



February 9, 2011

Mr. Jamey Bertram
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114

Subject: Evaluation of Liquefaction Potential
Structures EP239-1, EP240 and EP242
SDG&E Sunrise Powerlink Project
San Diego and Imperial Counties, California
URS Project No. 27661032.01001

Dear Mr. Bertram:

URS Corporation Americas (URS) is submitting this letter to summarize the evaluation of the potential for liquefaction at structures EP239-1, EP240 and EP242 for the Sunrise Powerlink Project. This letter addresses Mitigation Measure G-4b, which requires evaluation of the potential for liquefaction for these structures.

BACKGROUND

Liquefaction is a phenomenon where saturated coarse-grained soils (less than 50% passing the No. 200 sieve) lose their strength and acquire some mobility from strong ground motion. While not related to liquefaction, some fine-grained soils (more than 50% passing the No. 200 sieve) are vulnerable to similar liquefaction-type behavior or strength loss.

Geologic hazards, including the potential for liquefaction, were discussed in the October 1, 2010 URS report titled "Geotechnical and Geologic Hazards Investigation, Sunrise Powerlink Project, San Diego and Imperial Counties, California". The report concluded that the potential for liquefaction required additional evaluation in several areas along the alignment, including Jacumba Valley, where EP239-1, EP240 and EP242 are located.

The need for additional evaluation of the potential for liquefaction was noted by the California Public Utilities Commission (CPUC) through their consultant, Aspen Environmental (Aspen). On June 28, 2010, Aspen transmitted a letter from Geotechnical Consultants, Inc. dated June 18, 2010 that provided review comments on all geotechnical-related mitigation measures.

EVALUATION

URS completed a subsurface exploration consisting of one boring at EP239-1 and one boring at EP240 on January 28 and 29, 2011. The borings were drilled to a depth of approximately 50 feet.

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Laboratory testing was performed to evaluate grain size distribution and plasticity characteristics to support the assessment of the potential for liquefaction.

The findings from the subsurface exploration and laboratory testing indicate that loose to medium dense sand and silty to clayey sand occur to depths of at least 50 feet. Groundwater was observed in the borings at depths ranging from about 14 to 17 feet.

A boring was not drilled at structure EP242. Seismic refraction data collected at the structure indicate that potentially loose alluvial soil is present to a depth of about 15 to 20 feet, and the alluvium is underlain by weathered rock.

The potential for liquefaction in coarse grained soils was evaluated using the Standard Penetration Test blow counts (SPT N-Values) from the borings in accordance with current criteria and procedures (Youd, *et al.*, 2001; Idriss and Boulanger, 2008). The procedure for evaluating liquefaction potential is empirical and it is based on data and observations at sites that have, and have not liquefied during an earthquake.

The potential for liquefaction was assessed in terms of a factor of safety against liquefaction, FS_{liq} . The factor of safety is defined as the Cyclic Resistance Ratio required to resist liquefaction (CRR) divided by the Cyclic Stress Ratio (CSR) generated by the design ground motion. The seismic demand is a function of the anticipated peak ground acceleration (PGA). The assessment adopted a PGA of 0.25g, representative of an earthquake with a probability of exceedence of 10 percent in 50 years, and an earthquake magnitude of M7.0. The calculations assumed the depth to groundwater was five feet above the highest level measured in the borings. Soils were considered potentially liquefiable if the factor of safety against liquefaction was calculated to be less than about 1.1.

A screening evaluation was completed by comparing the laboratory test data to evaluation criteria that relates potential behavior to index properties. Screening evaluations indicate that fine-grained soils should not be susceptible to liquefaction-type behavior or strength loss.

CONCLUSIONS AND RECOMMENDATIONS

The results of our evaluation indicate there is potential for liquefaction to occur at structures EP239-1 and EP240. To mitigate the potential for liquefaction, the foundations for these structures should be designed considering:

- A reduction in the axial and lateral soil resistances within the potentially liquefiable soils.
- The downdrag load on the pile shaft that can develop from liquefaction-induced settlement.
- A settlement below the pile tip that will provide acceptable performance of the structure.

A qualitative evaluation of liquefaction potential at structure EP242 was performed considering the results of the subsurface investigation and evaluation of the potential for liquefaction at structures EP239-1 and EP240. Based on that information, as well as the seismic refraction survey completed

Mr. Jamey Bertram
Burns & McDonnell
February 7, 2010
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at EP242, the higher topography of the area and the drilled shaft installation logs from the nearby Southwest Powerlink (SWPL) structure, we conclude the potential for groundwater to occur within the alluvium is low. Consequently, it is our opinion that the potential for liquefaction to occur at structure EP242 is very low. If groundwater is encountered within the alluvium during construction, revised foundation design parameters will be provided.


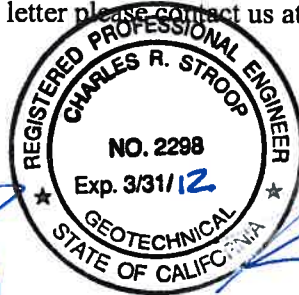
If you any questions regarding the letter please contact us at (858) 812-9292.

Sincerely,

URS CORPORATION



Charles Robin (Rob) Stroop, G.E. 2298
Senior Project Geotechnical Engineer



Kelly C. Giesing, G.E. 2749
Project Geotechnical Engineer



Attachments:

Log of Boring B-EP239
Log of Boring B-EP240
Results of Laboratory Testing

Project: Sunrise Powerlink Project
Section/Tower No.: San Diego and Imperial Counties, California
Project Number: 27661032

Log of Boring B-EP239-1

Sheet 1 of 2

Date(s) Drilled	01/28/11	Logged By	J. Gratzer	Checked By	M. Schmoll
Drilling Method	Rotary Wash	Drill Bit Size/Type	HWT-Tri-cone	Total Depth of Borehole	51 feet
Drill Rig Type	Burley 4000, Rig #1	Drilling Contractor	Crux	Approximate Surface Elevation	2759.0 ft (NAVD 88)
Water Level Depth (Feet)	17.2 feet (1 hour 50 minutes after drilling)	Sampling Method(s)	SPT/2.5" I.D.	Hammer Data	140 lbs/30-inch drop
Borehole Backfill	Bentonite chips	Coordinate Location (NAD 83)	32.63029 -116.17922	Location	Link 1, Section 9C

Elevation, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	Depth, feet	Type	Number					
0					ALLUVIUM Very loose to loose, moist, olive brown, sandy SILT (ML), fine grained sand, micaceous, low plasticity to non-plastic			
2755	1		4		Loose, moist, mottled olive brown, interbedded sandy SILT (ML) to silty SAND (SM), fine grained, micaceous			
5	2		8		Trace of carbonaceous elastic sandy SILT (MH)			
2750	3		4					
10	4		9		Loose, moist, olive brown, sandy CLAY (CL), fine grained sand, carbonate nodules, micaceous, iron oxide staining	30	93	SA(73)
2745	5		4		With interbedded clayey SAND (SC) and 1" thick lean CLAY (CL) layers	26		HYD(48), LL(36), PI(14)
2740	6		12		Medium dense, moist, yellowish brown, silty SAND (SM), fine grained, micaceous, some clay			SA(32)
2735	7		12		Becomes fine to medium grained, iron oxide staining, decreased clay content			
2730								
30								

Report: SUNRISE_SOIL LOG; File: 27661032.GPJ; 2/9/2011 B-EP239-1



Elevation, feet	Depth, feet	SAMPLES			MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
		Type	Number	Blows per foot				
30			8	14	↓ Becomes light yellowish brown, decreased silt content Soft, moist, dark yellowish brown, sandy CLAY (CL), micaceous			WA(14)
2725	35		9	3				
2720			10	8	↓ Becomes medium stiff Loose, moist, dark yellowish brown, silty SAND (SM), fine to medium grained, micaceous, trace of clay binder	31	93	HYD(67), LL(35), PI(15)
	40		11	6				No recovery
			12	8				
2715	45		13	8	↓ Becomes olive brown, iron oxide stains			WA(23)
2710	50		14	15	↓ Becomes medium dense, wet, light olive brown, trace coarse sand			
					Bottom of boring at 51 feet			
2705	55							
2700	60							
2695	65							

Report: SUNRISE_SOIL LOG; File: 27661032.GPJ; 2/9/2011 B-EP239-1

Project: Sunrise Powerlink Project
Section/Tower No.: San Diego and Imperial Counties, California
Project Number: 27661032

Log of Boring B-EP240

Sheet 1 of 2

Date(s) Drilled	01/29/11	Logged By	J. Gratzner	Checked By	M. Schmoll
Drilling Method	Rotary Wash	Drill Bit Size/Type	HWT-Tri-cone	Total Depth of Borehole	51.5 feet
Drill Rig Type	Burley 4000, Rig #1	Drilling Contractor	Crux	Approximate Surface Elevation	2771.1 ft (NAVD 88)
Water Level Depth (Feet)	14.5 feet (1.5 hours after drilling)	Sampling Method(s)	SPT/2.5" I.D.	Hammer Data	140 lbs/30-inch drop
Borehole Backfill	Bentonite chips	Coordinate Location (NAD 83)	32.63055 -116.17343	Location	Link 1, Section 9C

Elevation, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
	Depth, feet	Type	Number					
0								
2770			1	10	ALLUVIUM Medium dense, moist, dark yellowish brown, silty SAND (SM), fine to medium grained, micaceous			
5			2	8	Loose, moist, dark brownish gray, poorly graded SAND (SP), fine to medium grained, trace coarse sand			
2765			3	9	↓ Becomes light brownish gray, medium grained, moist, trace fine gravel			SA(4)
10			4	6	Loose, moist, dark yellowish brown, silty SAND (SM), fine grained, micaceous			
2760					↓ Becomes medium dense, fine to medium grained, trace fine gravel			
15			5	17		17	112	SA(19)
2755					Loose, moist, dark yellowish brown, clayey SAND (SC), fine grained, micaceous, some silt			
20			6	9				HYD(35)
2750					↓ Becomes fine to medium grained			
25			7	9				
2745								
30								

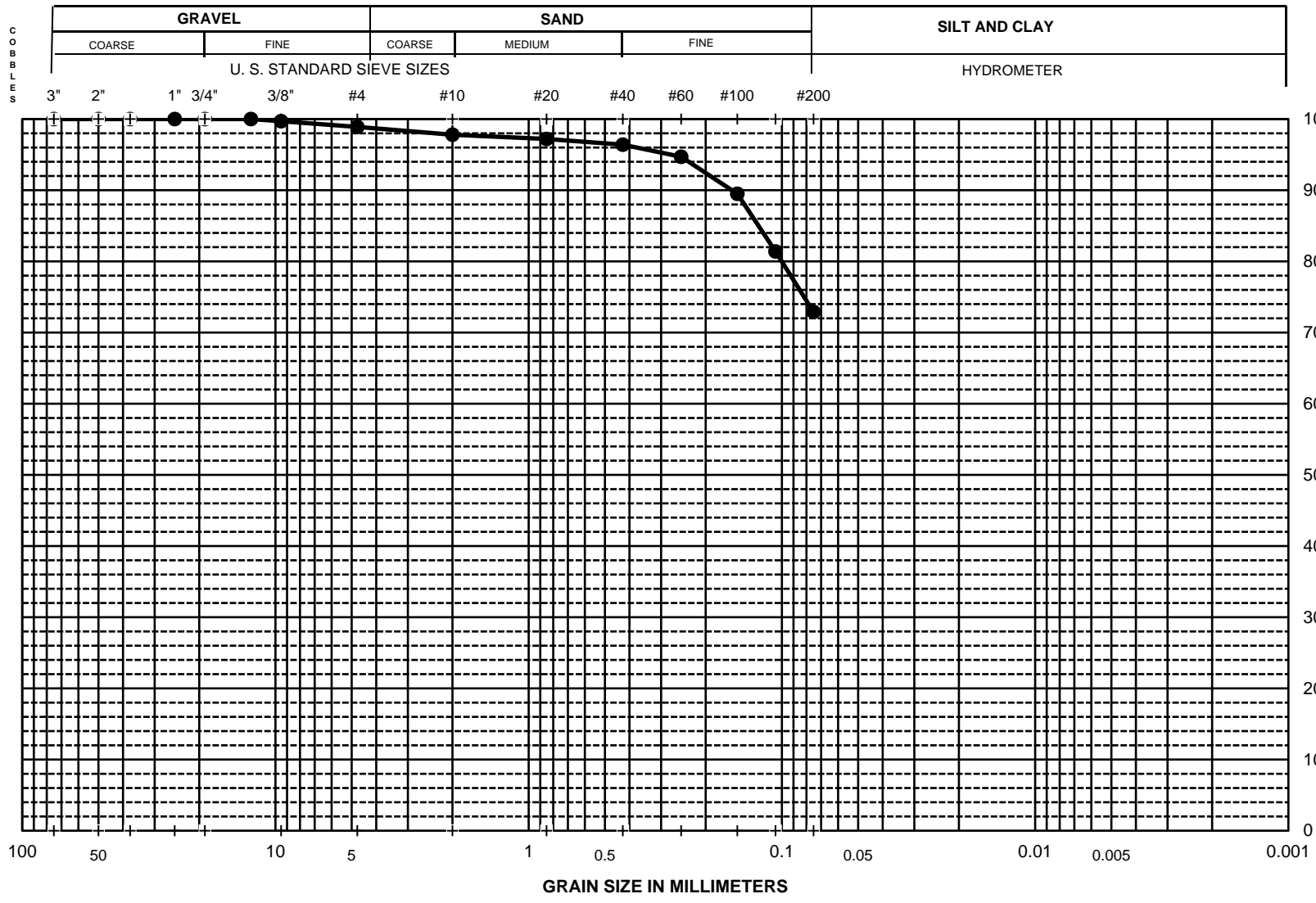
Report: SUNRISE_SOIL LOG; File: 27661032.GPJ; 2/9/2011 B-EP240



Elevation, feet	Depth, feet	SAMPLES		Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Density, pcf	REMARKS AND OTHER TESTS
		Type	Number					
2735	30	8	12		↓ Becomes medium dense, fine grained and more silty Medium dense, moist, dark grayish brown, SAND with silt (SP-SM), fine to medium grained, trace coarse sand			WA(8)
2730	35	10	12		↓ Trace fine to coarse gravel up to 3/4", subrounded Medium dense, moist, dark yellowish brown, interbedded poorly graded SAND (SP) and clayey SAND (SC), fine to medium grained, micaceous			SA(30)
2725	40	11	11					
2720	45	12	12					
2715	50	13	14		↓ Becomes grayish brown, trace coarse sand and gravel, 1/2" thick sandy SILT (ML) interbeds Bottom of boring at 51.5 feet			
2710	55							
2705	60							
65	65							

Report: SUNRISE_SOIL LOG; File: 27661032.GPJ; 2/9/2011 B-EP240

UNIFIED SOIL CLASSIFICATION



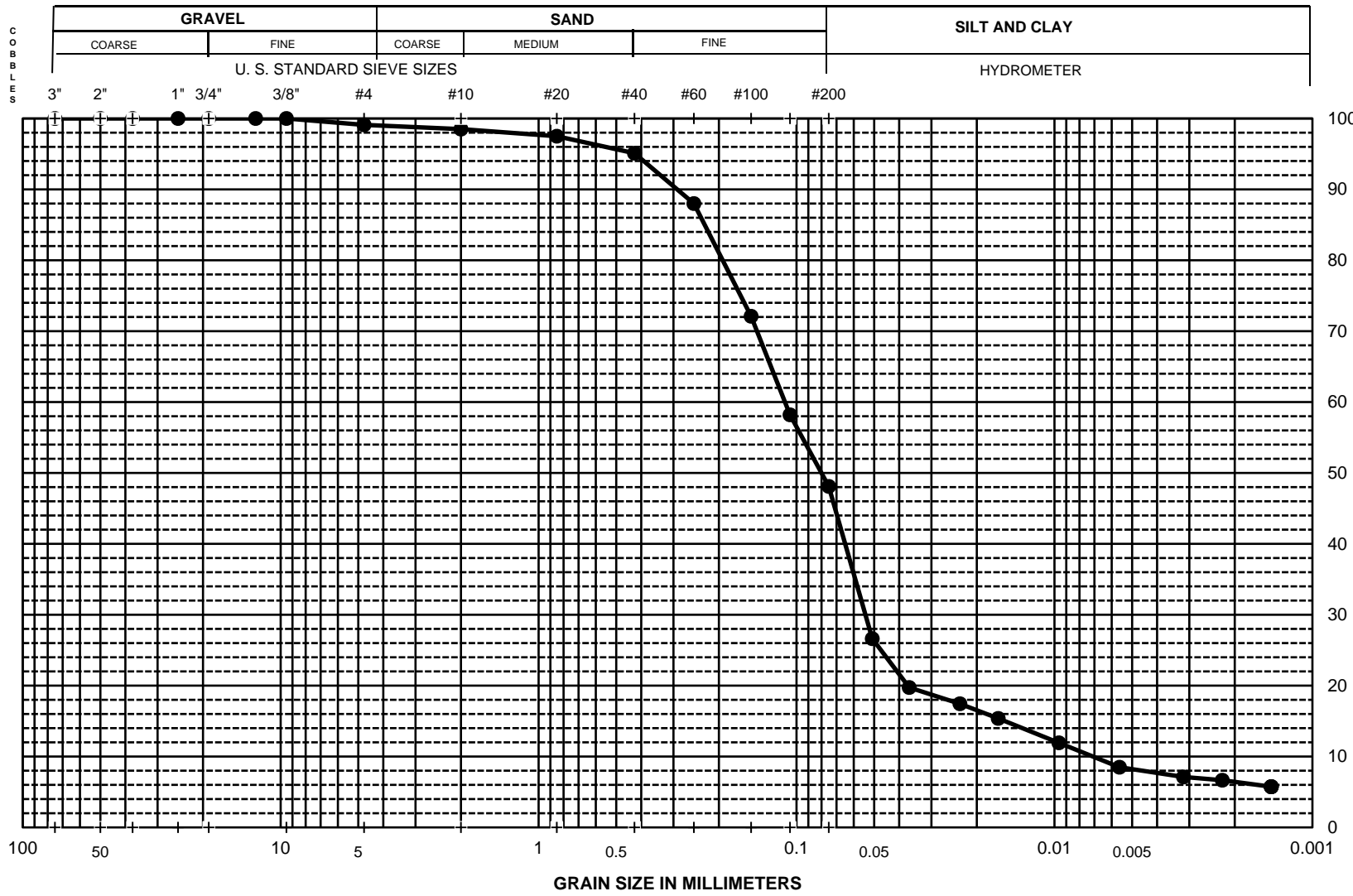
Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	99.7
#4	4.75	98.9
#10	2.00	97.8
#20	0.850	97.2
#40	0.425	96.4
#60	0.250	94.7
#100	0.150	89.5
#140	0.106	81.4
#200	0.075	72.9
Hydrometer Analysis		
% Cobbles		XX
% Gravel		1.1
% Sand		26.0
% Fines		72.9
D ₈₅	0.124	
D ₆₀	#N/A	
D ₅₀	#N/A	
D ₃₀	#N/A	
D ₁₅	#N/A	
D ₁₀	#N/A	
C _u	XXX	
C _c	XXX	

Boring No.	Sample No.	Depth (ft)	SYMBOL	W _n (%)	LL	PI	% 2 μm	Description and Classification
B-EP239	4	10.0	●	95.3	NA	NA	NA	Olive brown sandy Clay (CL)

PROJECT NAME: Sunrise Powerlink
PROJECT NUMBER: 27661032

PARTICLE-SIZE DISTRIBUTION CURVES

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	99.1
#10	2.00	98.5
#20	0.850	97.5
#40	0.425	95.1
#60	0.250	88.0
#100	0.150	72.1
#140	0.106	58.2
#200	0.075	48.1
Hydrometer Analysis		
	0.0509	26.6
	0.0366	19.7
	0.0233	17.4
	0.0165	15.4
	0.0096	11.9
	0.0056	8.5
	0.0032	7.1
	0.0022	6.7
	0.0014	5.7
	0.0014	5.7
% Cobbles		XX
% Gravel		0.9
% Sand		51.0
% Fines		48.1
D ₈₅	0.227	
D ₆₀	0.111	
D ₃₀	#N/A	
D ₁₅	#N/A	
D ₁₀	#N/A	
C _u	XXX	
C _c	XXX	

Boring No.	Sample No.	Depth (ft)	SYMBOL	W _n (%)	LL	PI	% 2 μm	Description and Classification
B-EP239	5	15.0	●	26.4	36	14	6	Olive brown clayey Sand (SC)

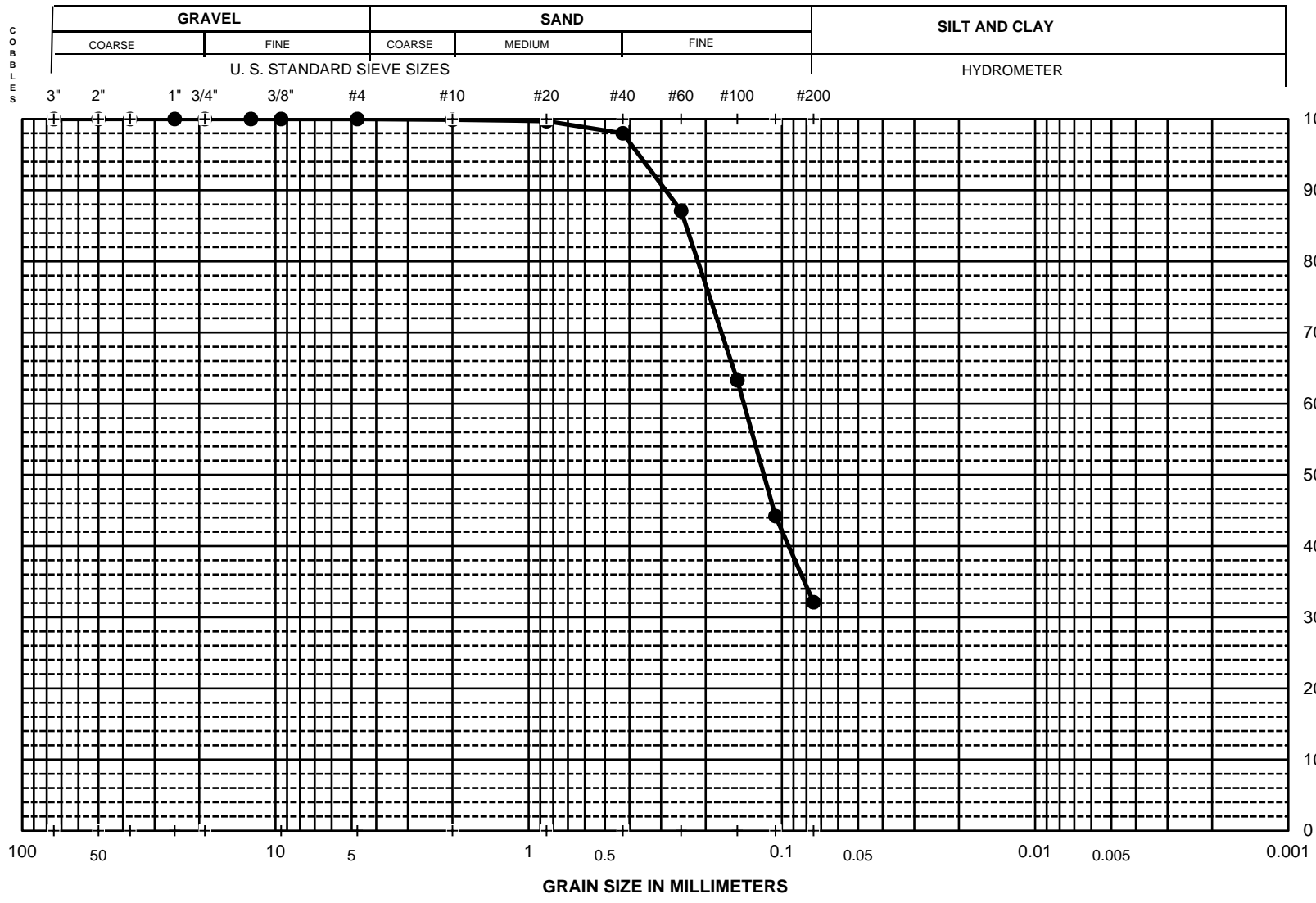
PROJECT NAME: **Sunrise Powerlink**
 PROJECT NUMBER: **27661032**

PARTICLE-SIZE DISTRIBUTION CURVES

(SNA) sieve only (04/2000)

Hydrometer Sunrise EP239 015

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	100.0
#10	2.00	99.9
#20	0.850	99.7
#40	0.425	98.0
#60	0.250	87.1
#100	0.150	63.3
#140	0.106	44.2
#200	0.075	32.1

% Cobbles	XX
% Gravel	0.0
% Sand	67.9
% Fines	32.1

D ₈₅	0.239
D ₆₀	0.141
D ₅₀	0.118
D ₃₀	#N/A
D ₁₅	#N/A
D ₁₀	#N/A

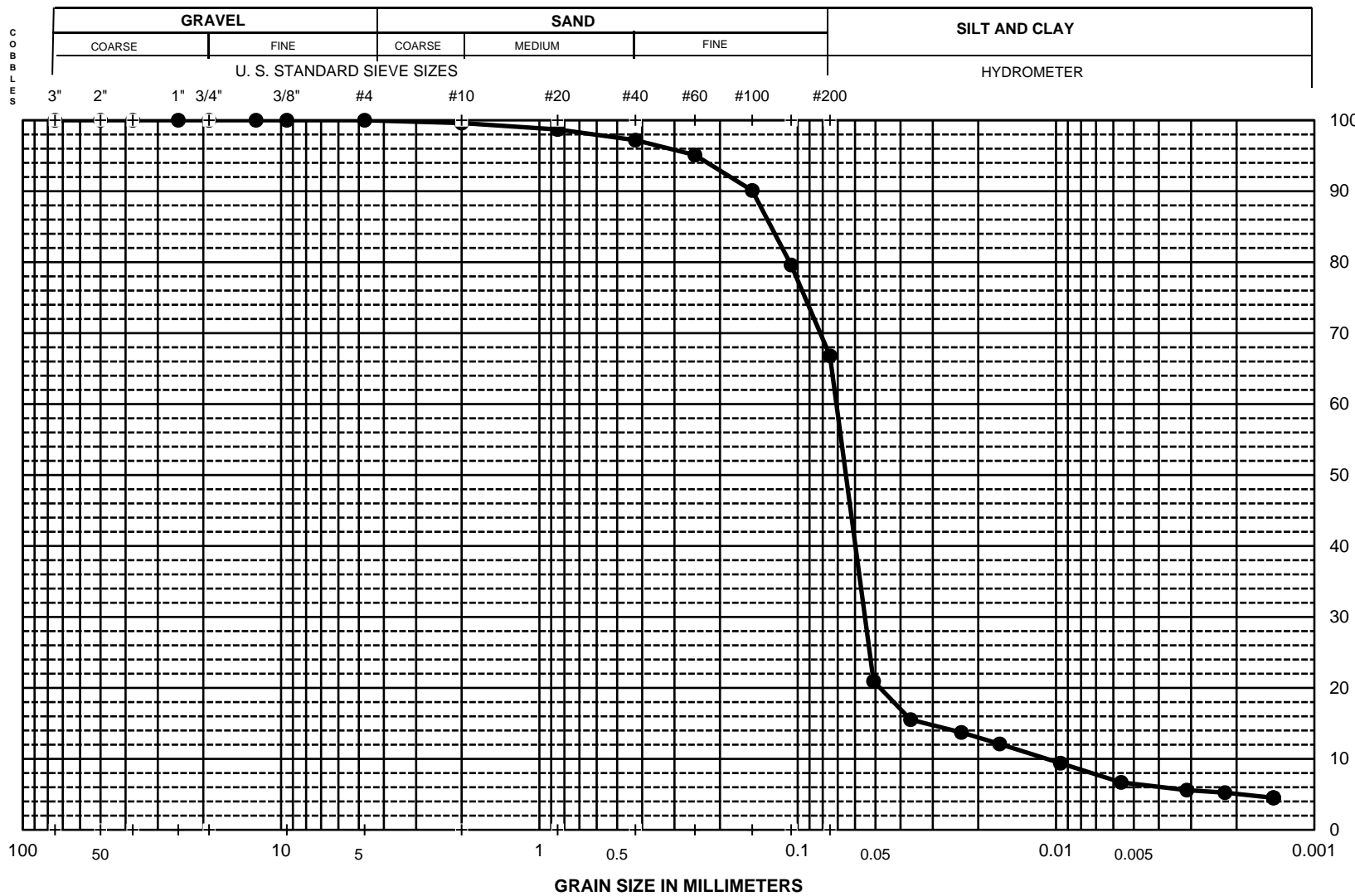
Boring No.	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 2 μm	Description and Classification
B-EP239	6	20.0	●	NA	NA	NA	NA	Yellowish brown silty Sand (SM)

C _u	XXX
C _c	XXX

PROJECT NAME: Sunrise Powerlink
PROJECT NUMBER: 27661032

PARTICLE-SIZE DISTRIBUTION CURVES

UNIFIED SOIL CLASSIFICATION

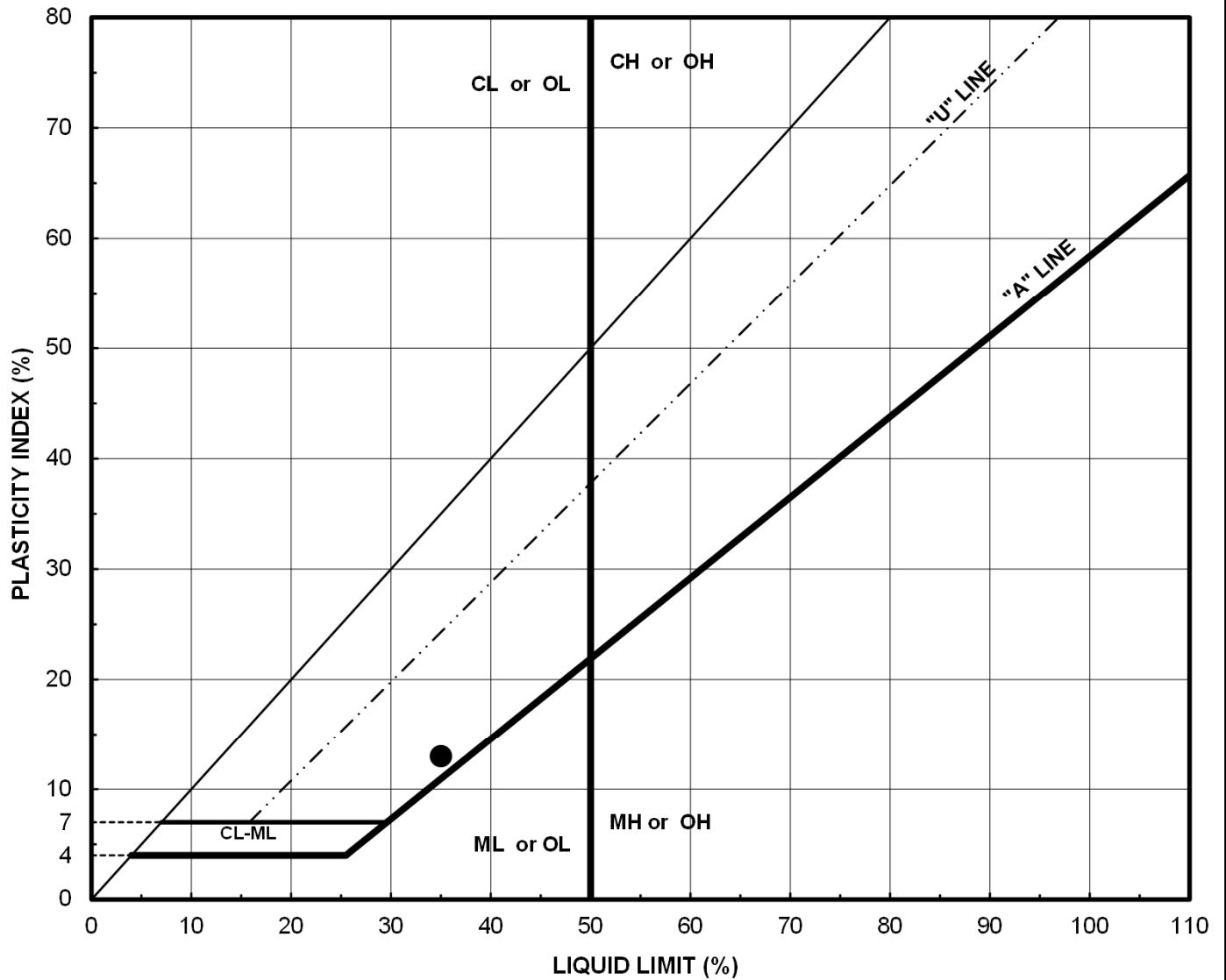


Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	100.0
#10	2.00	99.6
#20	0.850	98.7
#40	0.425	97.2
#60	0.250	95.1
#100	0.150	90.1
#140	0.106	79.6
#200	0.075	66.8
Hydrometer Analysis		
	0.0508	20.9
	0.0366	15.5
	0.0233	13.7
	0.0165	12.1
	0.0096	9.4
	0.0056	6.7
	0.0031	5.6
	0.0022	5.2
	0.0014	4.5
	0.0014	4.5
% Cobbles		XX
% Gravel		0.0
% Sand		33.2
% Fines		66.8
D ₈₅	0.127	
D ₆₀	#N/A	
D ₃₀	#N/A	
D ₁₅	#N/A	
D ₁₀	#N/A	
C _u	XXX	
C _c	XXX	

Boring No.	Sample No.	Depth (ft)	SYMBOL	W _n (%)	LL	PI	% 2 μm	Description and Classification
B-EP239	10	37.5	●	30.6	35	15	5	Dark yellowish brown sandy Clay (CL)

PROJECT NAME: Sunrise Powerlink
PROJECT NUMBER: 27661032

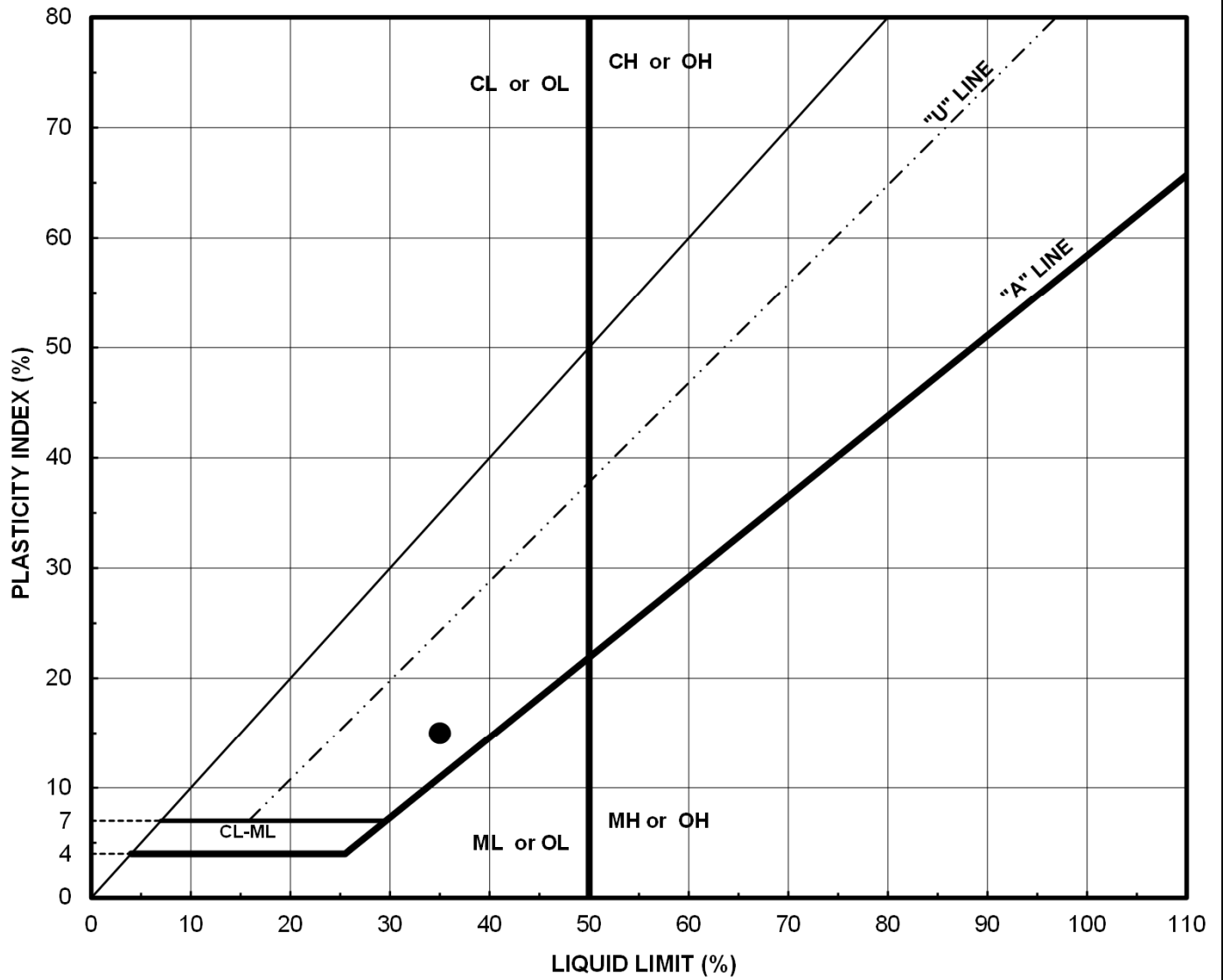
PARTICLE-SIZE DISTRIBUTION CURVES



BORING No.	SAMPLE No.	DEPTH (ft.)	WATER CONTENT (%)	LL (%)	PI (%)	DESCRIPTION / CLASSIFICATION
B-EP239	5	15.0	26.4	35	13	Olive brown clayey Sand (SC)

Project Name: Sunrise Powerlink
 Project Number: 27661032

PLASTICITY CHART

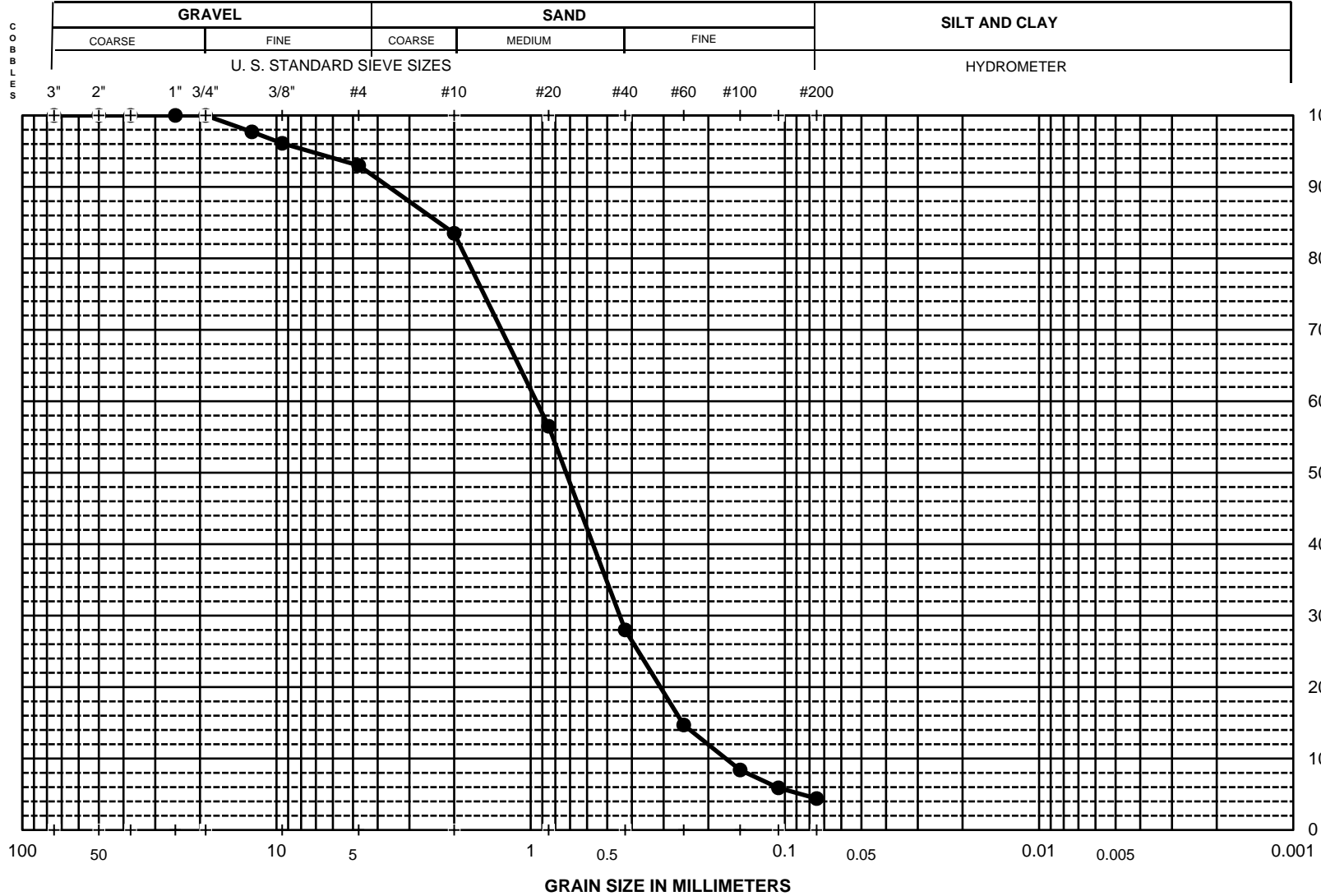


BORING No.	SAMPLE No.	DEPTH (ft.)	WATER CONTENT (%)	LL (%)	PI (%)	DESCRIPTION / CLASSIFICATION
B-EP239	10	37.5	30.6	35	15	Dark yellowish brown sandy Clay (CL)

Project Name: Sunrise Powerlink
 Project Number: 27661032

PLASTICITY CHART

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	97.7
3/8"	9.50	96.1
#4	4.75	93.0
#10	2.00	83.5
#20	0.850	56.5
#40	0.425	28.0
#60	0.250	14.7
#100	0.150	8.4
#140	0.106	5.9
#200	0.075	4.4

Hydrometer Analysis	
% Cobbles	XX
% Gravel	7.0
% Sand	88.6
% Fines	4.4
D ₈₅	2.293
D ₆₀	0.950
D ₅₀	0.726
D ₃₀	0.446
D ₁₅	0.253
D ₁₀	0.171

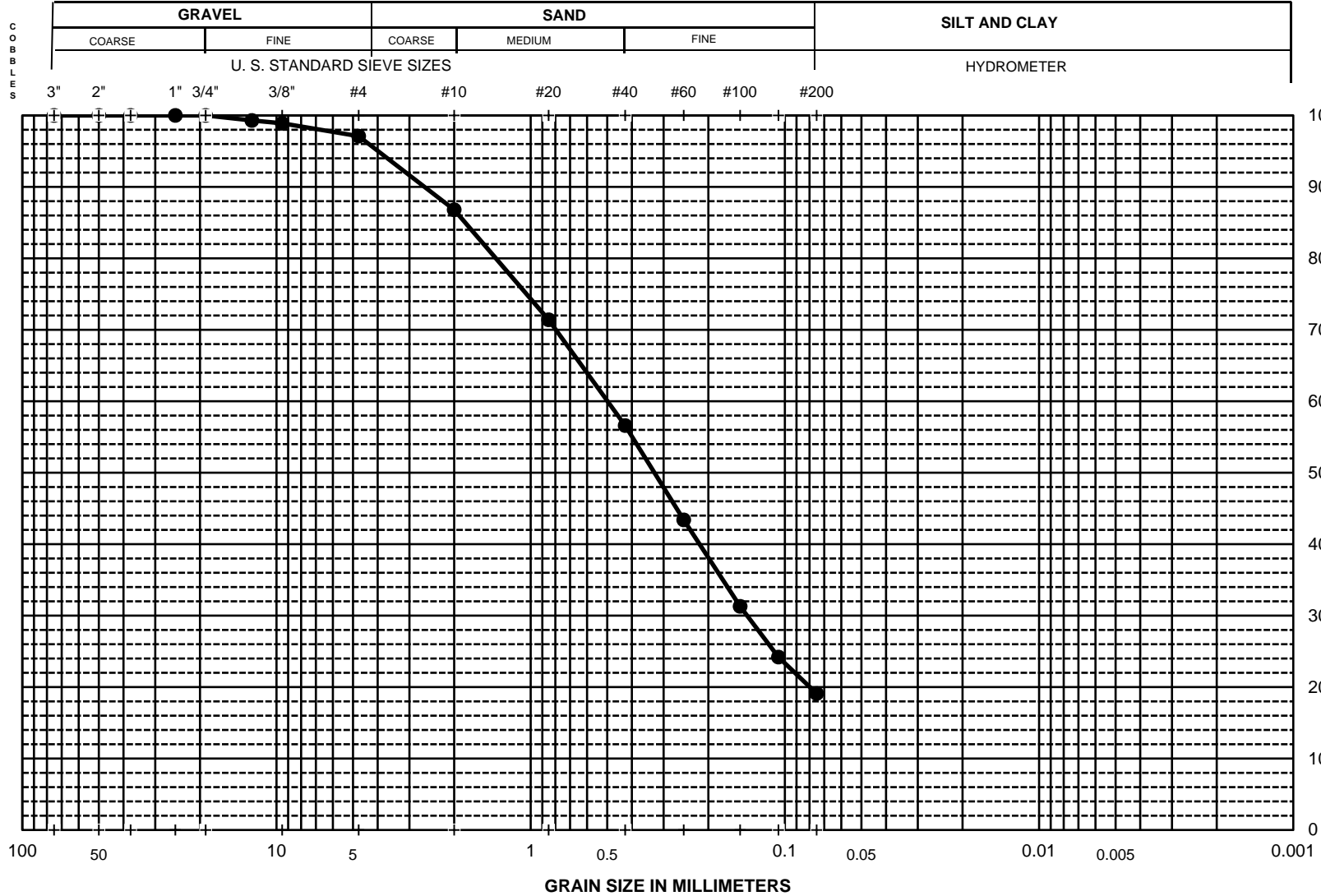
Boring No.	Sample No.	Depth (ft)	SYMBOL	W _n (%)	LL	PI	% 2 μm	Description and Classification
B-EP240	3	7.5	●	NA	NA	NA	NA	Light brownish gray poorly graded Sand (SP)

C _u	5.6
C _c	1.2

PROJECT NAME: Sunrise Powerlink
PROJECT NUMBER: 27661032

PARTICLE-SIZE DISTRIBUTION CURVES

UNIFIED SOIL CLASSIFICATION



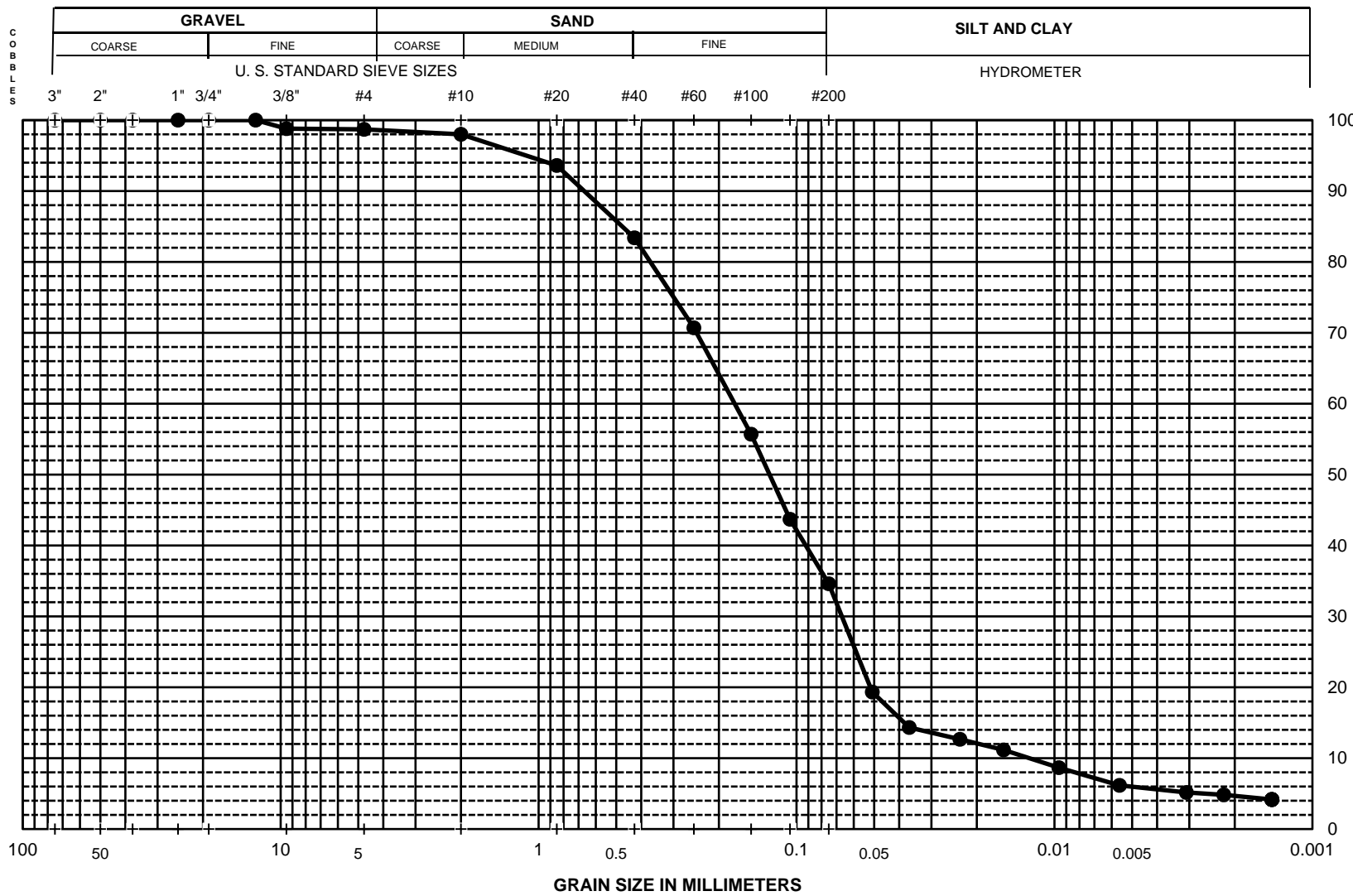
Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	99.3
3/8"	9.50	98.9
#4	4.75	97.1
#10	2.00	86.8
#20	0.850	71.4
#40	0.425	56.6
#60	0.250	43.4
#100	0.150	31.3
#140	0.106	24.2
#200	0.075	19.1
Hydrometer Analysis		
% Cobbles	XX	
% Gravel	2.9	
% Sand	78.0	
% Fines	19.1	
D ₈₅	1.810	
D ₆₀	0.498	
D ₅₀	0.326	
D ₃₀	0.141	
D ₁₅	#N/A	
D ₁₀	#N/A	
C _u	XXX	
C _c	XXX	

Boring No.	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 2 μm	Description and Classification
B-EP240	5	15.0	●	17.3	NA	NA	NA	Dark yellowish brown silty Sand (SM)

PROJECT NAME: Sunrise Powerlink
PROJECT NUMBER: 27661032

PARTICLE-SIZE DISTRIBUTION CURVES

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	98.8
#4	4.75	98.7
#10	2.00	98.0
#20	0.850	93.6
#40	0.425	83.4
#60	0.250	70.7
#100	0.150	55.7
#140	0.106	43.7
#200	0.075	34.6
Hydrometer Analysis		
	0.0508	19.3
	0.0366	14.3
	0.0233	12.7
	0.0158	11.2
	0.0096	8.7
	0.0056	6.2
	0.0031	5.2
	0.0022	4.8
	0.0014	4.2
	0.0014	4.2
% Cobbles		XX
% Gravel		1.3
% Sand		64.1
% Fines		34.6
D ₈₅	0.474	
D ₆₀	0.174	
D ₃₀	#N/A	
D ₁₅	#N/A	
D ₁₀	#N/A	
C _u	XXX	
C _c	XXX	

Boring No.	Sample No.	Depth (ft)	SYMBOL	W _n (%)	LL	PI	% 2 μm	Description and Classification
B-EP240	6	20.0	•	NA	NA	NA	5	Dark yellowish brown clayey Sand (SC)

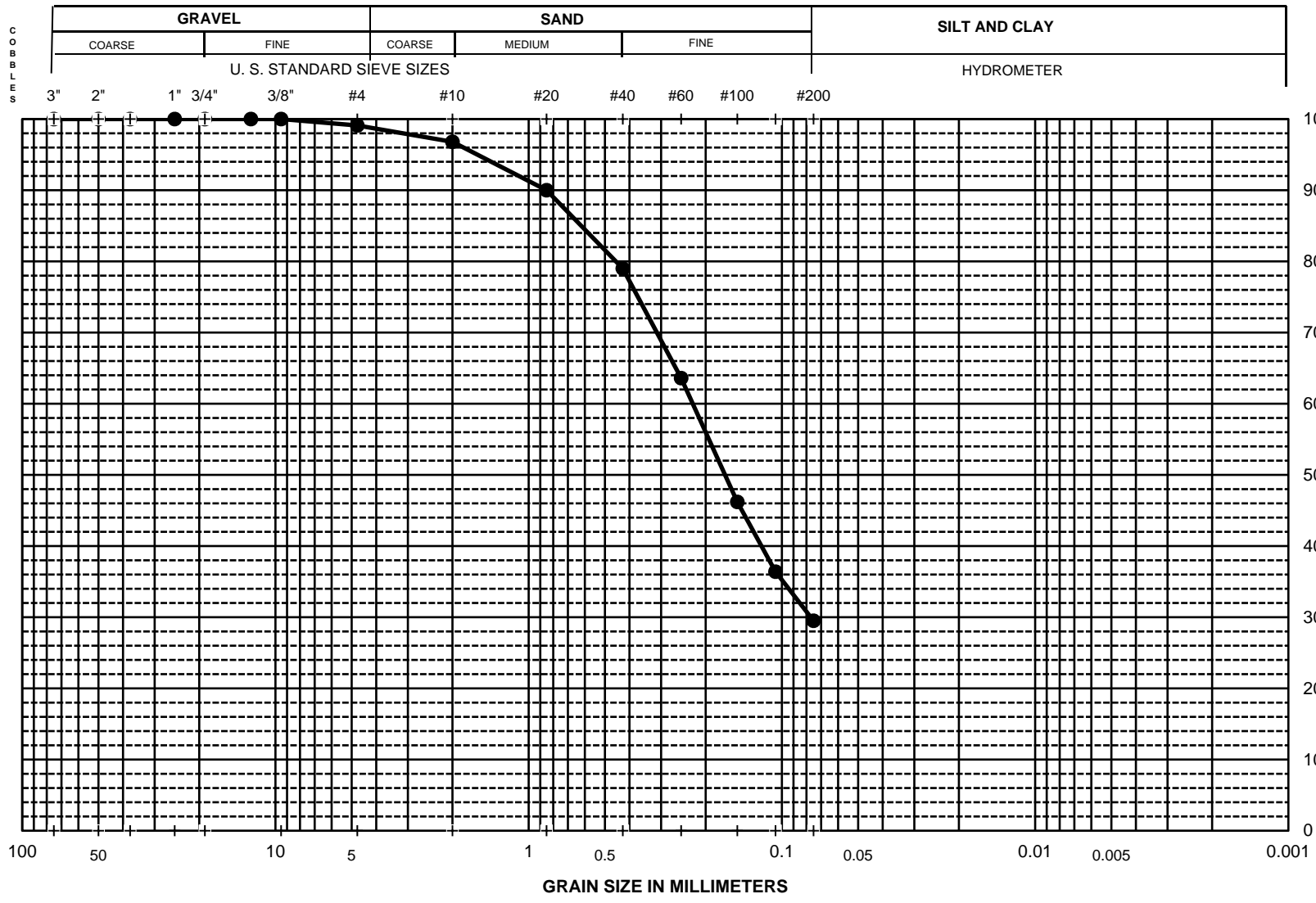
PROJECT NAME: Sunrise Powerlink
PROJECT NUMBER: 27661032

PARTICLE-SIZE DISTRIBUTION CURVES

(SNA) sieve only (04/2000)

Hydrometer Sunrise EP240 020

UNIFIED SOIL CLASSIFICATION



Sieve No.	Dia. mm	% Finer
3"	75.0	100.0
2"	50.0	100.0
1.5"	37.5	100.0
1"	25.0	100.0
3/4"	19.00	100.0
1/2"	12.50	100.0
3/8"	9.50	100.0
#4	4.75	99.1
#10	2.00	96.8
#20	0.850	90.0
#40	0.425	79.0
#60	0.250	63.6
#100	0.150	46.2
#140	0.106	36.4
#200	0.075	29.5
Hydrometer Analysis		
% Cobbles	XX	
% Gravel	0.9	
% Sand	69.6	
% Fines	29.5	
D ₈₅	0.620	
D ₆₀	0.225	
D ₅₀	0.168	
D ₃₀	0.077	
D ₁₅	#N/A	
D ₁₀	#N/A	
C _u	XXX	
C _c	XXX	

Boring No.	Sample No.	Depth (ft)	SYMBOL	Wn (%)	LL	PI	% 2 μm	Description and Classification
B-EP240	11	40.0	●	NA	NA	NA	NA	Dark yellowish brown clayey Sand (SC)

PROJECT NAME: **Sunrise Powerlink**
 PROJECT NUMBER: **27661032**

PARTICLE-SIZE DISTRIBUTION CURVES