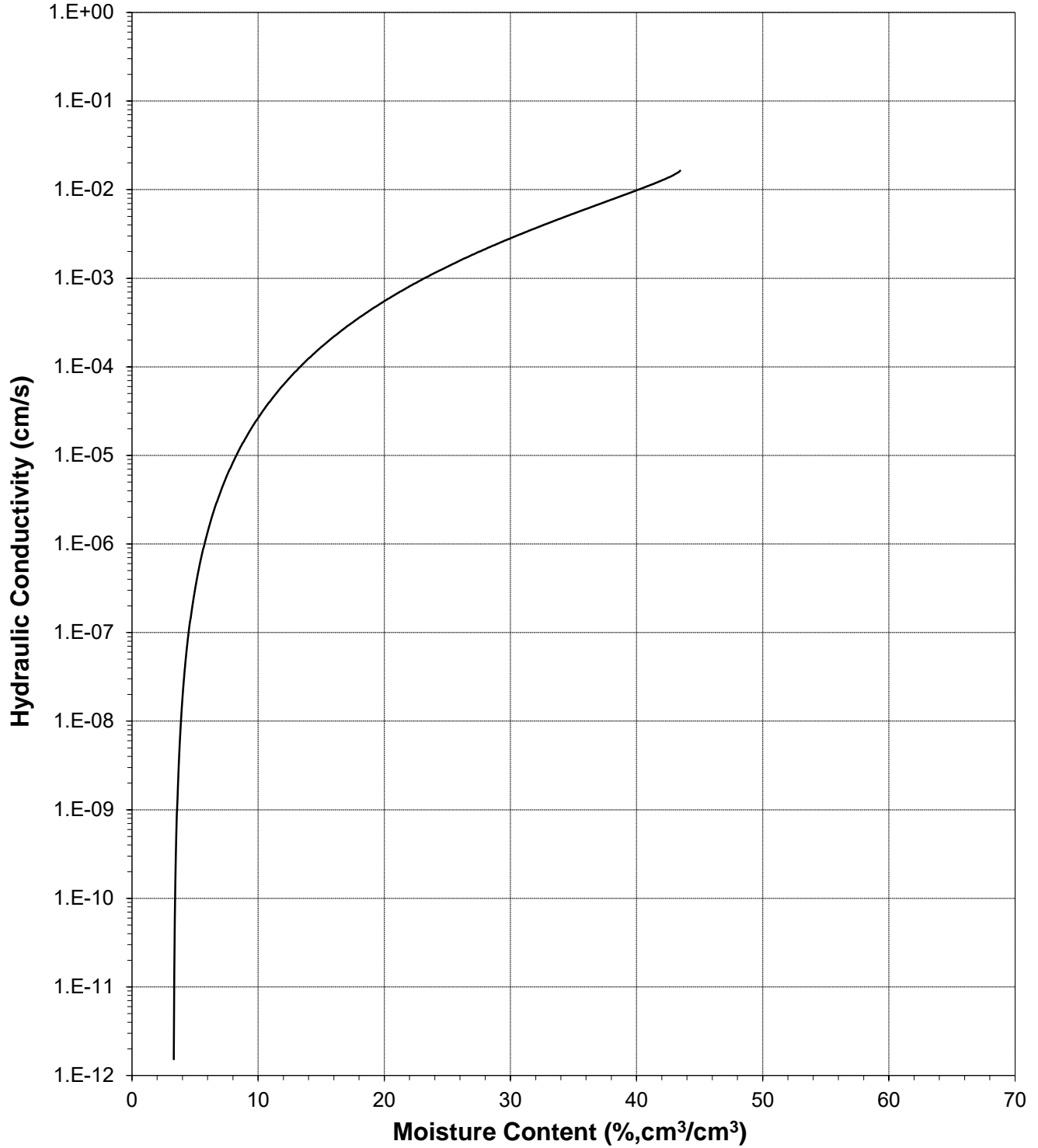
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





### Plot of Hydraulic Conductivity vs Moisture Content

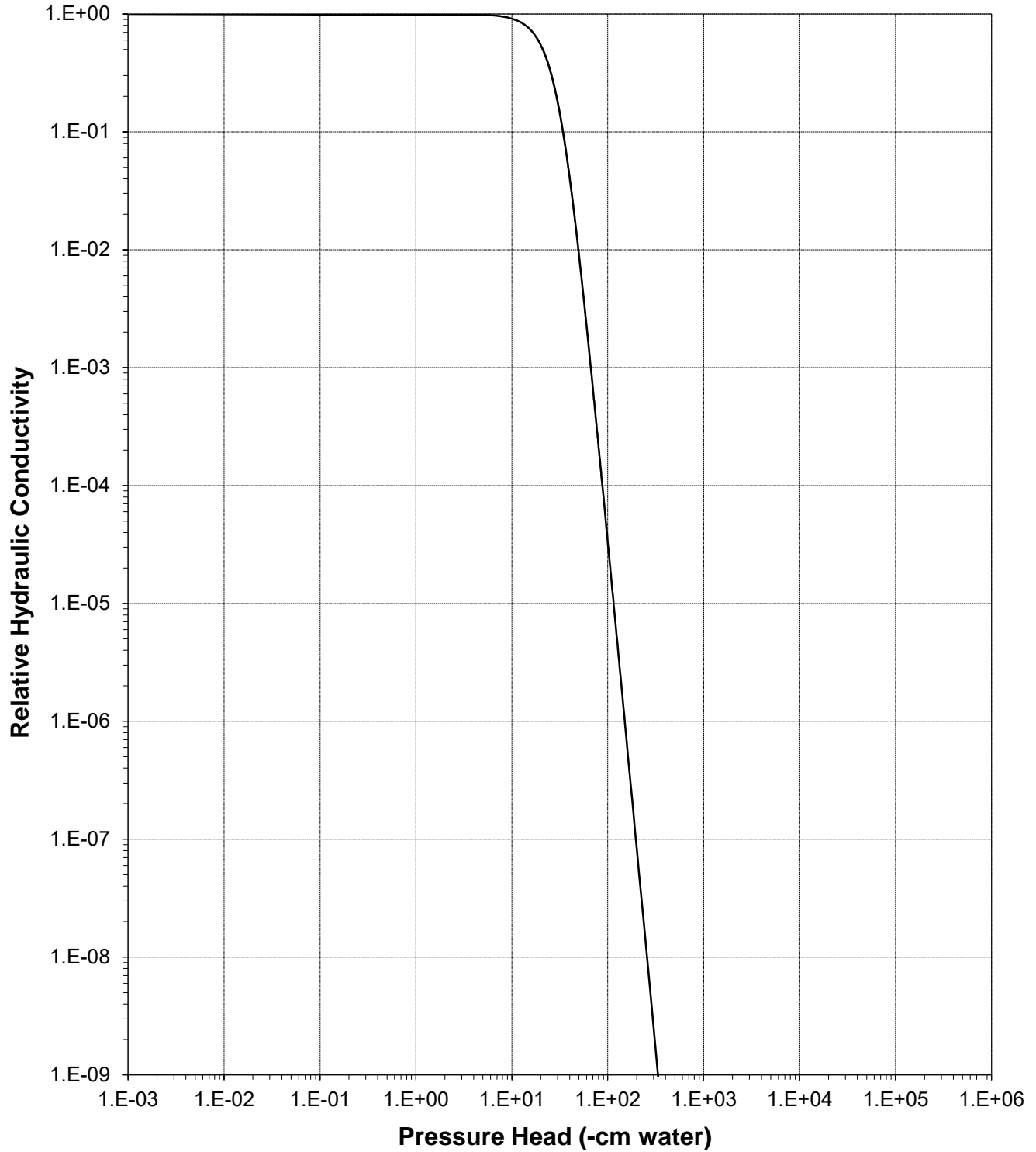
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

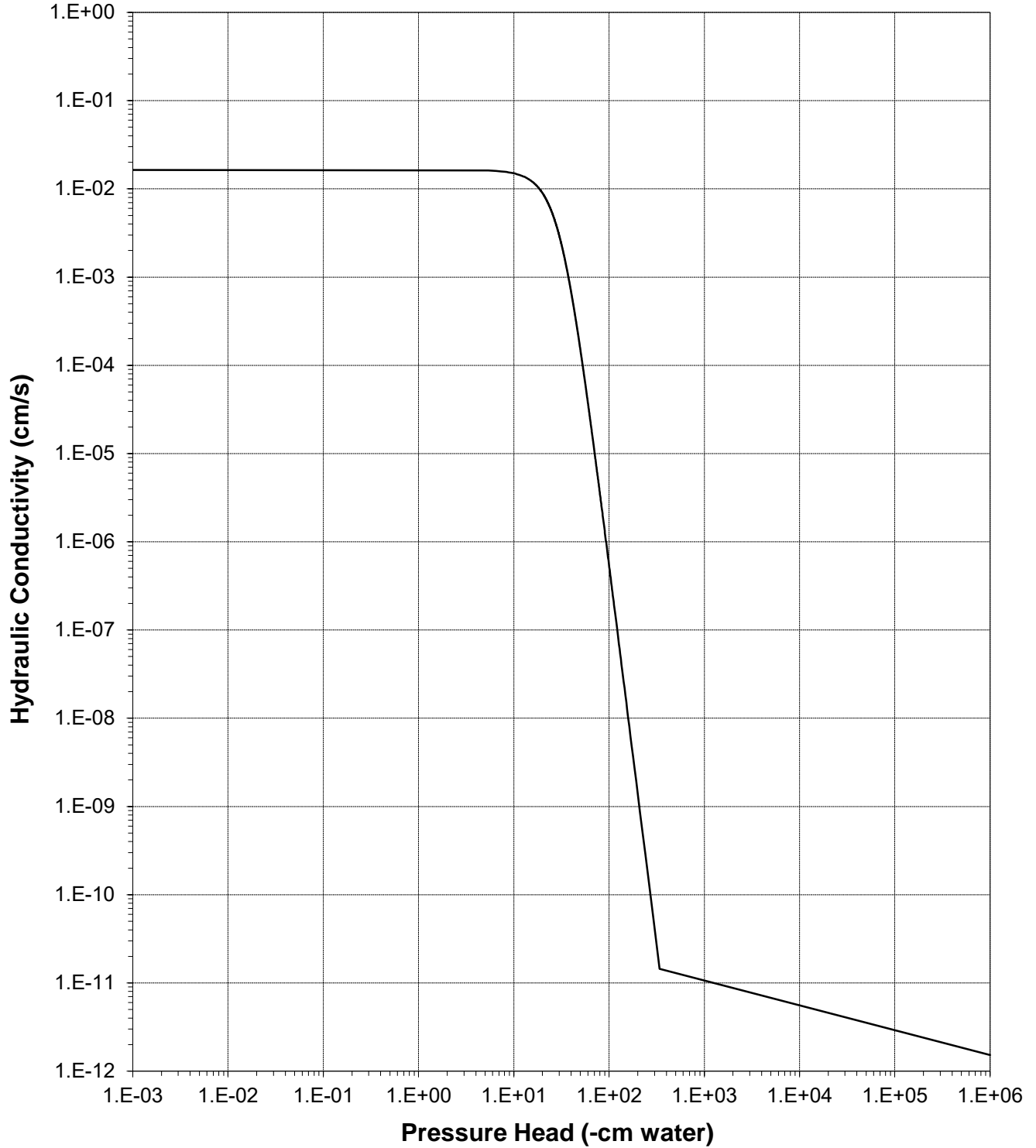
Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-ADK-01 (Undisturbed) (1.46 g/cc)







**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-ADK-01 (1.60 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

Dry wt. of sample (g): 358.85  
 Tare wt., ring (g): 140.92  
 Tare wt., screen & clamp (g): 28.00  
 Initial sample volume (cm<sup>3</sup>): 224.93  
 Initial dry bulk density (g/cm<sup>3</sup>): 1.60  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Initial calculated total porosity (%): 39.80

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
<i>Hanging column:</i>	20-Aug-19	14:00	618.70	0	40.43
	27-Aug-19	9:30	617.53	5.0	39.91
	3-Sep-19	16:40	616.89	13.0	39.62
	10-Sep-19	11:30	552.17	52.0	10.85
	17-Sep-19	15:30	546.18	197.0	8.18

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	5.0	---	---	---	---
	13.0	---	---	---	---
	52.0	---	---	---	---
	197.0	---	---	---	---

**Comments:**

- <sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.
- <sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.
- \* Weight including tares
- † Assumed density of water is 1.0 g/cm<sup>3</sup>
- ‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

Laboratory analysis by: D. O'Dowd  
 Data entered by: A. Albay-Yenney  
 Checked by: J. Hines



**Moisture Retention Data**

**Dew Point Potentiometer / Relative Humidity Box**  
(Soil-Water Characteristic Curve)

Sample Number: SS-ADK-01 (1.60 g/cc)

Initial sample bulk density (g/cm<sup>3</sup>): 1.60

Fraction of bulk sample used (<2.00mm fraction) (%): 98.96

Dry weight\* of dew point potentiometer sample (g): 194.65

Tare weight, jar (g): 113.34

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Dew point potentiometer:	4-Sep-19	14:55	195.48	9280	1.61
	28-Aug-19	8:13	195.12	34265	0.91
	26-Aug-19	10:20	194.99	265760	0.66

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	9280	---	---	---	---
	34265	---	---	---	---
	265760	---	---	---	---

Dry weight\* of relative humidity box sample (g): 89.64

Tare weight (g): 41.74

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Relative humidity box:	21-Aug-19	10:15	89.75	846993	0.37

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	846993	---	---	---	---

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

<sup>‡</sup> Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

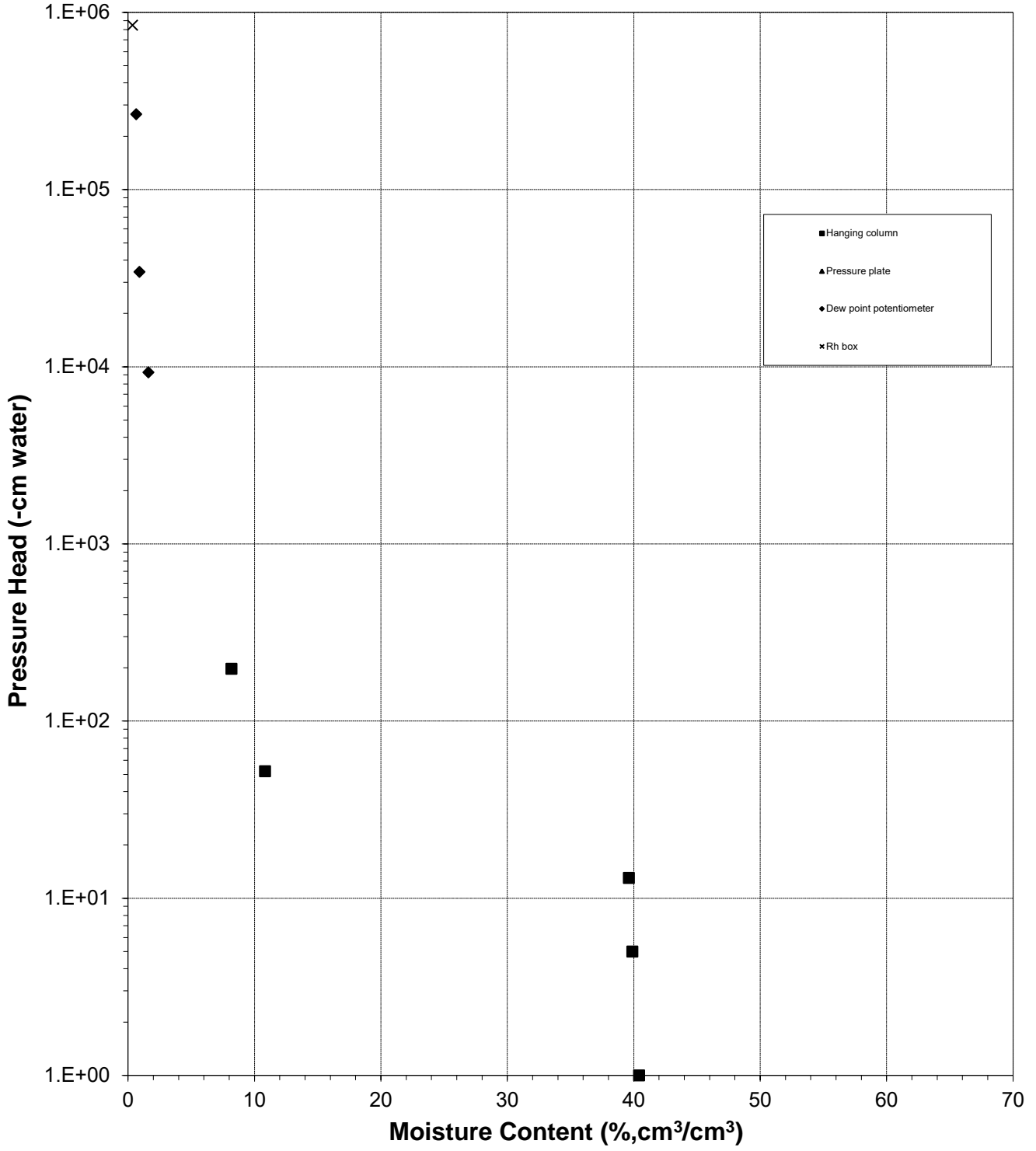
Data entered by: A. Albay-Yenney

Checked by: J. Hines



### Water Retention Data Points

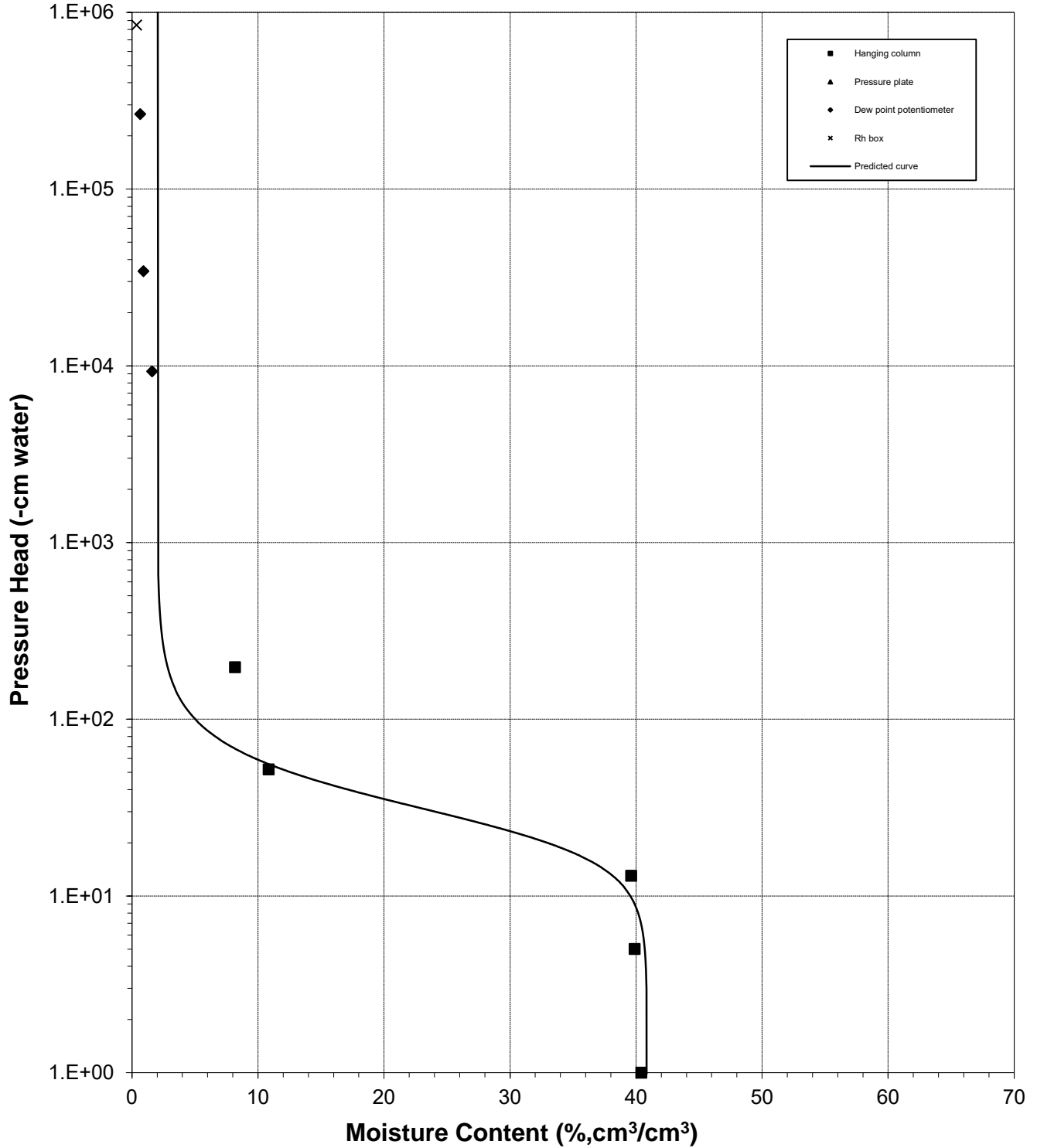
Sample Number: SS-ADK-01 (1.60 g/cc)





### Predicted Calibration Curve and Data Points

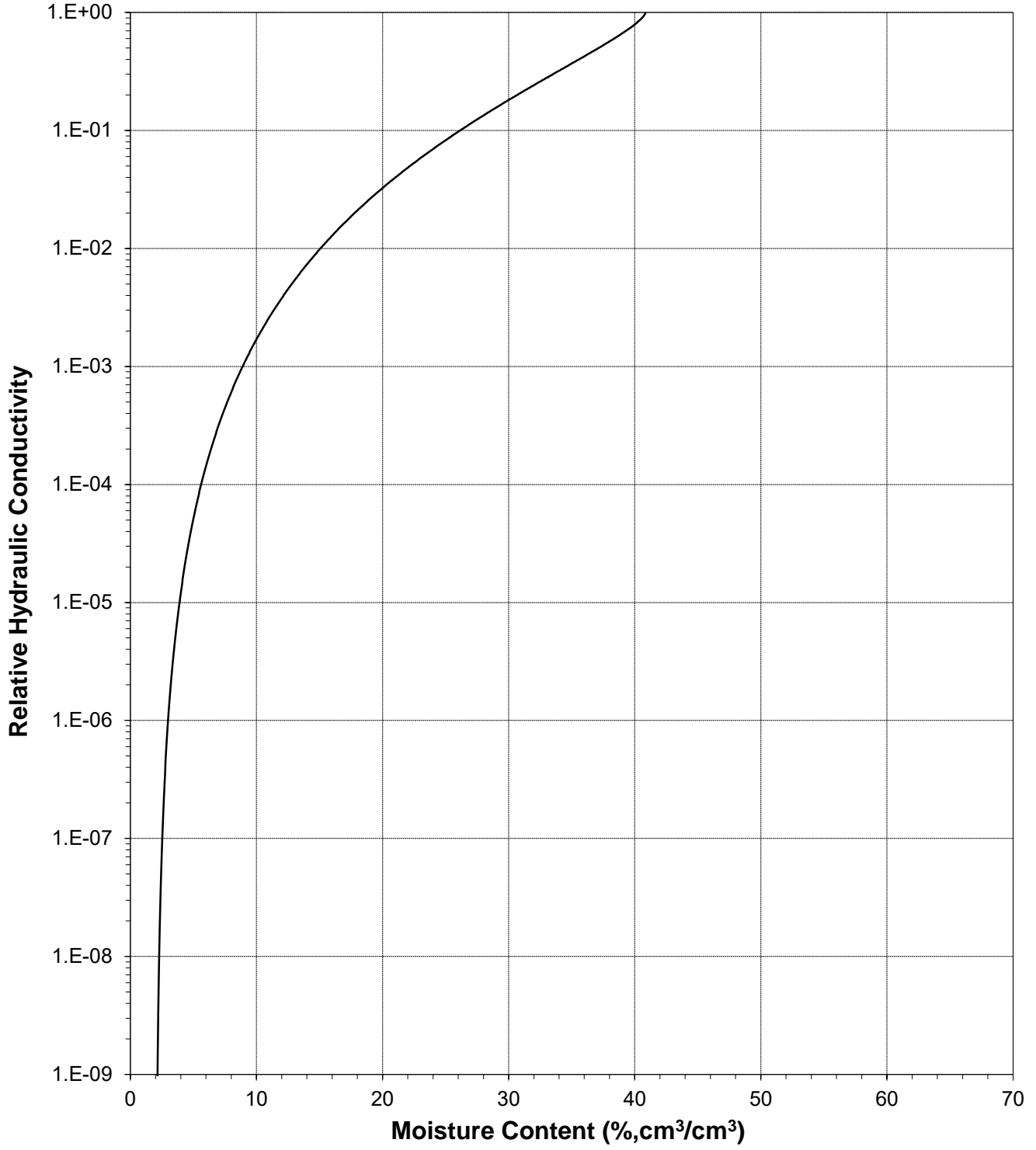
Sample Number: SS-ADK-01 (1.60 g/cc)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

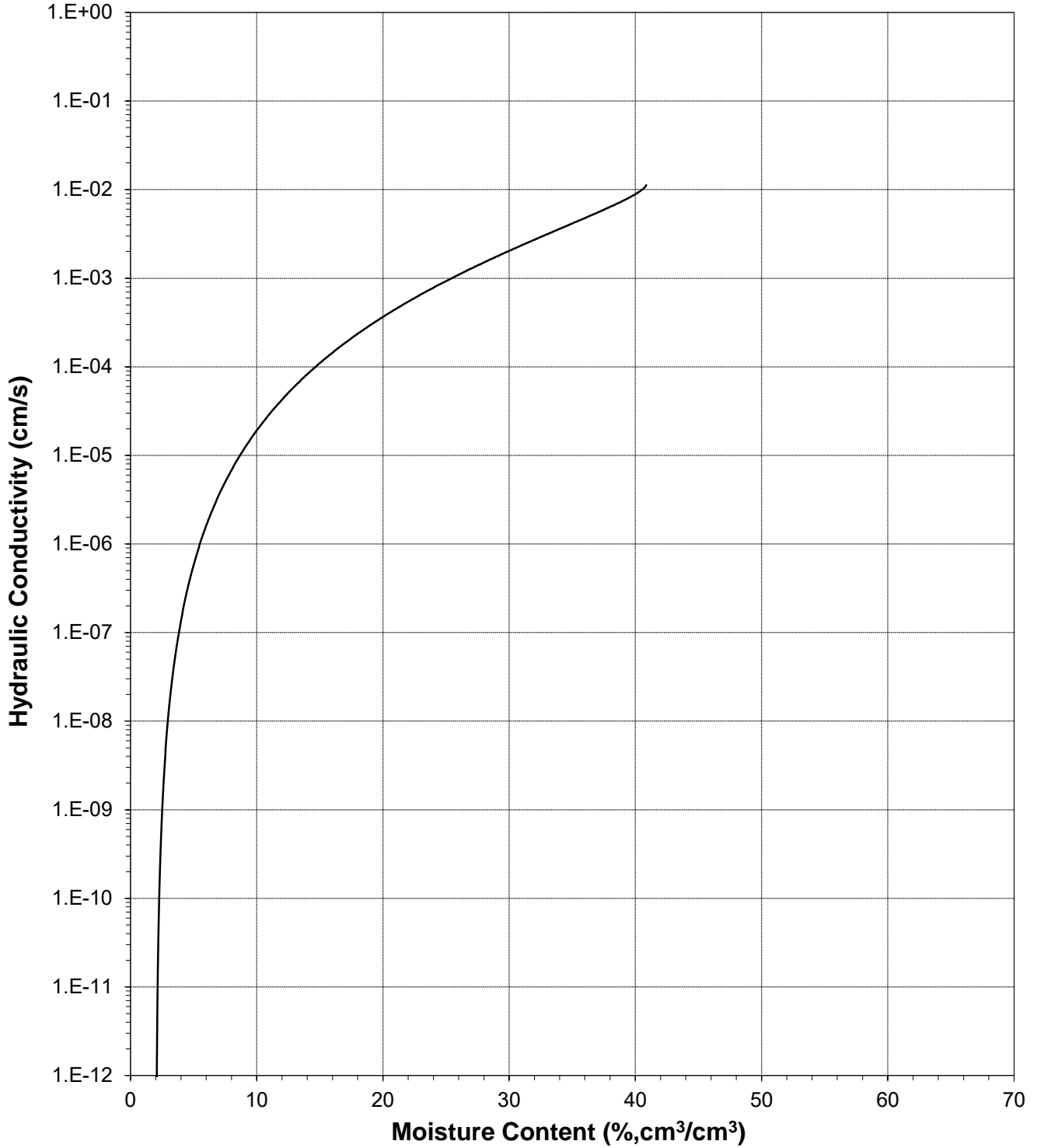
Sample Number: SS-ADK-01 (1.60 g/cc)





### Plot of Hydraulic Conductivity vs Moisture Content

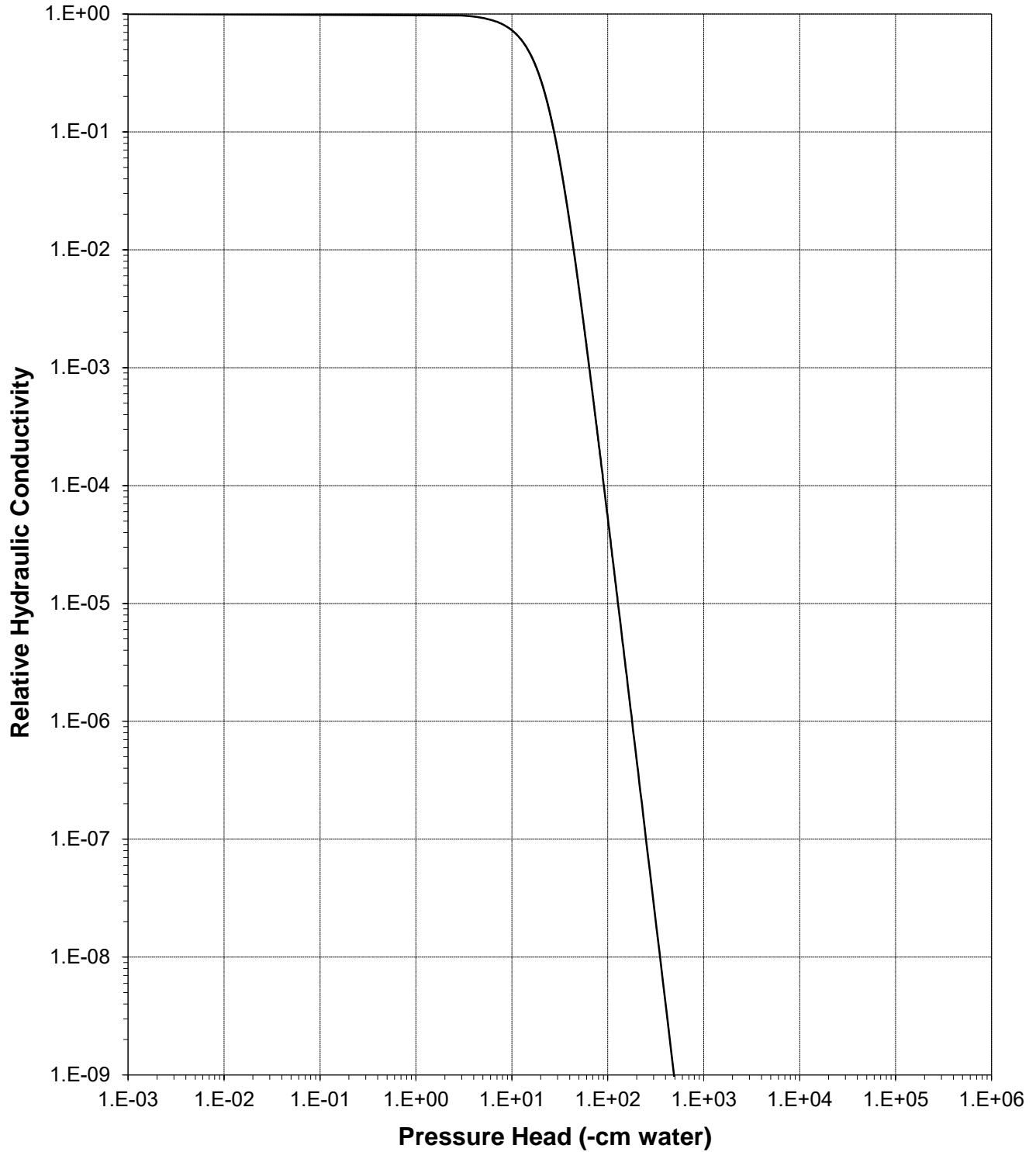
Sample Number: SS-ADK-01 (1.60 g/cc)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

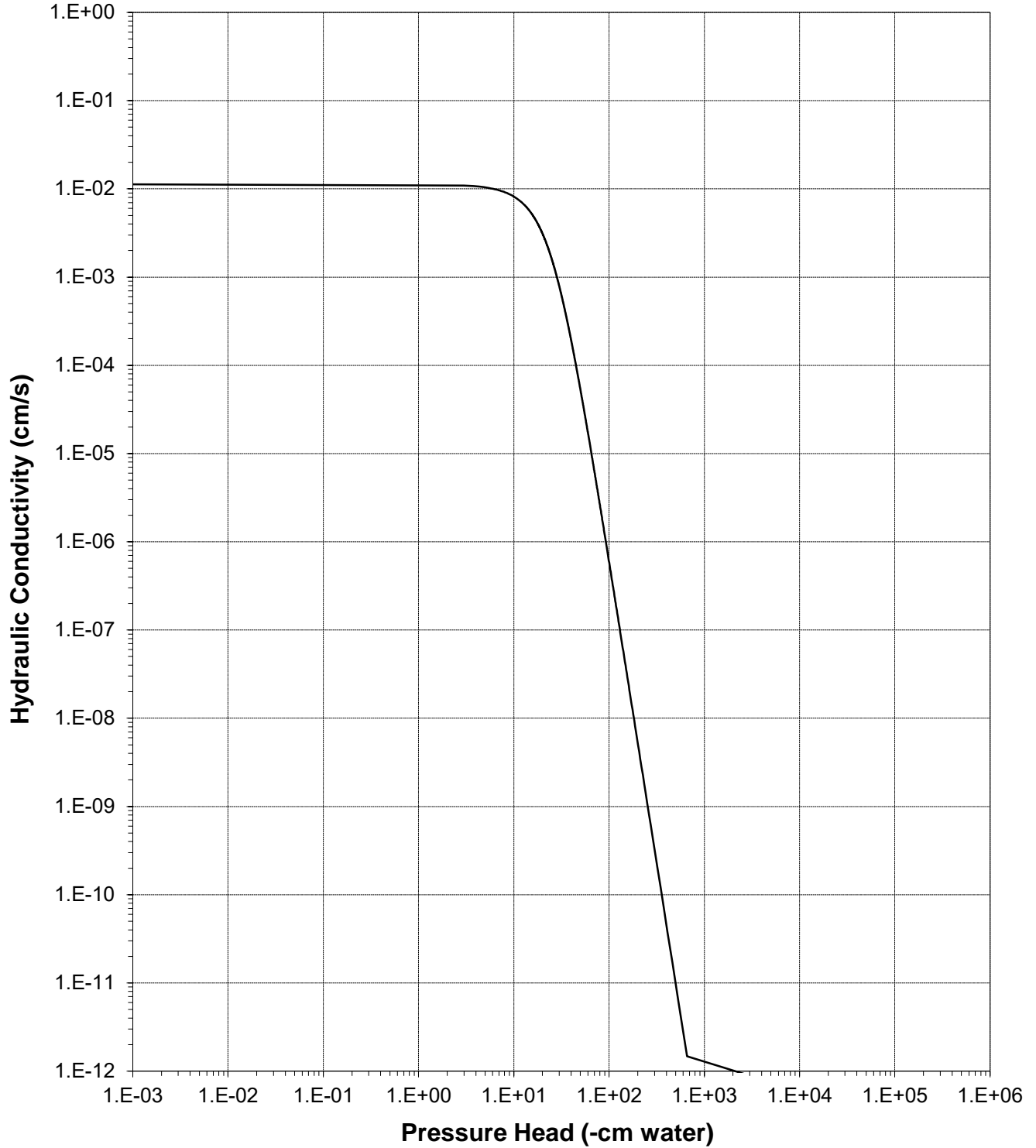
Sample Number: SS-ADK-01 (1.60 g/cc)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-ADK-01 (1.60 g/cc)







**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

Dry wt. of sample (g): 464.92  
 Tare wt., ring (g): 245.11  
 Tare wt., screen & clamp (g): 27.04  
 Initial sample volume (cm<sup>3</sup>): 285.47  
 Initial dry bulk density (g/cm<sup>3</sup>): 1.63  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Initial calculated total porosity (%): 38.54

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	5-Apr-19	15:00	842.47	0	36.92
	15-Apr-19	17:00	840.26	6.0	36.15
	22-Apr-19	16:00	837.87	18.5	35.31
	29-Apr-19	13:55	802.77	49.0	23.02
	7-May-19	14:45	787.71	186.0	17.74

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	6.0	---	---	---	---
	18.5	---	---	---	---
	49.0	---	---	---	---
	186.0	---	---	---	---

**Comments:**

- <sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.
- <sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.
- \* Weight including tares
- † Assumed density of water is 1.0 g/cm<sup>3</sup>
- ‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

Laboratory analysis by: D. O'Dowd/A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines



**Moisture Retention Data**

**Dew Point Potentiometer / Relative Humidity Box**  
(Soil-Water Characteristic Curve)

Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)

Initial sample bulk density (g/cm<sup>3</sup>): 1.63

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight\* of dew point potentiometer sample (g): 166.85

Tare weight, jar (g): 116.56

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Dew point potentiometer:	25-Apr-19	11:00	167.88	3773	3.32
	17-Apr-19	15:05	167.22	37733	1.20
	10-Apr-19	15:15	167.13	267901	0.90

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	3773	---	---	---	---
	37733	---	---	---	---
	267901	---	---	---	---

Dry weight\* of relative humidity box sample (g): 64.16

Tare weight (g): 40.69

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Relative humidity box:	23-Apr-19	9:40	64.25	852439	0.60

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	852439	---	---	---	---

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

<sup>‡</sup> Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: C. Krous/D. O'Dowd

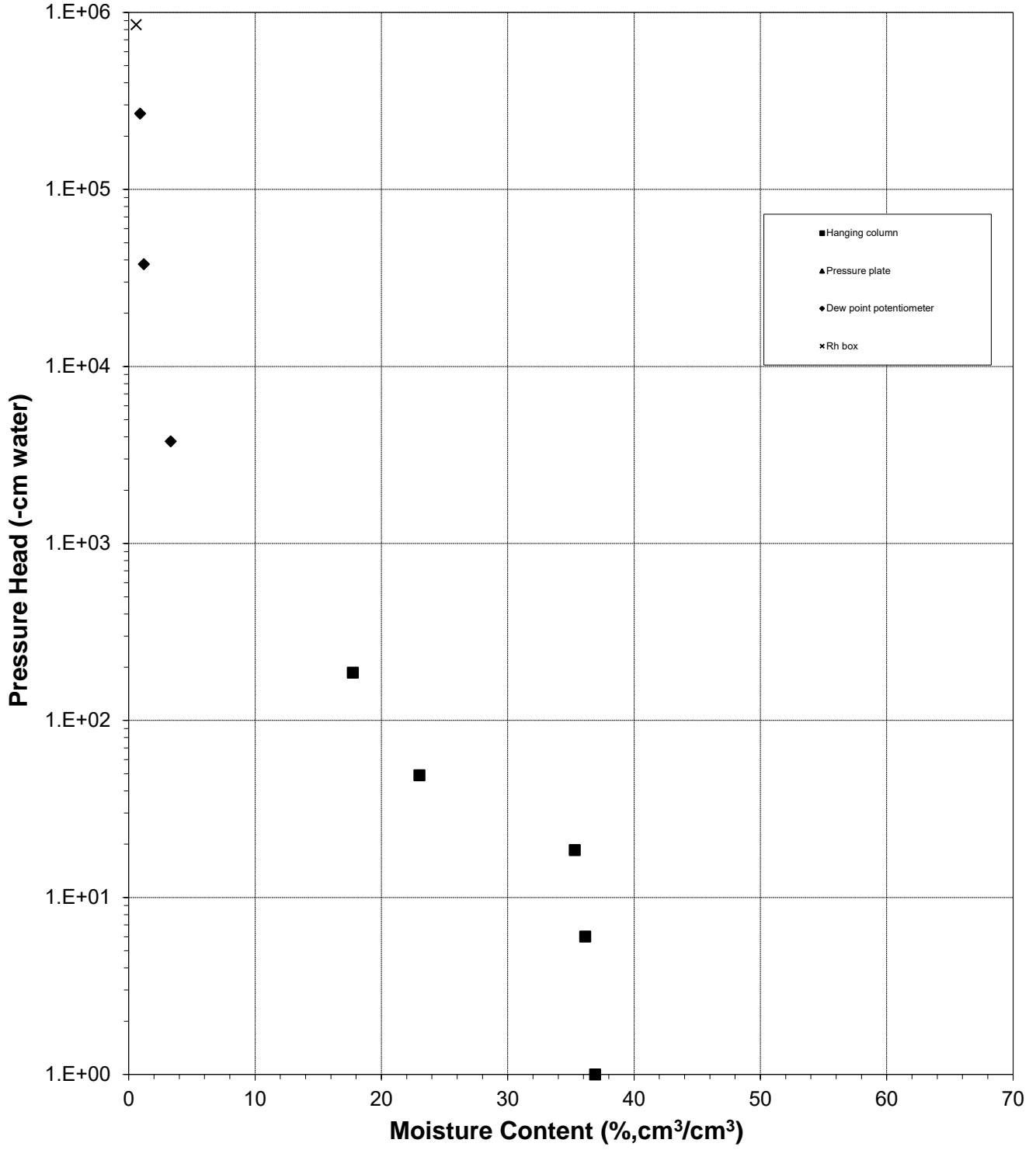
Data entered by: C. Krous

Checked by: J. Hines



### Water Retention Data Points

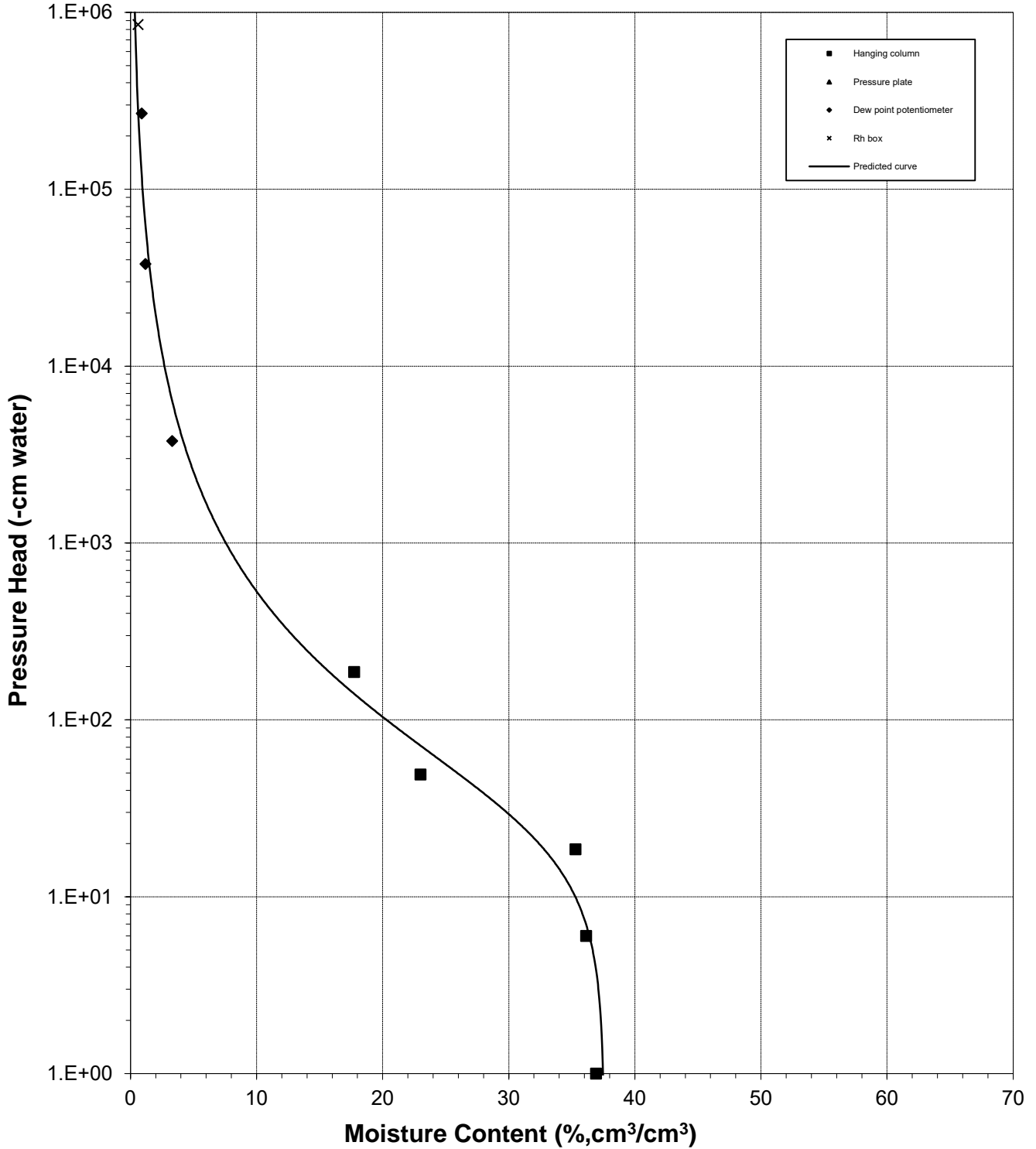
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





### Predicted Calibration Curve and Data Points

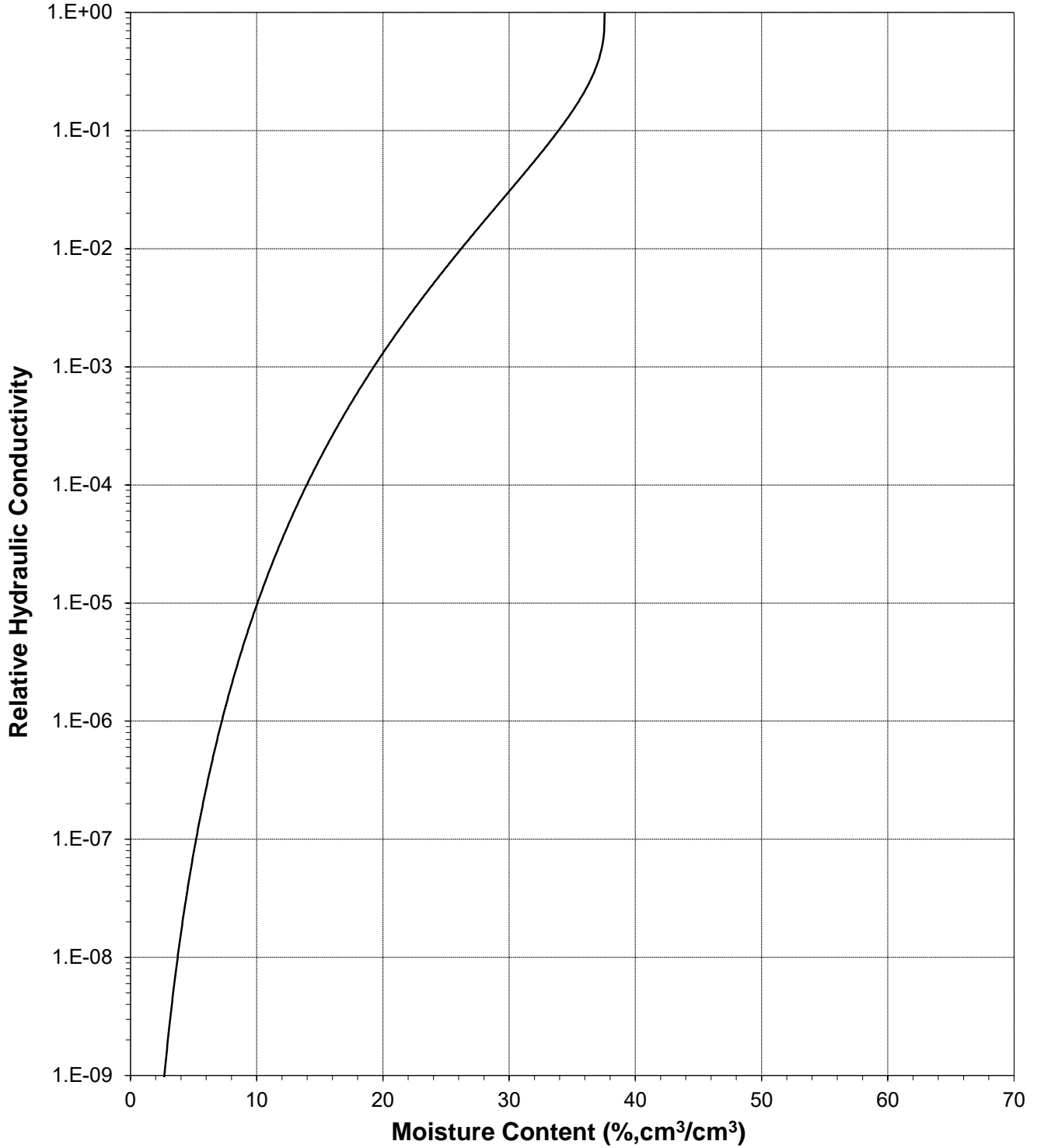
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

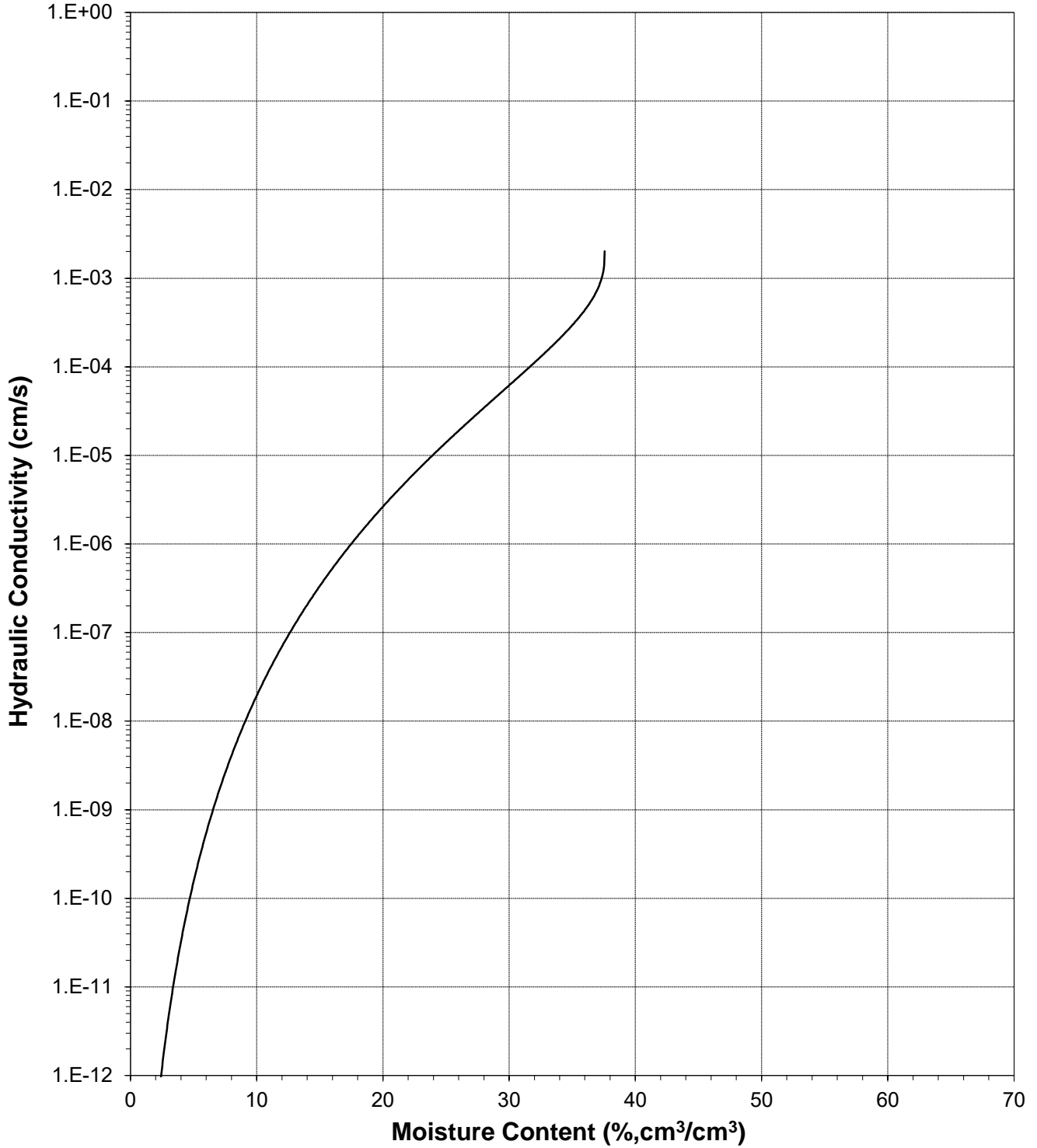
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





### Plot of Hydraulic Conductivity vs Moisture Content

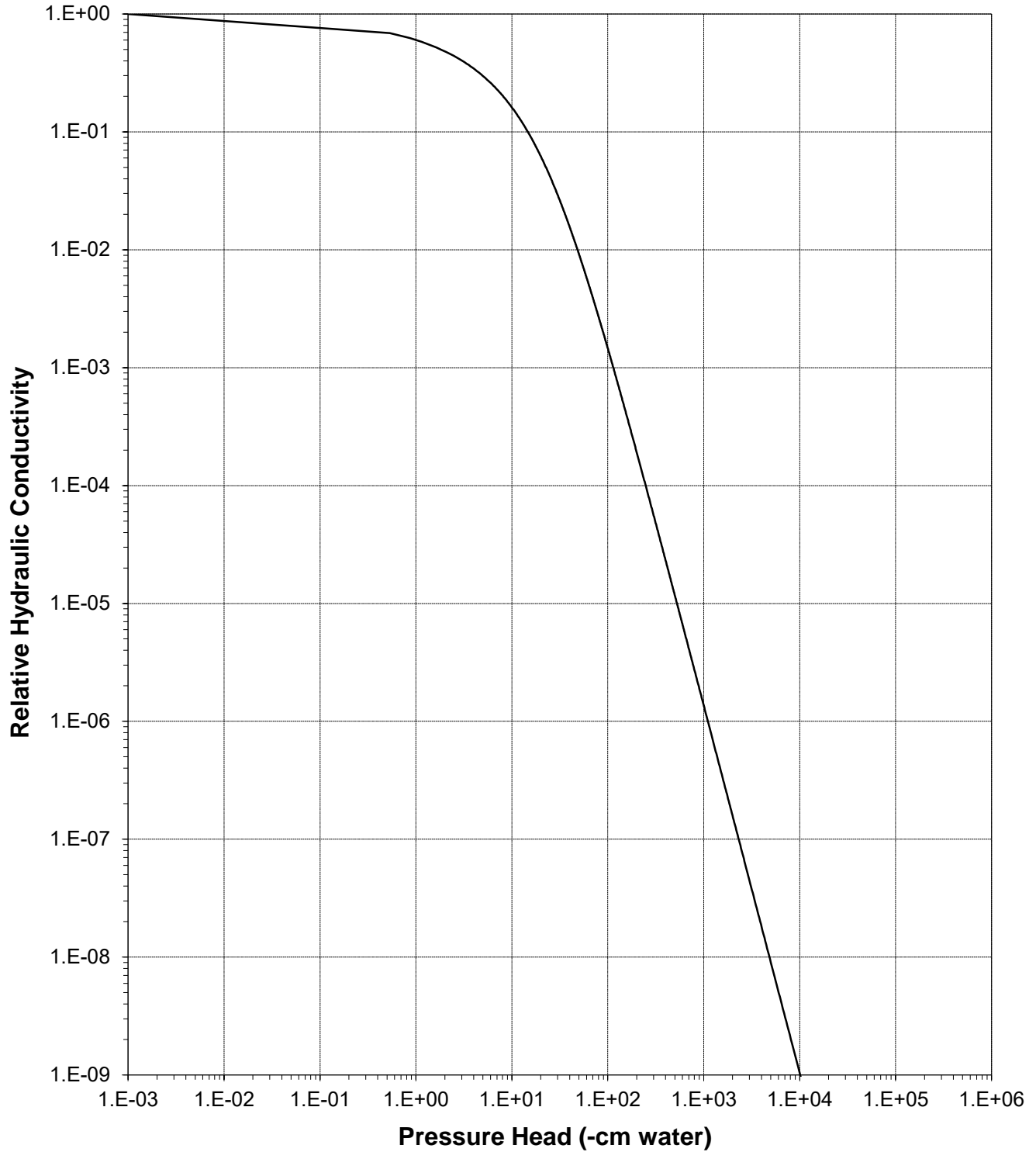
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

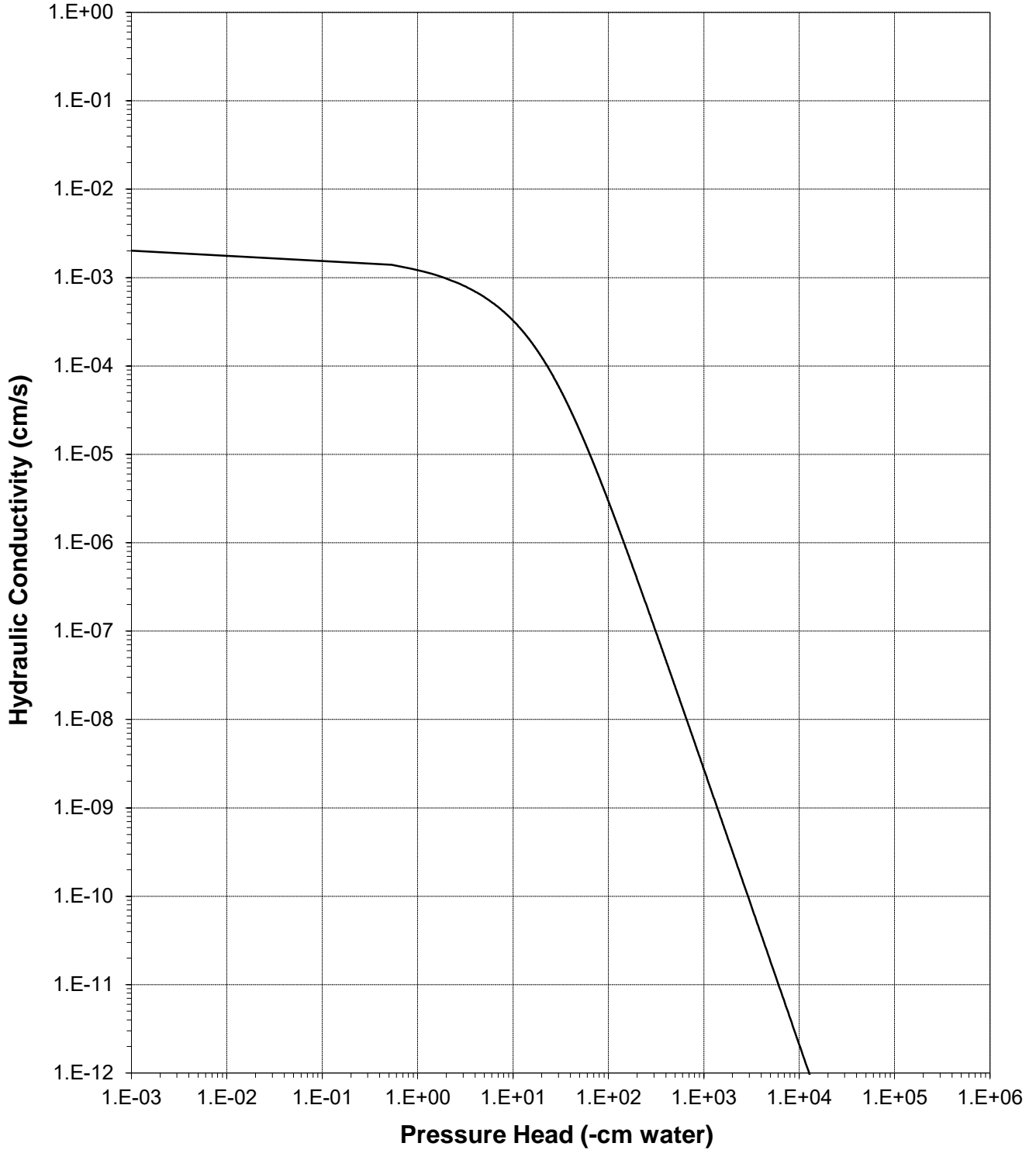
Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-KEY-01 (Undisturbed) (1.63 g/cc)







**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-KEY-01 (1.59 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

Dry wt. of sample (g): 350.79  
 Tare wt., ring (g): 137.30  
 Tare wt., screen & clamp (g): 26.32  
 Initial sample volume (cm<sup>3</sup>): 220.36  
 Initial dry bulk density (g/cm<sup>3</sup>): 1.59  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Initial calculated total porosity (%): 39.93

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	20-Aug-19	14:00	602.19	0	39.83
	27-Aug-19	9:30	602.12	4.0	39.80
	3-Sep-19	16:40	594.57	25.0	36.38
Pressure plate:	19-Sep-19	15:35	542.40	337	12.70

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	4.0	---	---	---	---
	25.0	---	---	---	---
Pressure plate:	337	---	---	---	---

**Comments:**

- <sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.
- <sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and "---" denotes no volume change occurred.
- \* Weight including tares
- † Assumed density of water is 1.0 g/cm<sup>3</sup>
- ‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

Laboratory analysis by: D. O'Dowd  
 Data entered by: A. Albay-Yenney  
 Checked by: J. Hines



**Moisture Retention Data**

**Dew Point Potentiometer / Relative Humidity Box**  
(Soil-Water Characteristic Curve)

Sample Number: SS-KEY-01 (1.59 g/cc)

Initial sample bulk density (g/cm<sup>3</sup>): 1.59

Fraction of bulk sample used (<2.00mm fraction) (%): 99.08

Dry weight\* of dew point potentiometer sample (g): 198.76

Tare weight, jar (g): 114.85

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Dew point potentiometer:	4-Sep-19	14:40	200.16	9178	2.63
	28-Aug-19	8:05	199.38	39568	1.17
	26-Aug-19	10:10	199.21	303492	0.85

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	9178	---	---	---	---
	39568	---	---	---	---
	303492	---	---	---	---

Dry weight\* of relative humidity box sample (g): 74.29

Tare weight (g): 38.02

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Relative humidity box:	21-Aug-19	10:15	74.38	846993	0.39

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	846993	---	---	---	---

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

<sup>‡</sup> Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

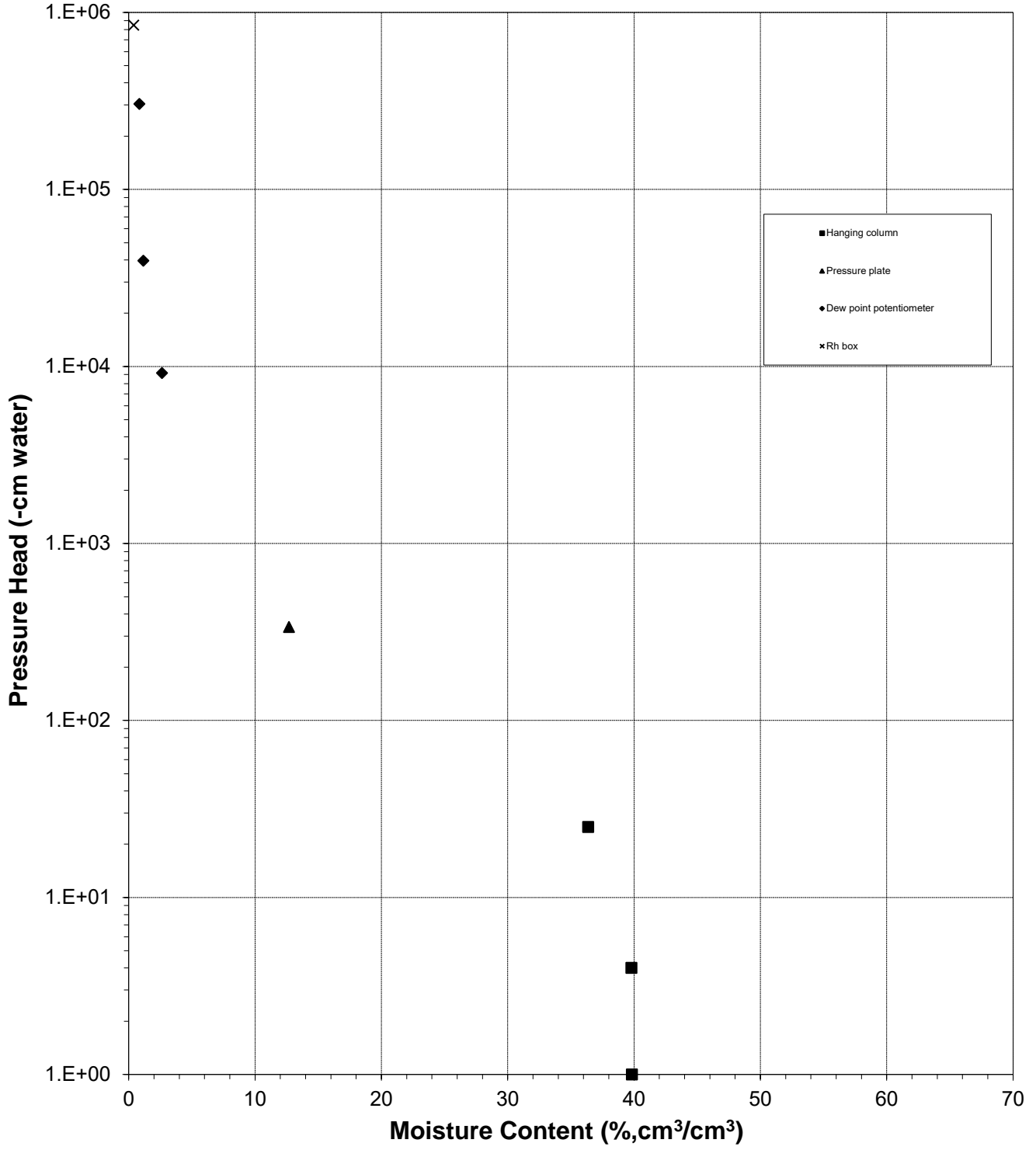
Data entered by: A. Albay-Yenney

Checked by: J. Hines



### Water Retention Data Points

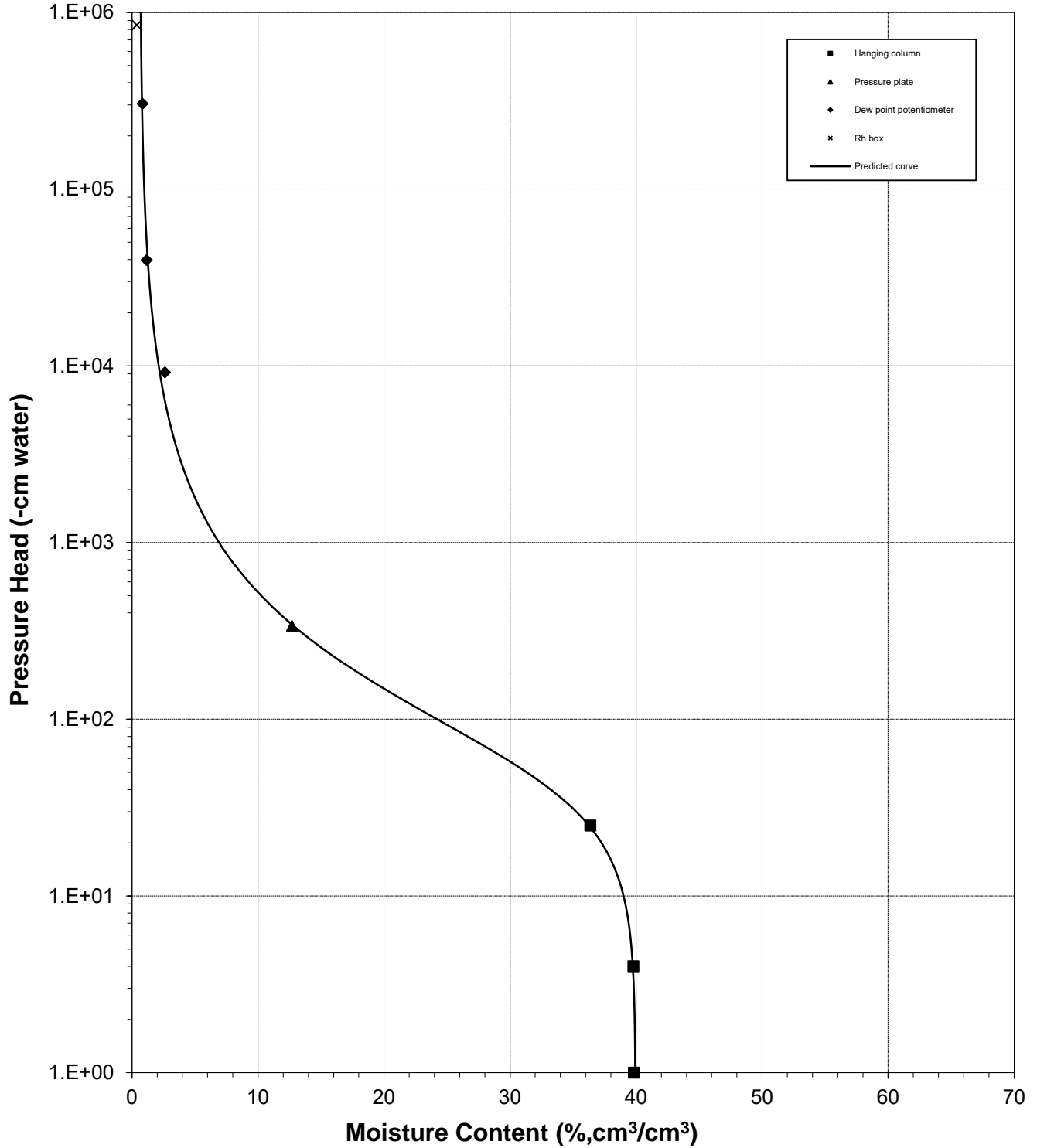
Sample Number: SS-KEY-01 (1.59 g/cc)





### Predicted Calibration Curve and Data Points

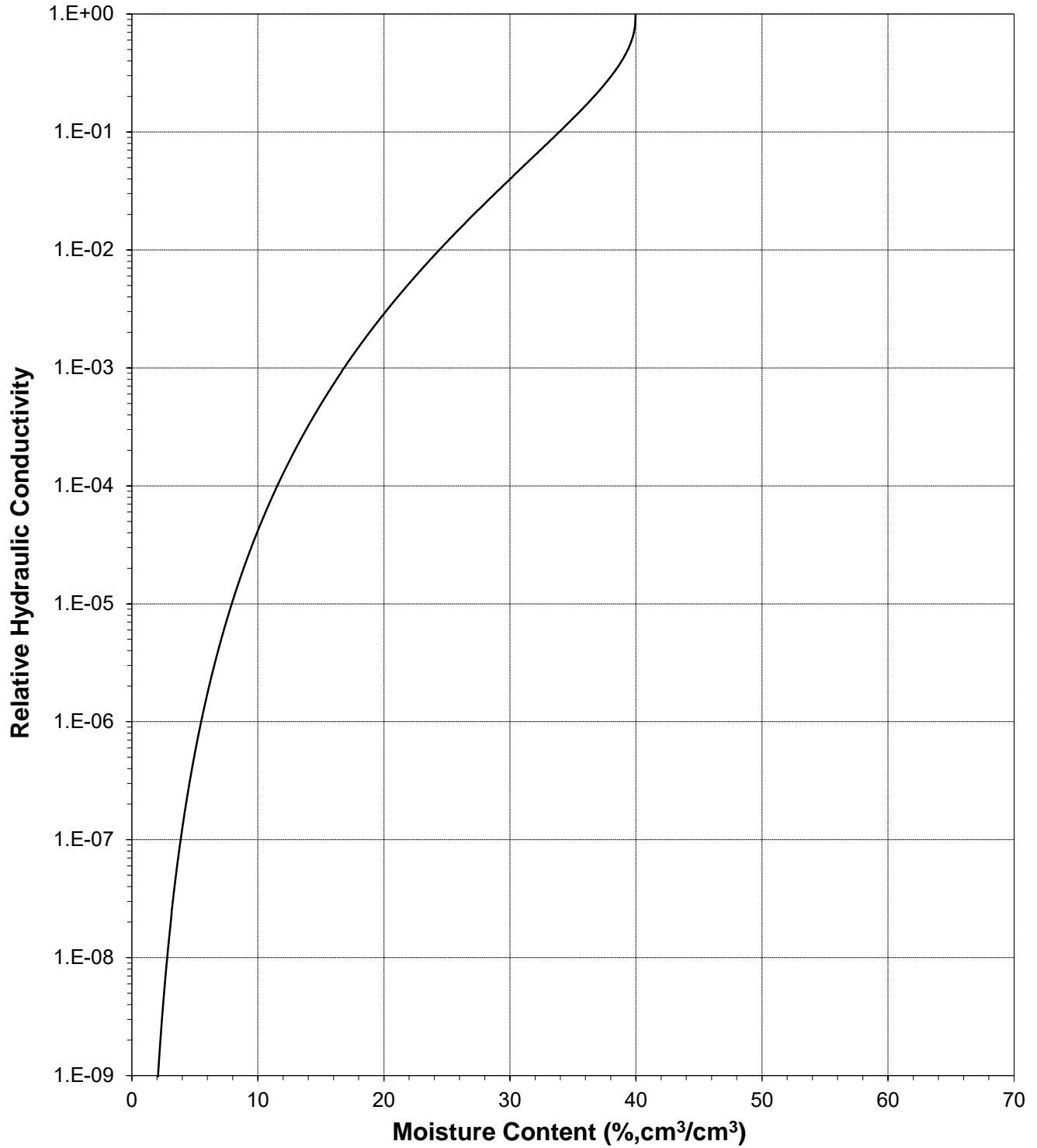
Sample Number: SS-KEY-01 (1.59 g/cc)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

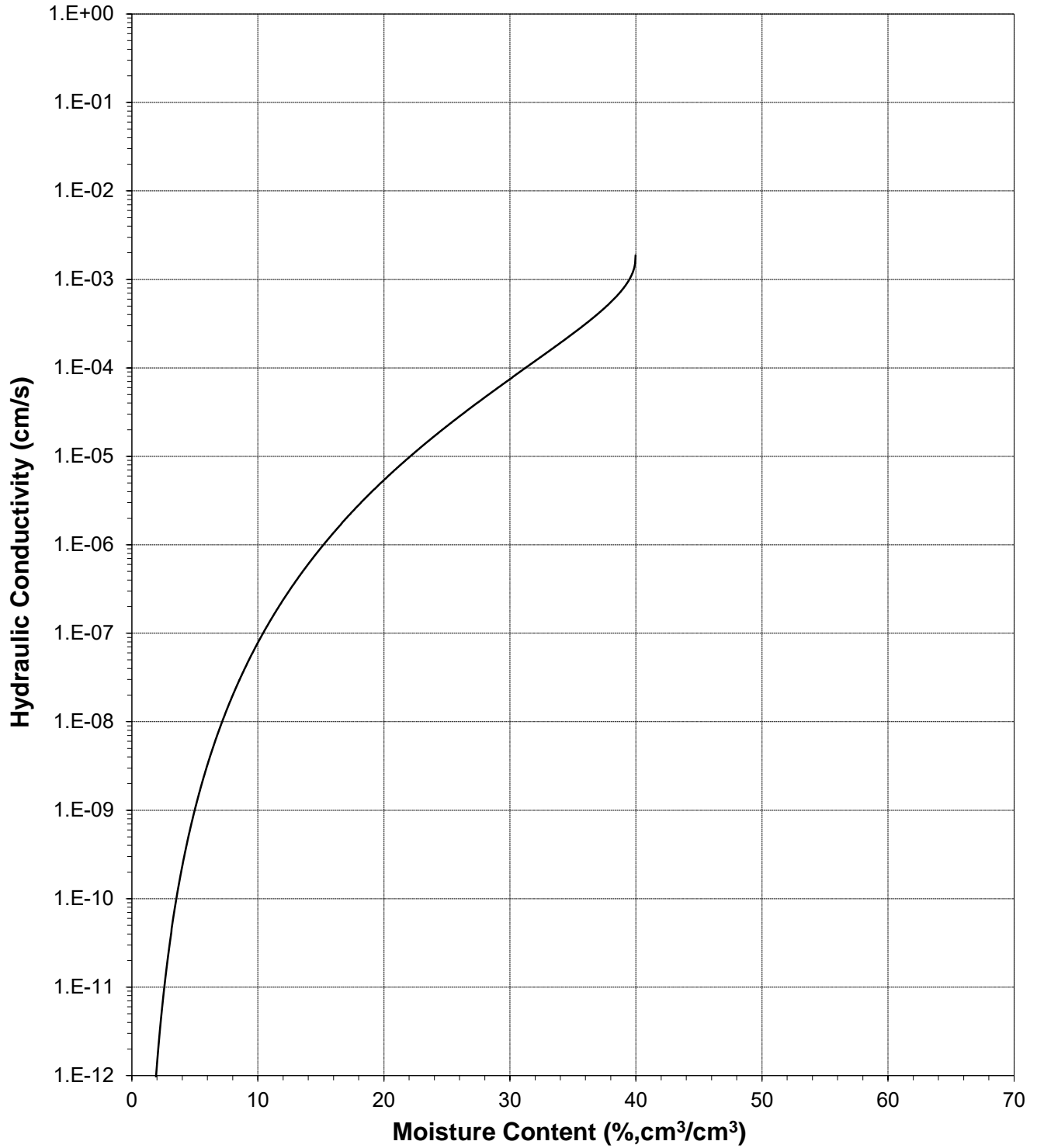
Sample Number: SS-KEY-01 (1.59 g/cc)





### Plot of Hydraulic Conductivity vs Moisture Content

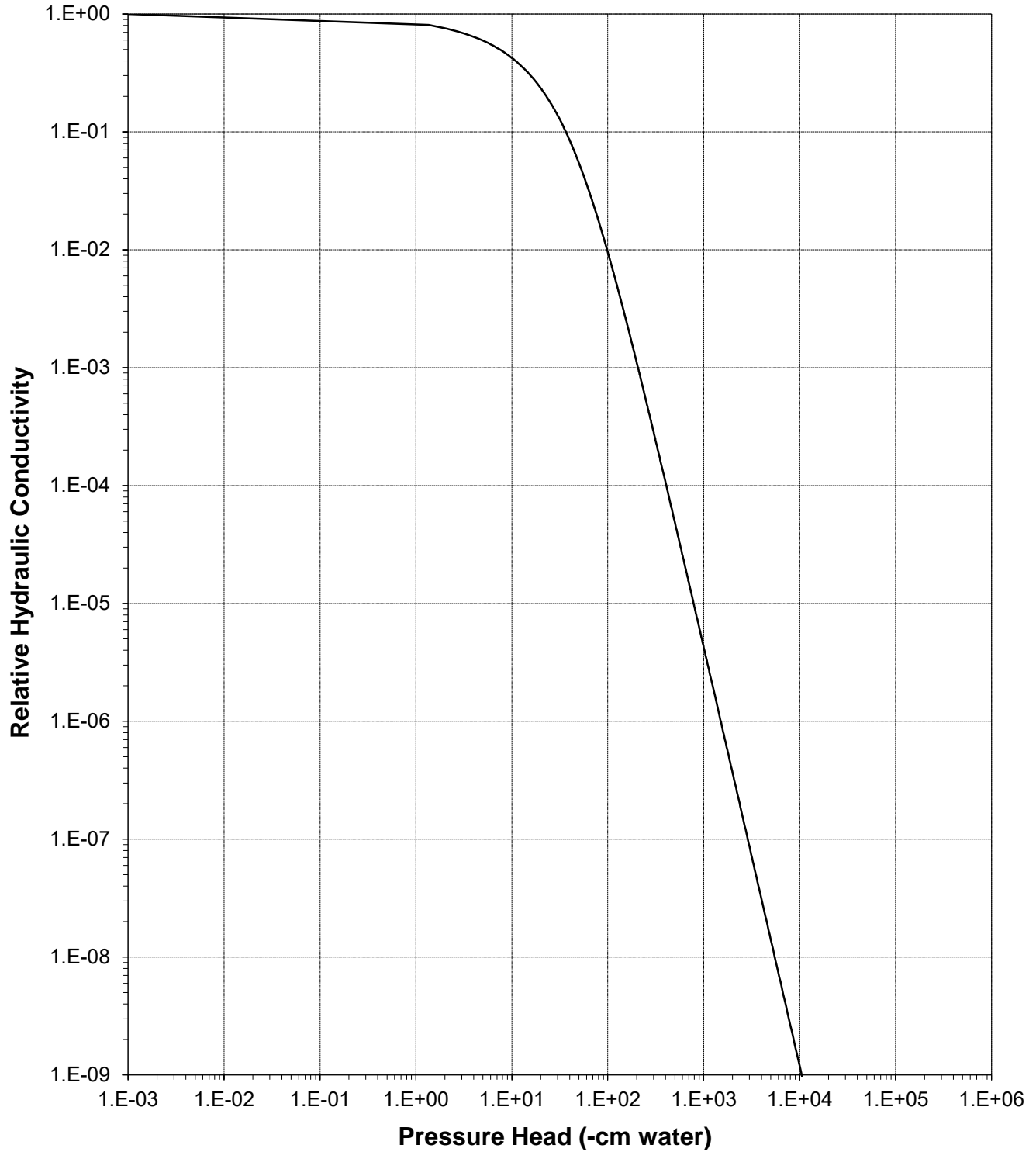
Sample Number: SS-KEY-01 (1.59 g/cc)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

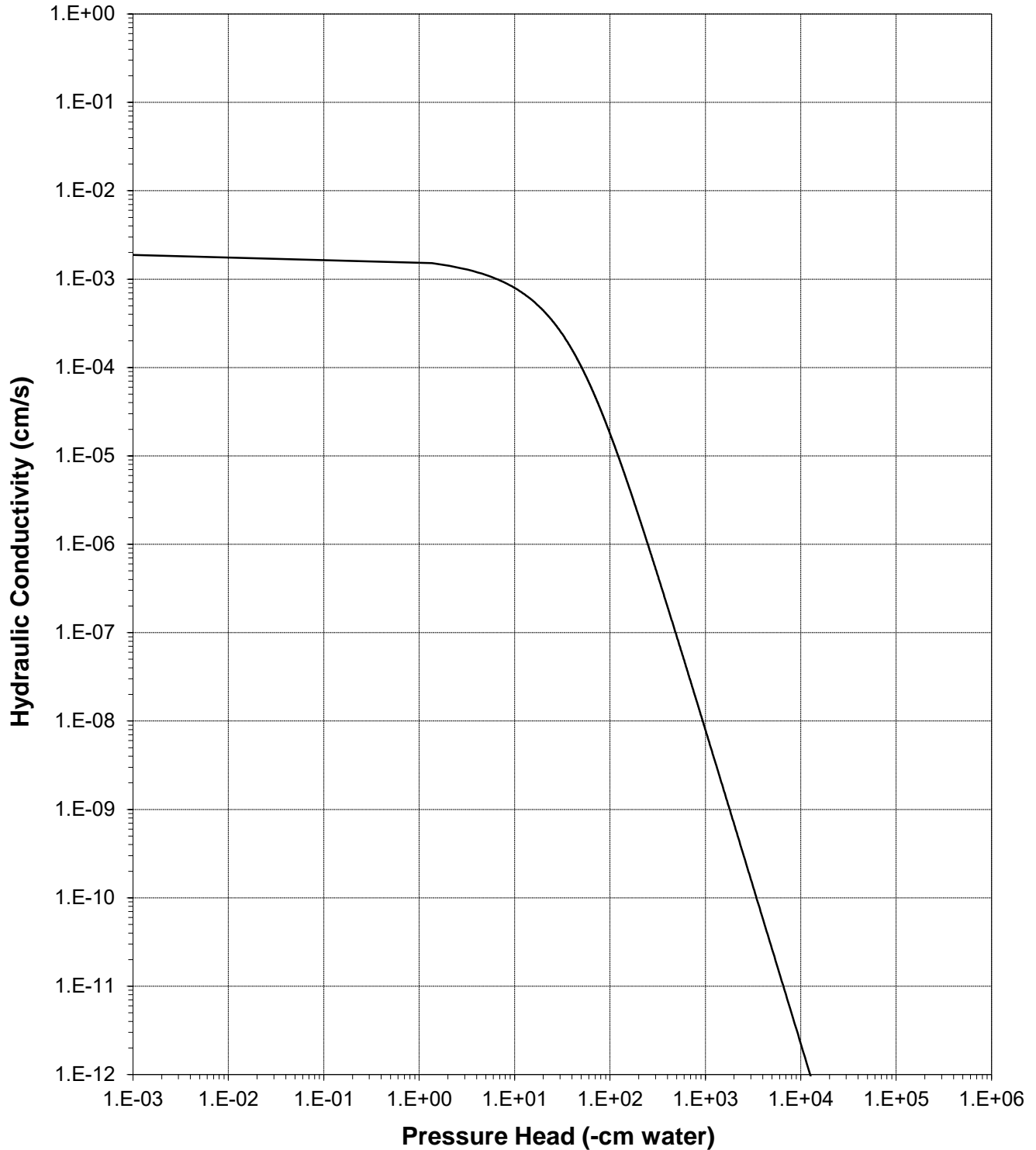
Sample Number: SS-KEY-01 (1.59 g/cc)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-KEY-01 (1.59 g/cc)







**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

Dry wt. of sample (g): 438.64  
 Tare wt., ring (g): 245.30  
 Tare wt., screen & clamp (g): 26.61  
 Initial sample volume (cm<sup>3</sup>): 285.39  
 Initial dry bulk density (g/cm<sup>3</sup>): 1.54  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Initial calculated total porosity (%): 42.00

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
Hanging column:	5-Apr-19	15:00	824.87	0	40.06
	15-Apr-19	17:00	823.96	6.0	39.74
	22-Apr-19	16:00	822.67	18.5	39.29
	29-Apr-19	13:55	788.75	49.0	27.40
	7-May-19	14:45	766.15	186.0	19.48

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
Hanging column:	0.0	---	---	---	---
	6.0	---	---	---	---
	18.5	---	---	---	---
	49.0	---	---	---	---
	186.0	---	---	---	---

**Comments:**

- <sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.
- <sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.
- \* Weight including tares
- † Assumed density of water is 1.0 g/cm<sup>3</sup>
- ‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

Laboratory analysis by: D. O'Dowd/A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines



**Moisture Retention Data**

**Dew Point Potentiometer / Relative Humidity Box**  
(Soil-Water Characteristic Curve)

Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)

Initial sample bulk density (g/cm<sup>3</sup>): 1.54

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight\* of dew point potentiometer sample (g): 154.19

Tare weight, jar (g): 113.15

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Dew point potentiometer:	2-May-19	11:26	156.98	4079	10.46
	18-Apr-19	10:05	155.06	37631	3.27
	10-Apr-19	15:35	154.66	173162	1.75

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	4079	---	---	---	---
	37631	---	---	---	---
	173162	---	---	---	---

Dry weight\* of relative humidity box sample (g): 58.66

Tare weight (g): 41.90

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Relative humidity box:	23-Apr-19	9:40	58.73	852439	0.62

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	852439	---	---	---	---

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

<sup>‡</sup> Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: C. Krous/D. O'Dowd

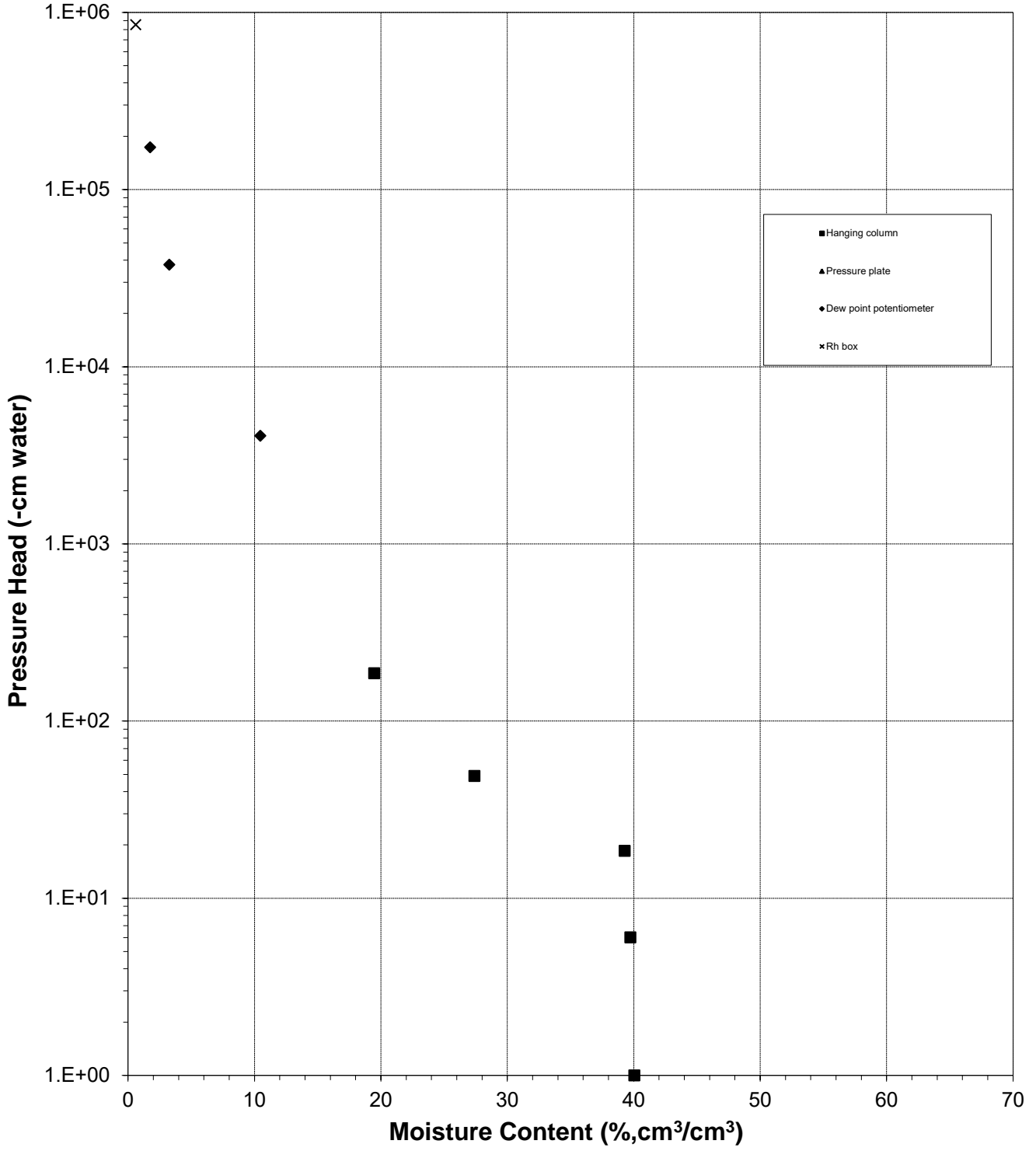
Data entered by: C. Krous

Checked by: J. Hines



### Water Retention Data Points

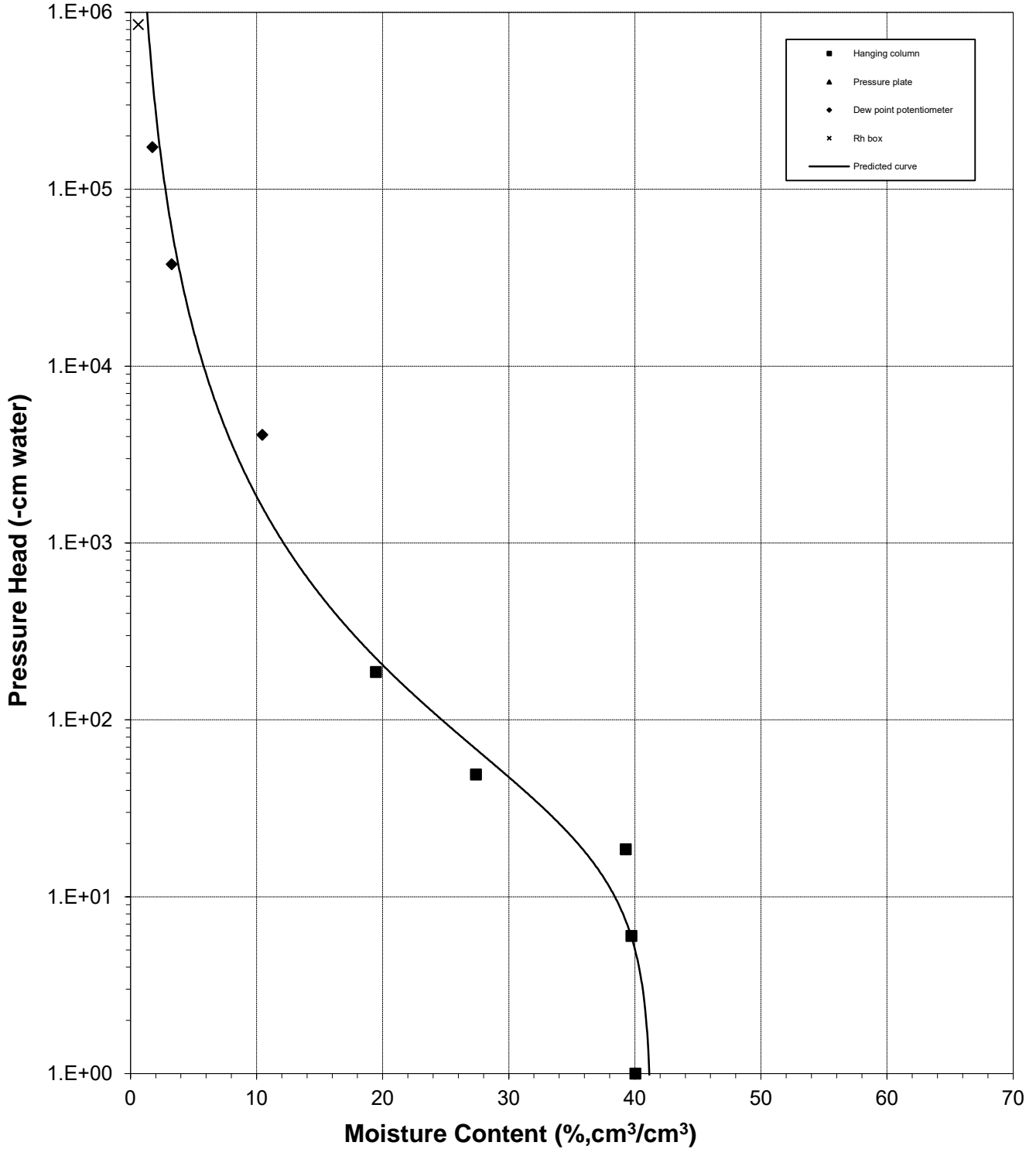
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





### Predicted Calibration Curve and Data Points

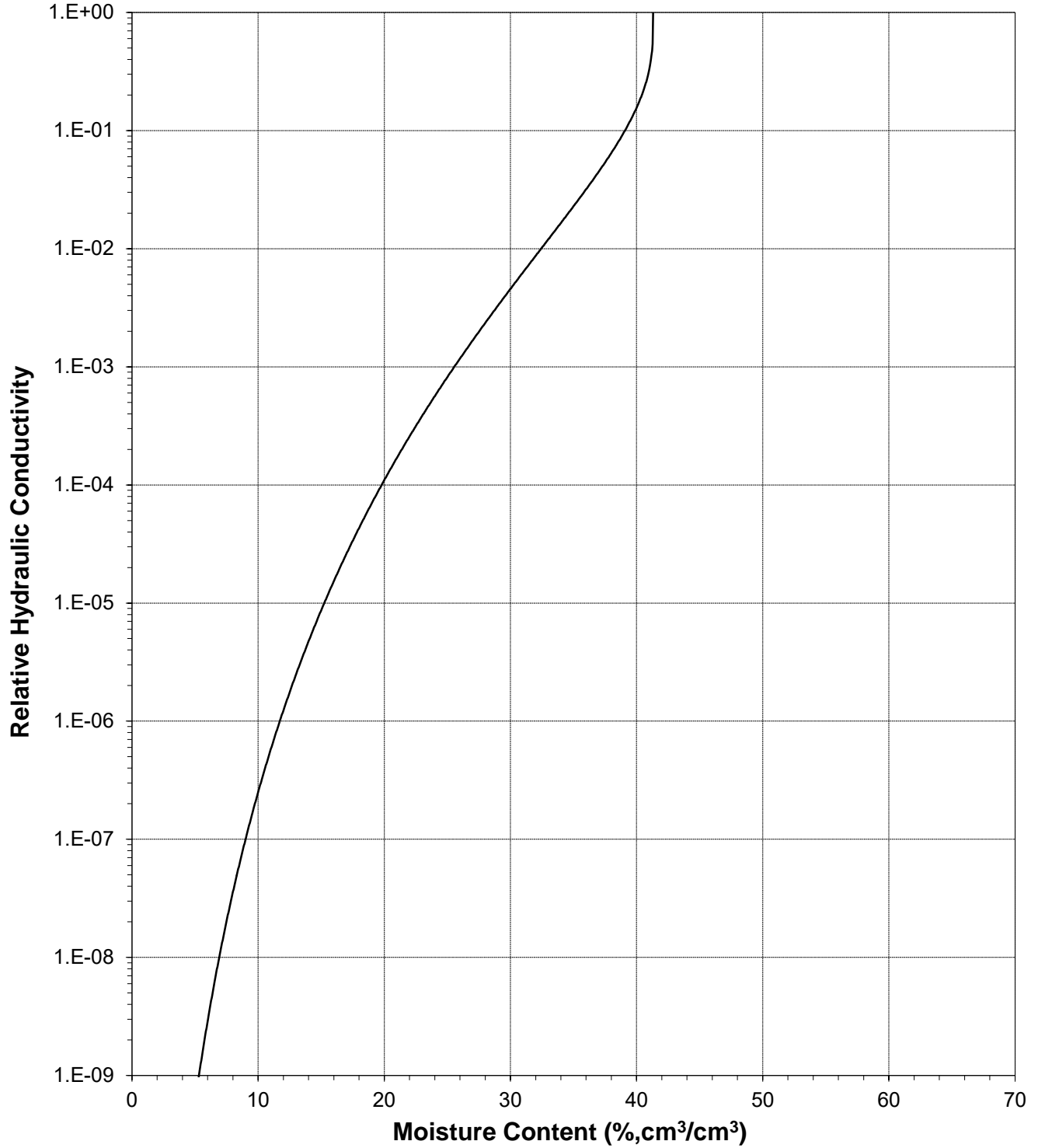
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

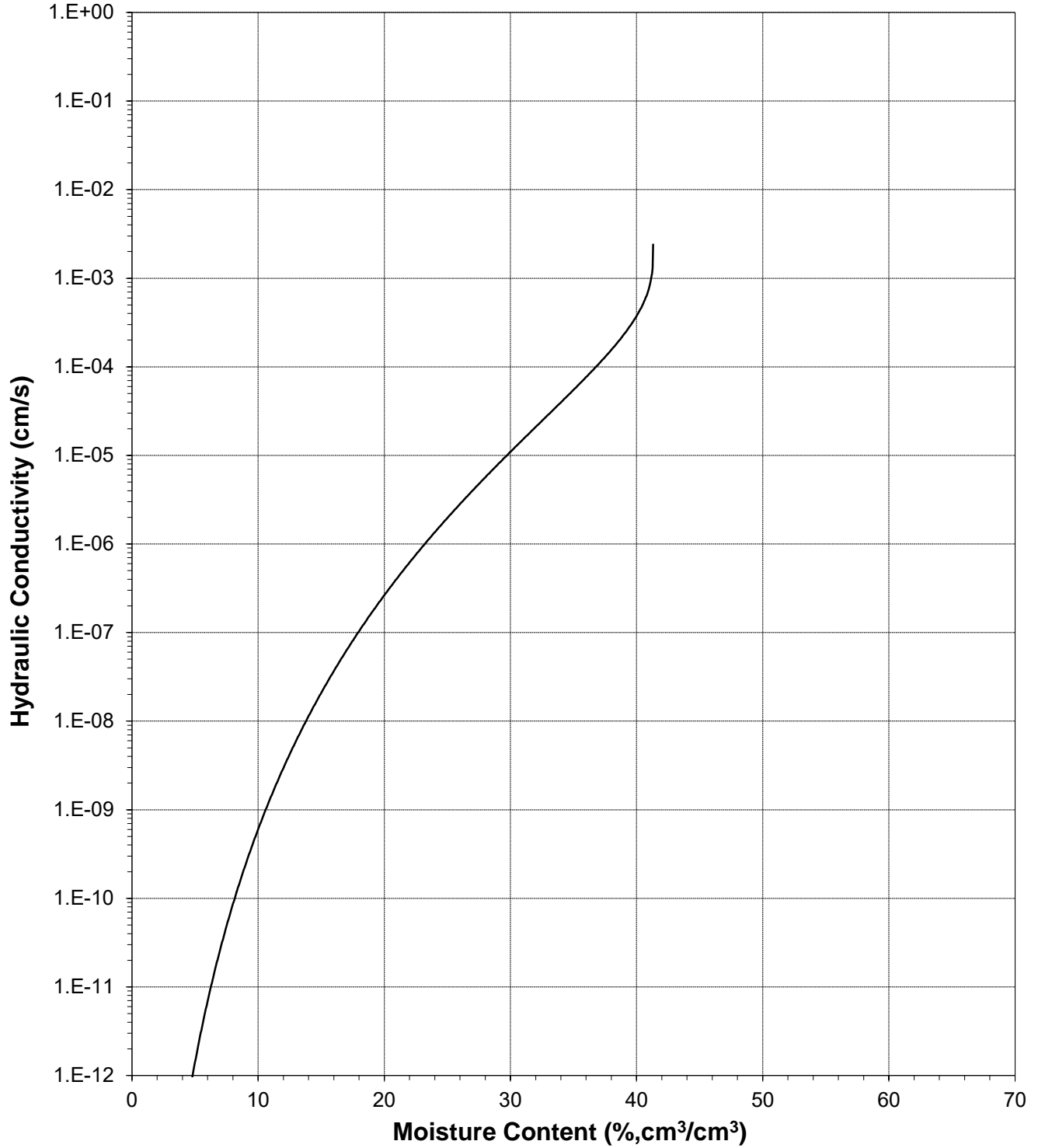
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





### Plot of Hydraulic Conductivity vs Moisture Content

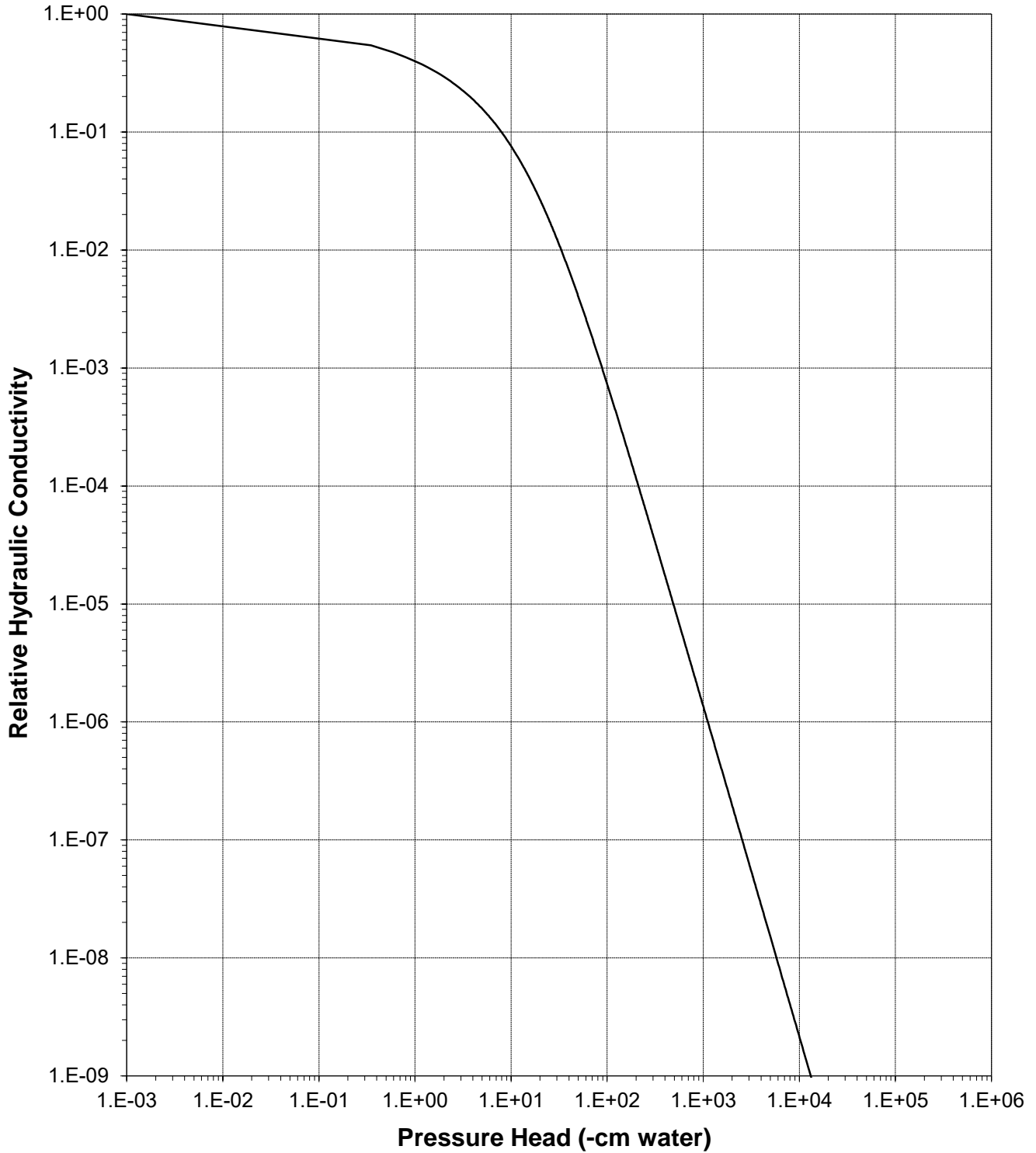
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

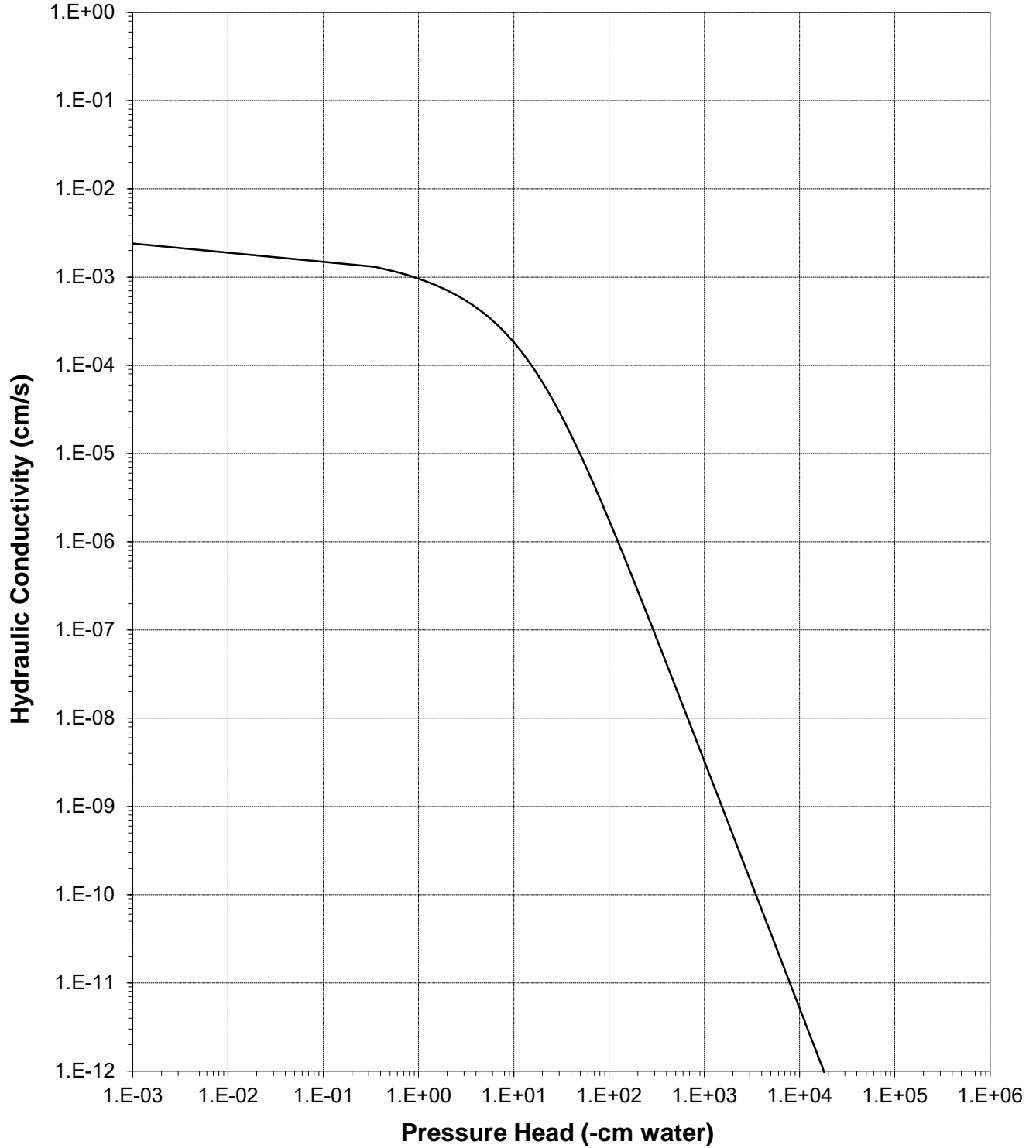
Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-T1A-01 (Undisturbed) (1.54 g/cc)







**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

Job Name: TTL, Inc.  
 Job Number: DB19.1098.00  
 Sample Number: SS-T1A-01 (1.59 g/cc)  
 Project Name: Twin Pines  
 Project Number: 000180200804.00

Dry wt. of sample (g): 354.98  
 Tare wt., ring (g): 140.50  
 Tare wt., screen & clamp (g): 28.07  
 Initial sample volume (cm<sup>3</sup>): 223.74  
 Initial dry bulk density (g/cm<sup>3</sup>): 1.59  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Initial calculated total porosity (%): 40.13

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content † (% vol)
<i>Hanging column:</i>	20-Aug-19	14:00	608.78	0	38.09
	27-Aug-19	9:30	608.00	11.0	37.74
	3-Sep-19	16:40	603.05	32.0	35.53
	10-Sep-19	11:30	571.82	99.0	21.57
<i>Pressure plate:</i>	19-Sep-19	15:30	564.71	337	18.40

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	11.0	---	---	---	---
	32.0	---	---	---	---
	99.0	---	---	---	---
<i>Pressure plate:</i>	337	---	---	---	---

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

\* Weight including tares

† Assumed density of water is 1.0 g/cm<sup>3</sup>

‡ Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

Laboratory analysis by: D. O'Dowd  
 Data entered by: A. Albay-Yenney  
 Checked by: J. Hines



**Moisture Retention Data**

**Dew Point Potentiometer / Relative Humidity Box**  
(Soil-Water Characteristic Curve)

Sample Number: SS-T1A-01 (1.59 g/cc)

Initial sample bulk density (g/cm<sup>3</sup>): 1.59

Fraction of bulk sample used (<2.00mm fraction) (%): 97.84

Dry weight\* of dew point potentiometer sample (g): 183.78

Tare weight, jar (g): 111.98

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Dew point potentiometer:	9-Sep-19	9:25	186.57	2448	6.03
	28-Aug-19	8:10	184.41	37325	1.36
	26-Aug-19	10:30	184.23	251381	0.97

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	2448	---	---	---	---
	37325	---	---	---	---
	251381	---	---	---	---

Dry weight\* of relative humidity box sample (g): 79.68

Tare weight (g): 42.90

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Relative humidity box:	21-Aug-19	10:15	79.84	846993	0.66

Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	846993	---	---	---	---

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

<sup>‡</sup> Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

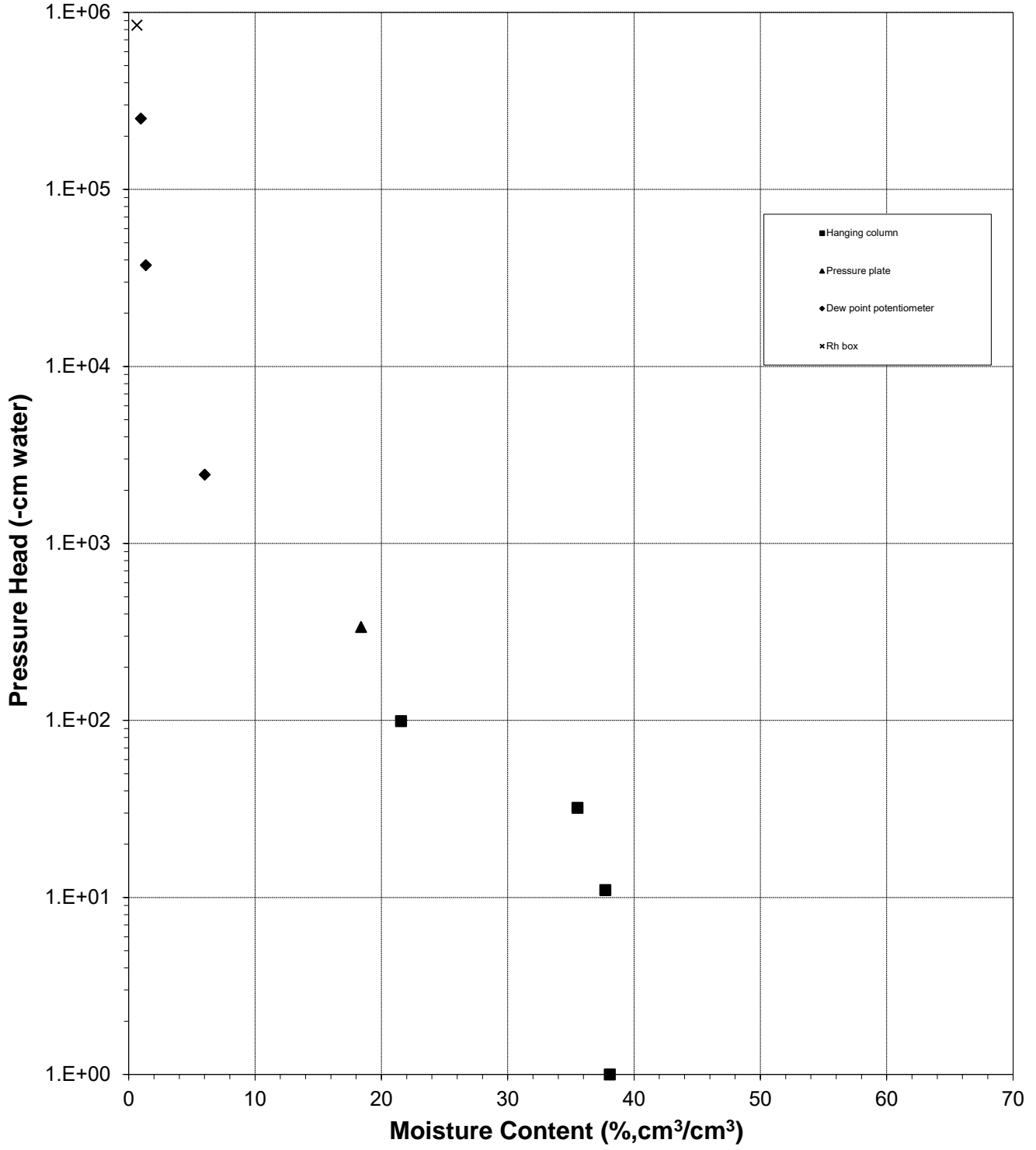
Data entered by: A. Albay-Yenney

Checked by: J. Hines



### Water Retention Data Points

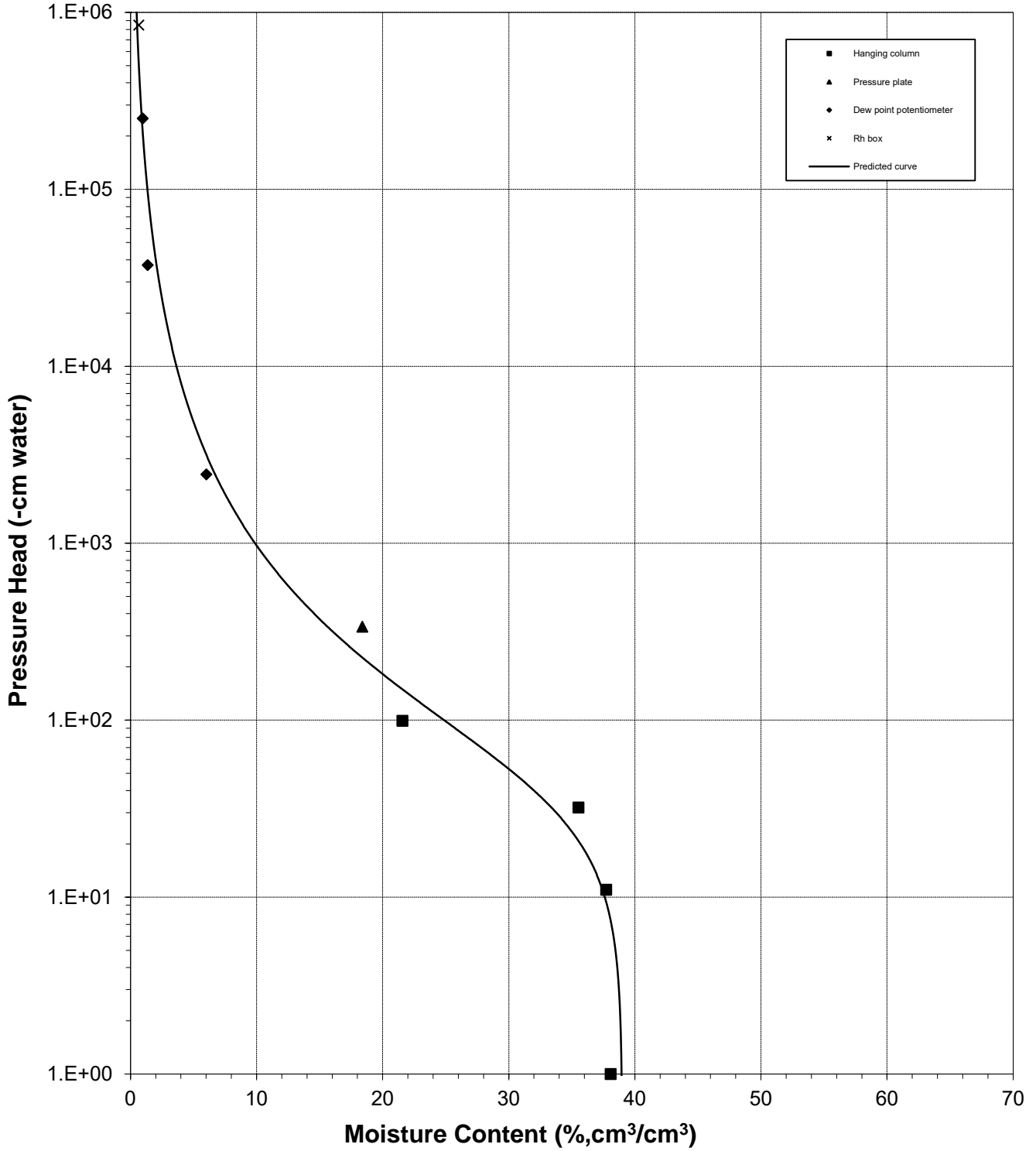
Sample Number: SS-T1A-01 (1.59 g/cc)





### Predicted Calibration Curve and Data Points

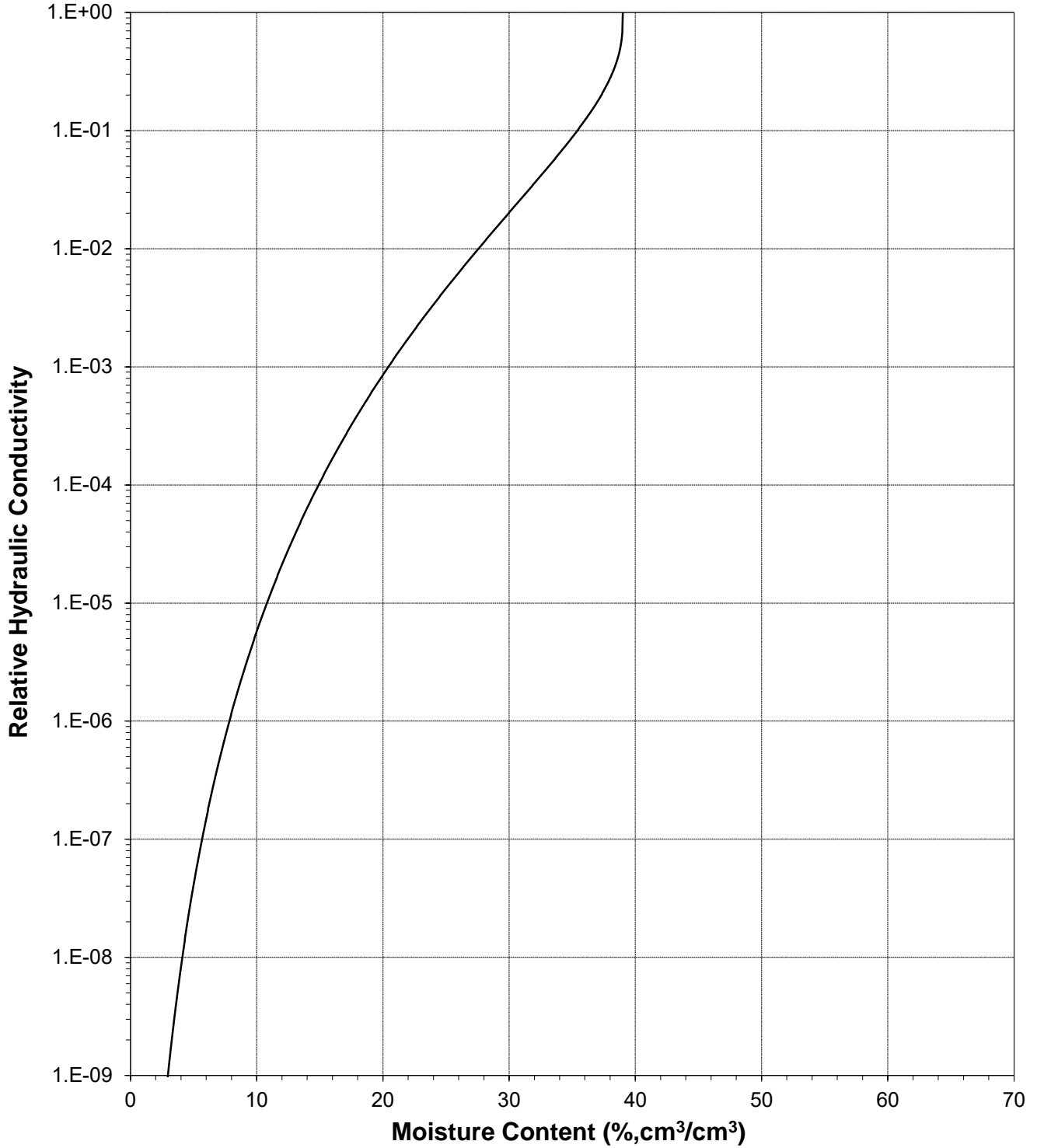
Sample Number: SS-T1A-01 (1.59 g/cc)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

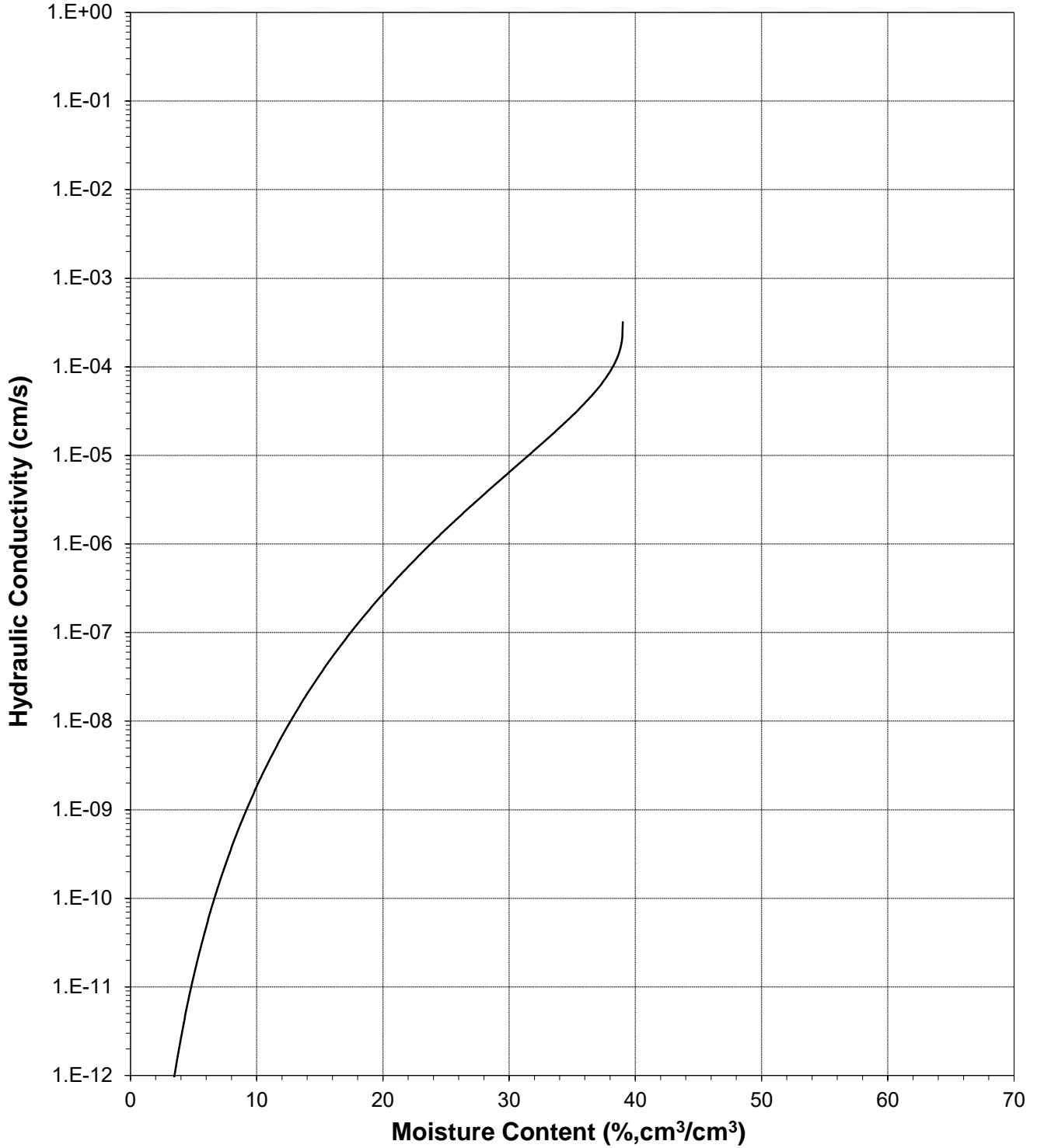
Sample Number: SS-T1A-01 (1.59 g/cc)





### Plot of Hydraulic Conductivity vs Moisture Content

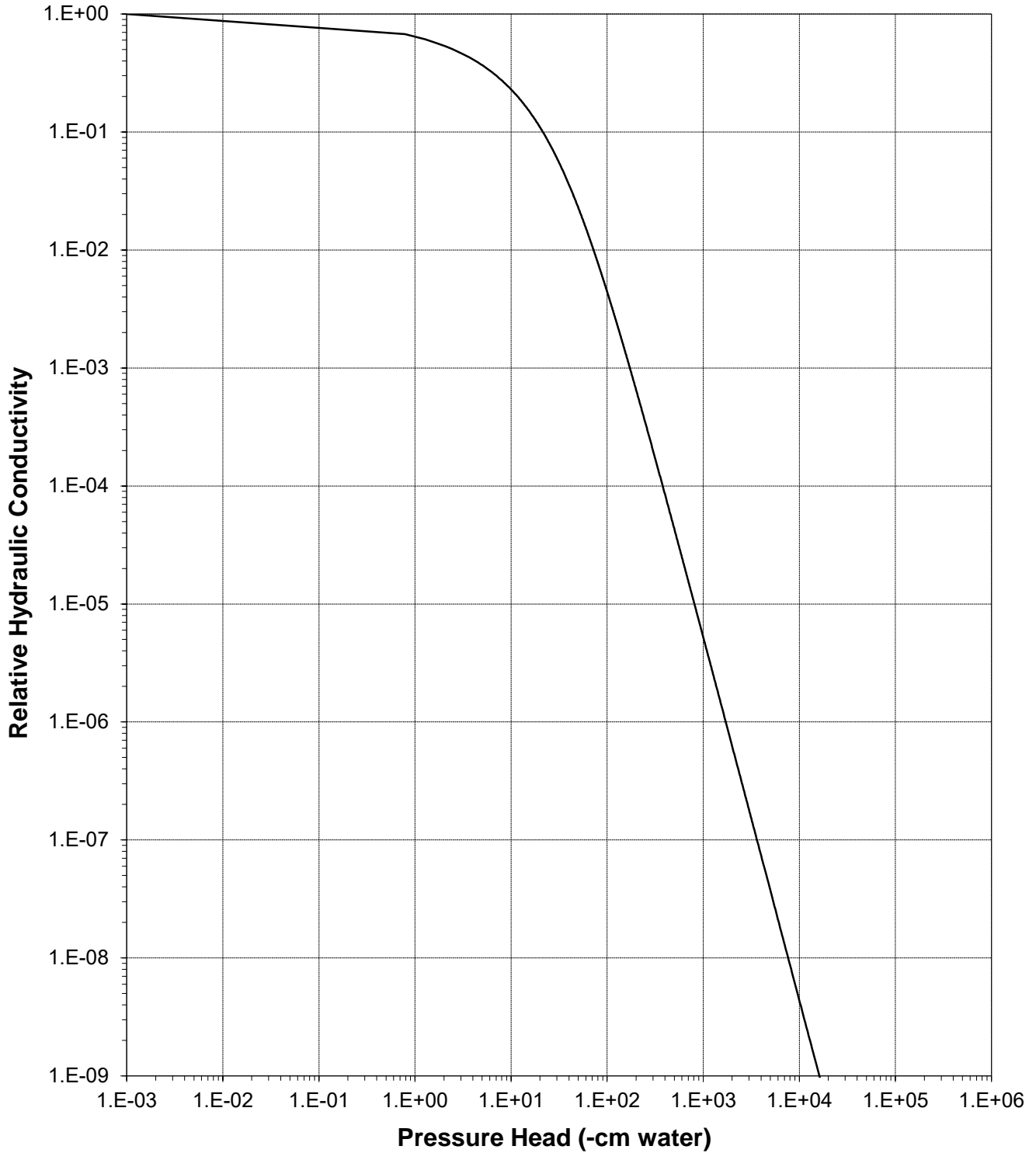
Sample Number: SS-T1A-01 (1.59 g/cc)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

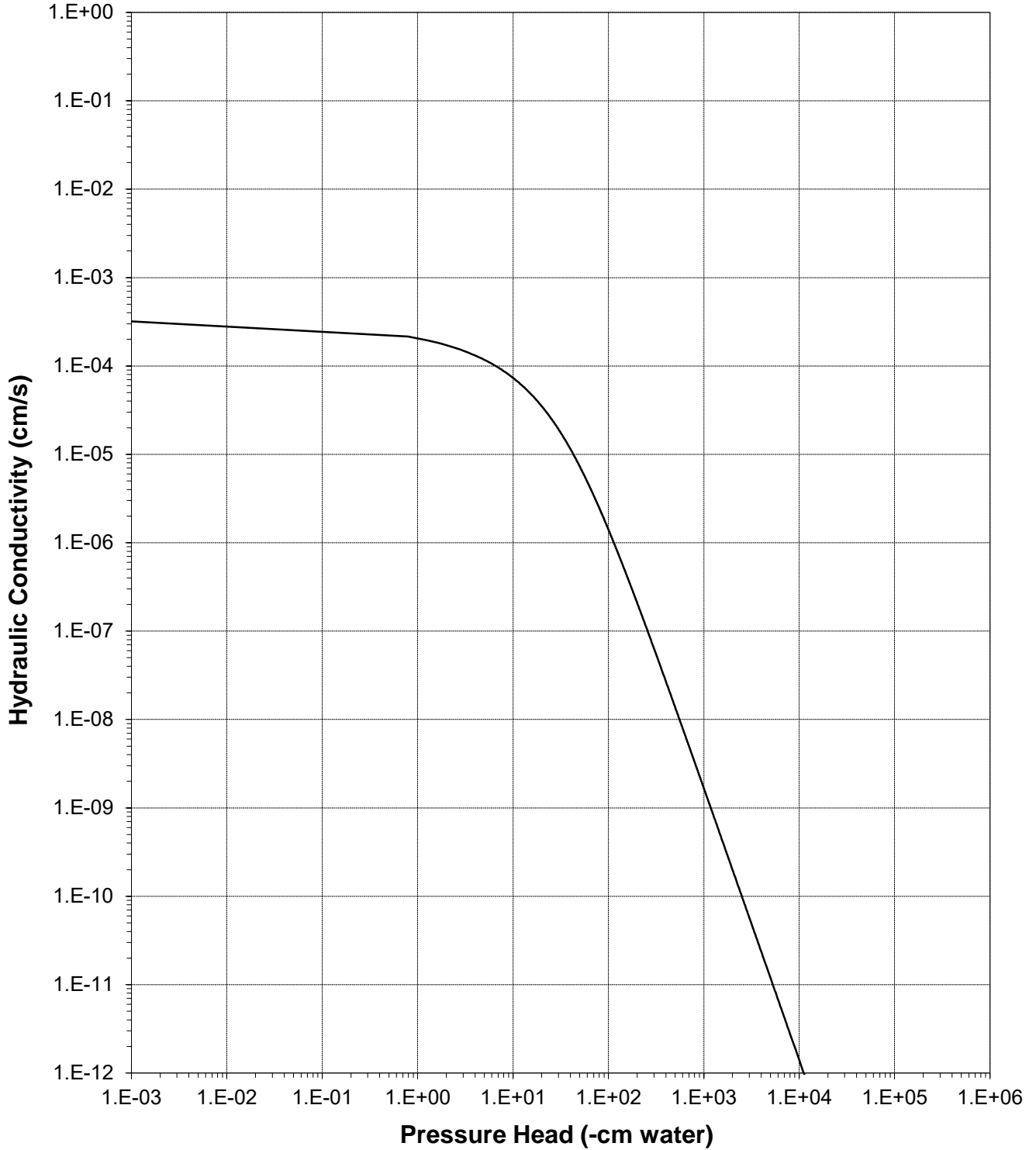
Sample Number: SS-T1A-01 (1.59 g/cc)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: SS-T1A-01 (1.59 g/cc)





# **Laboratory Tests and Methods**



## Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 5856 (modified apparatus)
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Relative Humidity (Box) Method:	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991

## **ATTACHMENT D**

**Photographs of Heavy Minerals Processing of  
Drummed UD Samples & Bench-Scale Study  
Testing**

APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 1. Processing of UD boring drummed soil through mineral extraction processing plant.

APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 2. Processing of UD drummed soil through mineral extraction processing plant by Mineral Technologies personnel.



APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 3. Processing of UD drummed soil through mineral extraction processing plant by Mineral Technologies personnel.

APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 4. Sand mixed with water flowing through heavy mineral separation spirals.



APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 5. Alternate view of sand mixed with water flowing through heavy mineral separation spirals.



APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 6. Outfall for process sand.

APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 7. Processed sand minus heavy mineral and any humate and/or clays returned to drum.

APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 8. Post-processed drummed sand delivered to TTL's office in Tuscaloosa, Alabama.



Photograph 9. Steel chamber used for applying load to processed sand.



APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 10. Sand from drum UD338/25 being transferred into steel chamber.

APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 11. Steel chamber sealed with lid for load application via pneumatic jack.

APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 12. Load applied via pneumatic jack.



Photograph 13. Alternate view of pneumatic jack.



APPENDIX H  
SUPPORTING PHOTOGRAPHS



Photograph 14. Bentonite used for bench-scale testing.

## **ATTACHMENT E**

### **Bench-Scale Study - Vertical Hydraulic Conductivity Test Reports**





3516 Greensboro Avenue  
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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**May 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - A

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 98.9 pcf

Simulated In Situ Moisture: 15.1 %

Hydraulic Conductivity "k":  $1.1 \times 10^{-3}$  cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**May 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - B

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 98.9 pcf

Simulated In Situ Moisture: 15.2 %

Hydraulic Conductivity "k": 1.1 X 10<sup>-3</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**May 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - C

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 100.1 pcf

Simulated In Situ Moisture: 15.2 %

Hydraulic Conductivity "k": 7.2 X 10<sup>-4</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - A (0.35% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 93.4 pcf

Simulated In Situ Moisture: 16.5 %

Hydraulic Conductivity "k": 7.0 X 10<sup>-4</sup> cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - B (0.35% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 91.5 pcf

Simulated In Situ Moisture: 16.5 %

Hydraulic Conductivity "k":  $5.6 \times 10^{-4}$  cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - C (0.35% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 88.9 pcf

Simulated In Situ Moisture: 16.5 %

Hydraulic Conductivity "k":  $1.2 \times 10^{-3}$  cm/sec



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**HYDRAULIC CONDUCTIVITY ANALYSIS  
ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - A (1.42% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 93.7 pcf

Simulated In Situ Moisture: 15.7 %

Hydraulic Conductivity "k":  $1.7 \times 10^{-3}$  cm/sec



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ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - B (1.42% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 90.3 pcf

Simulated In Situ Moisture: 15.7 %

Hydraulic Conductivity "k":  $1.6 \times 10^{-3}$  cm/sec





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ASTM D 5084**

**Twin Pines Minerals, LLC  
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TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - C (1.42% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Simulated In Situ Dry Density: 92.7 pcf

Simulated In Situ Moisture: 15.7 %

Hydraulic Conductivity "k": 1.5 X 10<sup>-3</sup> cm/sec



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ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (5% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 98.5 pcf

Remolded Moisture: 22.1 %

Hydraulic Conductivity "k": 5.7 X 10<sup>-6</sup> cm/sec



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ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (7.5% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 98.5 pcf

Remolded Moisture: 22.1 %

Hydraulic Conductivity "k":  $2.0 \times 10^{-6}$  cm/sec



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ASTM D 5084**

**Twin Pines Minerals, LLC  
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**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 – (10% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 111.0 pcf

Remolded Moisture: 16.5 %

Hydraulic Conductivity "k": 3.0 X 10<sup>-7</sup> cm/sec



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ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (12.5% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 98.5 pcf

Remolded Moisture: 22.1 %

Hydraulic Conductivity "k": 1.0 X 10<sup>-8</sup> cm/sec



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ASTM D 5084**

**Twin Pines Minerals, LLC  
St. George, Georgia  
TTL Project No. 000180200804.00**

**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (15% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 113.6 pcf

Remolded Moisture: 15.2 %

Hydraulic Conductivity "k": 5.8 X 10<sup>-9</sup> cm/sec



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**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (30% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 110.9 pcf

Remolded Moisture: 15.9 %

Hydraulic Conductivity "k": 2.7 X 10<sup>-9</sup> cm/sec



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ASTM D 5084**

**Twin Pines Minerals, LLC  
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**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (10% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 102.9 pcf

Remolded Moisture: 21.8 %

Hydraulic Conductivity "k":  $6.8 \times 10^{-7}$  cm/sec





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ASTM D 5084**

**Twin Pines Minerals, LLC  
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**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (15% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 107.5 pcf

Remolded Moisture: 19.6 %

Hydraulic Conductivity "k": 5.0 X 10<sup>-9</sup> cm/sec



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ASTM D 5084**

**Twin Pines Minerals, LLC  
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**June 2019**

Material Description: Black Sand with Silt (Visual Description)

Sample: UD 338/25 - (30% Bentonite)

Sample Date: May 2019

Sampled By: TTL, Inc.

Remolded Dry Density: 106.9 pcf

Remolded Moisture: 19.4 %

Hydraulic Conductivity "k": 2.0 X 10<sup>-9</sup> cm/sec