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GEOTECHNICAL ENGINEERING STUDY
BRIDGE AND RETAINING WALL STRUCTURES
I-25 IMPROVEMENTS FROM
CIMARRON STREET TO BIJOU STREET
COLORADO SPRINGS, COLORADO

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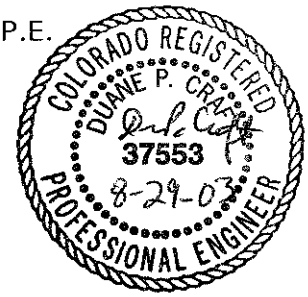

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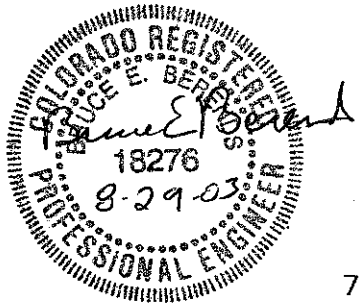

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Project No. 012-266

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SUMMARY

1. The subsurface conditions encountered generally consisted of fill over native soils underlain by claystone bedrock. The fill material ranged from silty to clayey sand, sandy gravel, and slightly sandy to sandy clay. Native soils consisted of clean to very silty/clayey sands and gravels, and slightly sandy to very sandy clays. Occasional cobble layers were also encountered in some of the borings. Very hard claystone was encountered at depths ranging from approximately 3 to 53 feet beneath the existing ground surface. Ground water was encountered in a majority of the borings at depths ranging from 0 to 48 feet either at the time of drilling or when the borings were checked up to 12 days later.

2. It appears that a deep foundation system consisting of either straight-shaft drilled caissons or driven steel H-piles bearing in the underlying bedrock are feasible for support of the proposed bridge structures and cast-in-place (CIP) concrete retaining walls. Caisson shafts will have to be cased during drilling and possibly dewatered because of the presence of granular soils and ground water. The foundation recommendations presented herein include both Load and Resistance Factor Design (LRFD) and Allowable Stress Design (ASD) parameters.

3. The subsurface conditions encountered in the borings drilled for the MSE walls indicate the native soils and most of the existing fill will be suitable for support of the proposed walls. For the CIP retaining wall with a proposed spread footing foundation, existing fill was encountered below the proposed bearing elevation. The fill appeared relatively compact; however, in order to provide a uniform bearing surface, we recommend the spread footings be constructed on a minimum 3-foot thick layer of structural fill. Additional retaining wall recommendations are presented in the report.

PURPOSE AND SCOPE OF STUDY

This report presents the results of a geotechnical engineering study for the proposed bridge and retaining wall structures for the I-25 improvement project from Cimarron Street to Bijou Street in Colorado Springs, Colorado. This study was conducted for the purpose of developing geotechnical engineering recommendations for design and construction of the proposed structures. The project site is shown on the attached Figures 1 and 2. This study was conducted in accordance with our proposal No. C00-242R, dated March 5, 2001. Information presented in our preliminary geotechnical engineering report dated January 10, 2003 was utilized in the development of this report.

This report has been prepared to summarize the data obtained during this study, and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction of the proposed structures are included in the report.

PROPOSED CONSTRUCTION

Based on plans provided to us, we understand the proposed construction will consist of nine bridge structures and fifteen retaining walls, as generally shown on Figures 1 and 2. A discussion of the proposed construction is summarized below.

Bridges: It is our understanding the bridge structure foundations will consist of drilled piers and/or steel H-piles. A summary description of the bridge structure follows:

Location		Structure No.	Type	No. of Spans	Dimensions (Width x Length) in feet
I-25 Mainline Bridges	Over Bear Creek	I-17-OL	Precast Prestressed Concrete Bulb Tee Girder	1	166x100
	Over Cimarron Street	I-17-OM	Precast Prestressed Concrete Colorado U-Girder	4	150X518
	Over Colorado Avenue	I-17-OO	Precast Prestressed Concrete Colorado U-Girder	3	185X365
Creek Bridges	Ramp C-2 over Fountain Creek	I-17-OR	Precast Prestressed Concrete Bulb Tee Girder	3	39X225
	Ramp C-3 over Fountain Creek	I-17-ON			
	Cimarron Street WB over Fountain Creek	CSG-F.85-08.23W	Precast Prestressed Concrete Bulb Tee Girder	3	59X297
	Cimarron Street EB over Fountain Creek	CSG-F.85-08.23E			
Bijou Street Bridges	Over I-25	I-17-OQ	Cast-in Place Post-Tensioned Concrete Box Girder	2	135x187
	Over RR's and Monument Creek	CSG-G.15-08.84A	Variable Depth Welded Steel Plate Girder	5	138x478

Retaining Walls: Retaining walls will consist of mechanically stabilized earth (MSE) walls, and cast-in-place concrete (CIP) walls supported on driven piles and spread footings. A summary description of the proposed retaining walls is as follows:

Location		Structure No.	Type	Max. Height (feet)	Length (feet)	Estimated Toe Pressure (psf)
I-25 Retaining Walls	Wall 1	Wall-I-17-CA	MSE	13	1,090	2,000
	Wall 2	Wall-I-17-CC	CIP on H-Piles	13	298	--
	Wall 3	Wall-I-17-CD	CIP on H-Piles	7	75	--
	Wall 4	Wall-I-17-CG	MSE	11	348	1,700
	Wall 5	Wall-I-17-CI	MSE	10	670	1,500
	Wall 6	Wall-I-17-BP	MSE	29	199	4,400
Ramp Retaining Walls	Wall C-1	Wall-I-17-CL	MSE	19	670	2,900
	Wall C-2					
	Lower	Wall-I-17-CL	MSE	24	1,039	7,500
	Upper	Wall-I-17-CJ	MSE	26	1,230	(combined)
	Wall C-3	Wall-I-17-CM	CIP on H-Piles	32	746	--
	Wall B-4R	Wall-I-17-BQ	CIP on H-Piles	32	1,450	--
	Wall B-4L	Wall-I-17-CR	MSE	19	256	2,900
	Wall B-3R	Wall-I-17-CP	CIP on Spread Footing	17	246	--
	Wall B-3L	Wall-I-17-CQ	MSE	19	366	2,900
	Cimarron St	Wall-I-17-BZ	MSE	20	315	3,000

MSE – Mechanically Stabilized Earth
CIP – Cast in Place (Concrete)

SITE CONDITIONS

I-25 trends roughly in a northeast-southwest direction through the study area and is mostly constructed on man-placed fill embankments with the exception of the Bijou Street underpass, which appeared to be in a cut area. City streets traversing under and over the I-25 mainline in the study area included Cimarron Street and Colorado Avenue, and Bijou Street, respectively, and appeared to be constructed on cut or native ground surfaces, with the exception of Bijou Street which is constructed on embankment fill. Existing bridges in the area of the Cimarron Street/I-25 interchange consist of the I-25 mainline bridge over Cimarron Street and Fountain Creek, an I-25 northbound on-ramp bridge over Fountain Creek, and Cimarron Street Bridge over Fountain Creek and Monument Creek confluence. Existing bridges in the Bijou Street/I-25 interchange area consist of the Bijou Street Bridge over the I-25 mainline, Monument Creek and the Union Pacific Railroad; and two I-25 mainline bridges over Colorado Avenue and the former Midland Railroad Right-of-Way which were located approximately 1,400 feet and 2,000 feet south, respectively, of the Bijou Street Bridge.

The northern portion of the study area is bordered to the east by Monument Creek, which flows generally in a southwesterly direction in this part of the study area. Fountain Creek, which flows generally from northwest to southeast along the north side US Highway 24, crosses underneath I-25 before merging with Monument Creek immediately northeast of the Cimarron Street and I-25 interchange. South of the confluence, Fountain Creek flows to the east of I-25 in a southeasterly direction. Bear Creek, a southeasterly-flowing tributary of Fountain Creek, crosses under I-25 via a concrete box culvert, approximately 2,500-feet south of the Monument Creek confluence. The banks bounding Monument Creek and Fountain Creek range from nearly level to very steep with a maximum height of approximately 25 feet in the vicinity of the Bijou Street Bridge. Banks bounding Bear Creek along the west side of I-25 are moderately steep to steep with a maximum height of approximately 10 feet.

Topography in the study area generally consists of nearly level to very steeply sloping ground surfaces that slope down toward the lower floodplain terraces and active channels of Monument Creek and Fountain Creek. Moderately steep to very steep man-placed embankment slopes bounded the majority of the I-25 mainline and associated on- and off-ramps. Elevations in the study area range from a high of approximately 5,995 feet above mean sea level at the north end of the study area to a low of approximately 5,930 feet at the south end of the study area.

The majority of the study area, excluding the existing asphalt-paved roadways and concrete structures, consisted of the Colorado Department of Transportation (CDOT) Right-of-Ways (ROW), the Union Pacific Railroad ROW, City of Colorado Springs Parks and Recreation land, commercial and industrial development, and Fountain Creek, Monument Creek and Bear Creek. Vegetation in the study area consisted mainly of grasses and weeds with isolated areas of deciduous trees. Thick riparian vegetation consisting of large deciduous trees, willows and cattails was observed along Fountain and Monument Creeks. Flowing water was observed in Fountain Creek and its tributaries, Monument Creek and Bear Creek. Several bedrock outcroppings of the Pierre Shale were observed along the banks of Monument Creek and Fountain Creek.

SITE GEOLOGY

The site geology is based on the "Environmental and Engineering Geologic Map for Land Use," Colorado Springs Quadrangle, by Charles S. Robinson (1977) and the "Geologic Map of the Colorado Springs-Castle Rock Area, Front Range Urban Corridor," by Trimble and Machette (1979). The surficial geology in the study area is characterized by the Upper Holocene- to Recent-age Piney Creek Alluvium on flat to gentle slopes. The alluvial floodplain and terrace deposits generally consist of gravel, sand, silt and clay deposited upon gently northeasterly-dipping sedimentary bedrock of the Upper Cretaceous-age Pierre Shale. The Pierre Shale typically consists of interbedded claystone and clayshale with occasional thin interbedded limestone, sandstone, and bentonite beds. Several outcroppings of the Pierre Shale were observed along the banks of Monument Creek and Fountain Creek. The alluvial deposits and bedrock are locally overlain by man-placed fill embankments. The Rampart Range Fault, a high-angle generally north-south trending reverse fault, and the Ute Pass Fault, generally characterized by several low angle, northwest-southeast trending reverse faults, are mapped approximately 2.6 miles northwest and 2.5 miles southwest, respectively, of the study area.

FIELD EXPLORATION

The field exploration for the project was conducted between August 15th and 25th, 2003. A total of 29 borings were drilled at locations determined by Fellsburg, Holt, and Ullevig, Inc. The boring locations were staked by representatives of Wilson and Company, and are shown on Figures 1 and 2. Additionally, information obtained from 16 borings previously drilled during our preliminary geotechnical study drilled in January and February 2002 was utilitized in evaluating subsurface conditions in this report. The logs of the borings are presented on the Engineering Geology Sheets on Figures 3 through 14. Logs of five borings (Borings 14, 17, 18 and 20) drilled in areas of previously proposed construction are included in the Appendix. Boring No.s 8, 15, 23, 28, 29, 30, 36, and 41 were not drilled due to accessibility; permit requirements and other factors beyond our control.

The borings were advanced through the overburden soils and underlying bedrock with 4-inch diameter continuous flight augers and 3.25-inch I.D. hollow-stem-augers. The borings were logged by a representative of Kumar & Associates, Inc. Samples of the soils and bedrock materials were taken with a 2-inch I.D. California liner sampler and 1 3/8-inch split

spoon sampler. The sampler was driven into the various strata with blows from a 140-pound hammer falling 30 inches. Penetration resistance values, when properly evaluated, provide an indication of the relative density or consistency of the soils. Depths at which the samples were taken and the penetration resistance values are shown on the boring logs.

Measurements of the water level were made in the borings by lowering a weighted tape measure into the open hole shortly after completion of drilling and up to 12 days subsequent to drilling. The elevations of the water levels measured and the number of days subsequent to drilling are shown on the boring logs.

LABORATORY TESTING

Samples obtained from the exploratory borings were visually classified in the laboratory by the project engineer and samples were selected for laboratory testing. Laboratory testing, including index property tests such as moisture content, dry unit weight, grain size analysis and liquid and plastic limits, was performed in general accordance with American Association of State Highway and Transportation Officials (AASHTO) standards. Swell-consolidation tests were conducted on samples of the soil and bedrock to provide information on their compressibility or swell characteristics under loading and when submerged in water. Concentration of water soluble sulfates were also measured in selected samples. Results of the laboratory testing program are shown on Figures 3 through 52.

SUBSURFACE CONDITIONS

A generalized description of the subsurface conditions encountered in the borings at each of the structure sites is presented in the paragraphs below. The descriptions highlight the major stratifications features encountered in the borings; the boring logs should be referenced for more detailed information. The estimated relative density of granular soils and consistency of cohesive soils and bedrock were estimated based on sampler penetration blow counts. The descriptions of the subsurface conditions include estimated depths of fill, where encountered, and are presented below; however, our study did not determine the lateral or vertical extent of the fill. The existing pavement sections, encountered in 19 of the borings are summarized in Table I.

Bridges: The paragraphs below provide a description of the subsurface conditions encountered at the bridge-structure sites.

I-25 over Bear Creek: Borings 2 and 22 were drilled in the vicinity of this structure. Borings encountered approximately 10 to 14 feet of clayey sand fill. Native soils, consisting of loose to dense silty sand and medium dense clayey sandy gravel were encountered below the fill and extended to depths ranging from approximately 20 to 27 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 20 to 27 feet, and extended to the maximum 30- to 35-foot depth explored. Results of a swell consolidation test presented on Figure 41 indicate the tested sample of claystone had a high swell potential when wetted under a constant 1-ksf surcharge. Ground water was encountered in each of the borings at depths ranging from approximately 16 to 17 feet either at the time of drilling or when the borings were checked up to eleven days later.

I-25 over Cimarron Street: Borings 3,9, and 24 through 27 were drilled in the vicinity of this structure. In four of the borings, approximately 4.5 to 34.5 feet of fill consisting of sandy gravel, clayey sand, and slightly sandy to sandy clay was encountered. Native soils consisted of very loose to dense, clean to silty sand with occasional cobbles, very dense clayey to silty sand with occasional cobbles, soft to medium stiff sandy clay, and medium dense to very dense sandy gravel, and extended to depths ranging from approximately 18.5 to 47.5 feet. Swell consolidation tests presented on Figures 36, 37 and 44 indicate the tested samples of slightly sandy to sandy clay fill had a low swell potential and the sample of very sandy clay had a low collapse potential when wetted under a constant 1-ksf surcharge. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 18.5 to 47.5 feet, and extended to the maximum 35- to 65-foot depth explored. Swell consolidation tests presented on Figures 42, 43 and 45 indicate the tested samples of claystone had a moderate to high swell potential when wetted under a constant 1-ksf surcharge. Ground water was encountered in each of the borings at depths ranging from approximately 9 to 43.5 feet either at the time of drilling or when the borings were checked up to twelve days later.

I-25 over Colorado Avenue: Borings 12, and 50 through 53 were drilled in the vicinity of this structure. Borings encountered approximately 3.5 to 39.5 feet of fill consisting of silty sand, and sandy clay. Native soils consisted of very loose to medium dense, slightly silty to very silty sand, and medium stiff to very stiff, very sandy clay and clayey sand, and extended to depths ranging from approximately 23 to 52.5 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 23 to 52.5 feet, and extended to the maximum 40- to 68-foot depth explored. Ground water was encountered in each of the borings at depths ranging from approximately 20 to 43.5 feet either at the time of drilling or when the borings were checked up to 8 days later.

Ramp C-2 over Fountain Creek: Boring 4 was drilled in the vicinity of this structure. Approximately 12 feet of clayey sand fill was encountered in the boring. Native soil, consisting of very stiff silty and clayey sand was encountered below the fill and extended to an approximate depth of 22 feet. Very hard claystone bedrock was encountered beneath the overburden soils at a depth of approximately 22 feet, and extended to the maximum 38-foot depth explored. Ground water was encountered in the boring at a depth of approximately 15 feet at the time of drilling.

Ramp C-3 over Fountain Creek: Borings 5, 10, 34 and 35 were drilled in the vicinity of this structure. Borings encountered approximately 9 to 14 feet of fill consisting of silty to very clayey sand and sandy to very sandy clay. Results of a swell consolidation test presented on Figure 36 indicate the tested sample of sandy clay fill had a low swell potential when wetted under a constant 1-ksf surcharge. Native soils, consisting of loose to medium dense silty to very silty sand, and stiff to very stiff silty and clayey sand were encountered below the fill and extended to depths ranging from approximately 21 to 25 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 21 to 25 feet, and extended to the maximum 37- to 40-foot depth explored. Swell consolidation tests presented on Figures 48 and 49 indicate the tested samples of claystone had a low swell potential when wetted under a constant 1-ksf surcharge. Ground water was encountered in each of the borings at depths ranging from approximately 17 to 23 feet either at the time of drilling or when the borings were checked up to seven days later.

Cimarron Street over Fountain Creek: Borings 6, 7, 32, and 33 were drilled in the vicinity of this structure. In three of the borings, approximately 13 to 15 feet of silty to clayey sand fill was encountered. Native soils consisted of medium dense to dense slightly silty to silty sand with occasional cobbles, and stiff to very stiff silty and clayey sand, and extended to depths ranging from approximately 5.5 to 31 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 5.5 to 31 feet, and extended to the maximum 20- to 47-foot depth explored. Swell consolidation tests presented on Figures 46 and 47 indicate the tested samples of claystone had a medium to very high swell potential when wetted under a constant 1-ksf surcharge. Ground water was encountered in each of the borings at depths ranging from approximately 0 to 28 feet either at the time of drilling or when the borings were checked up to twelve days later.

Bijou Street over I-25: Borings 16, 44, 46, and 47 were drilled in the vicinity of this structure. Borings encountered approximately 4 to 21 feet of fill consisting of silty sand, and sandy clay. Native soils consisted of medium stiff clayey sand, and loose to medium dense slightly silty sand, and extended to depths ranging from approximately 32 to 34 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 4 to 34 feet, and extended to the maximum 20- to 50-foot depth explored. Swell consolidation tests presented on Figures 37, 51 and 52 indicate the tested samples of claystone had a medium to high swell potential when wetted under a constant 1-ksf surcharge. Ground water was encountered in three of the borings at depths ranging from approximately 7 to 38 feet either at the time of drilling or when the borings were checked up to nine days later.

Bijou Street over RR and Monument Creek: Borings 39, 40, 42, and 43 were drilled in the vicinity of this structure. Borings encountered approximately 3 to 8 feet of fill consisting of silty gravelly sand. Native soils consisting of medium dense to dense very sandy gravel, and medium dense to dense slightly silty to silty sand with occasional cobbles, and extending to depths ranging from approximately 3 to 20.5 feet were encountered in the borings. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 3 to 20.5 feet, and extended to the maximum 20- to

40-foot depth explored. Results of a swell consolidation test presented on Figure 50 indicate the tested sample of claystone had a moderate swell potential when wetted under a constant 1-ksf surcharge. Ground water was encountered in three of the borings at depths ranging from approximately 1 to 19 feet either at the time of drilling or when the borings were checked up to nine days later.

Retaining Walls: The description of the subsurface conditions encountered at the proposed retaining-wall sites is presented in the paragraphs below.

Retaining Wall 1: Borings 1 and 19 were drilled in the vicinity of this structure. In each of the borings, approximately 8 to 9 feet of fill consisting of clayey to very clayey sand and sandy clay was encountered. Native soils consisted of loose to dense, clean to silty sand, and loose to medium dense sandy gravel with occasional cobbles, and extended to depths ranging from approximately 19.5 to 21 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 19.5 to 21 feet, and extended to the maximum 21- to 35-foot depth explored. Ground water was encountered in each of the borings at depths ranging from approximately 14 to 19 feet either at the time of drilling or when the borings were checked up to eleven days later.

Retaining Walls 2 & 3: Borings 2 and 21 were drilled in the vicinity of these structures. In one of the borings, approximately 14 feet fill consisting of clayey to very clayey sand was encountered. Native soils consisted of loose to dense, clean to silty sand, loose to medium dense sandy gravel with occasional cobbles, and stiff sandy clay, and extended to depths ranging from approximately 20.5 to 26.5 feet. Swell consolidation test results presented on Figure 39 indicate the tested sample of sandy clay had a low swell potential when wetted under a constant 1-ksf surcharge. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 20.5 to 26.5 feet, and extended to the maximum 30- to 35-foot depth explored. Swell consolidation test results presented on Figure 40 indicate the tested sample of claystone had a moderate swell potential when wetted under a constant 1-ksf surcharge. Ground water was encountered in each of the borings at depths ranging from approximately 15.5 to 17 feet either at the time of drilling or when the borings were checked up to eleven days later.

Retaining Wall C-1: No borings were drilled in the vicinity of this structure.

Retaining Wall 4: Boring 3 was drilled in the vicinity of this structure. Approximately 24.5 feet fill consisting of silty to clayey sand was encountered. Native soils consisted of very dense silty and clayey sand with occasional cobbles, and extended to an approximate depth of approximately 35.5 feet. Very hard claystone bedrock was encountered beneath the overburden soils at a depth of approximately 35.5 feet, and extended to the maximum 40-foot depth explored. Ground water was encountered at a depth of approximately 33 feet at the time of drilling.

Retaining Walls 5 and C-2 (Lower and Upper): Borings 27 and 37 were drilled in the vicinity of these structures. In one of the borings, approximately 7 feet silty to clayey sand fill was encountered. Native soils consisted of soft to hard slightly sandy to very sandy clay, and very loose to dense, clean to very silty sand with occasional cobbles, and extended to depths ranging from approximately 18.5 to 23 feet. Results of a swell consolidation test presented on Figure 44 indicate the tested sample of very sandy clay had a low collapse potential when wetted under a constant 1-ksf surcharge. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 18.5 to 23 feet, and extended to the maximum 25- to 35-foot depth explored. Swell consolidation test results presented on Figure 45 indicate the tested sample of claystone had a moderate swell potential when wetted under a constant 1-ksf surcharge. Ground water was encountered in each of the borings at depths ranging from approximately 9 to 14 feet either at the time of drilling or when the borings were checked up to six days later.

Cimarron Street Retaining Wall: Borings 31 and 32 were drilled in the vicinity of these structures. Borings encountered approximately 13 to 15 feet of fill consisting of silty to clayey sand and slightly sandy to very sandy clay. Native soils consisted of soft to hard slightly sandy to very sandy clay, very loose to dense, clean to very silty sand with occasional cobbles, and dense to very dense gravel, and extended to depths of approximately 27 and 48 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 27 and 48 feet, and extended to the maximum 45- to 50-foot depth explored. Swell consolidation test results presented on Figure 46 indicate the tested sample of claystone had a very high swell potential when

wetted under a constant 1-ksf surcharge. Ground water was encountered in each of the borings at depths ranging from approximately 17 to 41 feet either at the time of drilling or when the borings were checked up to twelve days later.

Retaining Wall 6: Boring 13 was drilled in the vicinity of this structure. Approximately 19.5 feet of fill consisting of silty to clayey sand was encountered. Native soils consisted of soft to hard sandy to very sandy clay, and extended to an approximate depth of approximately 44 feet. Very hard claystone bedrock was encountered beneath the overburden soils at a depth of approximately 44 feet, and extended to the maximum 60-foot depth explored. Ground water was encountered at a depth of approximately 42 feet at the time of drilling.

Retaining Walls B-3L and B-3R: Boring 45 was drilled in the vicinity of these structures. Approximately 9 feet of fill consisting of silty to clayey sand and sandy clay was encountered. Native soils consisted of medium stiff to very stiff clayey sand, and very loose to medium dense silty to very silty sand with occasional cobbles, and extended to an approximate depth of approximately 44 feet. Very hard claystone bedrock was encountered beneath the overburden soils at a depth of approximately 23 feet, and extended to the maximum 40-foot depth explored. Ground water was encountered at a depth of approximately 23 feet at the time of drilling and when the boring was checked nine days later.

Retaining Wall B-4L: Borings 44 and 48 were drilled in the vicinity of this structure. Borings encountered approximately 2.5 to 21 feet of fill consisting of silty to clayey sand and sandy clay. Native soils consisted of medium stiff to very stiff clayey sand, and very loose to medium dense silty to very silty, gravelly sand with occasional cobble layers, and extended to depths of approximately 25 and 32 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths of approximately 25 and 32 feet, and extended to the maximum 35- to 50-foot depth explored. Ground water was encountered in the borings at depths ranging from 31 to 38 feet when the borings were checked up to 8 days later.

Retaining Wall C-3: Borings 11, 38 and 53 were drilled in the vicinity of this structure. Borings encountered approximately 9.5 to 14 feet of fill consisting of silty to clayey sand. Native soils consisted of soft to hard sandy to very sandy clay, and very loose to medium dense silty to very silty gravelly sand with occasional cobbles, and extended to depths of ranging from approximately 24 to 29 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 24 and 29 feet, and extended to the maximum 35- to 45-foot depth explored. Ground water was encountered in each of the borings at depths ranging from approximately 15 to 29 feet either at the time of drilling or when the borings were checked up to eight days later.

Retaining Wall B-4R: Borings 48, 49, and 50 were drilled in the vicinity of this structure. Borings encountered approximately 2.5 to 12.5 feet of fill consisting of silty to clayey sand and sandy clay. Native soils consisted of very loose to medium dense silty to very silty gravelly sand with occasional cobbles, and extended to depths of ranging from approximately 25 to 43 feet. Very hard claystone bedrock was encountered beneath the overburden soils at depths ranging from approximately 25 and 43 feet, and extended to the maximum 35- to 60-foot depth explored. Ground water was encountered in each of the borings at depths ranging from approximately 23 to 48 feet either at the time of drilling or when the borings were checked up to 8 days later.

FOUNDATION RECOMMENDATIONS

We recommend the proposed bridge structures be founded on either caissons drilled into bedrock and/or driven H-piles bearing in the bedrock. Both the caisson and pile foundation systems will have the advantage that they will experience small total and differential settlements. Caisson shafts will have to be cased during drilling and may require dewatering due to the presence of granular soils and ground water. The presence of ground water above the bearing elevation will not impact construction of pile foundation systems.

Cast-in-place concrete Walls 2, 3, C-3 and B-4R may be supported on H-piles and Wall B-3R may be supported on spread footings, as proposed.

Recommendations for design and construction of drilled caissons, driven H-piles and spread footings are presented below.

Drilled Caissons: The design and construction criteria presented below should be observed for design of drilled caisson foundation systems. The construction details should be considered when preparing project documents.

1. Assuming the load and resistance factor design (LRFD) method will be used, an ultimate end bearing capacity of 180 ksf and an ultimate side resistance of 13.6 ksf may be used. The ultimate values assume a weighted load factor of 1.5, and resistance factors of 0.5 and 0.55 for end bearing and side resistance, respectively. For the allowable stress design (ASD) method, an allowable end bearing pressure of 60 ksf and an allowable side resistance of 5 ksf may be used.
2. Caissons should penetrate at least three pier diameters or 10 feet; whichever is greater, into the bedrock.
3. Assuming a computer program such as LPILE or COM624 is to be used; we recommend the parameters presented in Table II be used for analysis of laterally loaded caissons.
4. If excavations for caisson caps extend into bedrock, a 6-inch void should be provided beneath the caisson cap to concentrate the pier loadings and to separate the expansive bedrock from the bottom of the caisson cap.
5. Closely spaced caissons will require appropriate reductions of the lateral and axial capacities. Reduction in lateral load capacity may be avoided by spacing the caissons at a distance of at least six diameters from center to center in the direction parallel to loading and 2.5 diameters in the direction perpendicular to loading. For axial loading, the caissons should be spaced at a minimum 3 diameters center to center. More closely spaced piers should be studied on an individual basis to determine the appropriate reduction in axial and lateral load design parameters.
6. A minimum caisson diameter of 24 inches is recommended to facilitate proper cleaning and observation of the caisson holes. The caisson length-to-diameter ratio should not exceed 25.
7. Concrete used in the caissons should have a minimum slump in the range of 5 to 7 inches.
8. Based on the results of our field exploration, laboratory testing, analysis and our experience with similar, properly constructed drilled-caisson foundations, we estimate caisson settlement will be low. Generally, we estimate the settlement of caissons 4 feet or less in diameter will be approximately ½ inch or less when

designed according to the criteria presented herein. The settlement of closely spaced caissons will be larger and should be studied on an individual basis.

9. Caisson holes should be properly cleaned prior to the placement of concrete.

10. The presence of water and granular soils in some of the exploratory borings indicates casing and/or dewatering equipment will be required for some of the caissons. In no case should concrete be placed in more than 3 inches of water unless the tremie method is used. If water cannot be removed or prevented with the use of casing or dewatering equipment prior to placement of concrete, the tremie method should be used after the hole has been cleaned.

11. Casing procedures should be evaluated by the geotechnical engineer on piers which will be subjected to lateral loads. Oversizing the portion of the hole in the overburden to allow casing insertion can reduce the lateral pier capacity, particularly if the hole is processed with a dense, viscous mixture of water and soil. Depending on loading conditions and construction practices, densification of the materials around the pier top is sometimes required after construction.

12. When water and/or a drilling slurry is present outside the casing, care should be taken that concrete of sufficiently high slump is placed to a sufficiently high elevation inside the casing and casing is withdrawn slowly to prevent intrusion of the water and/or slurry into the concrete (necking) when the casing is withdrawn.

13. The drilled shaft contractor should mobilize equipment of sufficient size and adequate operating condition to achieve the required penetration in the very hard bedrock.

14. Concrete should be placed in caissons the same day they are drilled. The presence of water or caving soils may require that concrete be placed immediately after the caisson hole is completed. Failure to place concrete the day of drilling will normally result in a requirement for additional bedrock penetration.

15. Large gravel and cobbles were encountered in several of the exploratory borings. These conditions may complicate the drilling process, including affecting plumbness, causing oversize shaft diameters, and reducing the effectiveness of or preventing seating of the casing near the bedrock surface. The drilled shaft contractor should be aware of this information and be prepared for these conditions during pier installation.

16. A representative of the geotechnical engineer should observe pier drilling operations on a full-time basis to assist in identification of adequate bedrock strata and monitor pier construction procedures.

Driven H-Piles: The design and construction details presented below should be observed for design of driven H-piles.

1. The piles should consist of a heavy steel H-section with a commercial pile tip. The commercial pile tip should be adequate to protect the pile through difficult driving conditions in the dense gravels and cobbles.
2. H-piles driven to virtual refusal in the bedrock may be designed to their structural capacity. Virtual refusal is defined in Section 502.05 of the Colorado Department of Transportation's (CDOT) "Standard Specifications for Road and Bridge Construction" (1999). Assuming the LRFD method will be used, ultimate capacities of the piles should be calculated using an ultimate pile stress of 29 ksi for A36 steel or 40 ksi for Grade 50 steel. The ultimate capacity assumes a weighted load factor of 1.6. We recommend a resistance factor of 0.5 be used for pile design. For the ASD method, the allowable service stress should not exceed 25% of the yield strength of steel over the cross sectional area of the pile.
3. The surface of the bedrock should be at least 10 feet below the bottom of the pile cap. Where this condition is not satisfied, each pile location should be predrilled, in accordance with Section 502.06 of the Standard Specifications, to a depth of at least 10 feet below the bottom of the pile cap. Voids remaining between the predrilled hole and the pile after driving should be filled with pea gravel or sand.
4. Based on our field exploration, laboratory testing and experience with similar properly constructed driven pile foundations, we estimate individual pile settlement will be on the order of ½ inch or less when designed according to the criteria presented herein. The settlement of closely spaced piles in groups may be greater and should be studied on an individual basis.
5. Axial pile capacities may be increased by one-third when considering wind and/or earthquake loading.
6. Piles may be designed to resist lateral loads using the parameters presented above under "Drilled Caissons."

7. Resistance to horizontal forces may be provided by battered piles. It is normal to assume a battered pile can resist the same axial load as a vertical pile of the same type and size driven to the same elevation. The vertical and horizontal components of the load will depend on the batter inclinations. Batters should not exceed 1 horizontal to 4 vertical.
8. If excavations for pile caps extend into bedrock, a 6-inch void should be provided beneath the pile cap to concentrate the pier loadings and to separate the expansive bedrock from the bottom of the pile cap.
9. Closely spaced piles will require appropriate reductions of the lateral and axial capacities. Reduction in lateral load capacity may be avoided by spacing piles a center-to-center distance in the direction parallel to loading of at least six times the pile section depth, and at least 2.5 times the section depth in the direction perpendicular to loading. For axial loading, the center-to-center pile spacing should be a minimum three times the section depth. More closely spaced piles should be studied on an individual basis to determine the appropriate reduction in axial and lateral load design parameters.
10. The contractor should select a driving hammer according to the criteria presented in Sections 502.03 and 502.04 of the standard specifications.
11. The pile hammer should be operated at the manufacturer's recommended stroke when measuring penetration resistance for virtual refusal.
12. In the event that predrilling is required in order to terminate the piles in the underlying bedrock as a result of the very dense cobbles and boulders within the overburden soils, predrilling should be performed in accordance with Subsection 502.06 of CDOT Standard Specification for Road and Bridge Construction.
13. Considering the number of piles to be installed on the project, we recommend that at least 4 test piles be driven and tested with a Pile Driving Analyzer (PDA) at the start of construction to determine virtual refusal criteria based on the pile loads, as well as determine the condition of the pile during driving and the efficiency of the hammer. The same pile, pile hammer and cushion should be used for drilling the test piles as will be used to install the foundation piles.
14. The pile driving operations should be observed by a representative of the geotechnical engineer on a full-time basis. Each pile should be observed and

checked for buckling, crimping and alignment in addition to recording penetration resistance and general pile driving operations.

Spread Footings: The existing fill encountered in Borings 44 and 45 appears to be relatively compact. However, in order to provide uniform support for the retaining wall footing, we recommend the footing be supported on a layer of new structural fill. The design and construction details presented below should be observed for spread footings supporting retaining wall B-3R.

1. We recommend the existing soils below foundation bearing level be over excavated to a depth of 3 feet and replaced with compacted fill material consisting of Class I structural backfill. The fill should be compacted in accordance with the requirements of the standard specifications.
2. For the LRFD method of design, we recommend an ultimate bearing capacity of 9,600 psf be used. The ultimate capacity assumes a weighted load factor of 1.6 and a resistance factor of 0.5. For the ASD method, we recommend an allowable soil bearing pressure of 3,000 psf.
3. Footings should be provided with adequate soil cover above their bearing elevation for frost protection. Placements of foundations at least 30 inches below the exterior grade is typically used in this area.
4. The lateral existence of the footings will be a combination of the sliding resistance of the footing on the foundation materials and passive earth pressure against the side of the footing. Resistance to sliding at the bottom of the footings may be calculated based on a coefficient of friction of 0.30. Passive pressure against the side of the footing may be calculated using an equivalent fluid unit weight of 200 pcf. The coefficient for friction and passive values recommended above are working values. Compacted fill placed against the sides of the footings to resist lateral loads should be a nonexpansive, granular material compacted to at least 95% of the maximum standard Proctor density (AASHTO T-99) at a moisture content near optimum.
5. The retaining wall should be reinforced top and bottom to span an unsupported length of at least 10 feet.
6. Areas of noncompact and disturbed fill or deleterious substances encountered within the foundation excavations should be removed and replaced with new structural fill consisting of Class I backfill.

7. Granular foundation soil should be densified with a smooth vibratory compactor prior to placement of concrete.
8. A representative of the geotechnical engineer should observe all footing excavations prior to concrete placement.

CAST-IN-PLACE CONCRETE RETAINING STRUCTURES

We recommend backfill for cast-in-place bridge abutments and retaining walls consist of Class I structure backfill in accordance with Section 703.08 of the standard specifications. Assuming Class I structural backfill is used, we recommend earth retaining structures be designed for an equivalent fluid unit weight of 40 psf for the active condition, 55 psf for the at-rest condition and 45 psf for the intermediate condition. Walls should also be designed for appropriate hydrostatic pressures and surcharge pressures such as traffic, construction materials and equipment using coefficients of lateral earth pressure of 0.31, 0.42 and 0.35 for the active, at rest and intermediate conditions, respectively. The moisture content and compacted density of the backfill should be in accordance with the requirement of Section 203.07 of the standard specifications.

MECHANICALLY STABILIZED EARTH RETAINING WALLS

We recommend the reinforced infill and backfill located within a 45-degree projection extending up from the back of the reinforced zone at the base of the wall consist of CDOT Class I structural backfill compacted according to the criteria required by Section 203.07 of the Standard Specifications. We recommend the walls be designed using an angle of internal friction of 32 degrees and a moist soil unit weight of 130 psf for the Class I backfill material. These criteria assume drained conditions behind the walls. The design should also consider appropriate surcharge pressures such as traffic, construction materials and equipment. Suitable factors of safety should be included in the design. We recommend an angle of internal friction of 28 degrees be used for resistance to base sliding. The wall designer should evaluate the external stability using a factor of safety of 1.5 for base sliding, and a factor of safety of 2.0 for overturning in accordance with AASHTO requirements.

A drain system should be constructed behind the MSE walls. A toe drain consisting of a minimum 4-inch-diameter slotted PVC pipe surrounded with free-draining gravel above the

invert level should be constructed at the base of each wall behind the facia units. The toe drain should be wrapped in filter fabric and should be graded to a gravity outlet. The free-draining gravel layer should consist of a minimum 2-inch material with a maximum of 20% passing the No. 4 sieve and a maximum of 5% passing the No. 200 sieve.

The estimated toe pressures of the MSE walls are less than 3,000 psf, with the exception of Walls 6 and C-2, which have estimated toe pressures of approximately 4,400 psf and 7,500 psf. Based on the conditions encountered in the exploratory borings, it appears the bearing soils for Walls 1, 4 and B-3L, and the Cimarron wall will consist of native granular soils and/or relatively compact granular fill. It appears the leveling pad for these MSE walls may be placed directly on the existing soils or new structural fill. The base of Wall 5 will be located approximately 32 to 37 feet above the existing the grades. In order to reduce post-construction settlement of the wall, we recommend the compressible clay layer encountered in Boring 27 be removed and replaced with structural fill.

Additional subsurface studies should be performed at the locations of Walls 6, C-1 and C-2 in order to finalize the recommendations at these locations. Because of the high estimated toe pressures for Walls 6 and C-2, approximately 4,400 and 7,500 psf, respectively, we anticipate overexcavation of the foundation soils and replacement with Class I structural backfill will be required. For Wall C-2, geogrid reinforcement of the fill may be necessary. All of the compressible clay, similar to that encountered in Boring 27, should be removed from below Wall C-2.

Except where Class I backfill is required, all structural fill placed for support of the MSE walls should consist of a nonexpansive, granular material with AASHTO classifications of A-1, A-3, A-2-4 or A-2-5. All structural fill placed for support of the MSE walls should be in accordance with the requirements of Section 203.07 of the Standard Specifications. In general, all loose, soft or compressible soils and other deleterious materials encountered within the foundation excavations should be removed and replaced with nonexpansive structural fill material. A representative of the geotechnical engineer should observe excavations prior to fill placement and wall erection.

WATER SOLUBLE SULFATES

The concentration of water soluble sulfates measured in 36 samples obtained from the exploratory borings ranged from less than approximately 0.02% to 1.07%. These concentrations of water soluble sulfates represent a negligible to severe degree of sulfate attack on concrete exposed to these materials. A total of four of these samples are classified as having a severe degree of sulfate attack, one sample was classified as having a positive degree of sulfate attack, and the remaining samples are classified as having a negligible degree of sulfate attack. The degree of attack is based on a range of negligible, positive, severe and very severe as presented in the U.S. Bureau of Reclamation Concrete Manual. Based on this information, we recommend all concrete exposed to the on-site materials contain ASTM C 150 Type II cement or an appropriate blended cement intended for moderate sulfate resistance in accordance with ASTM C 595. Concrete should have a minimum cement content of 564 pounds (6 sacks) per cubic yard, have a maximum water-cement ratio (by weight) of 0.50, and have air entrainment.

EMBANKMENTS

All areas to receive fill should be stripped of topsoil and organic matter, and prepared in accordance with Section 203.06 of the Standard Specifications. Most of the existing fill encountered in our exploratory borings appeared to be relatively compact; however, field density testing should be performed at the time of construction to verify the condition of the fill. Embankments placed on slopes steeper than 4:1 should be keyed into the slope in accordance with Section 203.07. After each bench is cut into the slope, the materials exposed in the bench should be inspected for any weak or disturbed materials. If encountered, such materials should be removed. We recommend all embankment fill have a minimum R-value of 20. Compaction of all fill should be in accordance with Section 203.07 of the Standard Specifications.

Boring 27 drilled at the west end of the north abutment of the I-25 bridge over Cimarron Street contained an approximately 10-foot-thick layer of weak, compressible clay. Such materials may also be found at other locations and may require similar treatment as discussed below. In order to reduce post-construction settlement of the approach fill at the north abutment, we recommend this clay layer be removed prior to constructing the embankment at this location. Alternatively, a surcharge fill could be constructed to reduce

the post-construction settlements. Approximately 10- to 15-foot-thick layers of relatively compressible soils were also encountered in Borings 50 through 53, drilled at the I-25 bridge over Colorado Avenue, below depths of approximately 15 to 20 feet. We recommend consideration be given to constructing a surcharge fill at the abutments in order to reduce post-construction settlements at this structure.

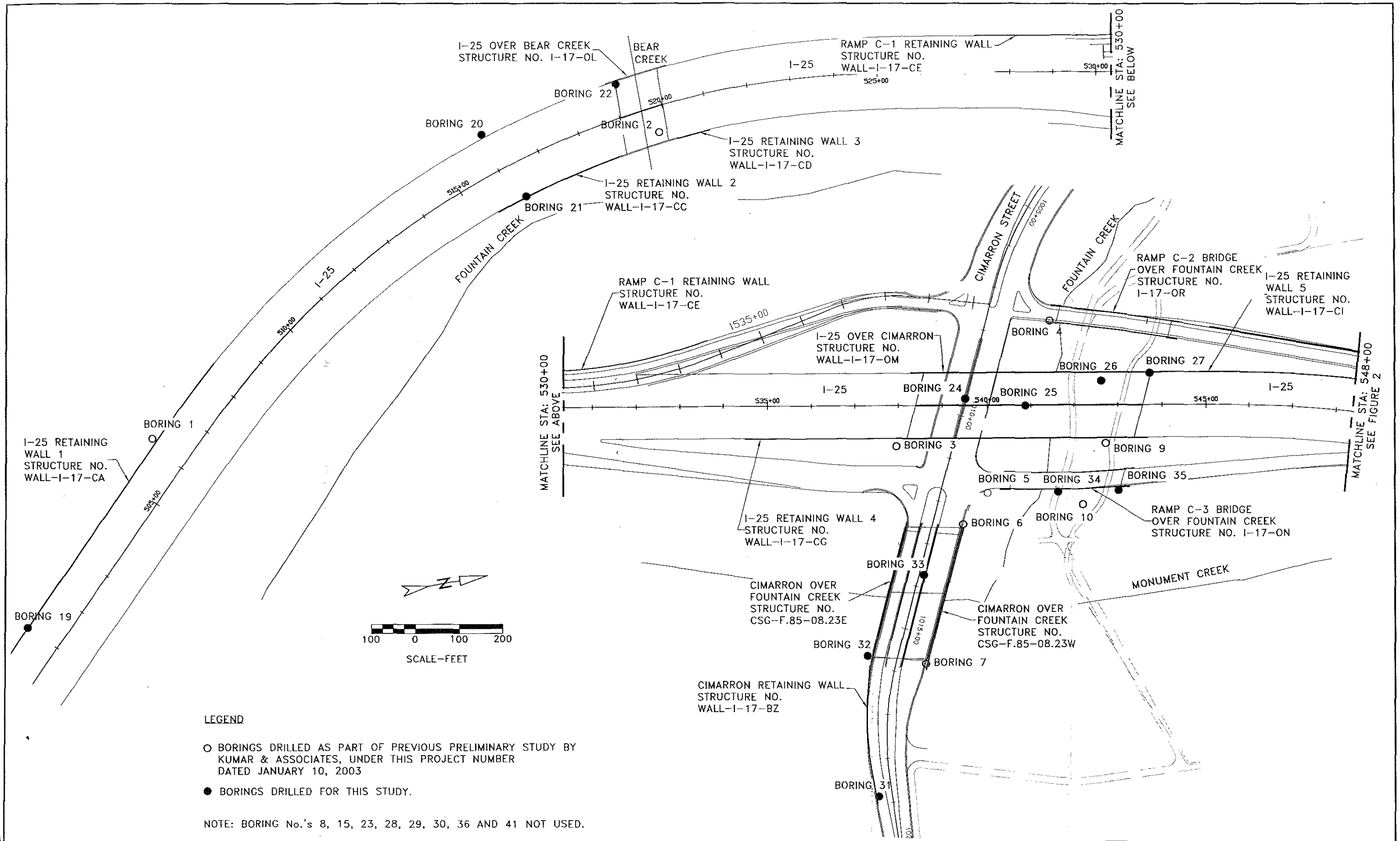
ADDITIONAL STUDIES

Exploratory borings should be drilled for Retaining Walls 6, C-1 and C-2, and additional borings should be drilled for the bridge structures and some of the retaining structures in order to confirm the recommendations provided in this report. We are available to provide a proposal for the additional scope of work for these structures.

LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory borings drilled at the locations indicated on Figures 1 and 2 and the proposed type of construction. The nature and extent of subsurface variations across the site may not become evident until excavation is performed. If during construction, fill, soil, rock or water conditions appear to be different from those described herein, this office should be advised at once so reevaluation of the recommendations may be made. We recommend on-site observation of excavations by a representative of the geotechnical engineer.

DC/BB/JS:pw

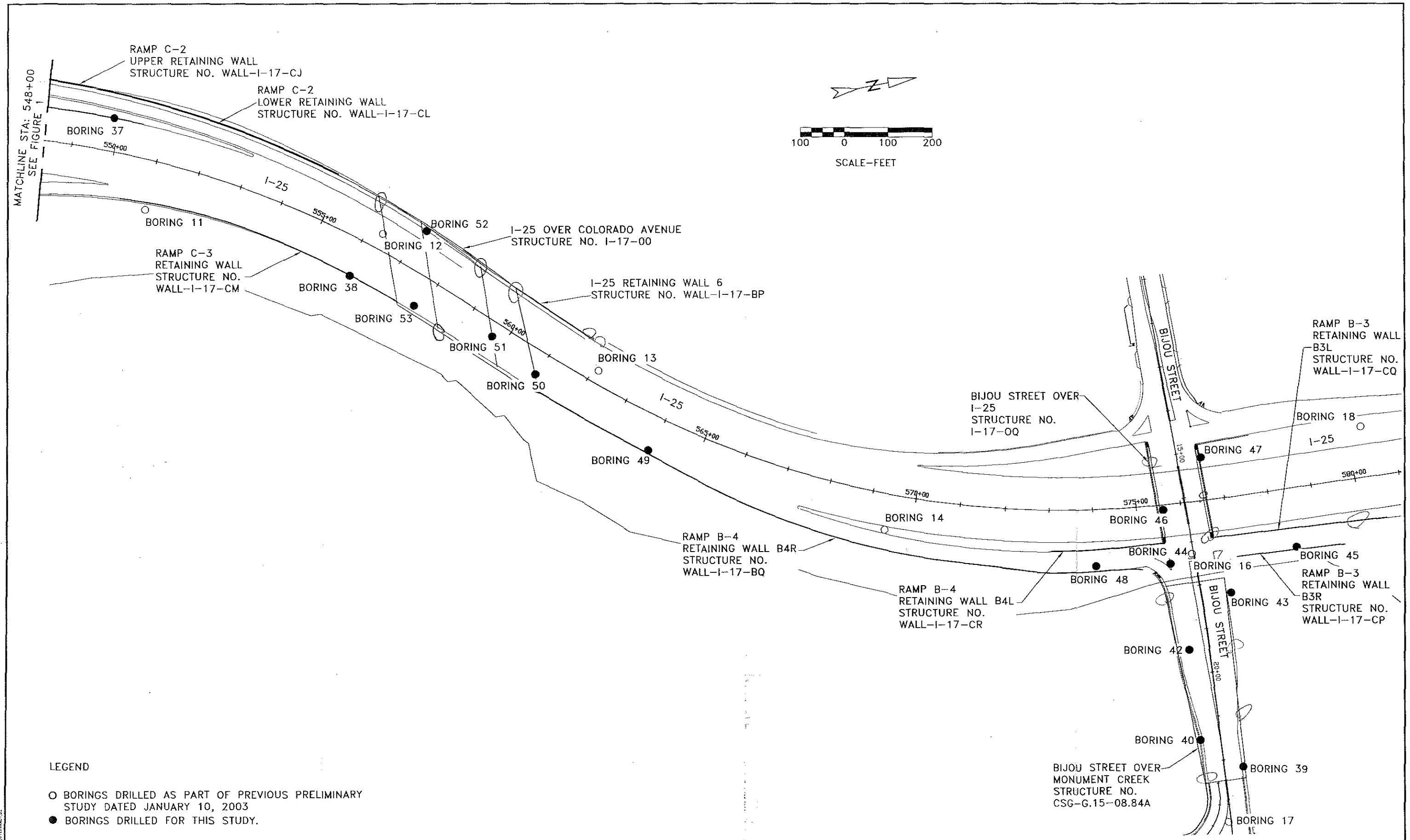


LEGEND

- O BORINGS DRILLED AS PART OF PREVIOUS PRELIMINARY STUDY BY KUMAR & ASSOCIATES, UNDER THIS PROJECT NUMBER DATED JANUARY 10, 2003
- ● BORINGS DRILLED FOR THIS STUDY.

NOTE: BORING No.'s 8, 15, 23, 28, 29, 30, 36 AND 41 NOT USED.

012-266	Kumar & Associates		LOCATION OF EXPLORATORY BORINGS	Fig. 1

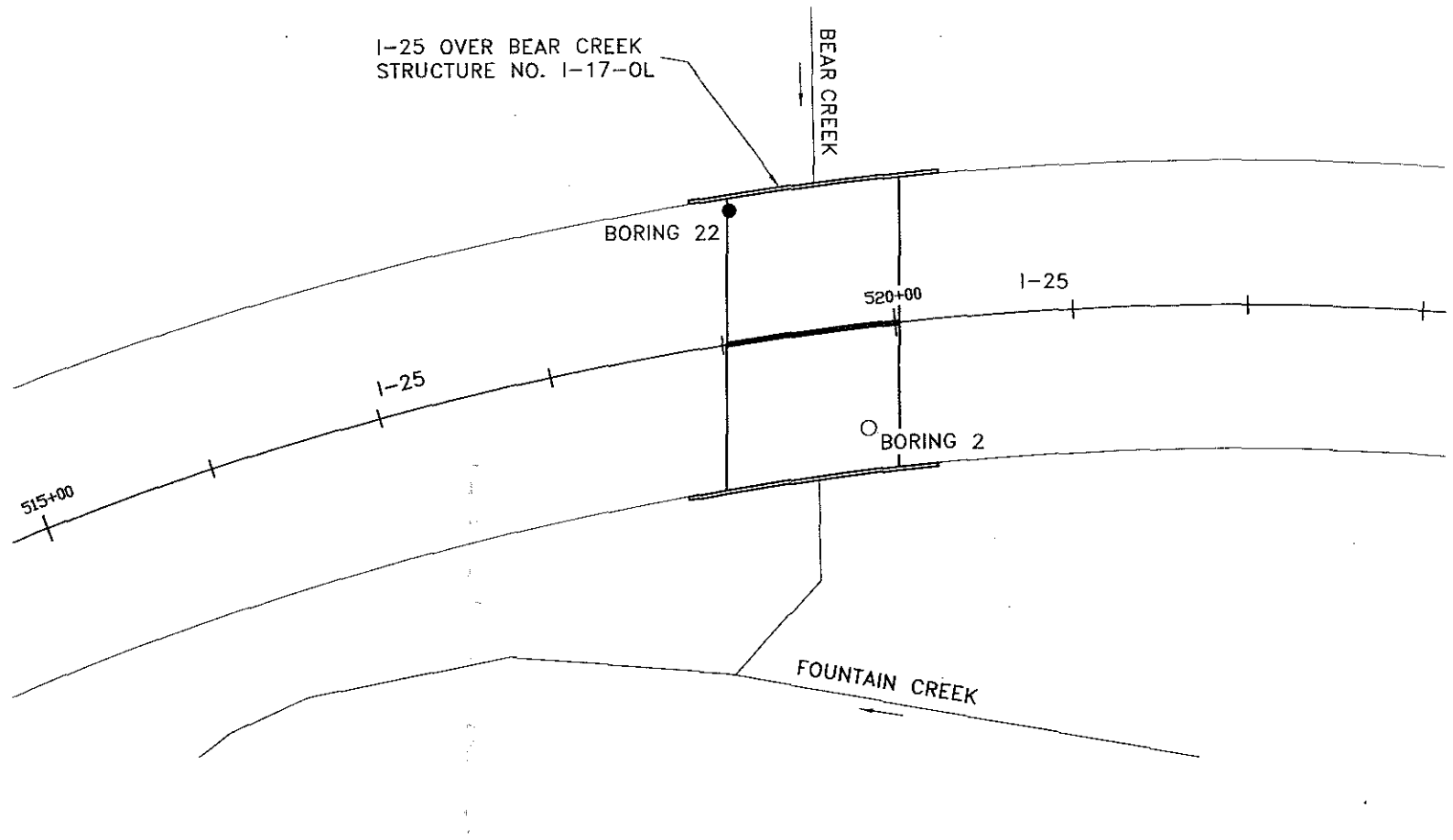


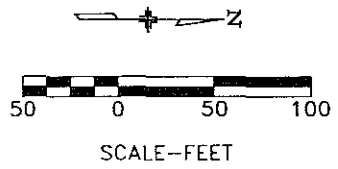
LEGEND

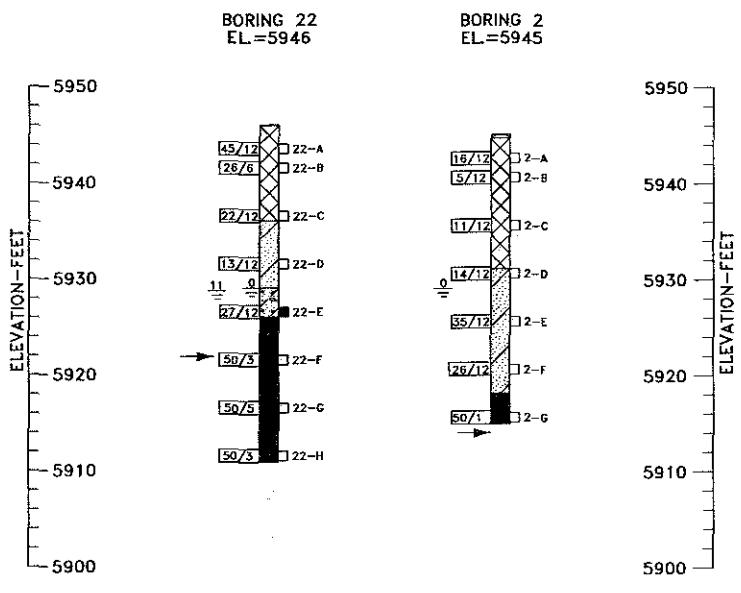
O BORINGS DRILLED AS PART OF PREVIOUS PRELIMINARY STUDY DATED JANUARY 10, 2003

● BORINGS DRILLED FOR THIS STUDY.

012-266	Kumar & Associates		LOCATION OF EXPLORATORY BORINGS	Fig. 2







TYPE OF MATERIAL

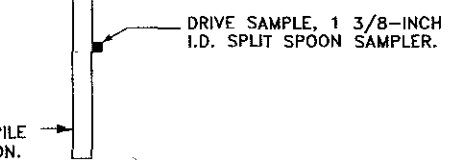
LEGEND

- ASPHALT.
- TOPSOIL.
- FILL: CLAYEY SAND TO CLAYEY, SANDY GRAVEL, MOIST TO WET, REDDISH BROWN TO BROWN.
- SAND (SP-SM), SILTY, OCCASIONALLY GRAVELLY, LOOSE TO DENSE, MOIST TO WET, LIGHT BROWN TO REDDISH BROWN.
- GRAVEL (GC), CLAYEY, SANDY, MEDIUM DENSE, WET, BROWN.
- CLAYSTONE BEDROCK, VERY HARD, MOIST, GRAY.

LEGEND AND NOTES

DRIVE SAMPLE BLOW COUNT. INDICATES THAT 45 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORING 2 WAS DRILLED IN FEBRUARY, 2002, AND BORING 22 WAS DRILLED IN AUGUST 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
2-B	4	11.9	115.7	19	54	27	29	12		A-2-6 (0)	Fill: gravelly, clayey sand
2-E	19	7.1	130.3	59	38	3		NP	0.05	A-1-a (0)	Sandy gravel
22-B	4	5.3	121.1	40	39	21	32	18	0.03	A-2-6 (0)	Fill: clayey, sandy gravel
22-E	19	17.1		44	30	26	31	15		A-2-6 (0)	Clayey, sandy gravel
22-G	29	17.2	112.3			99	66	42		A-7-6 (48)	Claystone

(Preliminary Stage Only)

Revision Dates

QUANTITIES: Initial / Date; Quantities by; Checked by

DETAIL: Initial / Date; Detailed by; Checked by

DESIGN: Initial / Date; Designed by; Checked by

WILSON & COMPANY — FELSBURG HOLT & ULLEVIG

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Last Modification Date:	Initials:
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Acad Ver. R2000i Scale: 1:100	Units: FEET

Index of Revisions

DEPARTMENT OF TRANSPORTATION Region 2

K&A Kumar and Associates, Inc. Geotechnical & Environmental Engineers
3015 PENNSYLVANIA AVENUE
COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

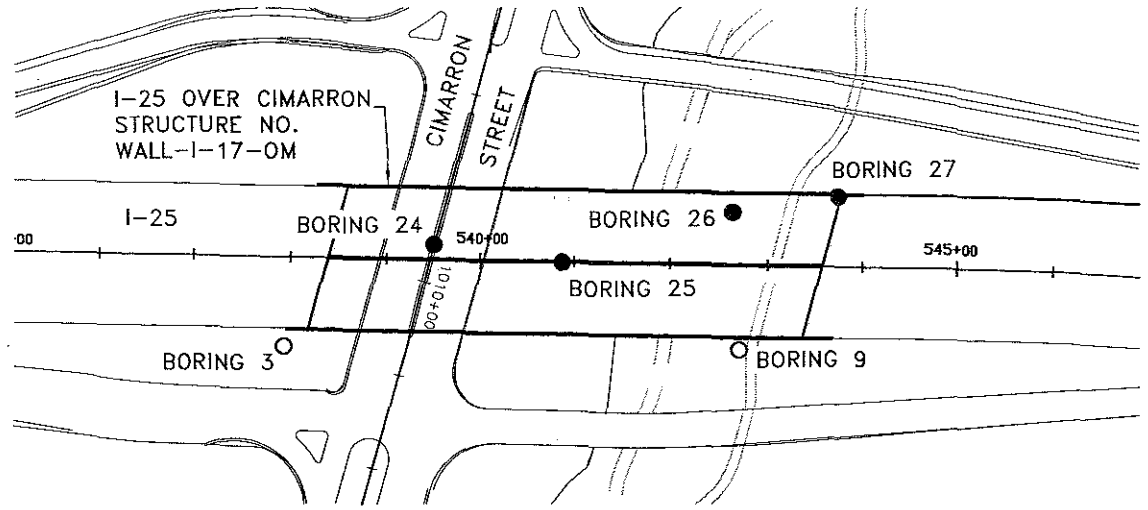
As Constructed
No Revisions:
Revised:
Void:

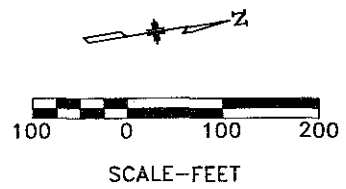
I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
I-25 BRIDGE OVER BEAR CREEK

Geologist: AB/JS	Structure Numbers	I-17-OL	
Drafter: CLP			
Sheet Subset:	Subset Sheets:	of	

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 3





TYPE OF MATERIAL

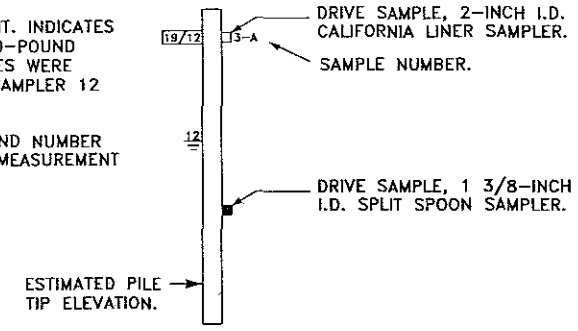
LEGEND

- ASPHALT
- BASE COURSE.
- FILL: SANDY GRAVEL AND CLAYEY SAND, OCCASIONALLY GRAVELLY, MOIST, BROWN TO DARK BROWN.
- FILL: SLIGHTLY SANDY TO SANDY CLAY, OCCASIONALLY GRAVELLY, MOIST TO WET, BROWN.
- SAND (SP/SP-SM/SM), CLEAN TO SILTY, OCCASIONAL GRAVEL AND COBBLES, VERY LOOSE TO DENSE, MOIST TO WET, BROWN TO REDDISH BROWN.
- SAND (SM-SC), SILTY TO CLAYEY, OCCASIONAL GRAVEL AND COBBLES, VERY DENSE, MOIST TO WET, BROWN.
- GRAVEL (GP), SANDY, MEDIUM DENSE TO VERY DENSE, DRY TO WET, REDDISH BROWN.
- CLAY (CL), SANDY, SOFT TO MEDIUM STIFF, MOIST, BROWN.
- CLAYSTONE BEDROCK, VERY HARD, MOIST, GRAY.

LEGEND AND NOTES

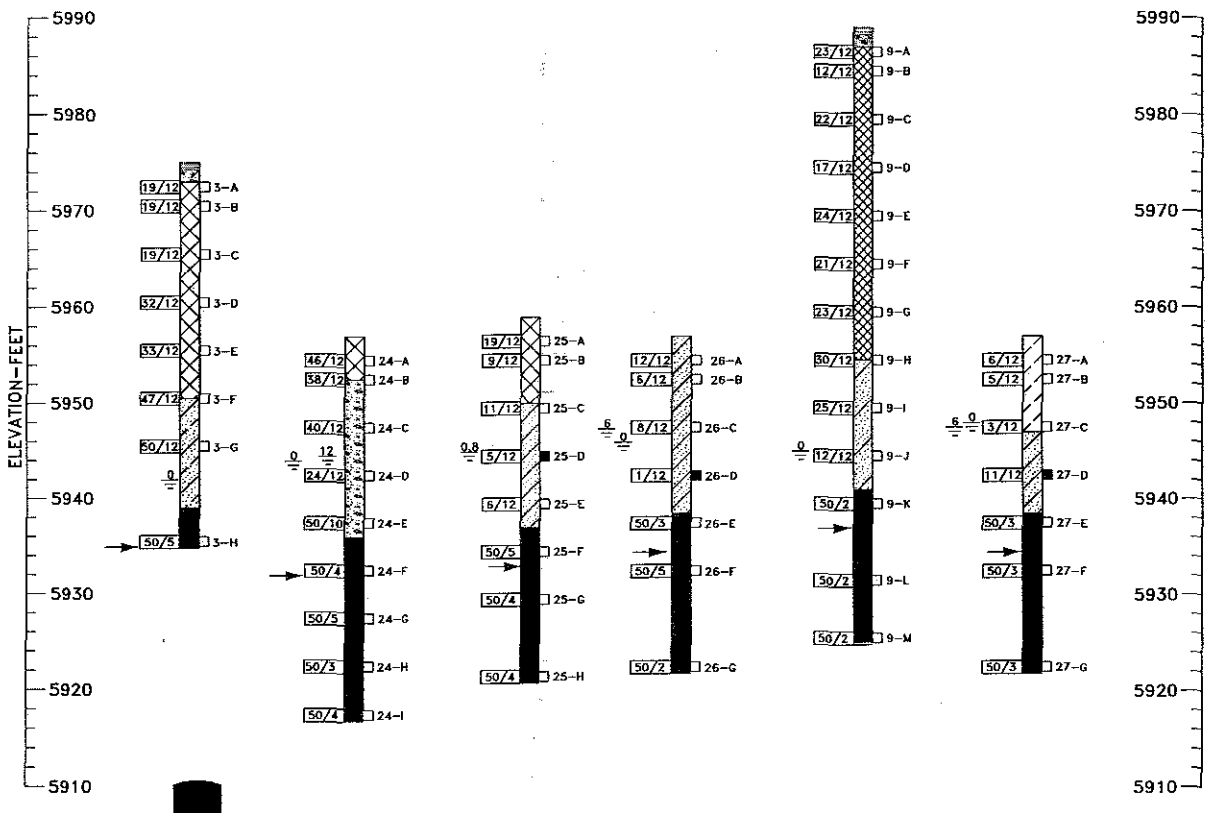
DRIVE SAMPLE BLOW COUNT. INDICATES THAT 19 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORINGS 3 AND 9 WERE DRILLED IN JANUARY, 2002, AND BORINGS 24 THROUGH 27 WERE DRILLED IN AUGUST 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER AND 3.25-INCH HOLLOW STEM AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.



SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
3-B	4	9.4	121.1	28	39	33	37	23	<0.02	A-2-6 (2)	Fill: Gravelly, clayey sand
3-D	14	7.5	128.8	17	58	25	28	11		A-2-6 (0)	Fill: Gravelly, clayey sand
3-F	24	12.3	118.5	1	61	38	28	7	0.05	A-4 (0)	Clayey sand
3-H	39	21.2	104.4			99	55	26		A-7-6 (31)	Claystone
9-B	4	18.6	108.2			63	48	27		A-7-6 (15)	Fill: sandy clay
9-G	29	22.1	103.0			88	54	31		A-7-6 (30)	Fill: slightly sandy clay
9-H	34	15.4	112.0						0.07		Silty sand
9-J	44	9.9	110.6	25	71	4		NP		A-1-a (0)	Gravelly sand
9-L	57	15.8	113.6			94	54	35		A-7-6 (36)	Claystone
24-D	14	8.1	121.3	64	32	4		NP		A-1-a (0)	Sandy gravel
24-G	29	13.9	117.5			84	59	35	0.06	A-7-6 (32)	Claystone
25-B	4	12.7	115.8	56	41	3	37	22		A-2-6 (0)	Fill: sandy gravel
25-F	24	13.7	119.2			62	47	19	0.02	A-7-6 (11)	Claystone
26-D	14			53	32	15		NP		A-1-b (0)	Silty sandy gravel
26-F	24	12.5	125.1			44	49	28	<0.02	A-7-6 (7)	Claystone
27-B	4	27.4	88.3								Sandy clay
27-C	9	28.6	92.2			51	30	14	0.03	A-6 (4)	Very sandy clay
27-E	19	17.7	109.1			80	43	23		A-7-6 (18)	Claystone

(Preliminary Stage Only)

Revision Dates	Date

QUANTITIES	Initial	Date
Quantities by		
Checked by		

DETAIL	Initial	Date
Detailed by		
Checked by		

DESIGN	Initial	Date
Designed by		
Checked by		

WILSON & COMPANY

FELSBURG HOLT & ULLEVIG

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Region 2

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(719) 632-7009

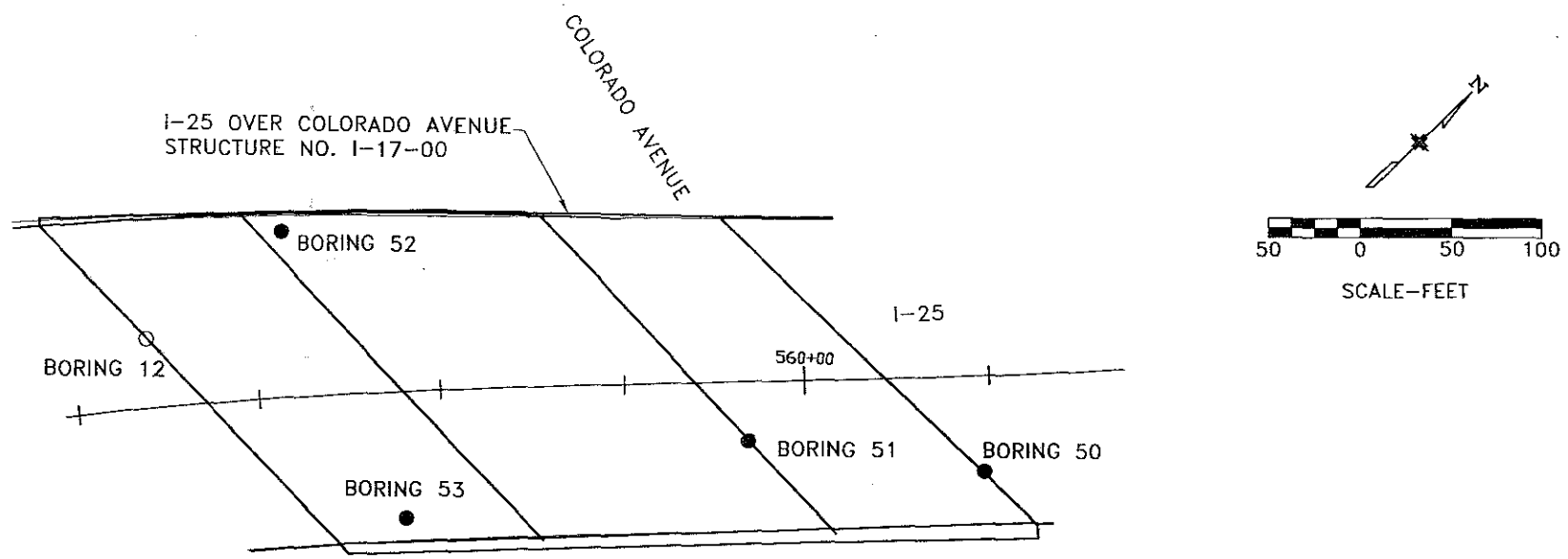
As Constructed	
No Revisions:	
Revised:	
Void:	

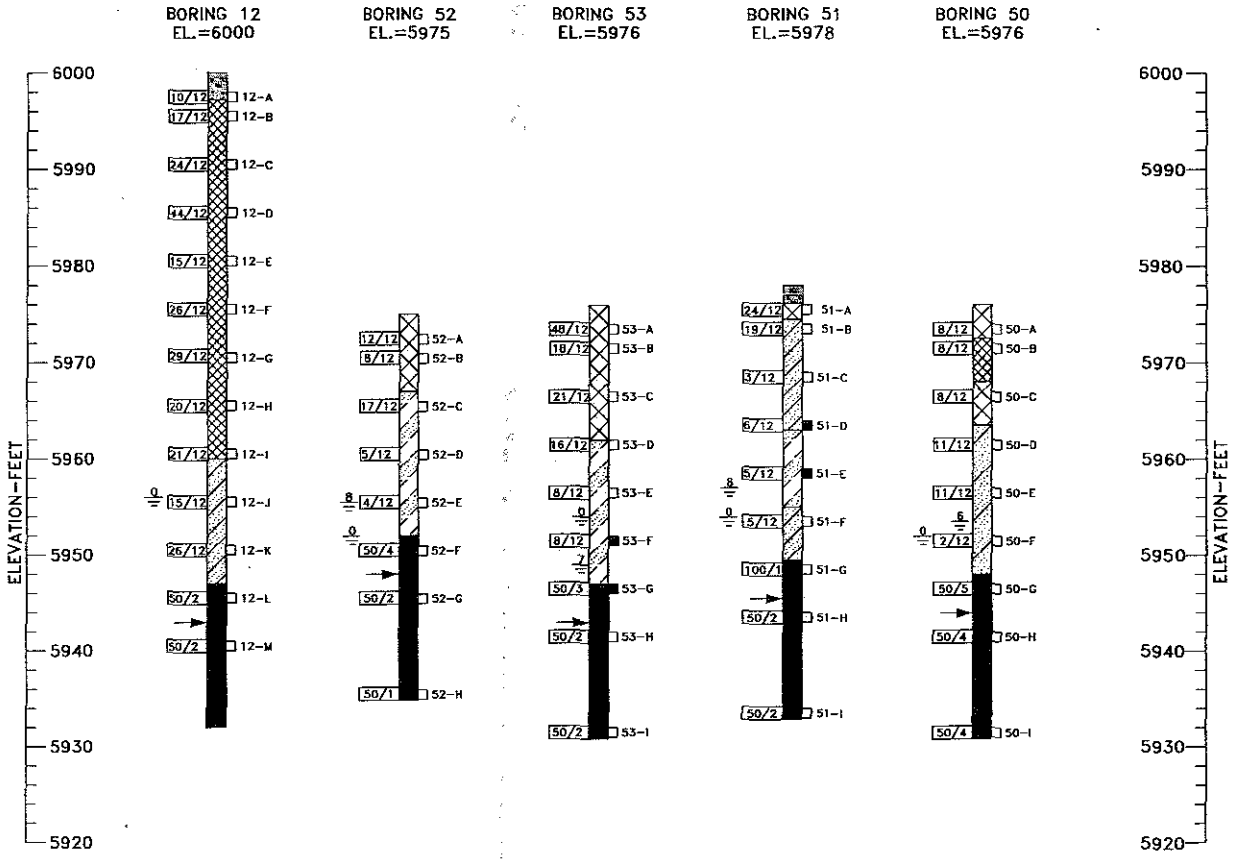
I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
I-25 BRIDGE OVER CIMARRON STREET

Geologist: AB/JS	Structure Numbers	I-17-OM	
Drafter: CLP			
Sheet Subset:	Subset Sheets:		of

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 4





TYPE OF MATERIAL

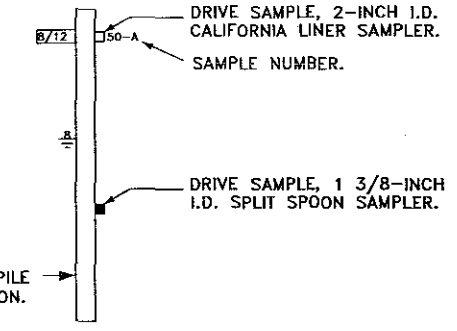
LEGEND

- ASPHALT
- BASE COURSE.
- FILL: SILTY SAND, OCCASIONALLY GRAVELLY, DRY TO SLIGHTLY MOIST, RED-BROWN AND DARK BROWN.
- FILL: SANDY CLAY, SLIGHTLY MOIST, BROWN.
- SAND (SP-SM/SM), SLIGHTLY SILTY TO VERY SILTY, VERY LOOSE TO MEDIUM DENSE, SLIGHTLY MOIST TO WET, TAN, OLIVE-BROWN AND RED-BROWN.
- CLAY (CL), VERY SANDY AND SAND (SC), CLAYEY, MEDIUM STIFF TO VERY STIFF, SLIGHTLY MOIST TO WET, OLIVE-BROWN TO TAN AND GRAY.
- CLAYSTONE BEDROCK, VERY HARD, SLIGHTLY MOIST TO MOIST, GRAY TO DARK GRAY.

LEGEND AND NOTES

DRIVE SAMPLE BLOW COUNT. INDICATES THAT 8 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORING 12 WAS DRILLED IN JANUARY, 2002, AND THE REMAINING BORINGS WERE DRILLED IN AUGUST, 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER AND 3.25-INCH HOLLOW STEM AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
12-D	14	19.4	103.4	5	22	73	51	31		A-7-6 (22)	Fill: slightly gravelly, sandy clay
12-J	44	25.7	95.2			49	25	5		A-4 (0)	Very silty sand
12-L	54	11.1	118.4			82	42	22	0.04	A-7-6 (18)	Claystone
50-F	24	27.8	92.9	4	55	41	21	2		A-4 (0)	Very silty sand
50-H	34	10.8	112.0			96	64	44		A-7-6 (47)	Claystone
51-D	14	2.8	92.1					NP			Silty sand
52-E	19	31.6	88.7			64	34	18	0.03	A-6 (9)	Sandy clay
52-F	24	15.4	116.5			76	40	18		A-6 (13)	Claystone
53-E	19	21.2	95.8			60	34	18	0.07	A-6 (8)	Very sandy clay
53-H	34	15.1	114.3			63	49	26		A-7-6(15)	Claystone

(Preliminary Stage Only)

Revision Dates

QUANTITIES Initial Date | Quantities by | Checked by

DETAIL Initial Date | Detailed by | Checked by

DESIGN Initial Date | Designed by | Checked by

WILSON & COMPANY

FELSBURG HOLT & ULLEVIG

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Acad Ver. R2000i Scale: 1:100	Units: FEET

Index of Revisions

DEPARTMENT OF TRANSPORTATION Region 2

K&A Kumar and Associates, Inc. Geotechnical & Environmental Engineers
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COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

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No Revisions:
Revised:
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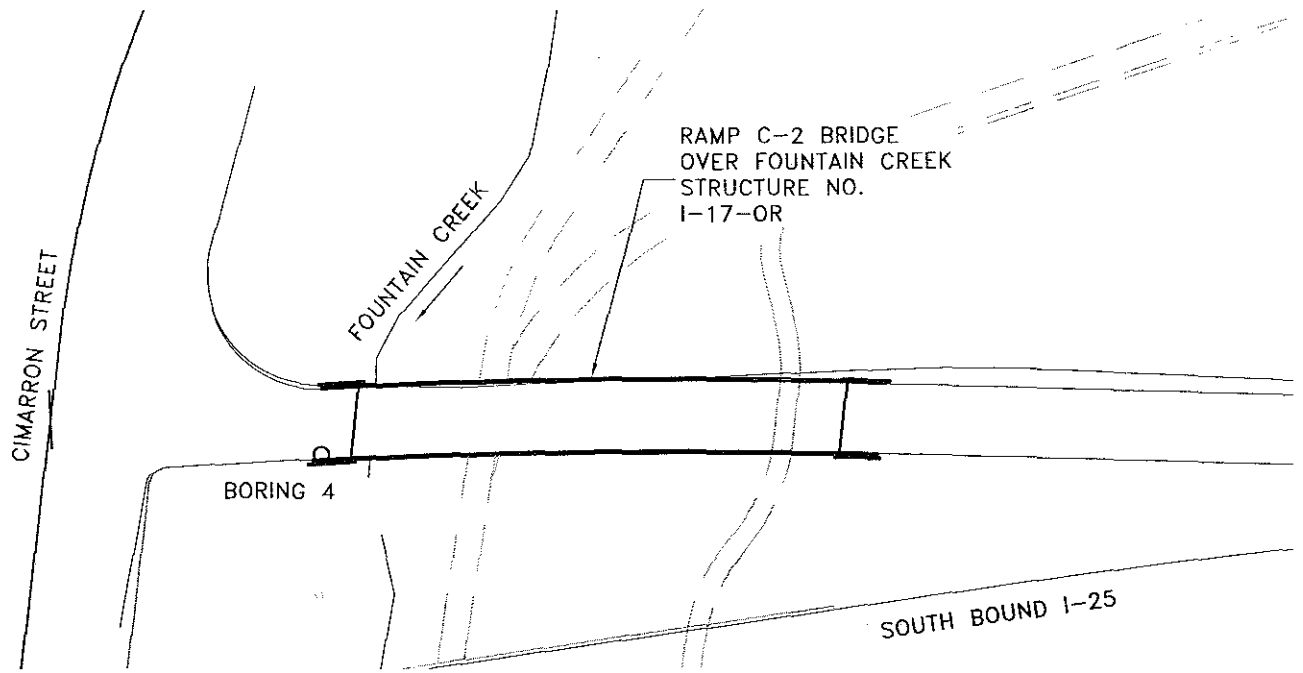
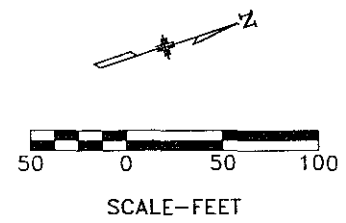
I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
I-25 BRIDGE OVER COLORADO AVENUE

Geologist: AB/JS	Structure Numbers	I-17-00	
Drafter: CLP			
Sheet Subset:	Subset Sheets:	of	

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 5





TYPE OF MATERIAL

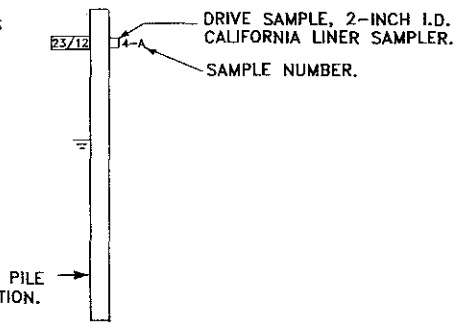
LEGEND

- ASPHALT
- BASE COURSE.
- FILL: CLAYEY SAND, OCCASIONALLY SLIGHTLY GRAVELLY TO GRAVELLY, MOIST TO WET, REDDISH BROWN TO BROWN.
- SAND (SM-SC), SILTY AND CLAYEY, OCCASIONALLY GRAVELLY TO VERY GRAVELLY, OCCASIONAL CLAY AND SILT LENSES, VERY STIFF, LIGHT BROWN TO BROWN.
- CLAYSTONE BEDROCK, VERY HARD, MOIST, GRAY.

LEGEND AND NOTES

DRIVE SAMPLE BLOW COUNT. INDICATES THAT 23 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

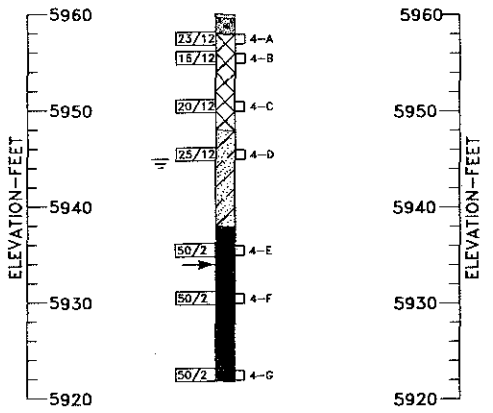
DEPTH TO WATER LEVEL AT TIME OF DRILLING.



NOTES

1. THE EXPLORATORY BORING WAS DRILLED IN FEBRUARY, 2002, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATION OF THE EXPLORATORY BORING WAS MEASURED APPROXIMATELY BY TAPING FROM FEATURES SHOWN ON THE SITE PLAN PROVIDED.
3. THE ELEVATION OF THE EXPLORATORY BORING WAS OBTAINED BY INTERPOLATION BETWEEN CONTOURS ON THE PLAN PROVIDED.
4. THE EXPLORATORY BORING LOCATION AND ELEVATION SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
5. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOG REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
6. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME OF DRILLING. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

BORING 4
EL.=5960



SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
4-D	14	18.0	108.2	22	58	20	27	6		A-2-4 (0)	Clayey, gravelly sand
4-F	24	13.5	118.7			45	43	23	<0.02	A-7-6 (6)	Claystone

DESIGN: Initial, Date; Designed by; Checked by

DETAIL: Initial, Date; Detailed by; Checked by

QUANTITIES: Initial, Date; Quantities by; Checked by

Revision Dates (Preliminary Stage Only)

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Acad Ver. R2000i Scale: 1:100	Units: FEET

Index of Revisions

CDOT DEPARTMENT OF TRANSPORTATION Region 2

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COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

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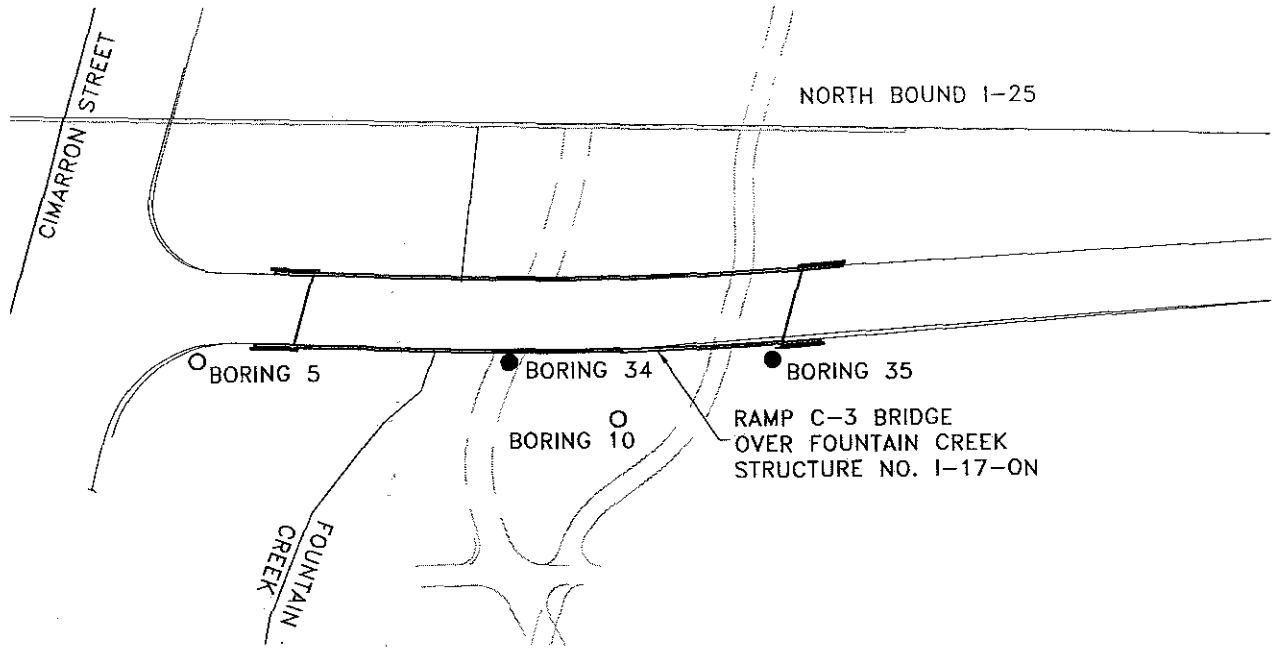
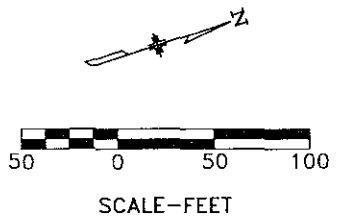
I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
RAMP C-2 BRIDGE OVER FOUNTAIN CREEK

Geologist: AB/JS	Structure Numbers	I-17-OR	
Drafter: CLP			
Sheet Subset:	Subset Sheets:	of	

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 6





TYPE OF MATERIAL

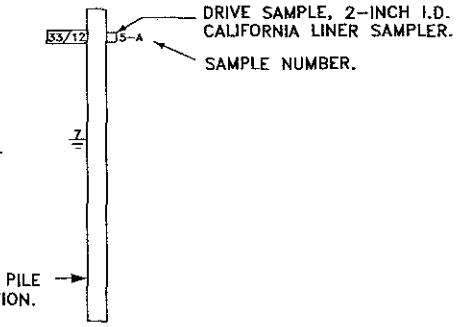
LEGEND

- ASPHALT
- BASE COURSE.
- FILL: SILTY TO VERY CLAYEY SAND, OCCASIONALLY GRAVELLY, DRY TO MOIST, REDDISH-BROWN AND BLACK.
- FILL: SANDY TO VERY SANDY CLAY, OCCASIONALLY GRAVELLY, SLIGHTLY MOIST TO MOIST, TAN AND BROWN.
- SAND (SM); SILTY TO VERY SILTY, LOOSE TO MEDIUM DENSE, SLIGHTLY MOIST TO WET, TAN TO REDDISH-BROWN.
- SAND (SC-SM), SILTY AND CLAYEY, OCCASIONALLY GRAVELLY, STIFF TO VERY STIFF, MOIST TO WET, BROWN TO LIGHT BROWN.
- CLAYSTONE BEDROCK WITH OCCASIONAL INTERBEDS OF SANDSTONE, VERY HARD, SLIGHTLY MOIST TO MOIST, GRAY TO DARK GRAY.

LEGEND AND NOTES

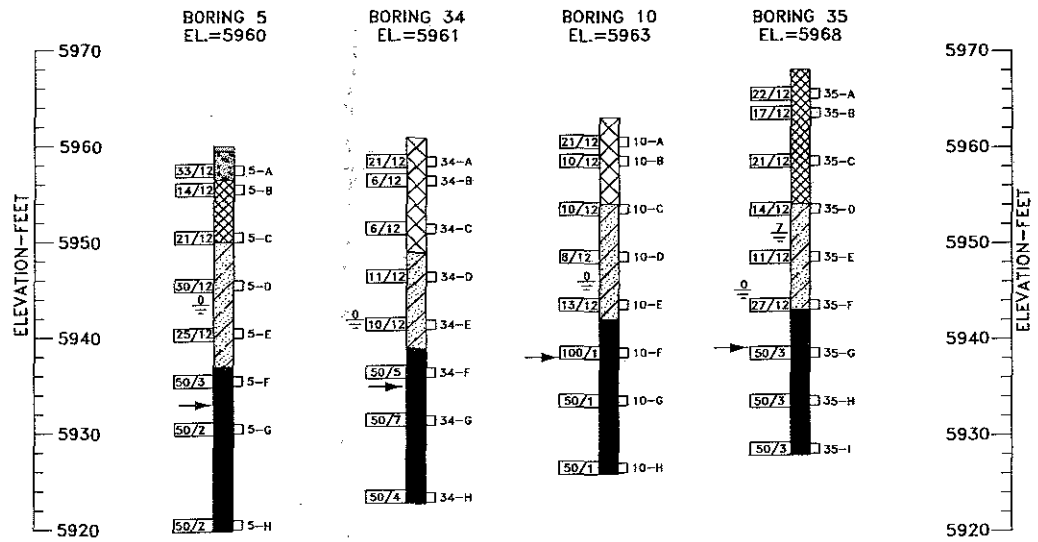
DRIVE SAMPLE BLOW COUNT. INDICATES THAT 33 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORINGS 5 AND 10 WERE DRILLED IN JANUARY AND FEBRUARY 2002, AND BORINGS 34 AND 35 WERE DRILLED IN AUGUST 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER AND 3.25-INCH HOLLOW STEM AUGER.
2. THE LOCATIONS AND EVLEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.



SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
5-C	9	20.2	105.3	9	27	64	50	29	0.25	A-7-6 (17)	Fill: slightly gravelly, sandy clay
5-H	39	8.9	130.1			19	40	22			Sandstone
10-C	9	14.9	100.4			45	25	5		A-4 (0)	Very silty sand
10-F	24	14.0	109.8			50	44	20	0.14	A-7-6 (7)	Claystone
34-C	9	17.6	98.7	1	52	47	29	11	0.26	A-6 (2)	Fill: very clayey sand
34-F	24	13.9	115.7			99	49	28		A-7-6 (31)	Claystone
35-C	9	16.3	80.9			60	46	32	0.09	A-7-6 (16)	Fill: very sandy clay
35-E	19	19.2	98.9	0	58	42	25	7		A-4 (0)	Very clayey sand
35-G	29	12.1	99.2			85	49	29		A-7-6 (26)	Claystone

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Revision Dates (Preliminary Stage Only)

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FELSBURG HOLT & ULLEVIG

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DEPARTMENT OF TRANSPORTATION
Region 2

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3015 PENNSYLVANIA AVENUE
COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

As Constructed
No Revisions:
Revised:
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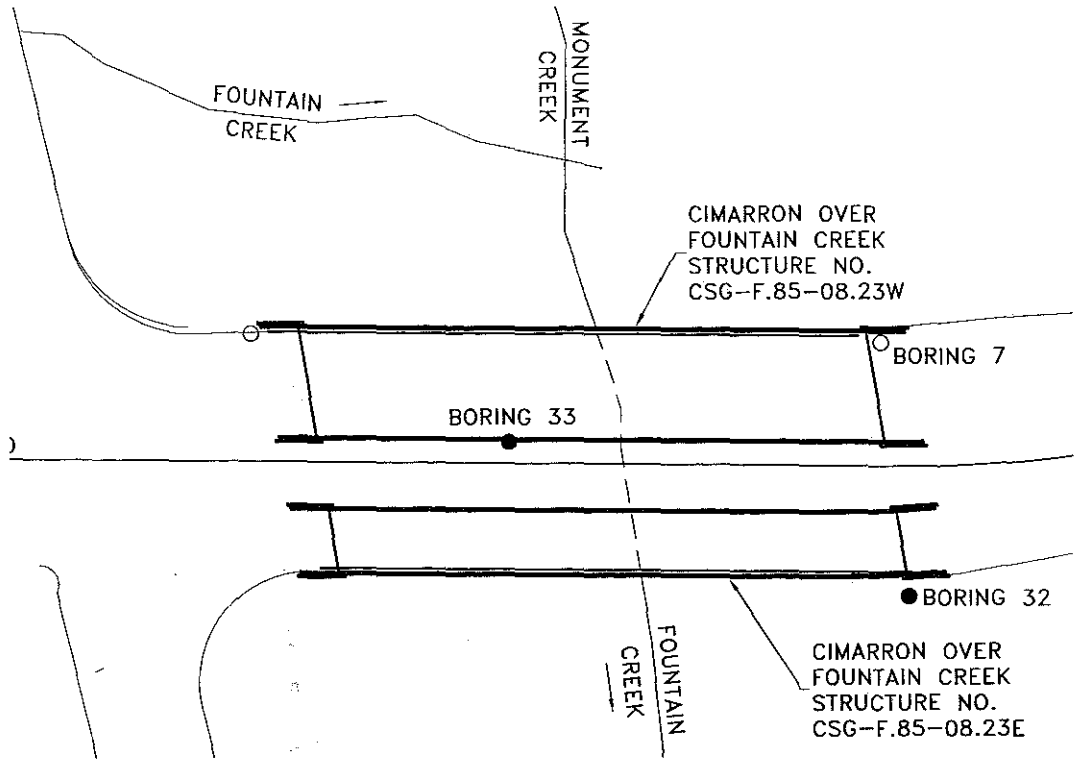
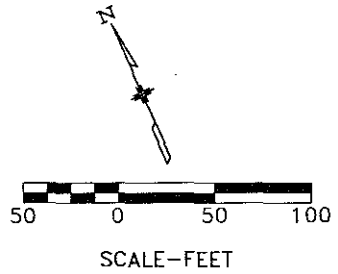
I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
RAMP C-3 BRIDGE OVER FOUNTAIN CREEK

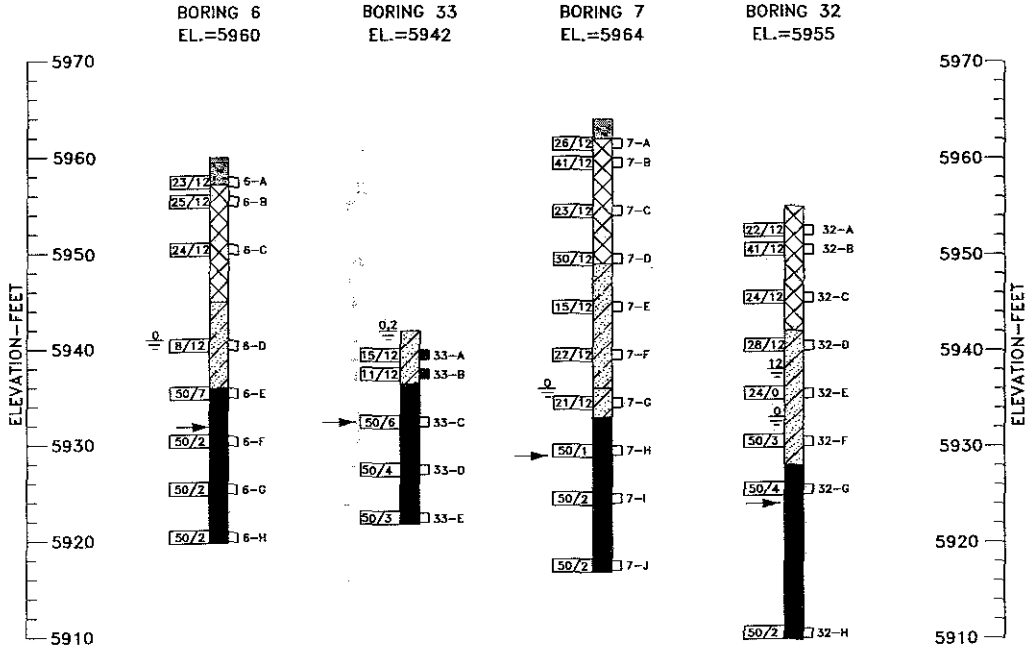
Geologist: AB/JS | Structure Numbers: I-17-ON
Drafter: CLP
Sheet Subset: | Subset Sheets: of

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 7







TYPE OF MATERIAL

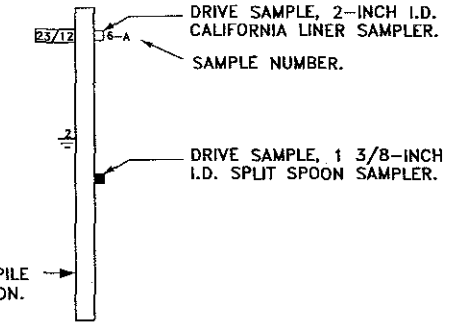
LEGEND

- ASPHALT
- BASE COURSE.
- FILL: SILTY TO VERY CLAYEY SAND, OCCASIONALLY GRAVELLY, DRY TO MOIST, TAN TO BROWN.
- SAND (SP-SM,SM), SLIGHTLY SILTY TO SILTY SAND, WITH OCCASIONAL GRAVEL AND COBBLE LAYERS, MEDIUM DENSE TO DENSE, SLIGHTLY MOIST TO WET, TAN TO REDDISH-BROWN.
- SAND (SC-SM), SILTY AND CLAYEY, OCCASIONALLY GRAVELLY, STIFF TO VERY STIFF, MOIST TO WET, BROWN TO LIGHT BROWN.
- CLAYSTONE BEDROCK, VERY HARD, SLIGHTLY MOIST, GRAY.

LEGEND AND NOTES

DRIVE SAMPLE BLOW COUNT. INDICATES THAT 23 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORINGS 6 AND 7 WERE DRILLED IN JANUARY AND FEBRUARY 2002, AND BORINGS 32 AND 33 IN AUGUST 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER AND 3.25-INCH HOLLOW STEM AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
6-A	2	5.0	122.7	26	64	10	21	6		A-2-4 (0)	Fill: slightly clayey, gravelly sand
6-D	19	18.9	105.3	9	67	24	34	16		A-2-6 (1)	Slightly gravelly, clayey sand
7-C	9	9.7	111.7	13	57	30	38	26	1.07	A-2-6 (2)	Fill: gravelly, clayey sand
7-F	24	13.9	109.4			29	27	7			Clayey sand
7-I	39	14.5	101.2			99	52	26		A-7-6 (30)	Claystone
32-D	14	3.8	102.7	3	84	13		NP		A-1-a (0)	Silty sand
32-H	44	19.6	110.2			91	83	66	0.04	A-7-6 (66)	Claystone
33-A	2	5.0		46	35	19	24	5		A-1-b (0)	Silty sandy gravel
33-D	14	14.8	118.5			99	48	27	<0.02	A-7-6 (30)	Claystone

(Preliminary Stage Only)

Revision Dates

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DETAIL Initial / Date / Detailed by / Checked by

DESIGN Initial / Date / Designed by / Checked by

WILSON & COMPANY

FELSBURG HOLT & ULLEVIG

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COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

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Revised:
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I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
CIMARRON BRIDGE OVER FOUNTAIN CREEK

Geologist: AB/JS	Structure Numbers	CSG-F.85-08.23E	Project No./Code: IM 0252-334
Drafter: CLP		CSG-F.85-08.23W	13126
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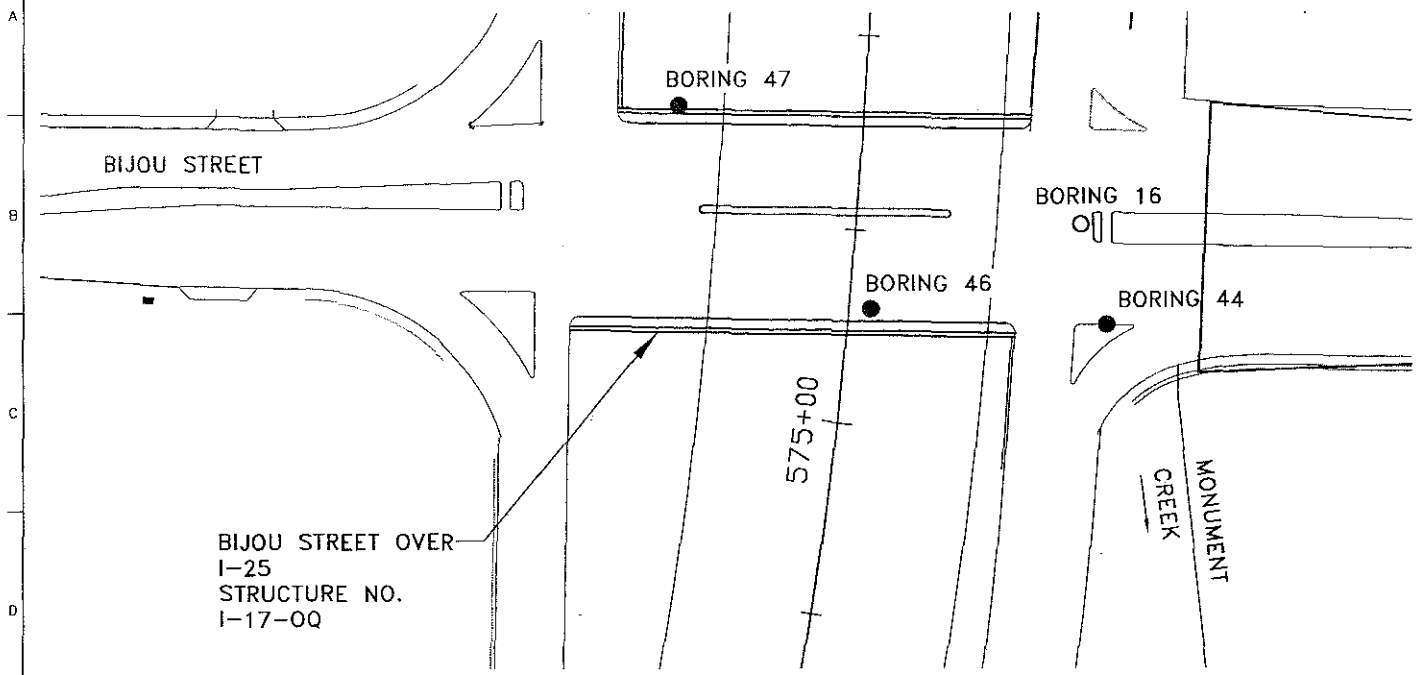
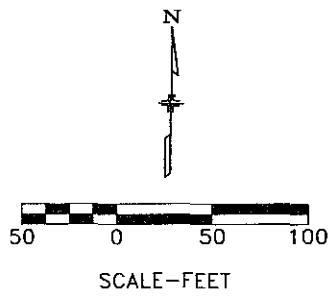
FIGURE 8





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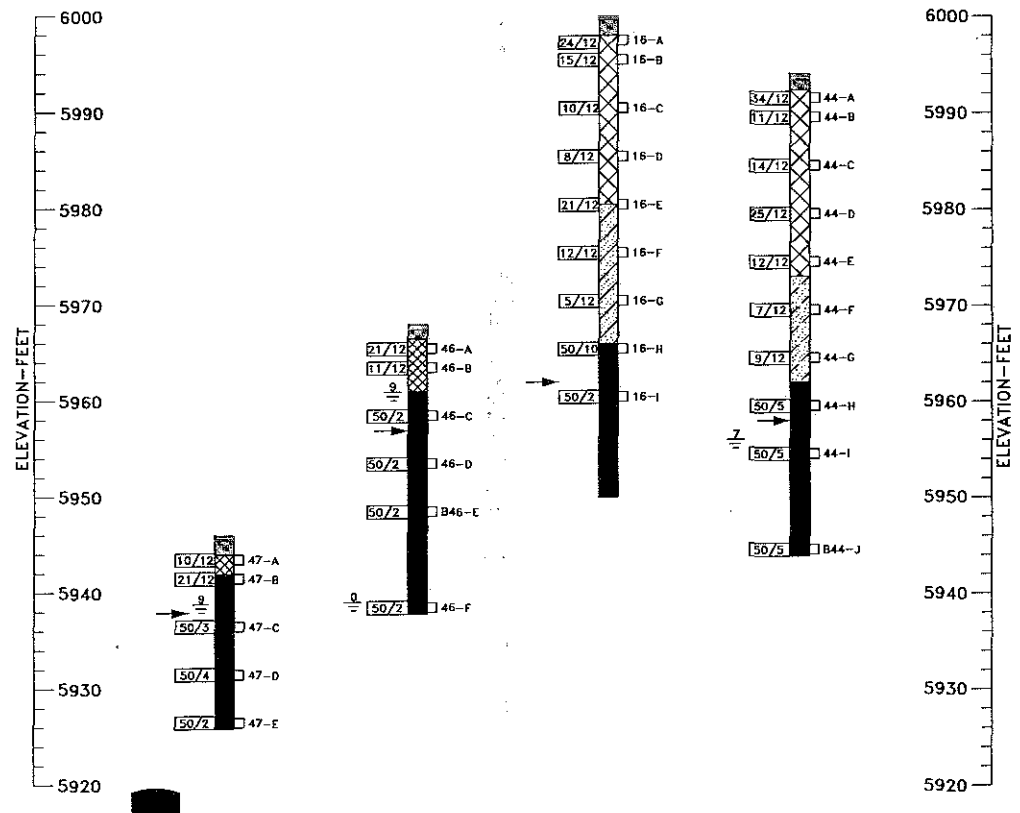


TYPE OF MATERIAL

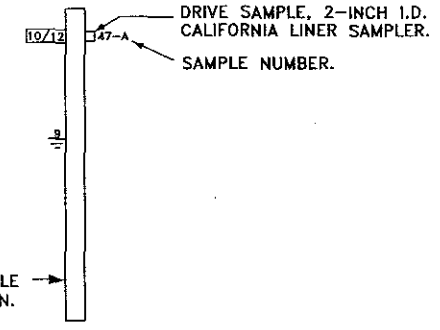
LEGEND

- ASPHALT
- BASE COURSE.
- FILL: SILTY SAND, OCCASIONALLY GRAVELLY, DRY TO SLIGHTLY MOIST, TAN TO BROWN.
- FILL: SANDY CLAY, OCCASIONALLY GRAVELLY, DRY TO MOIST, OLIVE-BROWN TO GRAY.
- SAND (SC), CLAYEY, MEDIUM STIFF, SLIGHTLY MOIST, BROWN.
- SAND (SP-SM), SLIGHTLY SILTY, LOOSE TO MEDIUM DENSE, MOIST TO WET, RED-BROWN TO TAN.
- CLAYSTONE BEDROCK, HARD TO VERY HARD, SLIGHTLY MOIST, GRAY.

LEGEND AND NOTES

DRIVE SAMPLE BLOW COUNT. INDICATES THAT 10 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORING 16 WAS DRILLED IN FEBRUARY, 2002, AND BORINGS 44, 46 AND 47 WERE DRILLED IN AUGUST, 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER AND 3.25-INCH HOLLW STEM AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
16-B	4	22.3	94.4	15	61	24	29	3		A-2-4 (0)	Fill: gravelly, silty sand
16-H	34	19.5	105.5			100	55	31	0.04	A-7-6 (36)	Claystone
44-C	9	12.4	113.7			19		NP	0.02	A-1-b (0)	Fill: silty sand
44-H	34	11.2	114.6			89	40	15		A-6 (15)	Claystone
46-B	4	18.6	107.4			77	38	15		A-6 (11)	Fill: sandy clay
46-E	19	11.4	120.3			95	63	41	0.02	A-7-6 (44)	Claystone
47-D	14	11.1	127.2			92	57	37		A-7-6 (37)	Claystone

(Preliminary Stage Only)

Revision Dates

QUANTITIES: Initial | Date | Quantities by | Checked by

DETAIL: Initial | Date | Detailed by | Checked by

DESIGN: Initial | Date | Designed by | Checked by

WILSON & COMPANY

FELSBURG HOLT & ULLEVIG

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Acad Ver. R2000i Scale: 1:100	Units: FEET

Index of Revisions

DEPARTMENT OF TRANSPORTATION Region 2

K&A Kumar and Associates, Inc. Geotechnical & Environmental Engineers
3015 PENNSYLVANIA AVENUE
COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

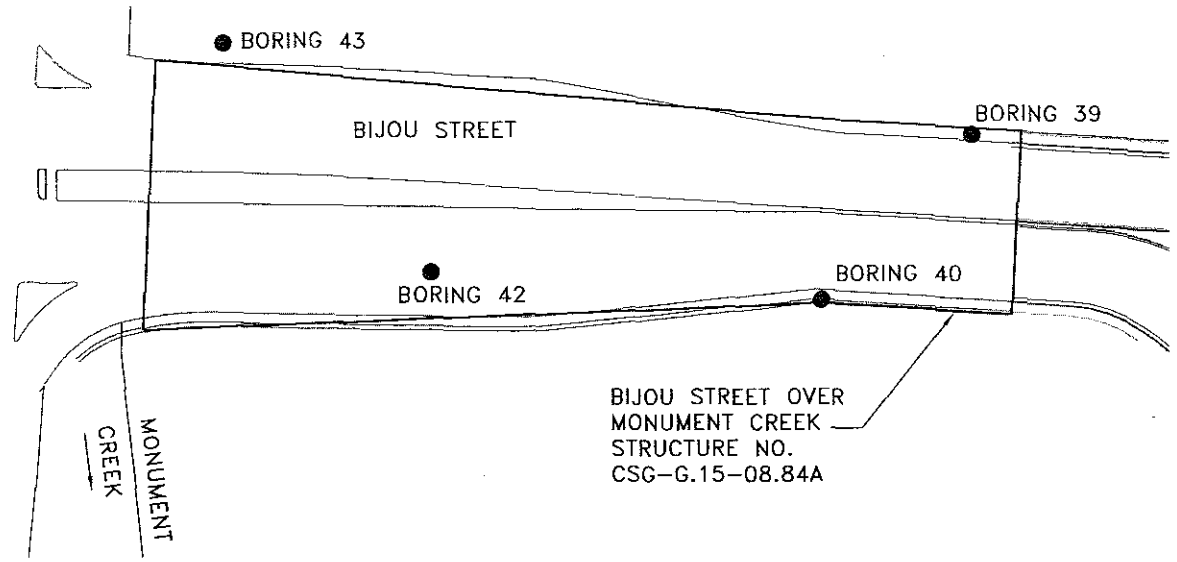
As Constructed
No Revisions:
Revised:
Void:

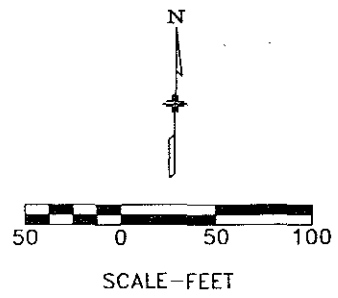
I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
BIJOU BRIDGE OVER MONUMENT CREEK

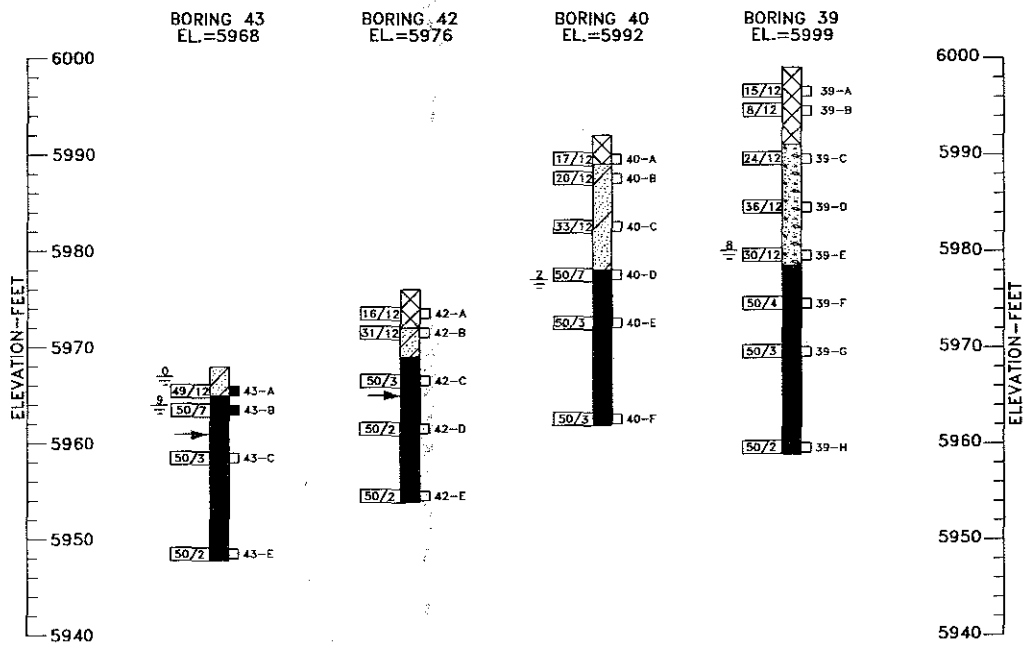
Geologist: AB/JS | Structure Numbers: I-17-OQ
Drafter: CLP
Sheet Subset: | Subset Sheets: of

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 9







TYPE OF MATERIAL

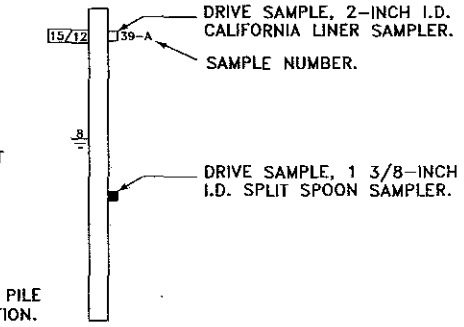
LEGEND

- FILL: SILTY, GRAVELLY SAND, SLIGHTLY MOIST, TAN AND BROWN.
- GRAVEL (GP), VERY SANDY, MEDIUM DENSE TO DENSE, SLIGHTLY MOIST TO MOIST, TAN TO BROWN.
- SAND (SP-SM/SM), SLIGHTLY SILTY TO SILTY, OCCASIONALLY GRAVEL AND COBBLE LAYERS, MEDIUM DENSE TO DENSE, SLIGHTLY MOIST TO MOIST, TAN.
- CLAYSTONE BEDROCK, VERY HARD, SLIGHTLY MOIST, GRAY.

LEGEND AND NOTES

DRIVE SAMPLE BLOW COUNT. INDICATES THAT 15 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. THE EXPLORATORY BORINGS WERE DRILLED IN AUGUST 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
39-C	9	10.6	89.4	55	44	1		NP		A-1-a (1)	Very sandy gravel
39-F	24	16.7	113.7			84	48	24	0.06	A-7-6 (21)	Claystone
40-A	2	4.4	116.7	30	46	24	21	4		A-1-b (0)	Fill: silty, gravelly sand
40-E	19	14.3	113.2			94	39	16	<0.02	A-6 (16)	Claystone
42-B	4	7.1	102.9	3	81	16		NP		A-1-b (0)	Silty sand
42-D	14	12.8	117.1			99	88	67	0.02	A-7-6 (76)	Claystone
43-A	2	8.7	92.2	66	29	5		NP		A-1-a (0)	Slighty silty, sandy gravel
43-C	9	13.7	114.2			98	73	50	<0.02	A-7-6 (56)	Claystone

QUANTITIES Initial / Date — Quantities by / Checked by
DETAIL Initial / Date — Detailed by / Checked by
DESIGN Initial / Date — Designed by / Checked by
Revision Dates (Preliminary Stage Only)

WILSON & COMPANY — FELSBURG HOLT & ULLEVIG

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Last Modification Date:	Initials:
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Acad Ver. R2000i Scale: 1:100	Units: FEET

Index of Revisions

DEPARTMENT OF TRANSPORTATION Region 2

K&A Kumar and Associates, Inc. Geotechnical & Environmental Engineers
3015 PENNSYLVANIA AVENUE
COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

As Constructed	I-25/CIMARRON/BIJOU INTERCHANGE	Project No./Code
No Revisions:	ENGINEERING GEOLOGY SHEET BIJOU BRIDGE OVER MONUMENT CREEK	IM 0252-334
Revised:	Geologist: AB/JS — Structure Numbers: CSG-G.15-08.84A	13126
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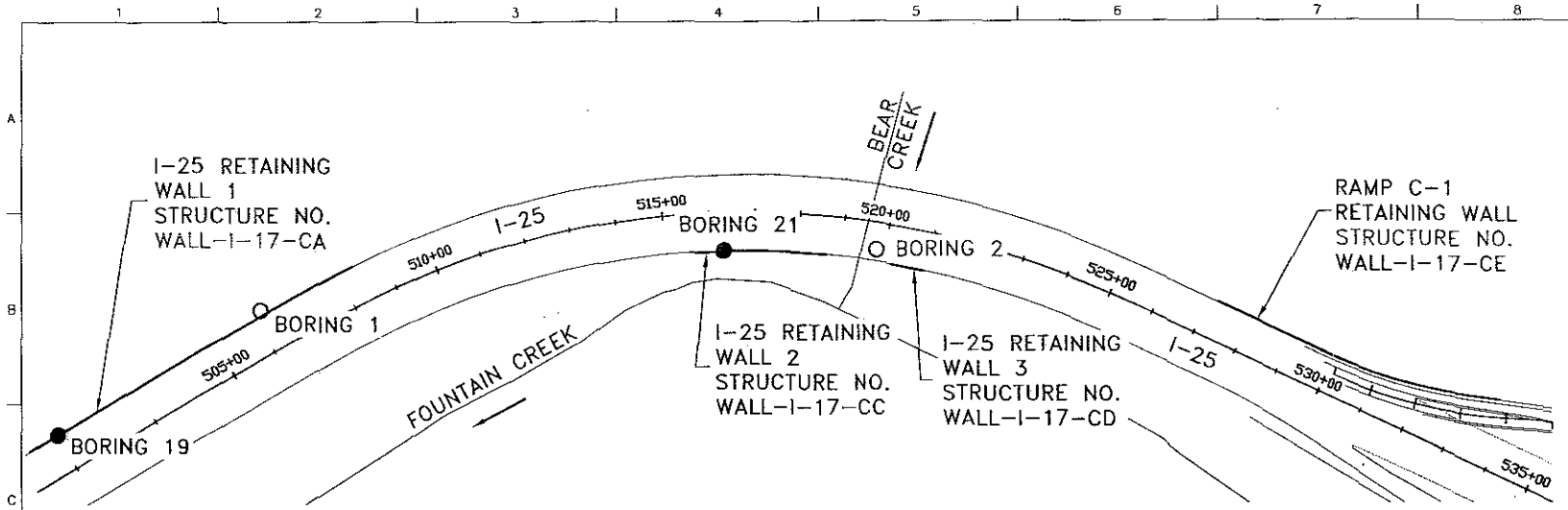
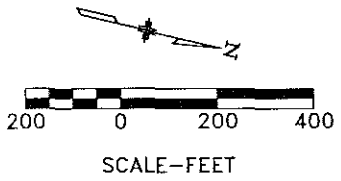
	Sheet Subset: — Subset Sheets: of	Sheet Number

FIGURE10





TYPE OF MATERIAL

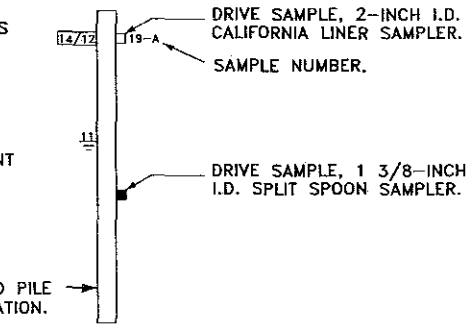
LEGEND

- ASPHALT
- BASE COURSE.
- FILL: CLAYEY TO VERY CLAYEY SAND, MOIST TO VERY MOIST, REDDISH BROWN TO BROWN.
- FILL: SANDY CLAY, OCCASIONALLY GRAVELLY, MOIST, BROWN.
- SAND (SP/SM), CLEAN TO SILTY, OCCASIONAL GRAVEL LAYERS, LOOSE TO DENSE, MOIST TO WET, REDDISH-BROWN TO TAN.
- GRAVEL (GP), SANDY, OCCASIONALLY CLAYEY, OCCASIONAL COBBLES, VERY LOOSE TO MEDIUM DENSE, MOIST TO WET, BROWN.
- CLAY (CL), SANDY, STIFF, SLIGHTLY MOIST, BROWN.
- CLAYSTONE BEDROCK, VERY HARD, MOIST, GRAY.

LEGEND AND NOTES

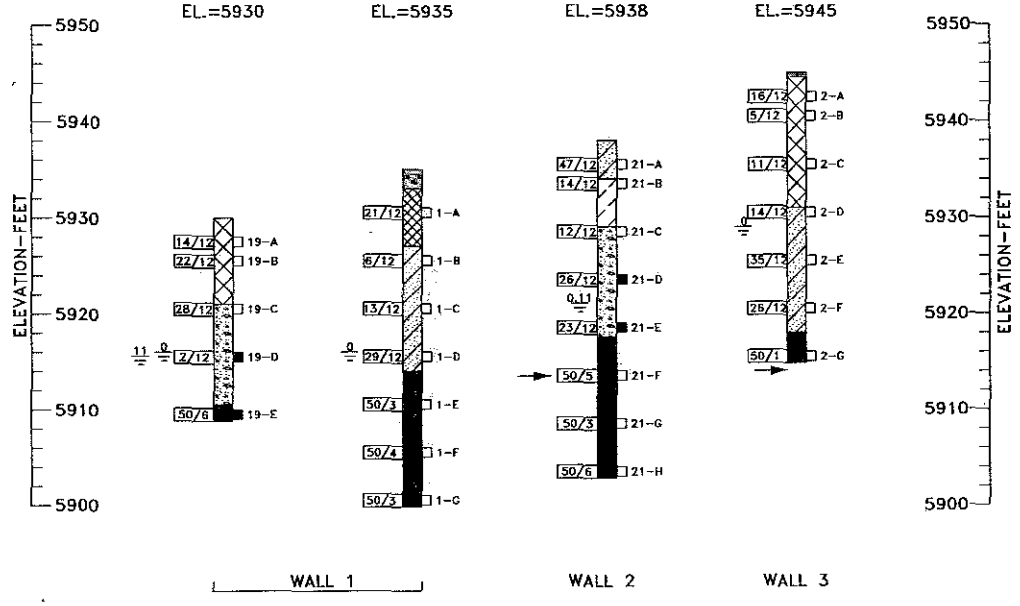
DRIVE SAMPLE BLOW COUNT. INDICATES THAT 14 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORINGS 1 AND 2 WERE DRILLED IN FEBRUARY 2002, AND BORINGS 19 AND 21 WERE DRILLED IN AUGUST 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.



SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
1-B	9	5.4	108.2	21	67	12	24	5		A-1-b (0)	Slightly silty, gravelly sand
1-E	24	19.1	108.3			99	53	25	0.03	A-7-6 (30)	Claystone
2-B	4	11.9	115.7	19	54	27	29	12		A-2-6 (0)	Fill: gravelly, clayey sand
2-E	19	7.1	130.3	59	38	3		NP	0.05	A-1-a (0)	Sandy gravel
19-B	4	10.0	125.1			40	33	19	0.26	A-6 (3)	Fill: very sandy gravel
19-C	9	2.1	118.0	61	35	4		NP		A-1-a (0)	Sandy gravel
21-B	4	15.7	90.9			83	33	13	0.05	A-6 (10)	Sandy clay
21-E	19	18.6		49	36	15	25	13		A-2-6 (0)	Clayey, sandy gravel
21-F	24	11.9	110.9			69	48	27		A-7-6 (17)	Claystone

DESIGN Initial / Date / Designed by / Checked by
DETAIL Initial / Date / Detailed by / Checked by
QUANTITIES Initial / Date / Quantities by / Checked by
Revision Dates (Preliminary Stage Only)

WILSON &COMPANY
FELSBURG HOLT & ULLEVIG

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CDOT DEPARTMENT OF TRANSPORTATION Region 2

K&A Kumar and Associates, Inc. Geotechnical & Environmental Engineers
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COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

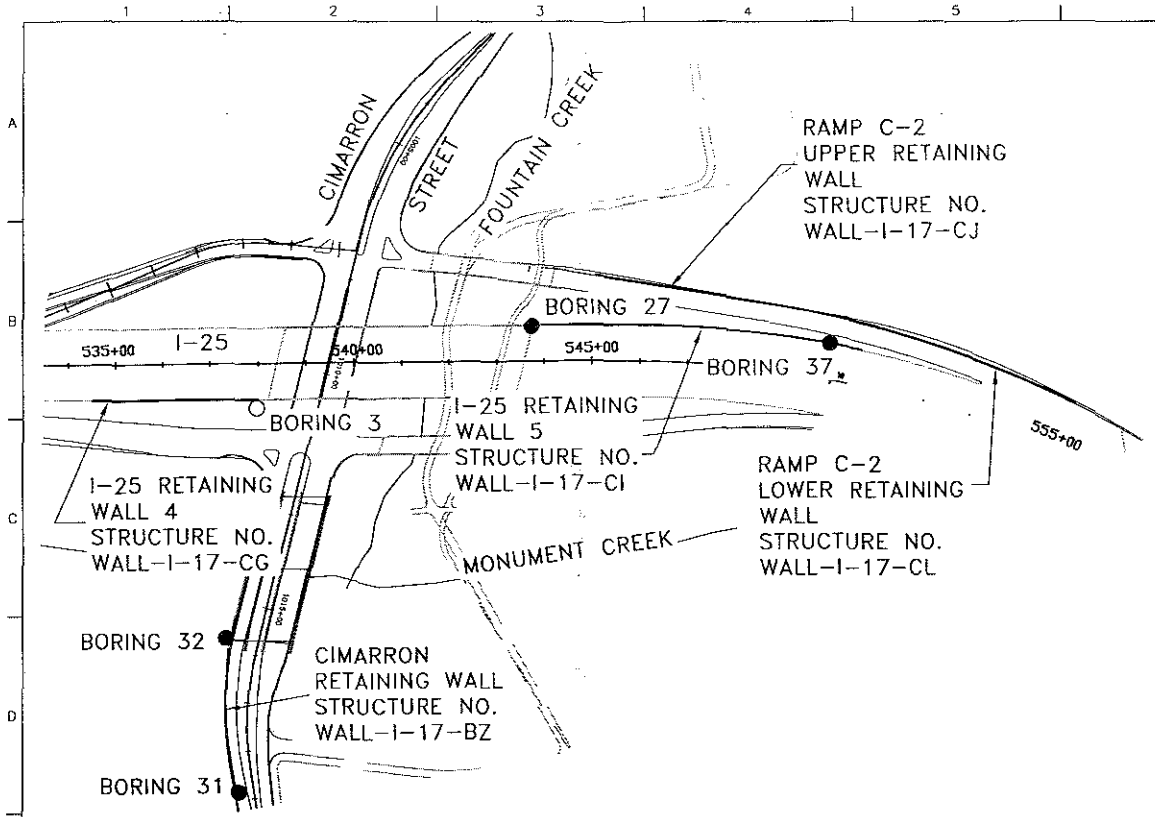
AS CONSTRUCTED
No Revisions:
Revised:
Void:

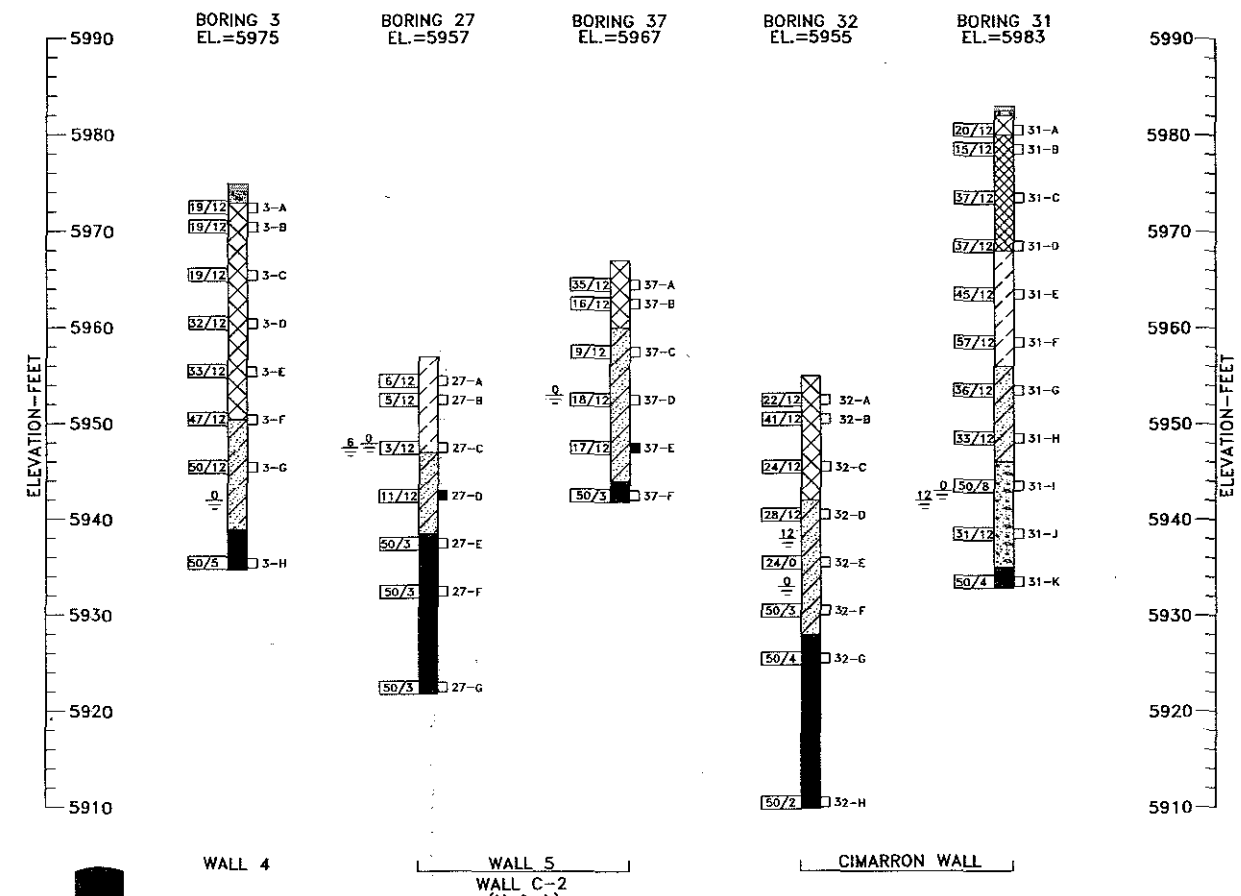
I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
RETAINING WALLS 1, 2 & 3

Geologist: AG/JS
Drafter: CLP
Sheet Subset:
Structure Number: I-17-CA, I-17-CC; I-17-CD, I-17-CE
Subset Sheets: of:

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 11





TYPE OF MATERIAL

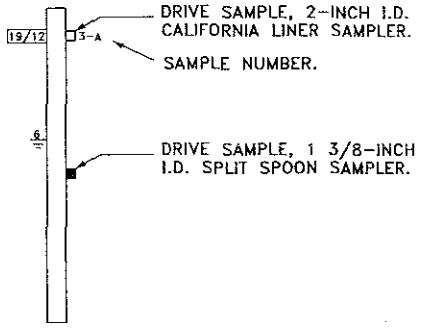
LEGEND

- ASPHALT
- BASE COURSE
- FILL: SILTY TO CLAYEY SAND, OCCASIONALLY GRAVELLY, DRY TO MOIST, REDDISH-BROWN TO DARK BROWN.
- FILL: SLIGHTLY SANDY TO VERY SANDY CLAY, OCCASIONALLY GRAVELLY, SLIGHTLY MOIST TO MOIST, OLIVE-BROWN, GRAY.
- SAND (SP/SP-SM/SM), CLEAN TO VERY SILTY, OCCASIONAL COBBLE AND GRAVEL LAYERS, VERY LOOSE TO DENSE, SLIGHTLY MOIST TO WET, TAN TO BROWN.
- SAND (SM-SC), SILTY AND CLAYEY, OCCASIONAL GRAVEL AND COBBLES, VERY DENSE, MOIST, REDDISH-BROWN.
- CLAY (CL), SLIGHTLY SANDY TO VERY SANDY, OCCASIONALLY GRAVELLY, SOFT TO HARD, MOIST, BROWN.
- GRAVEL (GP), OCCASIONALLY SILTY AND SANDY, DENSE TO VERY DENSE, MOIST TO WET, BROWN.
- CLAYSTONE BEDROCK, VERY HARD, SLIGHTLY MOIST TO MOIST, GRAY.

LEGEND AND NOTES

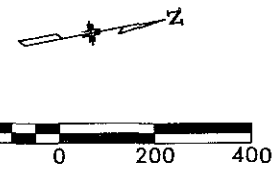
DRIVE SAMPLE BLOW COUNT. INDICATES THAT 19 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORINGS 3 AND 9 WERE DRILLED IN JANUARY 2002, AND BORINGS 26, 27, 31, 32 AND 37 WERE DRILLED IN AUGUST 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.



SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
3-B	4	9.4	121.1	28	39	33	37	23	<0.02	A-2-6 (2)	Fill: gravelly, clayey sand
3-D	14	7.5	128.8	17	58	25	28	11		A-2-6 (0)	Fill: gravelly, clayey sand
3-F	24	12.3	118.5	1	61	38	28	7	0.05	A-4 (0)	Clayey sand
3-H	39	21.2	104.4			99	55	26		A-7-6 (31)	Claystone
27-B	4	27.4	88.3								Sandy clay
27-C	9	28.6	92.2			51	30	14	0.03	A-6 (4)	Very sandy clay
27-E	19	17.7	109.1			80	43	23		A-7-6 (18)	Claystone
31-B	4	21.4	103.2			92	49	30	0.05	A-7-6 (29)	Fill: slightly sandy clay
31-E	19	9.4	118.0	23	31	46	42	24		A-7-6 (7)	Gravelly, sandy clay
32-D	14	3.8	102.7	3	84	13		NP		A-1-a (0)	Silty sand
32-H	44	19.6	110.2			91	83	66	0.04	A-7-6 (66)	Claystone
37-C	9	7.3	107.6	9	52	39	24	4	0.03	A-4 (0)	Slightly gravelly, silty sand
37-D	14	12.9	107.0	25	69	6		NP		A-1-a (1)	Slightly silty, gravelly sand

QUANTITIES Initial Date / Quantities by / Checked by
DETAIL Initial Date / Detailed by / Checked by
DESIGN Initial Date / Designed by / Checked by
Revision Dates (Preliminary Stage Only)

WILSON & COMPANY
FELSBURG HOLT & ULLEVIG

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DEPARTMENT OF TRANSPORTATION Region 2

K&A Kumar and Associates, Inc. Geotechnical & Environmental Engineers
3015 PENNSYLVANIA AVENUE
COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

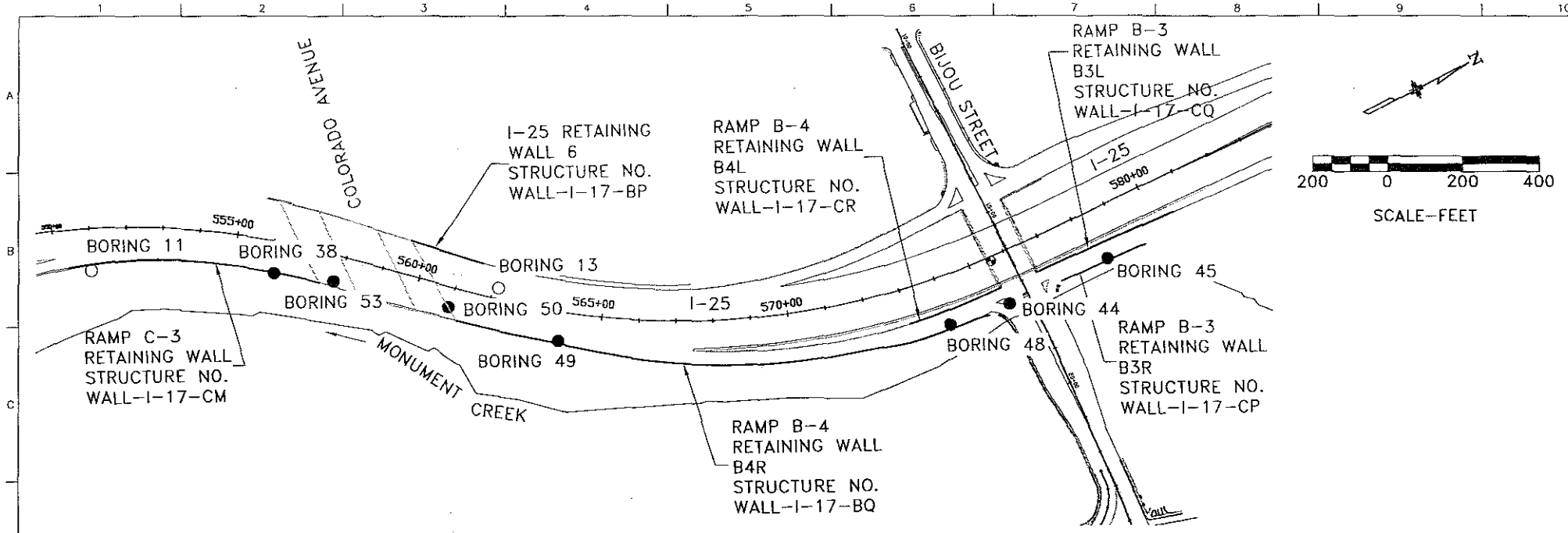
AS CONSTRUCTED
No Revisions:
Revised:
Void:

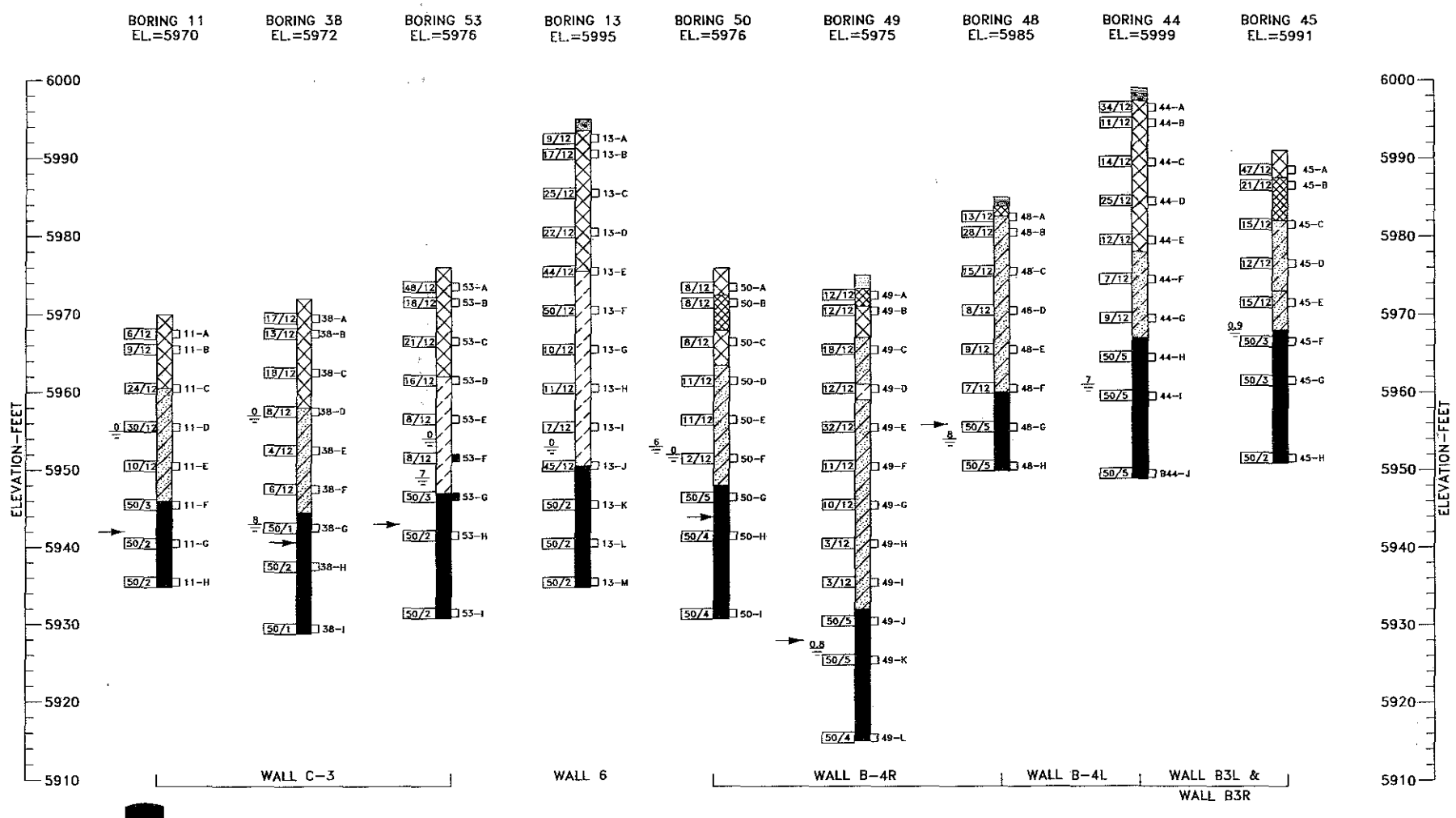
I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
RETAINING WALLS 4, 5, C-2 & CIMARRON

Geologist: AB/JS | Structure Numbers: I-17-CG, I-17-CI
Drafter: CLP | I-17-CJ, I-17-CL, I-17-BZ
Sheet Subset: | Subset Sheets: of

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 12





TYPE OF MATERIAL

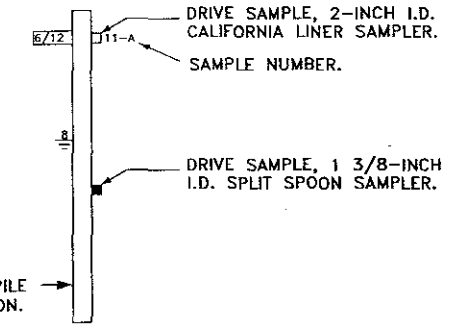
LEGEND

- ASPHALT
- BASE COURSE.
- FILL: SILTY TO CLAYEY SAND, OCCASIONALLY GRAVELLY, DRY TO MOIST, OLIVE-BROWN, TAN, DARK BROWN.
- FILL: SANDY CLAY, DRY TO SLIGHTLY MOIST, OLIVE-BROWN, TAN AND GRAY.
- SAND (SC), CLAYEY, SLIGHTLY GRAVELLY TO GRAVELLY, MEDIUM STIFF TO VERY STIFF, SLIGHTLY MOIST TO MOIST, TAN, GRAY AND OLIVE-BROWN.
- SAND (SP-SM/SM), SILTY TO VERY SILTY, GRAVELLY, OCCASIONAL GRAVEL AND COBBLE LAYERS, VERY LOOSE TO MEDIUM DENSE, SLIGHTLY MOIST TO MOIST, RED-BROWN TO TAN.
- CLAY (CL), SANDY TO VERY SANDY, SOFT TO HARD, VERY MOIST TO WET, OLIVE-BROWN TO GRAY AND BLACK.
- CLAYSTONE BEDROCK, VERY HARD, MOIST, GRAY.

LEGEND AND NOTES

DRIVE SAMPLE BLOW COUNT. INDICATES THAT 6 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.



NOTES

1. BORINGS 11 AND 13 WERE DRILLED IN JANUARY 2002, AND BORINGS 38, 44, 45, 48, 49, 50 AND 53 WERE DRILLED IN AUGUST 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

NOTE:
LAB DATA FOR THESE BORINGS ARE PRESENTED IN FIGURE 14.

(Preliminary Stage Only)

Revision Dates	Date
QUANTITIES	Initial
	Quantities by
	Checked by
DETAIL	Date
	Initial
	Detailed by
	Checked by
DESIGN	Date
	Initial
	Designed by
	Checked by

WILSON & COMPANY
FELSBURG HOLT & ULLEVIG

Computer File Information	
Creation Date: 8/25/03	Initials: CLP
Last Modification Date:	Initials:
Full Path: C:\DRAWINGS\2001\012-266\01226603,12	
Drawing File Name:01226603,12	
Acad Ver. R2000i Scale: 1:100	Units: FEET

Index of Revisions

CDOT DEPARTMENT OF TRANSPORTATION Region 2

K&A Kumar and Associates, Inc. Geotechnical & Environmental Engineers
3015 PENNSYLVANIA AVENUE
COLORADO SPRINGS, COLORADO 80907
(719) 632-7009

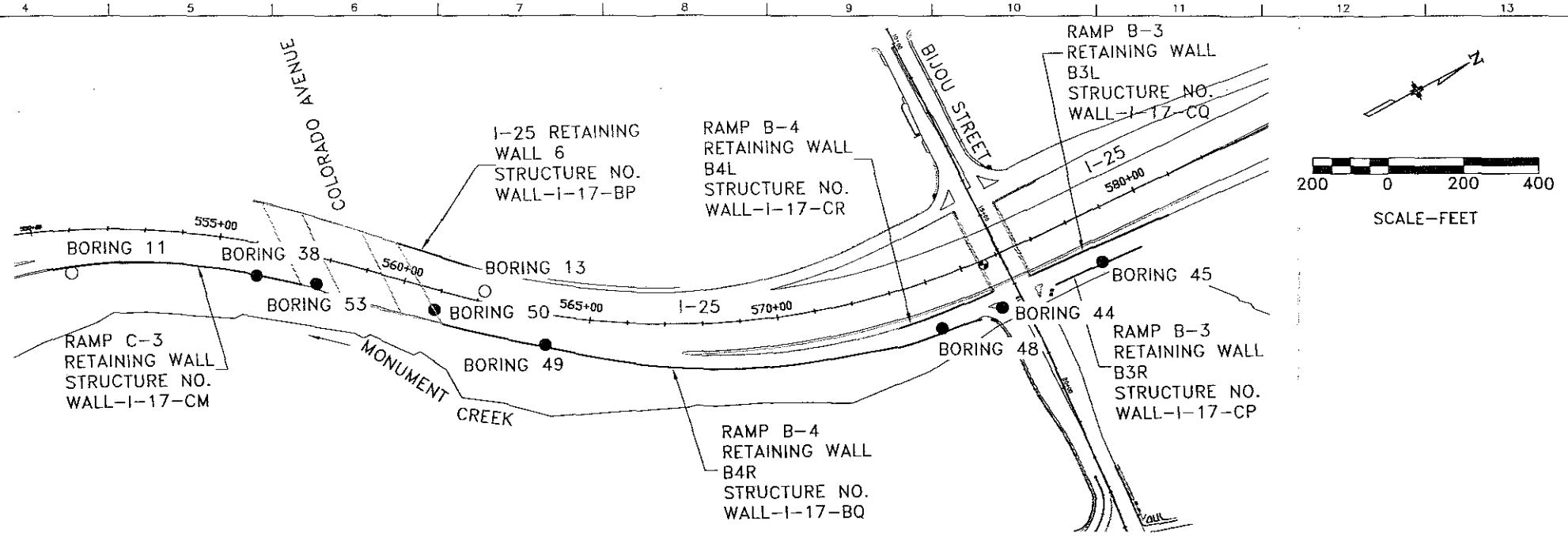
AS CONSTRUCTED
No Revisions:
Revised:
Void:

I-25/CIMARRON/BIJOU INTERCHANGE
ENGINEERING GEOLOGY SHEET
RETAINING WALLS C-3, 6, B-4R & L, B-3L & R

Geologist: AB/JS	Structure Numbers	I-17-BP, I-17-CQ,I-17-CP
Drafter: CLP		I-17-CM, I-17-BQ,I-17-CR
Sheet Subset:	Subset Sheets:	of: of

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 13



SUMMARY OF LABORATORY TEST RESULTS

SAMPLE NUMBER	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT (%)	NATURAL DRY UNIT WEIGHT (pcf)	GRADATION AASHTO T88 GRAVEL (%)	GRADATION AASHTO T88 SAND (%)	PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	WATER SOLUBLE SULFATES (%)	AASHTO CLASSIFICATION (GROUP INDEX)	SOIL OR BEDROCK TYPE
11-C	9	1.1	99.7			4		NP			Sand
11-G	29	16.7	111.8			93	57	31		A-7-6 (33)	Claystone
13-C	9	14.1	117.0			38	31	10		A-4 (0)	Fill: clayey sand
13-K	49	14.6	109.0			98	46	23	0.04	A-7-6 (25)	Claystone
38-F	24	21.9		16	54	30		NP		A-2-4 (0)	Gravelly, silty sand
38-G	29	14.8				77	33	15	0.05	A-6 (10)	Claystone
44-C	9	12.4	113.7			19		NP	0.02	A-1-b (0)	Fill: silty sand
44-H	34	11.2	114.6			89	40	15		A-6 (15)	Claystone
45-B	4	9.2	120.0			64	46	29		A-7-6 (16)	Fill: sandy clay
45-C	9	5.9	110.9	9	54	37	25	9		A-4 (0)	Slightly gravelly, clayey sand
48-A	2	12.9	116.4	10	45	45		NP		A-4 (0)	Fill: slightly gravelly, silty sand
48-B	4	4.6	120.0	38	41	21		NP		A-1-b (0)	Silty, gravelly sand
49-E	19	19.0	103.3	24	63	13		NP		A-1-a (0)	Silty, gravelly sand
49-K	49	12.2	115.1			96	64	44		A-7-6 (47)	Claystone
50-F	24	27.8	92.9	4	55	41	21	2		A-4 (0)	Very silty sand
50-H	34	10.8	112.0			64	64	44		A-7-6 (26)	Claystone
53-E	19	21.2	95.8			60	34	18	0.07	A-6 (8)	Very sandy clay
53-H	34	12.1	99.2			63	49	26		A-7-6 (15)	Claystone

Revision Dates (Preliminary Stage Only)

QUANTITIES: Initial, Date, Quantities by, Checked by

DETAIL: Initial, Date, Detailed by, Checked by

DESIGN: Initial, Date, Designed by, Checked by

WILSON &COMPANY — FELSBURG HOLT & ULLEVIG

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Creation Date: 8/25/03	Initials: CLP
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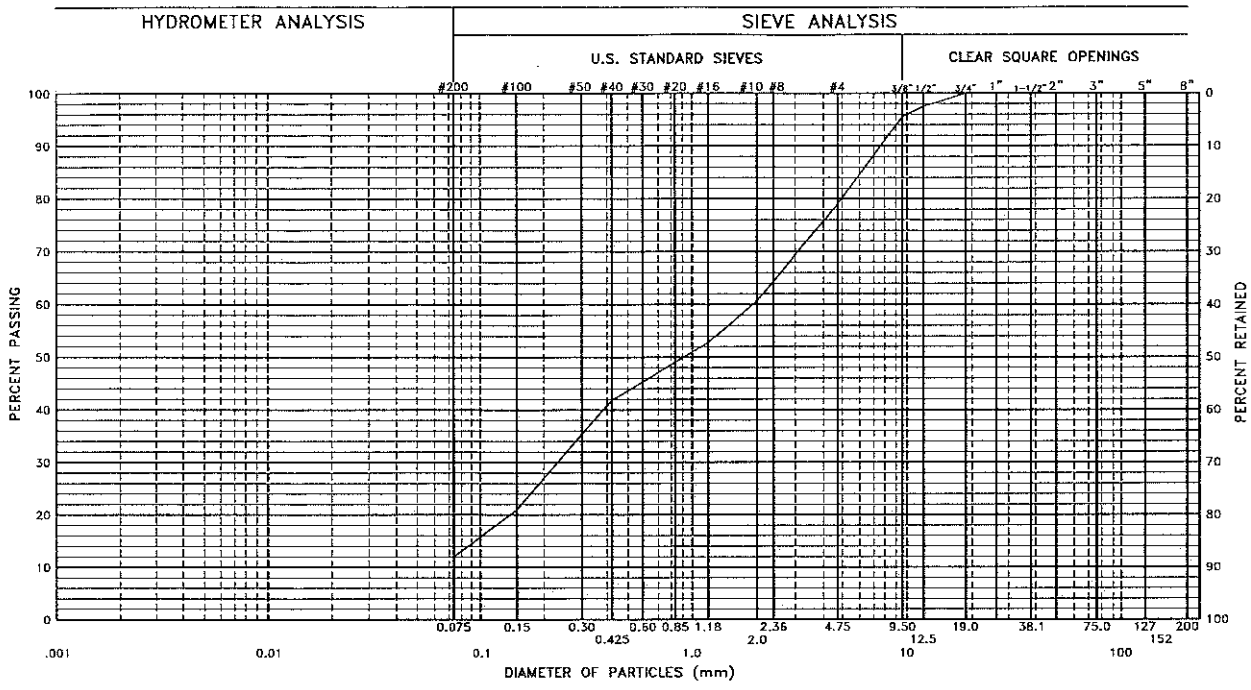
RETAINING WALLS C-3, 6, B-4R & L, B-3L & R

Geologist: AB/JS
Drafter: CLP
Sheet Subset:
Structure Numbers: I-17-BP, I-17-CQ,I-17-CP; I-17-CM, I-17-BQ,I-17-CR
Subset Sheets: of:

Project No./Code
IM 0252-334
13126
Sheet Number

FIGURE 14

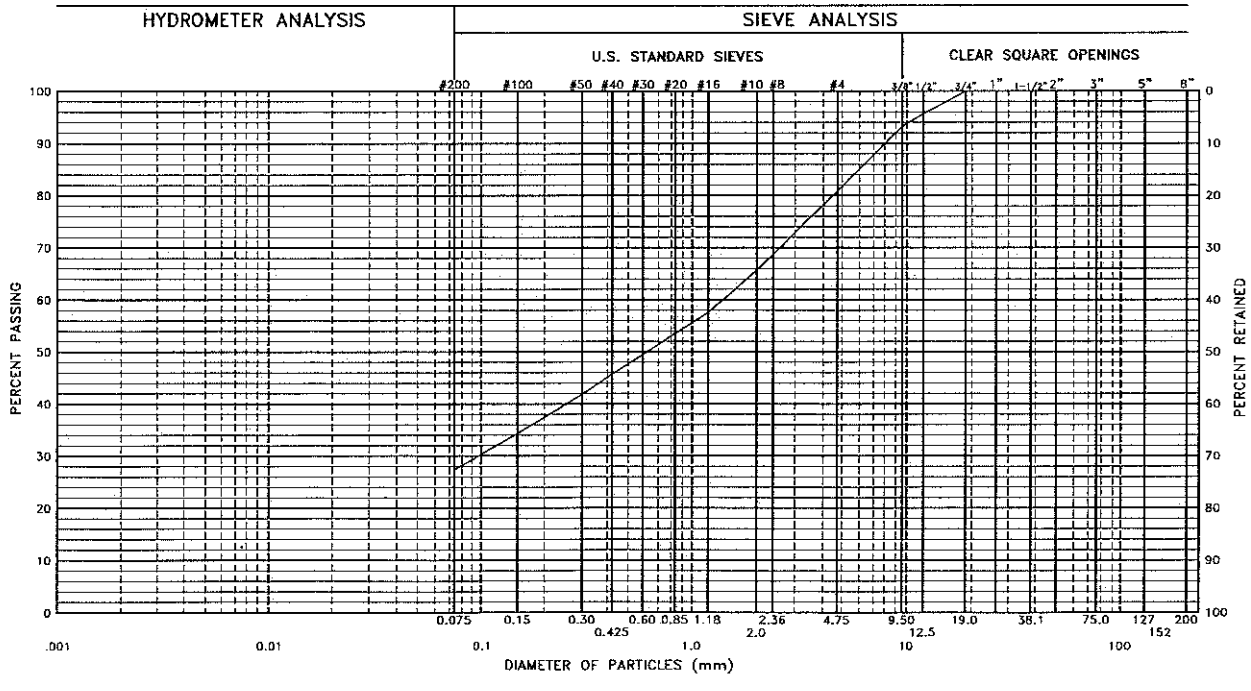


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 21 %
SAND: 67 %
SILT AND CLAY: 12 %

LIQUID LIMIT: 24
PLASTICITY INDEX: 5

SAMPLE OF: Slightly silty, gravelly sand
FROM: Boring 1 @ 9 feet



SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 19 %
SAND: 54 %
SILT AND CLAY: 27 %

LIQUID LIMIT: 29
PLASTICITY INDEX: 12

SAMPLE OF: Fill: Gravelly, clayey sand
FROM: Boring 2 @ 4 feet

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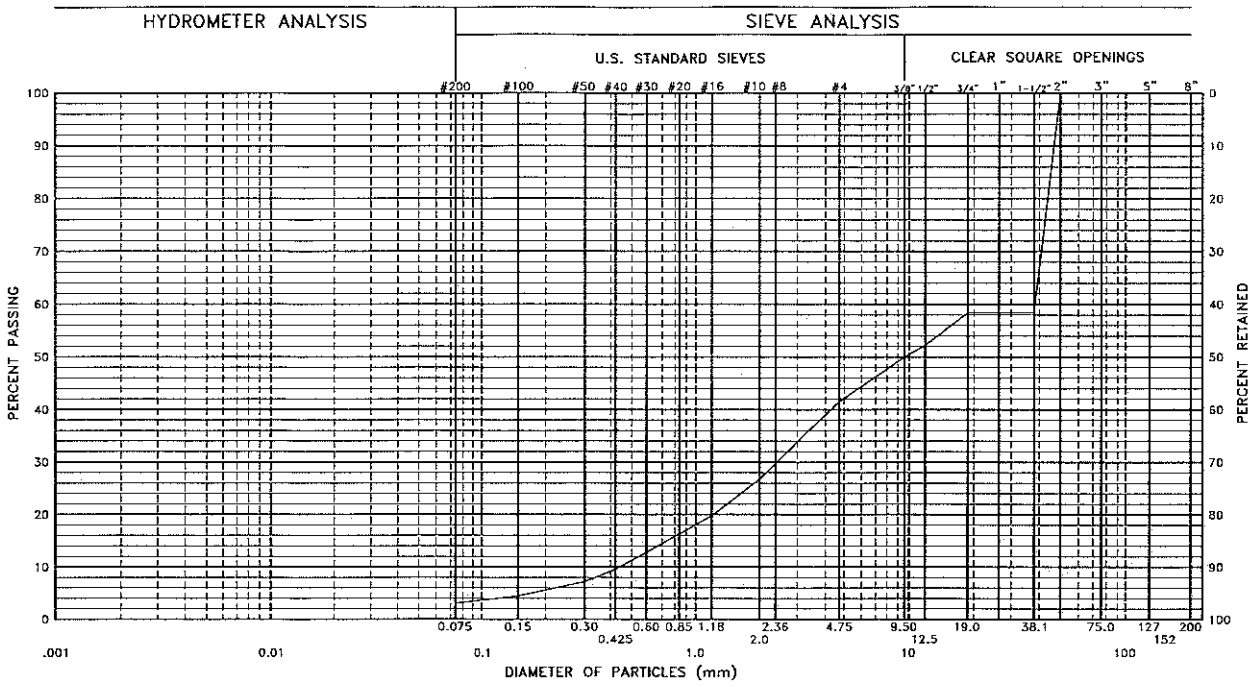
012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 15

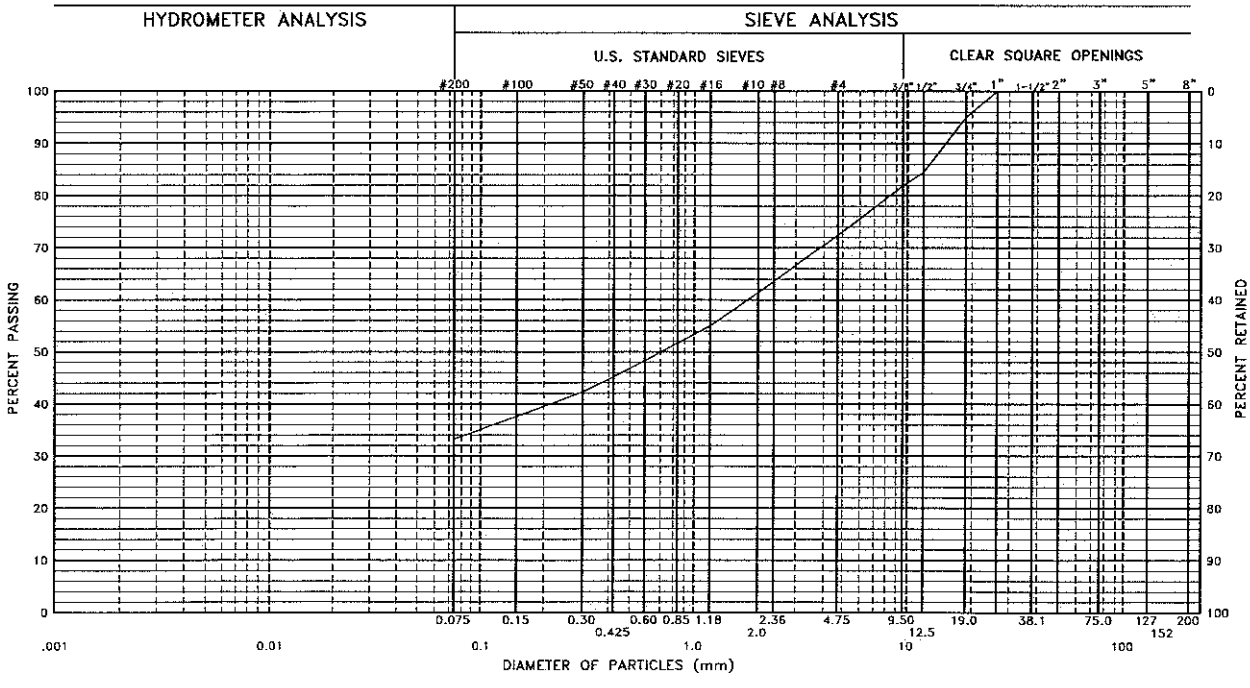


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 59 %
SAND: 38 %
SILT AND CLAY: 3 %

LIQUID LIMIT:
PLASTICITY INDEX: NP

SAMPLE OF: Sandy gravel
FROM: Boring 2 @ 19 feet



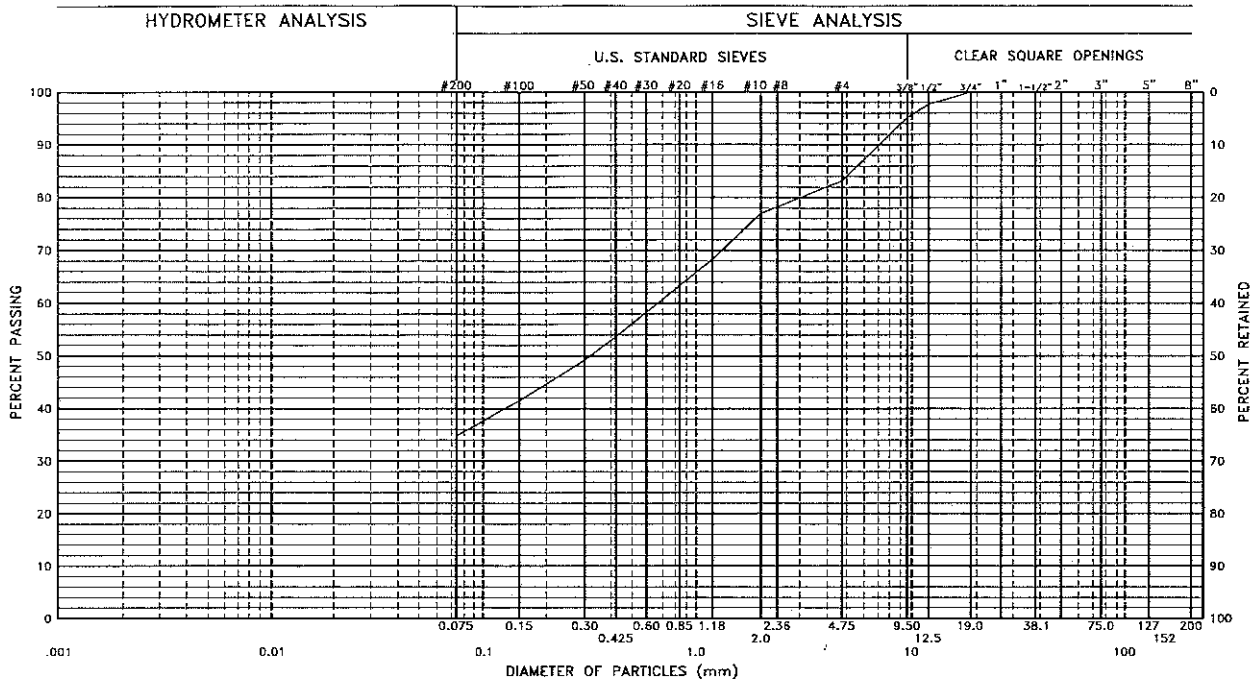
SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 28 %
SAND: 39 %
SILT AND CLAY: 33 %

LIQUID LIMIT: 37
PLASTICITY INDEX: 23

SAMPLE OF: Fill: Gravelly, clayey sand
FROM: Boring 3 @ 4 feet

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 16

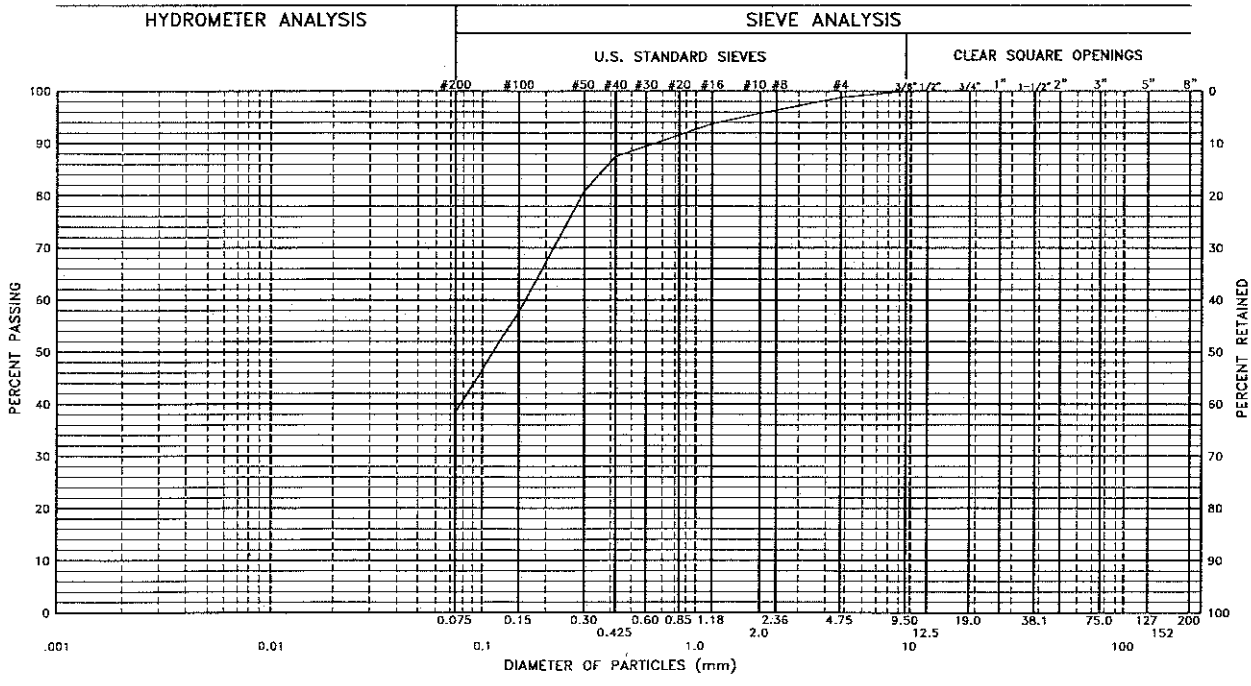


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 17 %
SAND: 58 %
SILT AND CLAY: 25 %

LIQUID LIMIT: 28
PLASTICITY INDEX: 11

SAMPLE OF: Fill: Gravelly, clayey sand
FROM: Boring 3 @ 14 feet



SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 1 %
SAND: 61 %
SILT AND CLAY: 38 %

LIQUID LIMIT: 28
PLASTICITY INDEX: 7

SAMPLE OF: Clayey sand
FROM: Boring 3 @ 24 feet

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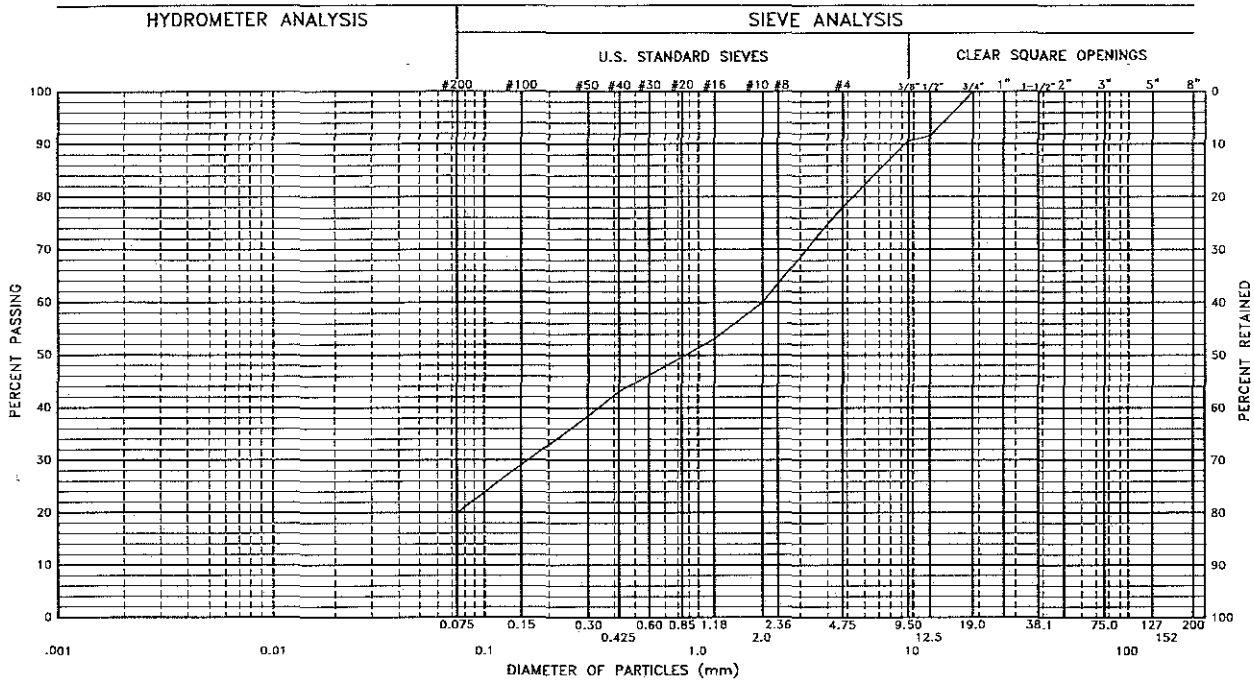
012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 17

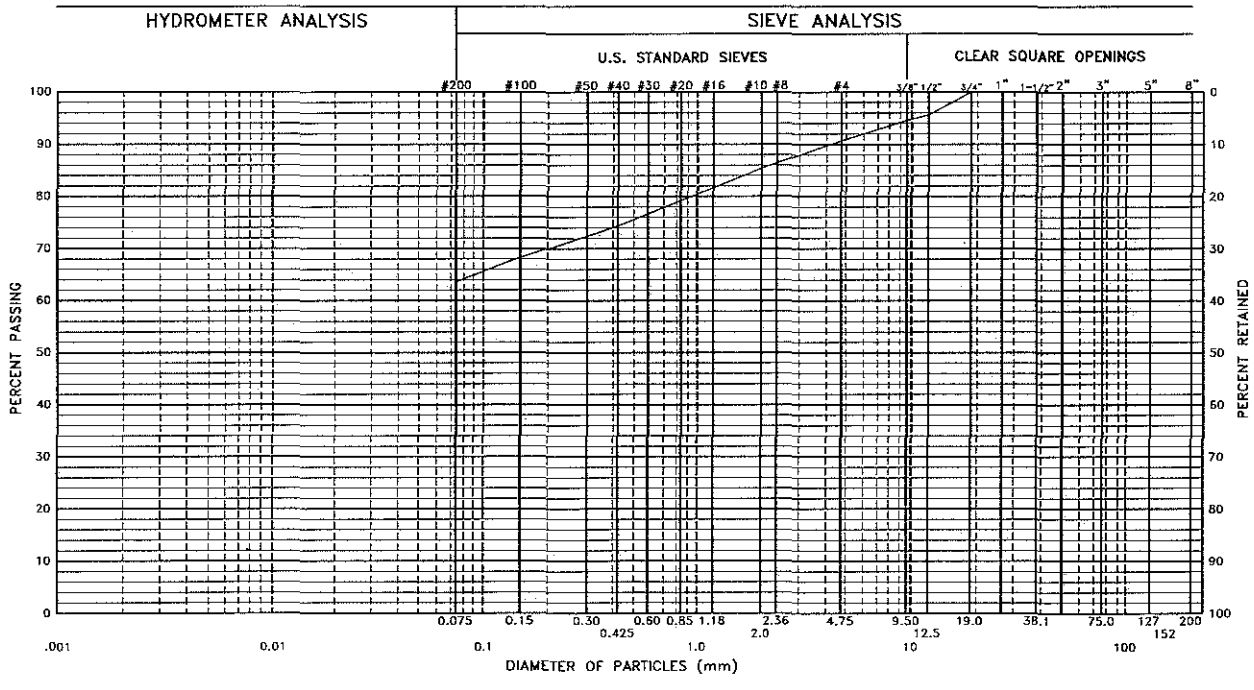


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 22 %
SAND: 58 %
SILT AND CLAY: 20 %

LIQUID LIMIT: 27
PLASTICITY INDEX: 6

SAMPLE OF: Clayey, gravelly sand
FROM: Boring 4 @ 14 feet



SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 9 %
SAND: 27 %
SILT AND CLAY: 64 %

LIQUID LIMIT: 50
PLASTICITY INDEX: 29

SAMPLE OF: Fill: slightly gravelly, sandy clay
FROM: Boring 5 @ 9 feet

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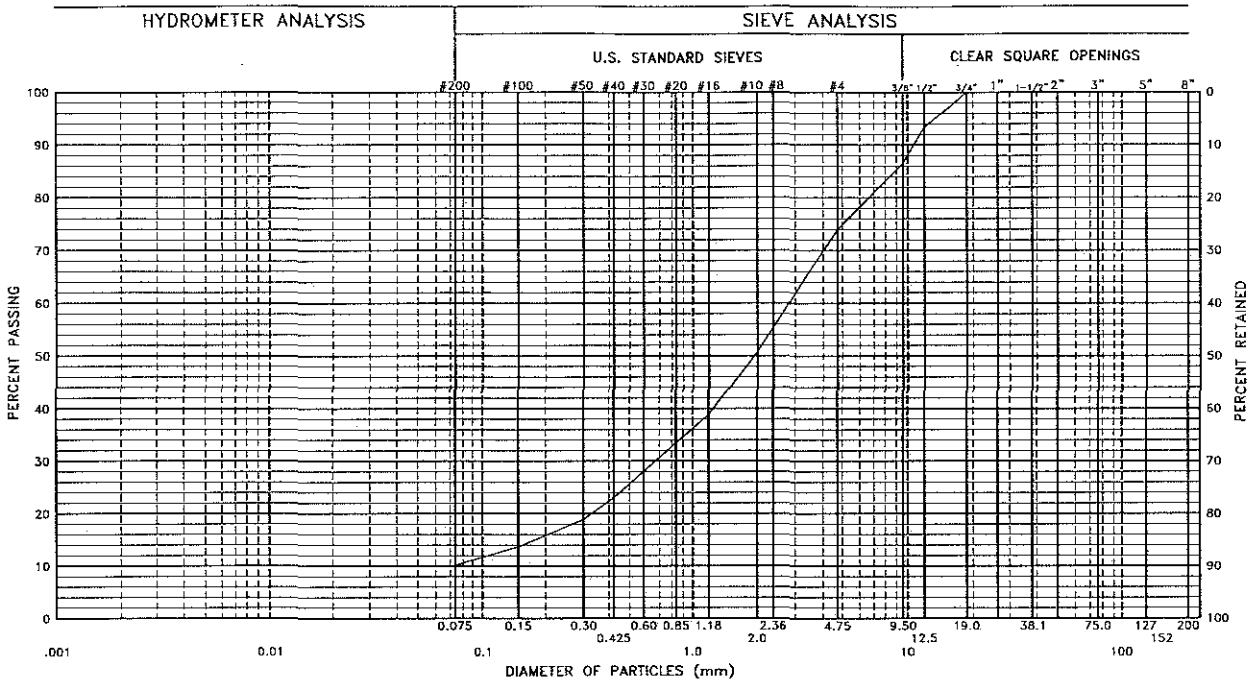
012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 18

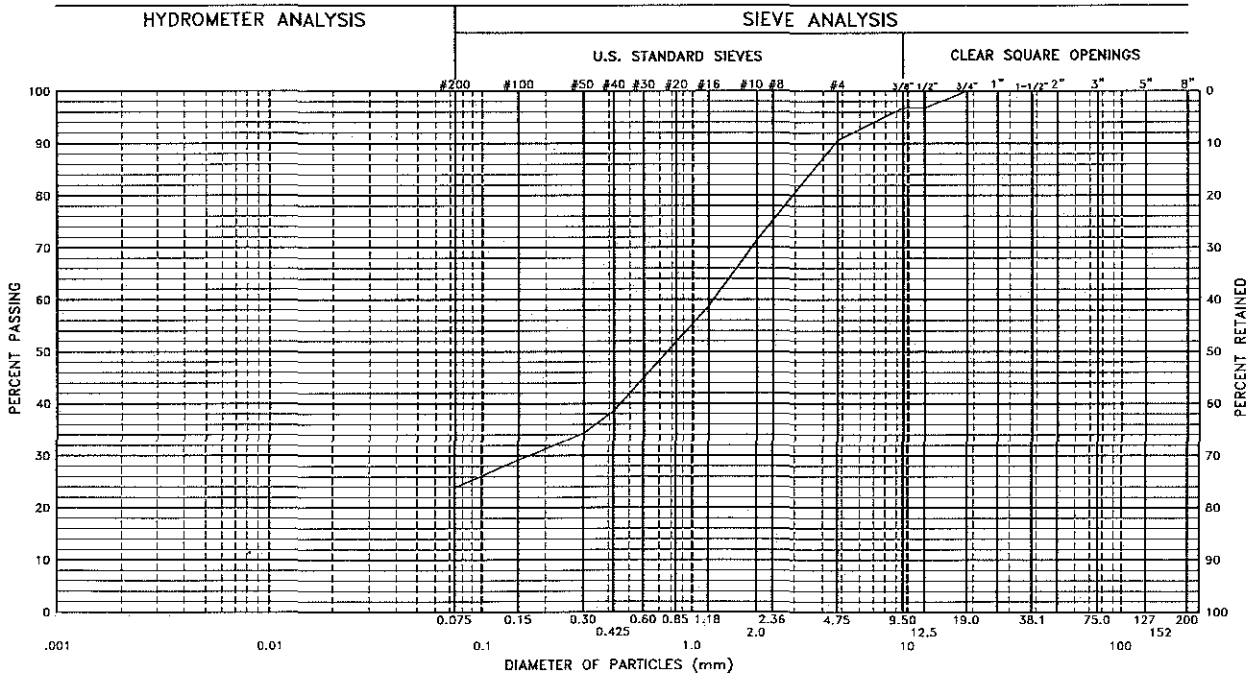


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 26 %
SAND: 64 %
SILT AND CLAY: 10 %

LIQUID LIMIT: 21
PLASTICITY INDEX: 6

SAMPLE OF: Fill: Slightly clayey, gravelly sand
FROM: Boring 6 @ 2 feet



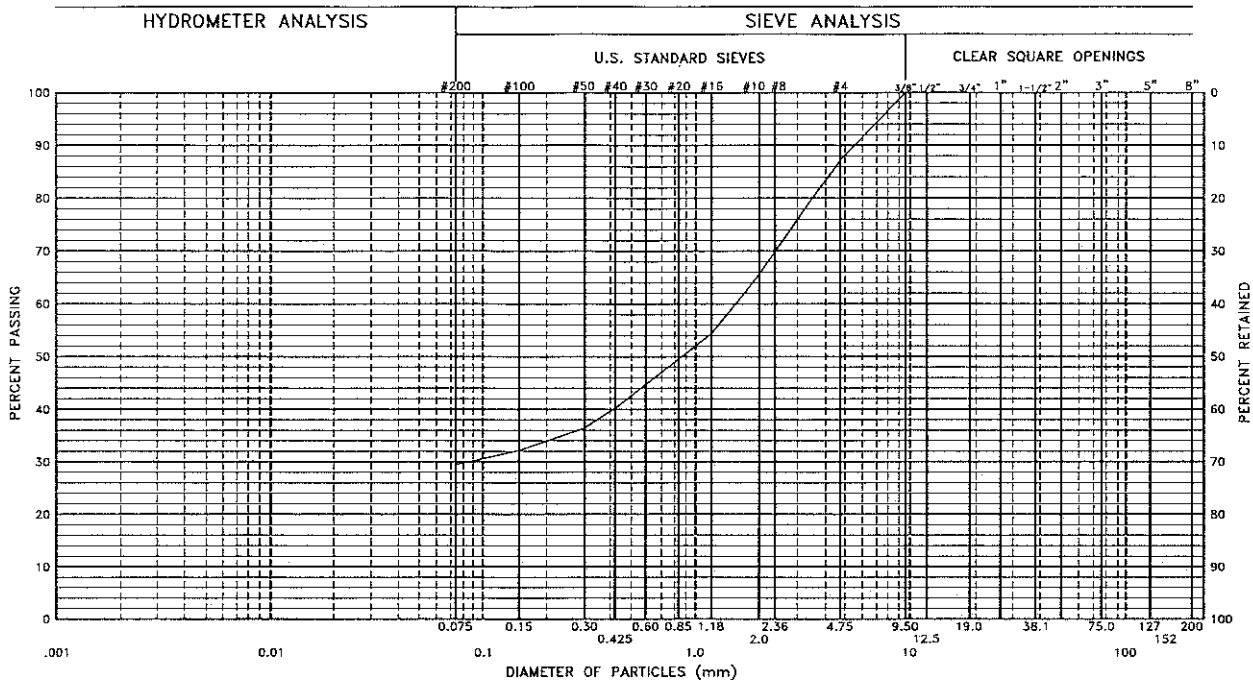
SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 9 %
SAND: 67 %
SILT AND CLAY: 24 %

LIQUID LIMIT: 34
PLASTICITY INDEX: 16

SAMPLE OF: Slightly gravelly, clayey sand
FROM: Boring 6 @ 19 feet

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 19

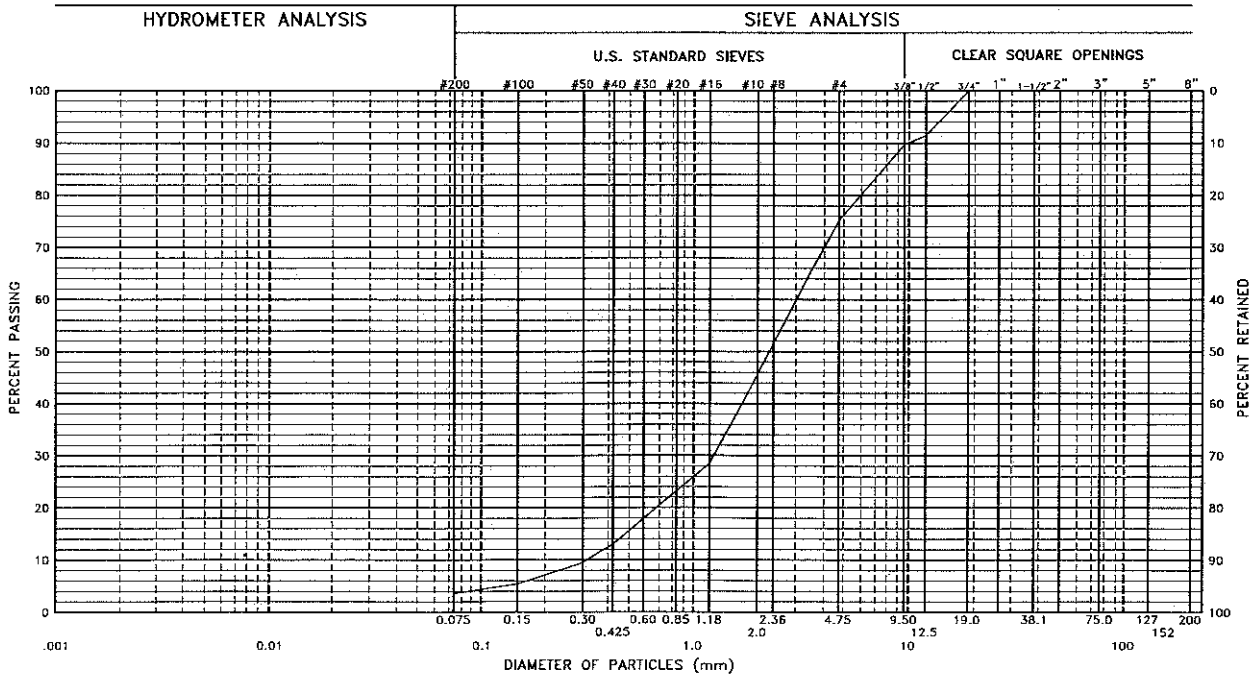


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 13 %
SAND: 57 %
SILT AND CLAY: 30 %

LIQUID LIMIT: 38
PLASTICITY INDEX: 26

SAMPLE OF: Fill: Gravelly, clayey sand
FROM: Boring 7 @ 9 feet



SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 25 %
SAND: 71 %
SILT AND CLAY: 4 %

LIQUID LIMIT:
PLASTICITY INDEX: NP

SAMPLE OF: Gravelly sand
FROM: Boring 9 @ 44 feet

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 20

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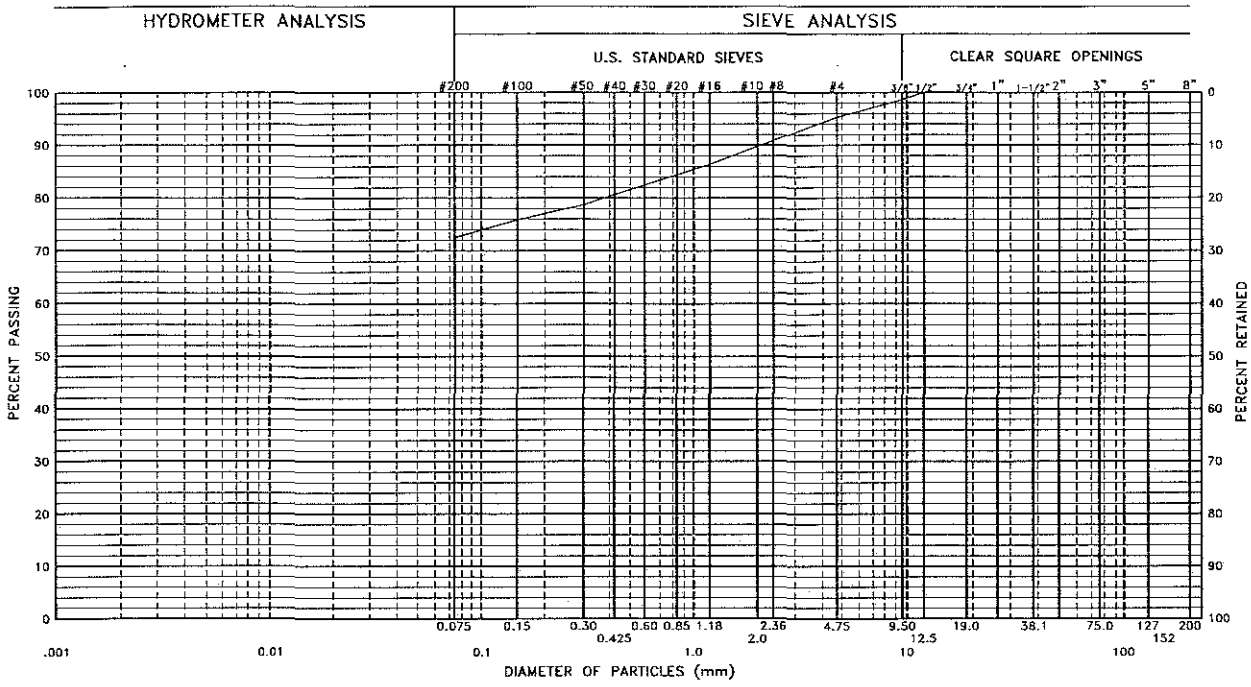
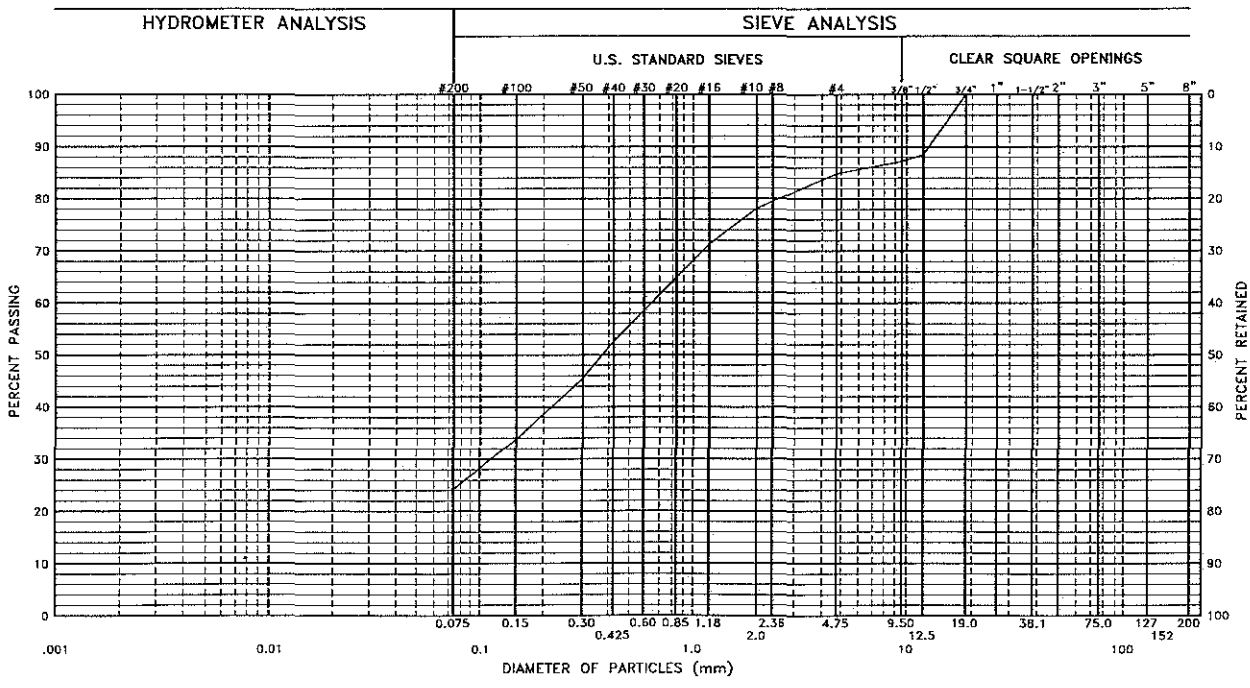


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 5 %
SAND: 22 %
SILT AND CLAY: 73 %

LIQUID LIMIT: 51
PLASTICITY INDEX: 31

SAMPLE OF: Fill: Slightly gravelly, sandy clay
FROM: Boring 12 @ 14 feet



SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 15 %
SAND: 61 %
SILT AND CLAY: 24 %

LIQUID LIMIT: 29
PLASTICITY INDEX: 3

SAMPLE OF: Fill: Gravelly, silty sand
FROM: Boring 16 @ 4 feet

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 21

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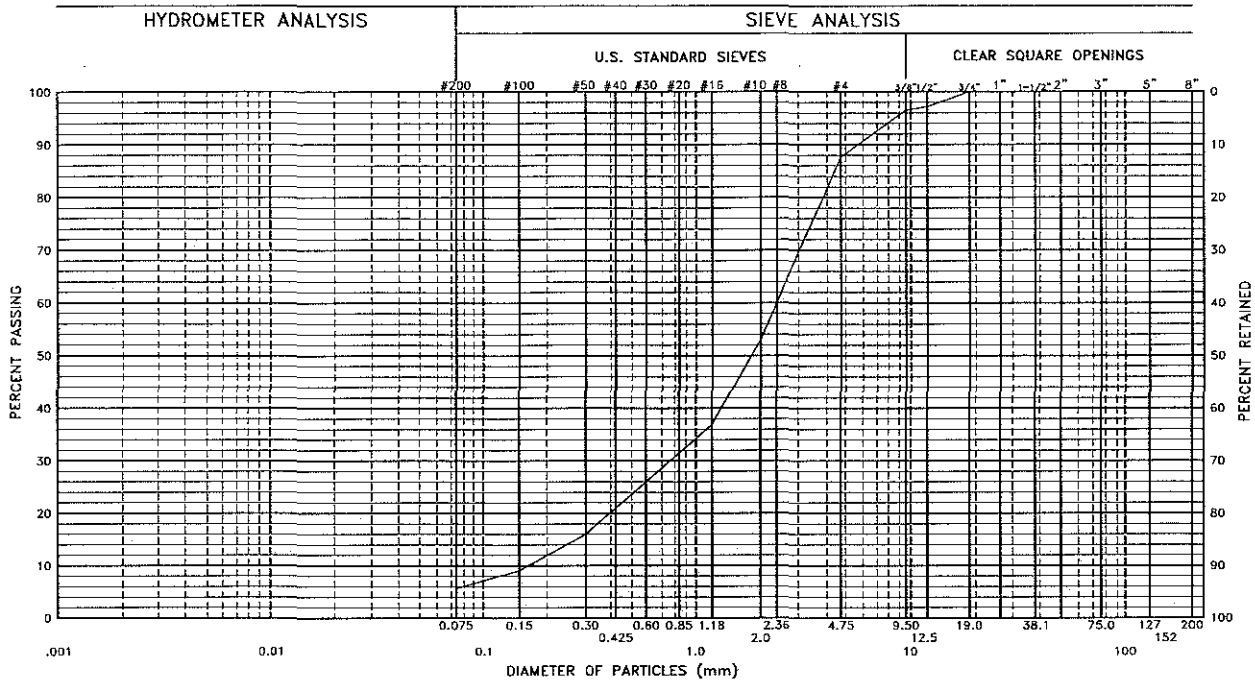
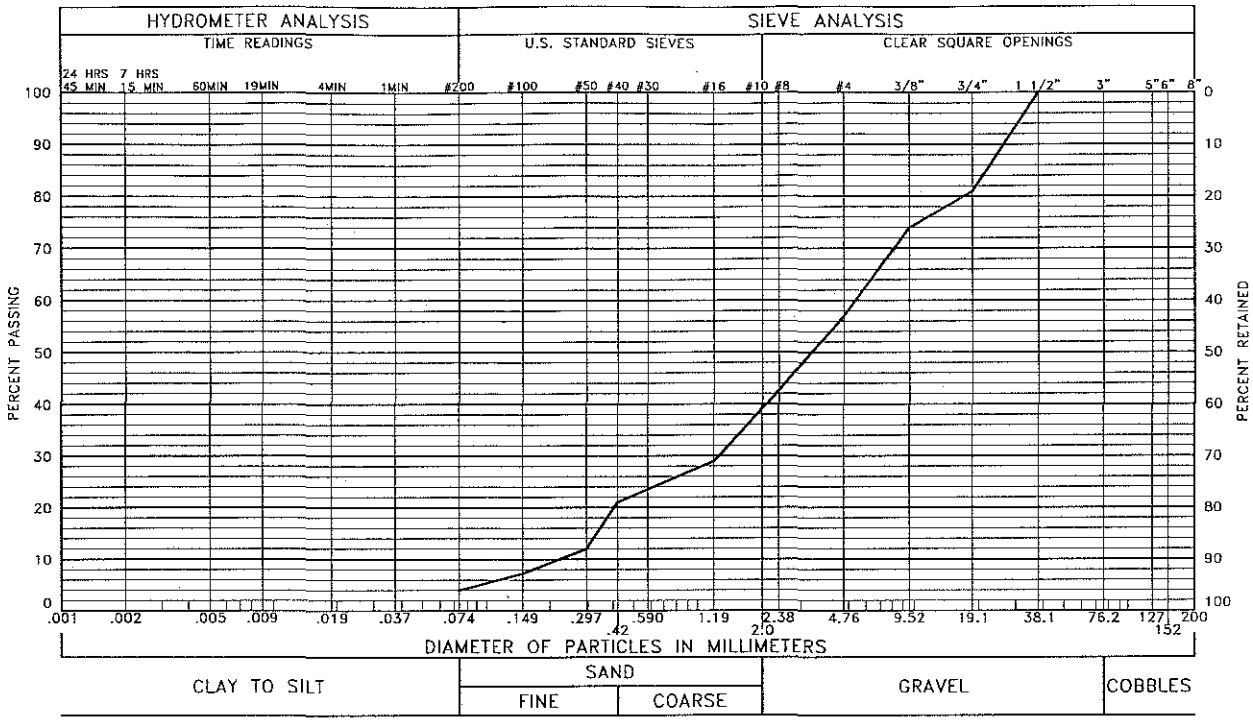


GRAVEL: 12 %
SAND: 82 %
SILT AND CLAY: 6 %

LIQUID LIMIT:
PLASTICITY INDEX: NP

SAMPLE OF: Slightly silty, slightly gravelly sand
FROM: Boring 17 @ 19 feet

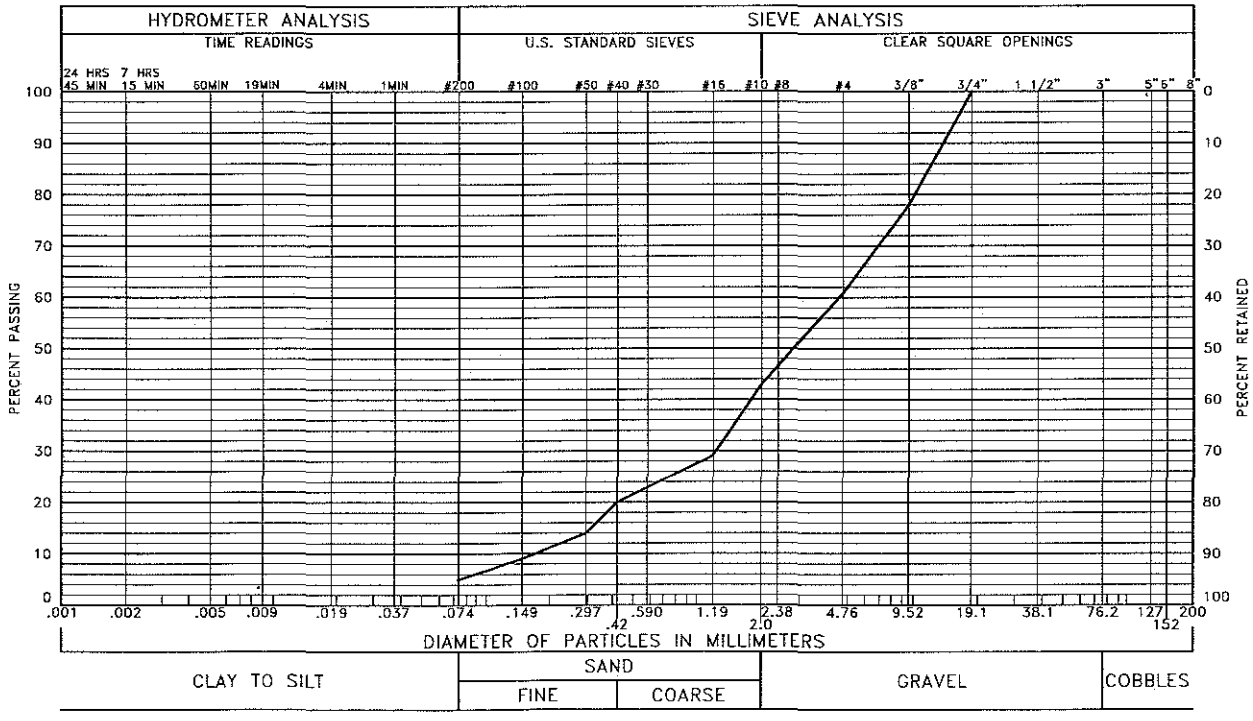


GRAVEL 61% SAND 35% SILT AND CLAY 4%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Sandy Gravel FROM: Boring 19 @ 9'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



GRAVEL 57% SAND 38% SILT AND CLAY 5%

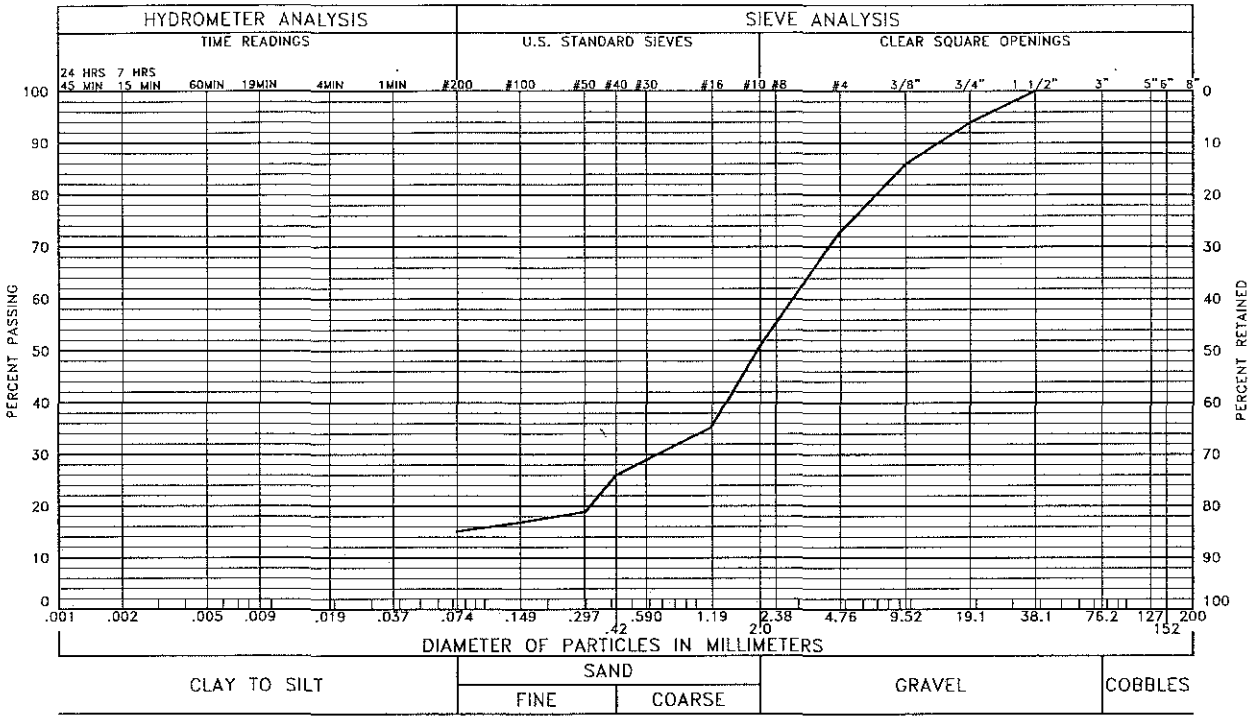
LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Slightly Silty, Sandy Gravel FROM: Boring 20 @ 5'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with AASHTO T-27 and/or T-88.

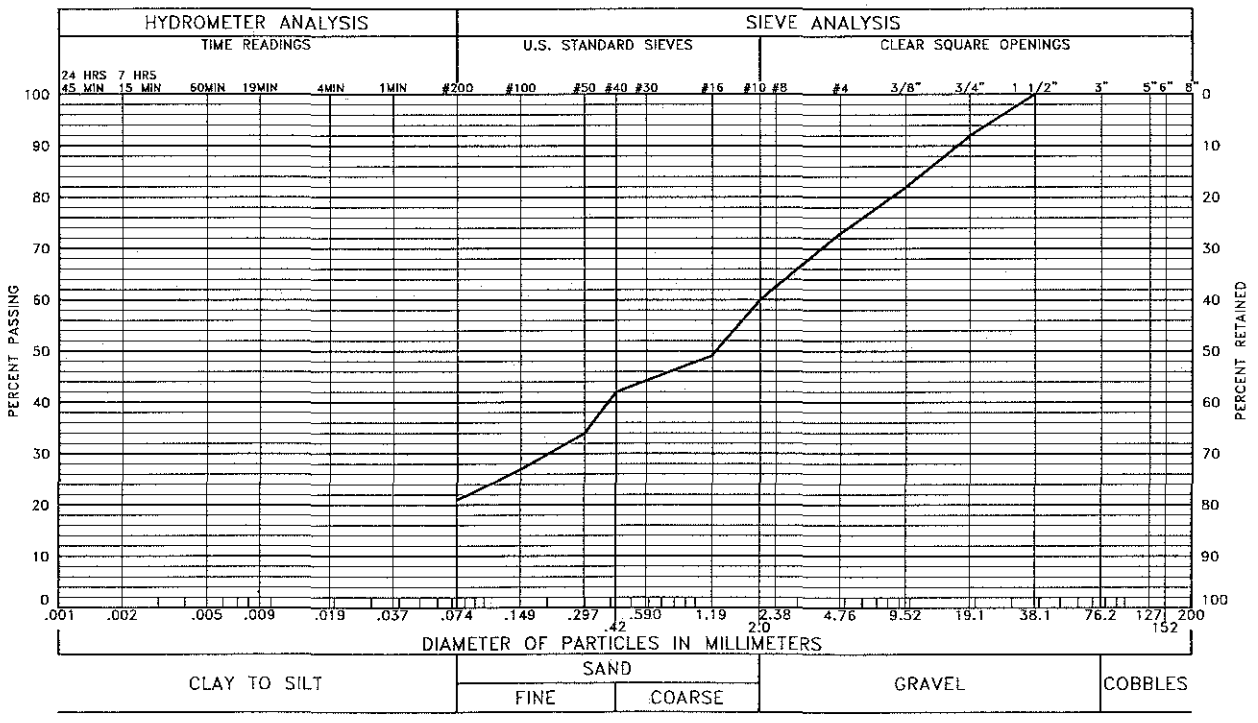
012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 23



GRAVEL	49%	SAND	36%	SILT AND CLAY	15%
LIQUID LIMIT	25%	PLASTICITY INDEX	13%		

SAMPLE OF: Clayey Sandy Gravel FROM: Boring 21 @ 19'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

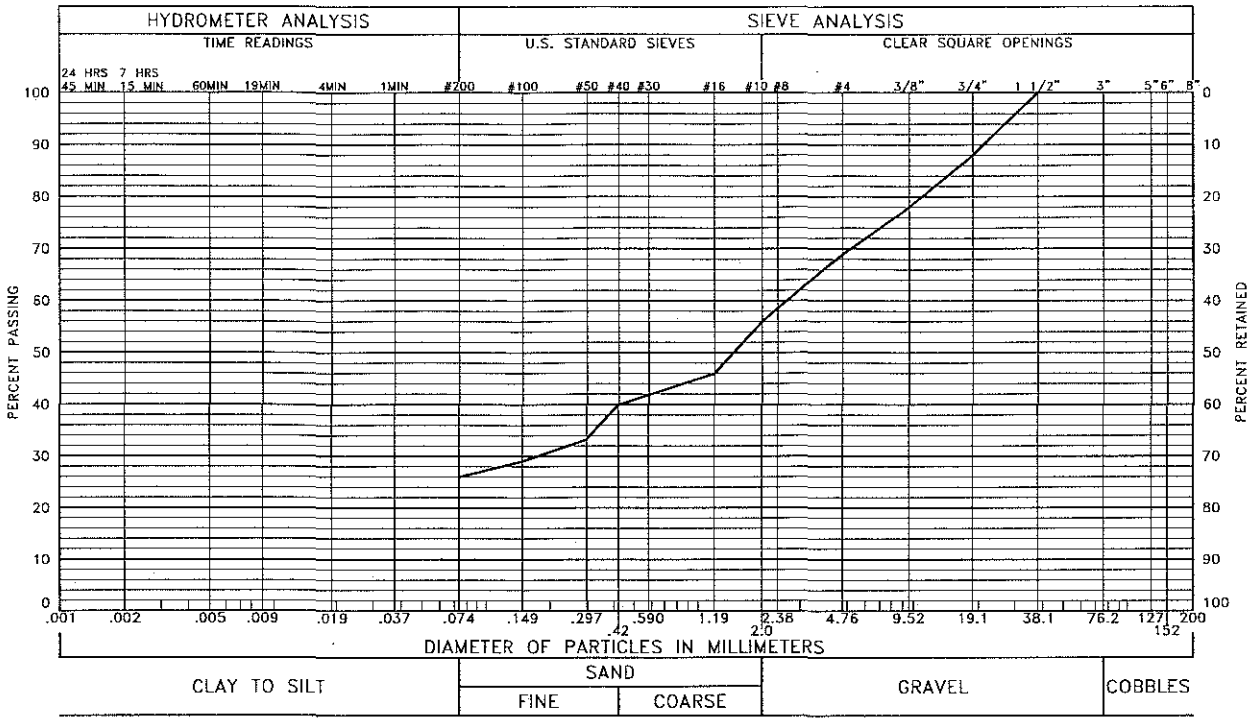


GRAVEL	40%	SAND	39%	SILT AND CLAY	21%
LIQUID LIMIT	32%	PLASTICITY INDEX	18%		

SAMPLE OF: Fill: Clayey Sandy Gravel FROM: Boring 22 @ 4'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 24

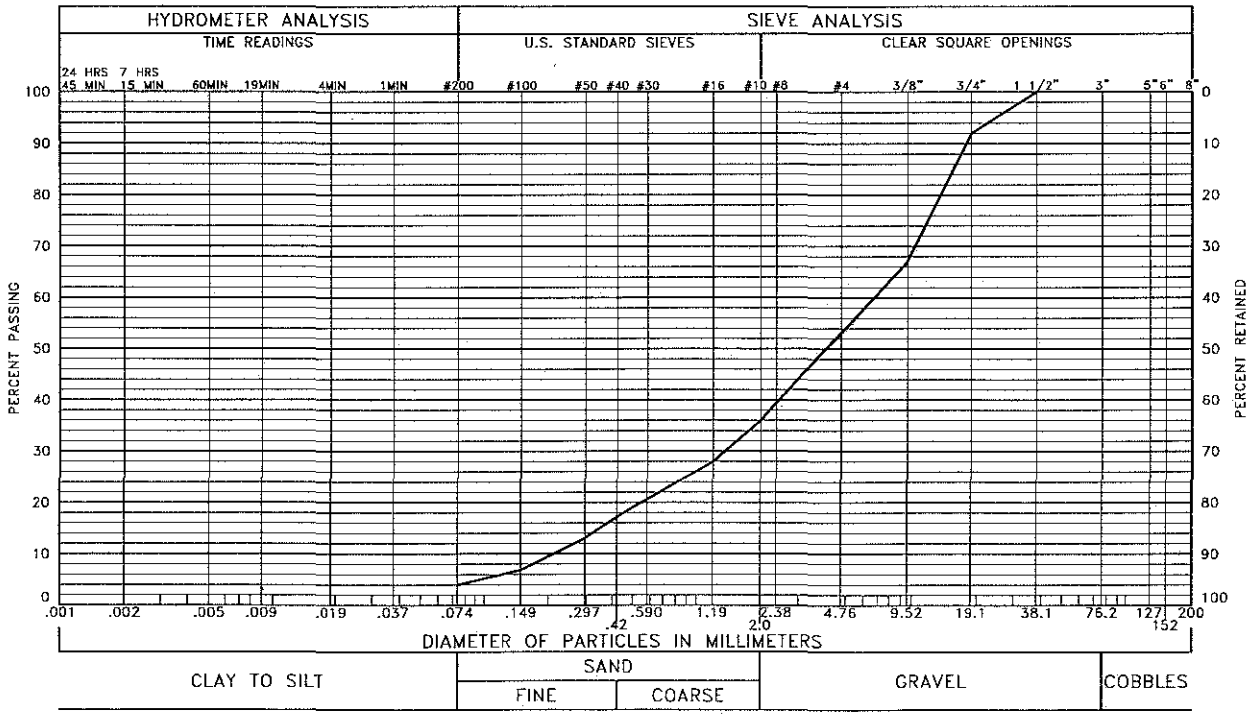


GRAVEL 44% SAND 30% SILT AND CLAY 26%

LIQUID LIMIT 31% PLASTICITY INDEX 15%

SAMPLE OF: Clayey Sandy Gravel FROM: Boring 22 @ 19'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



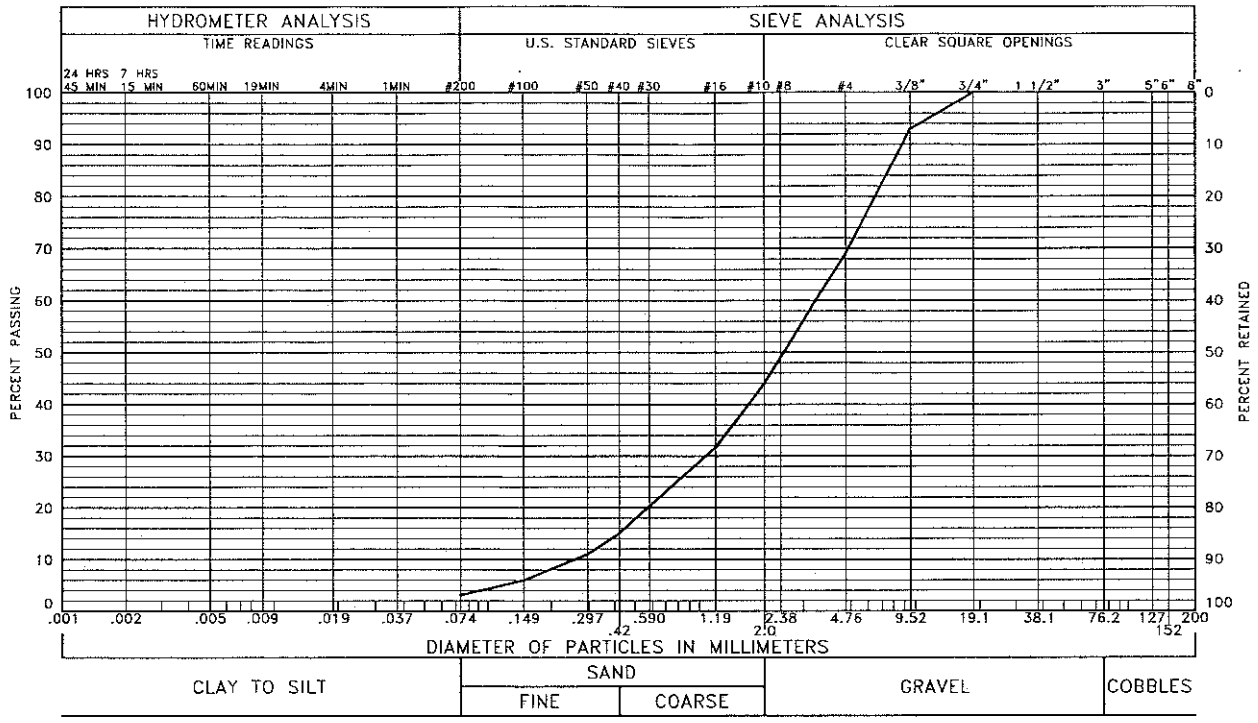
GRAVEL 64% SAND 32% SILT AND CLAY 4%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Sandy Gravel FROM: Boring 24 @ 14'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 25

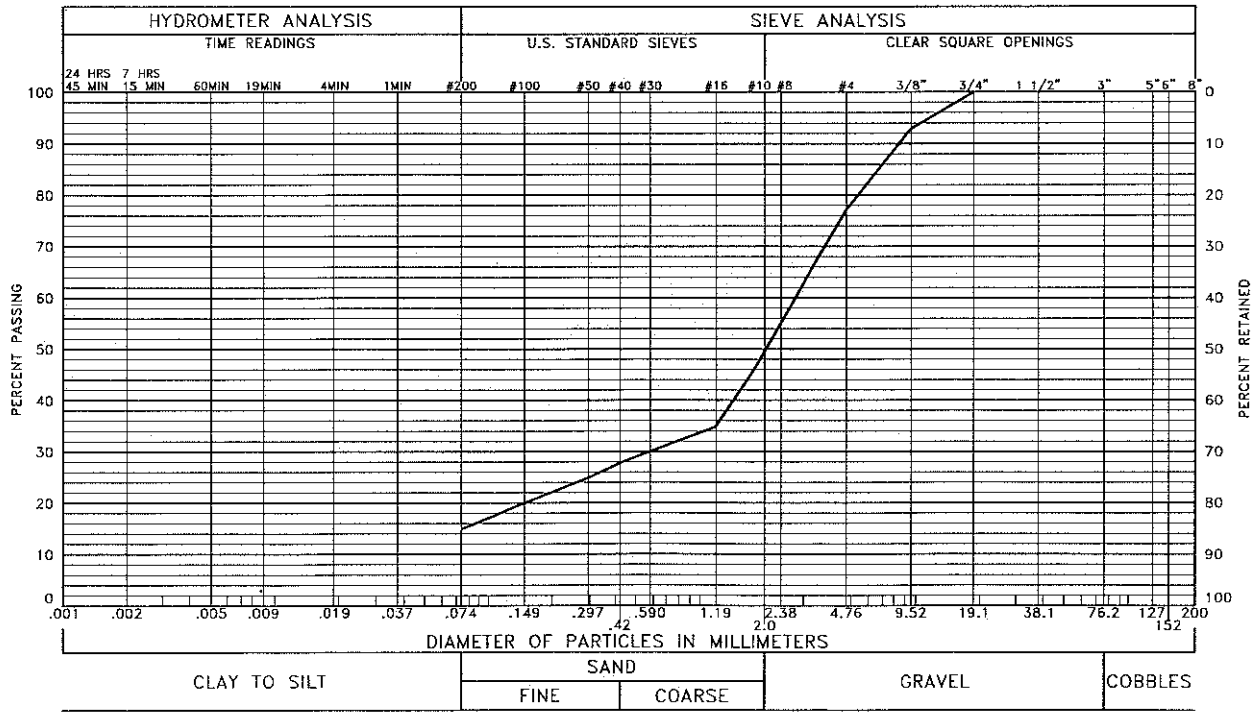


GRAVEL 56% SAND 41% SILT AND CLAY 3%

LIQUID LIMIT 37% PLASTICITY INDEX 22%

SAMPLE OF: Fill: Sandy Gravel FROM: Boring 25 @ 4'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



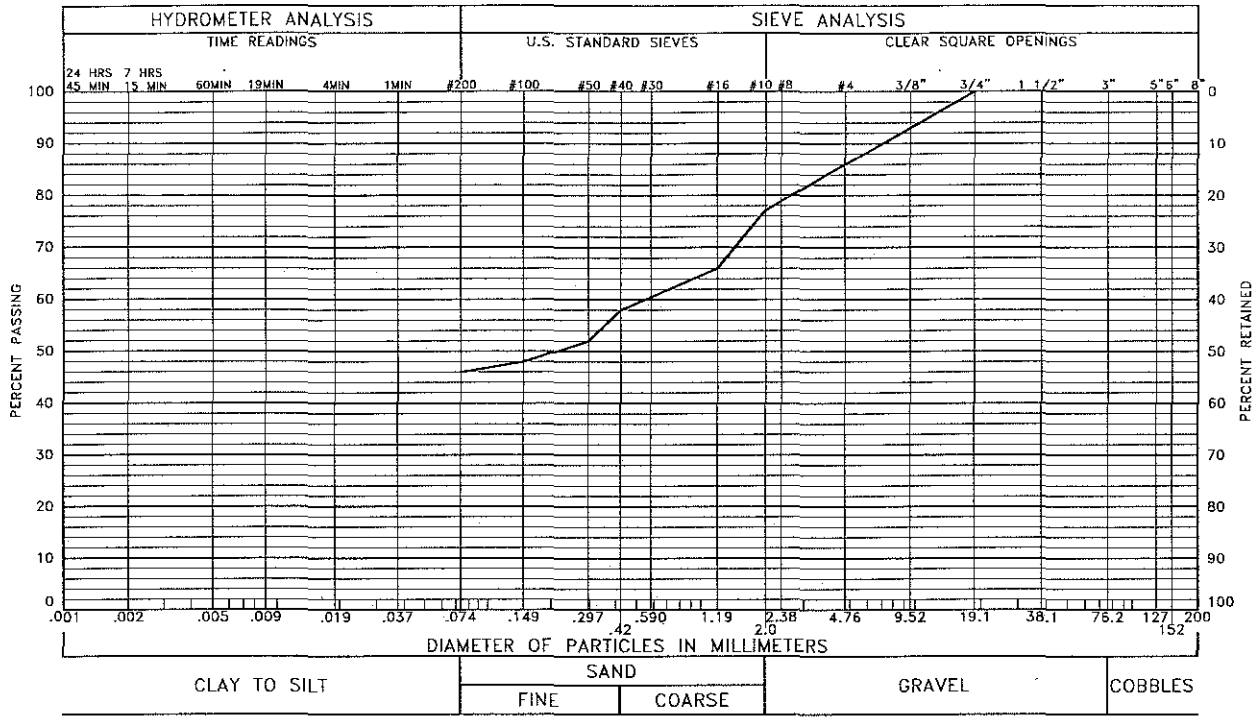
GRAVEL 53% SAND 32% SILT AND CLAY 15%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Silty Sandy Gravel FROM: Boring 26 @ 14'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 26

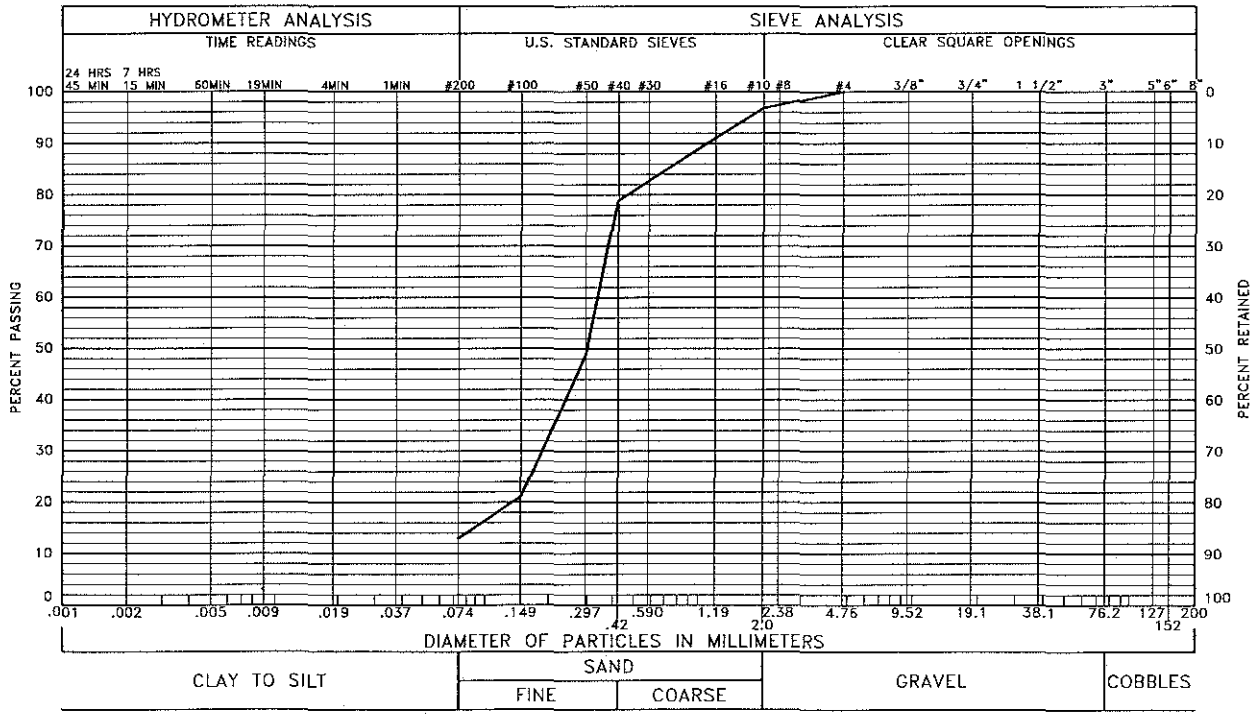


GRAVEL 23% SAND 31% SILT AND CLAY 46%

LIQUID LIMIT 42% PLASTICITY INDEX 24%

SAMPLE OF: Gravelly, Sandy Clay FROM: Boring 31 @ 19'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



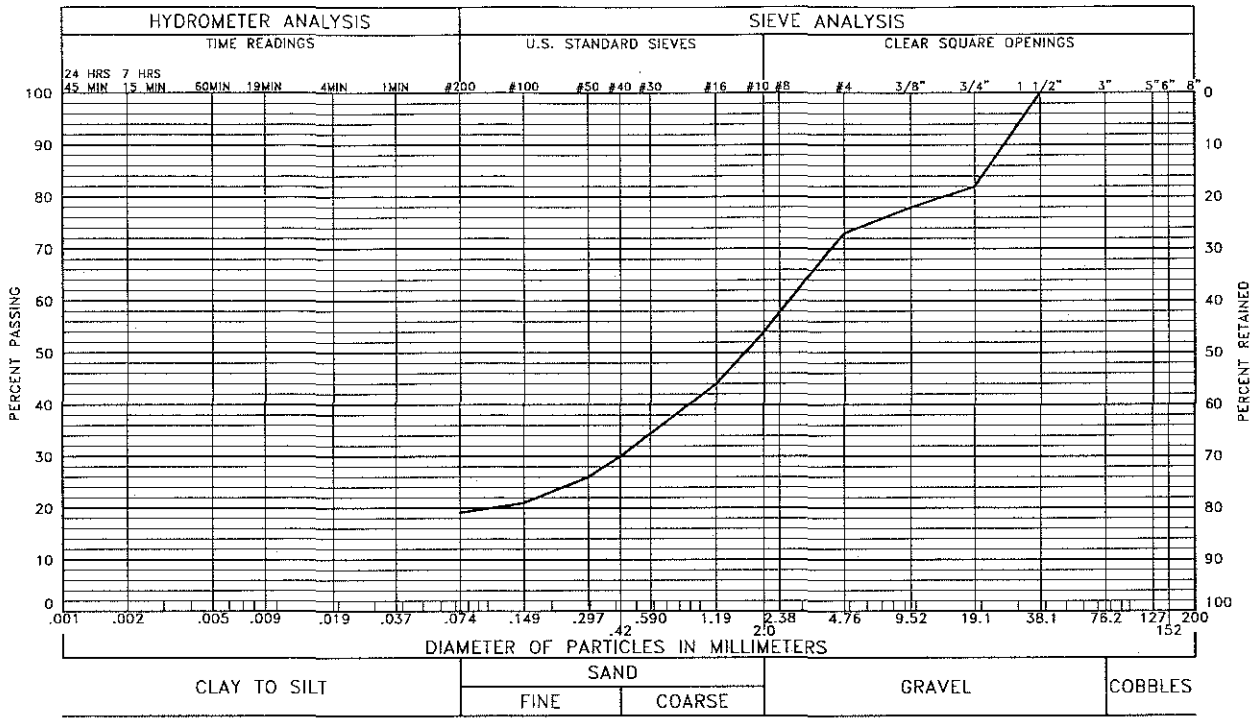
GRAVEL 3% SAND 84% SILT AND CLAY 13%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Silty Sand FROM: Boring 32 @ 14'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 27

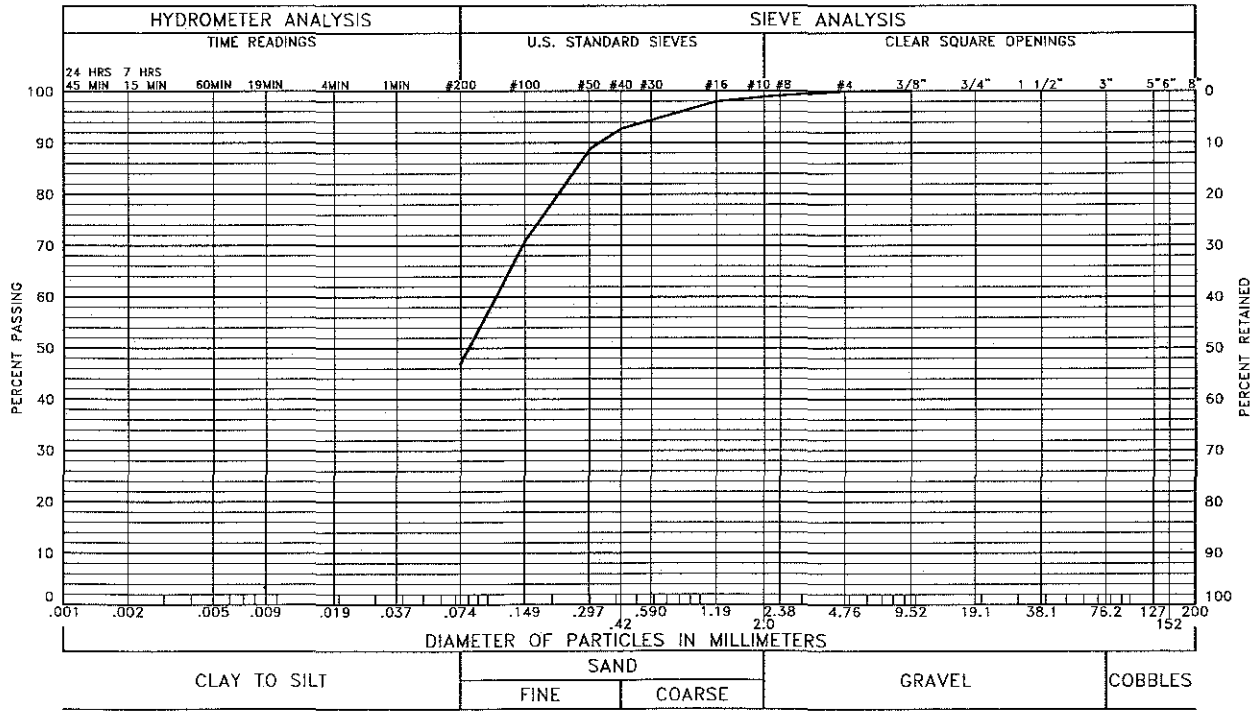


GRAVEL 46% SAND 35% SILT AND CLAY 19%

LIQUID LIMIT 24% PLASTICITY INDEX 5%

SAMPLE OF: Silty Sandy Gravel FROM: Boring 33 @ 2'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



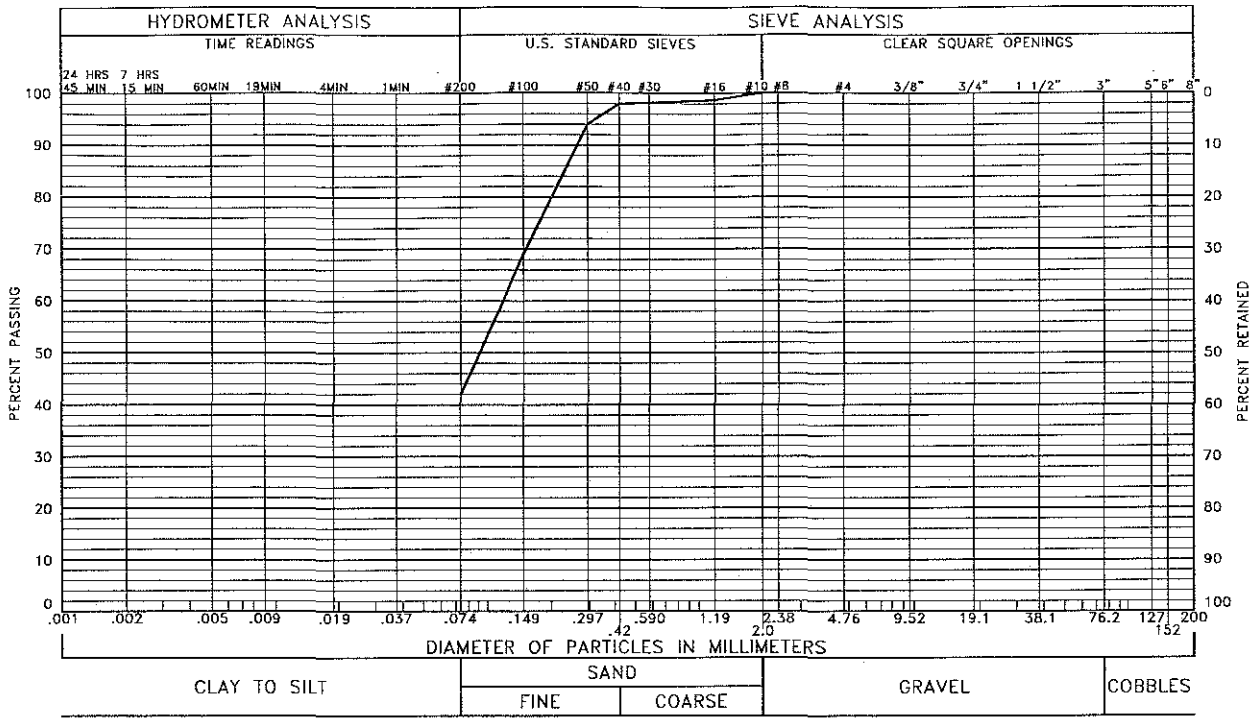
GRAVEL 1% SAND 52% SILT AND CLAY 47%

LIQUID LIMIT 29% PLASTICITY INDEX 11%

SAMPLE OF: Fill: Very Clayey Sand FROM: Boring 34 @ 9'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

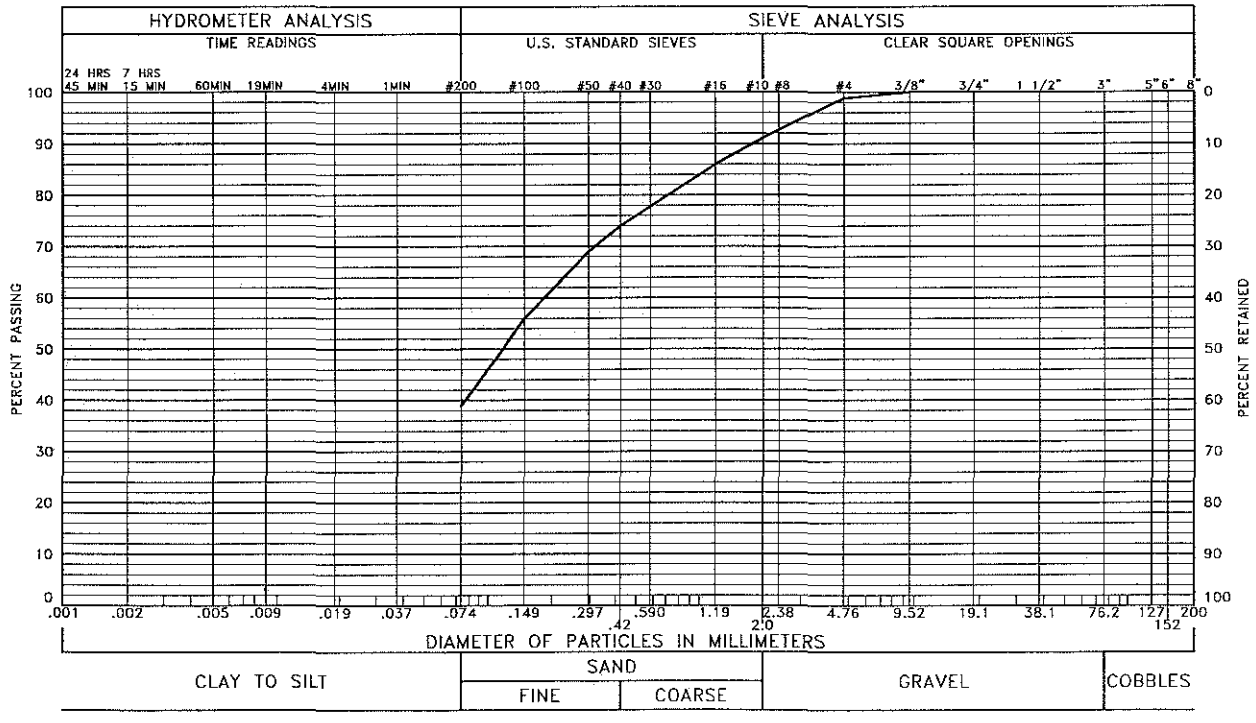
012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 28



GRAVEL	0%	SAND	58%	SILT AND CLAY	42%
LIQUID LIMIT	25%	PLASTICITY INDEX	7%		

SAMPLE OF: Very Clayey Sand FROM: Boring 35 @ 19'

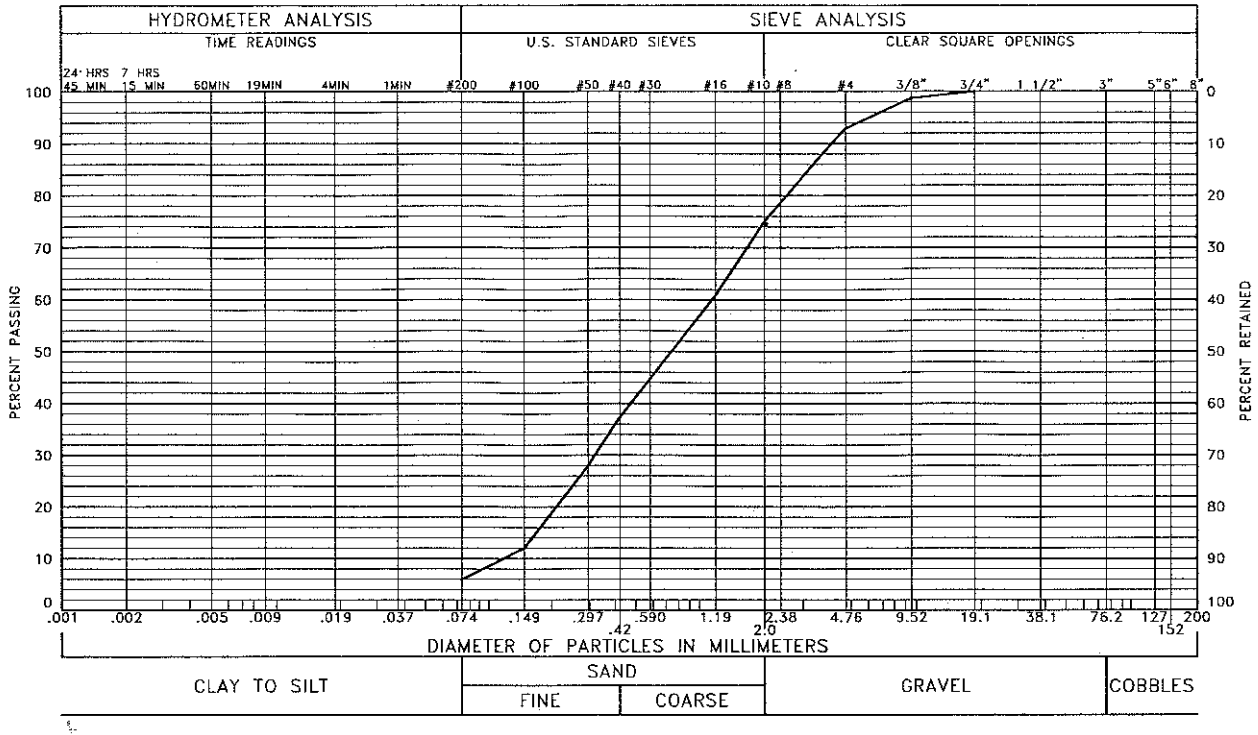
Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



GRAVEL	9%	SAND	52%	SILT AND CLAY	39%
LIQUID LIMIT	24%	PLASTICITY INDEX	4%		

SAMPLE OF: Slightly Gravelly, Silty Sand FROM: Boring 37 @ 9'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

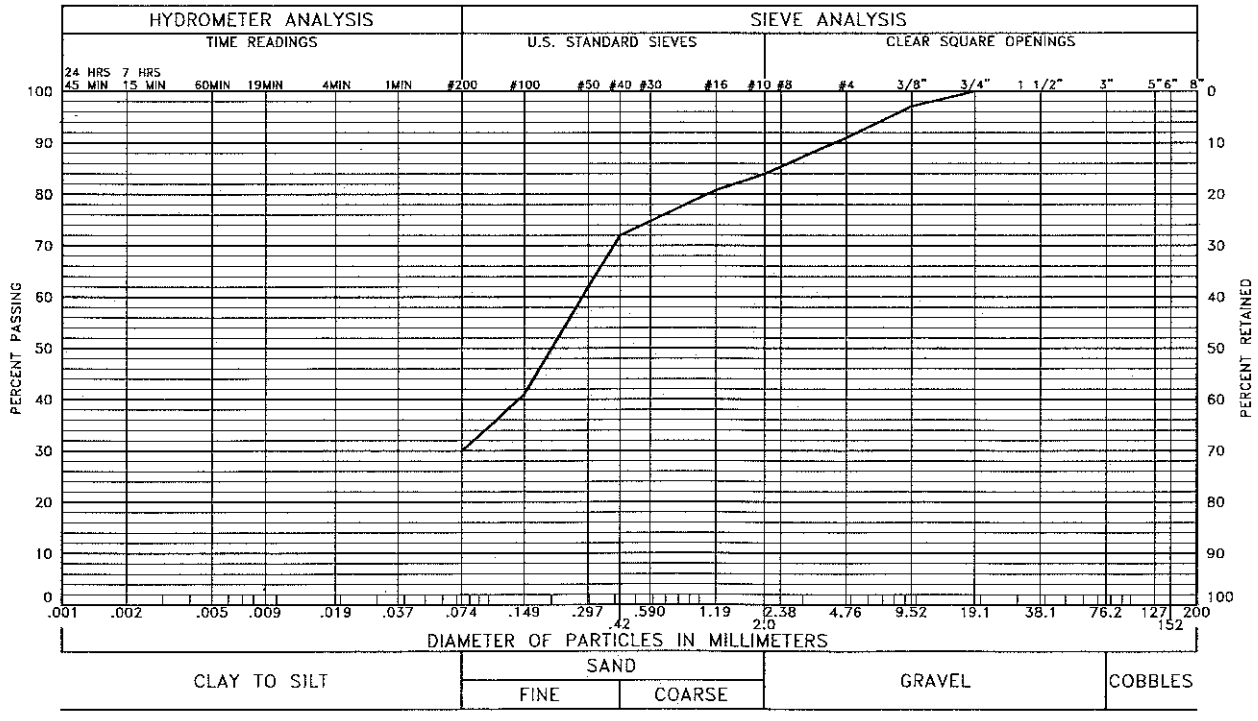


GRAVEL 25% SAND 69% SILT AND CLAY 6%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Slightly Silty, Gravelly Sand FROM: Boring 37 @ 14'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



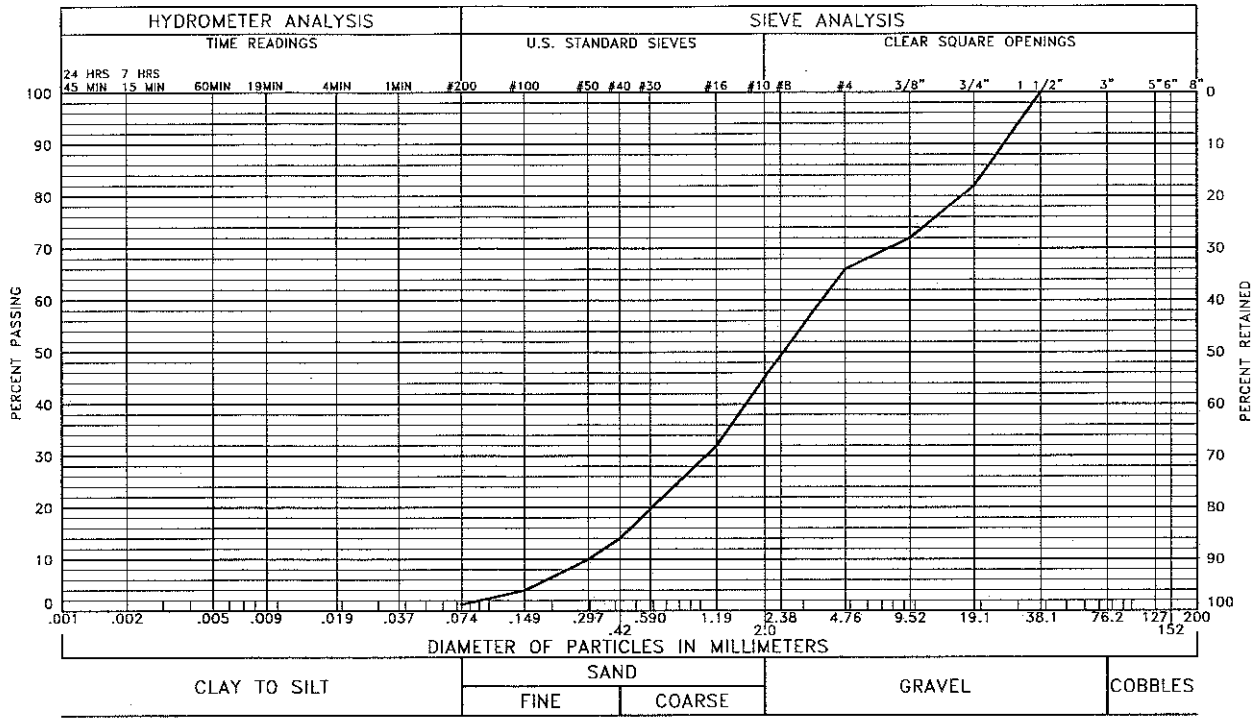
GRAVEL 16% SAND 54% SILT AND CLAY 30%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Gravelly, Silty Sand FROM: Boring 38 @ 24'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 30

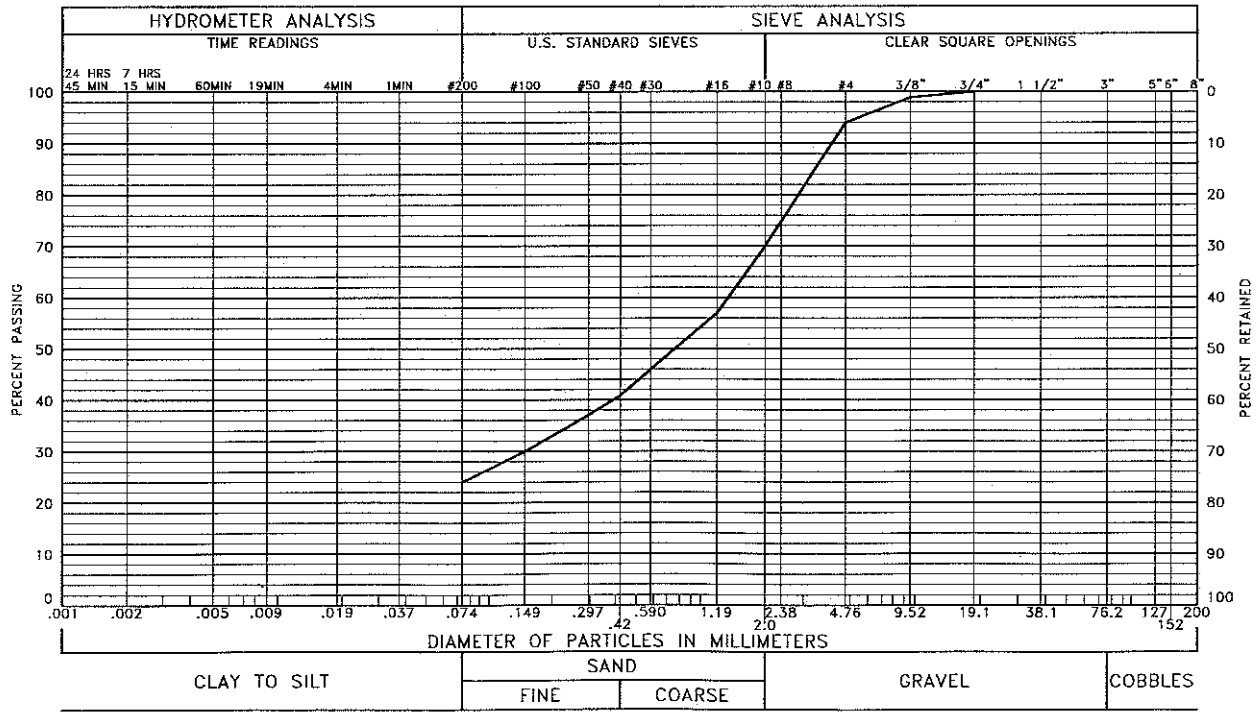


GRAVEL 55% SAND 44% SILT AND CLAY 1%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Very Sandy Gravel FROM: Boring 39 @ 9'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



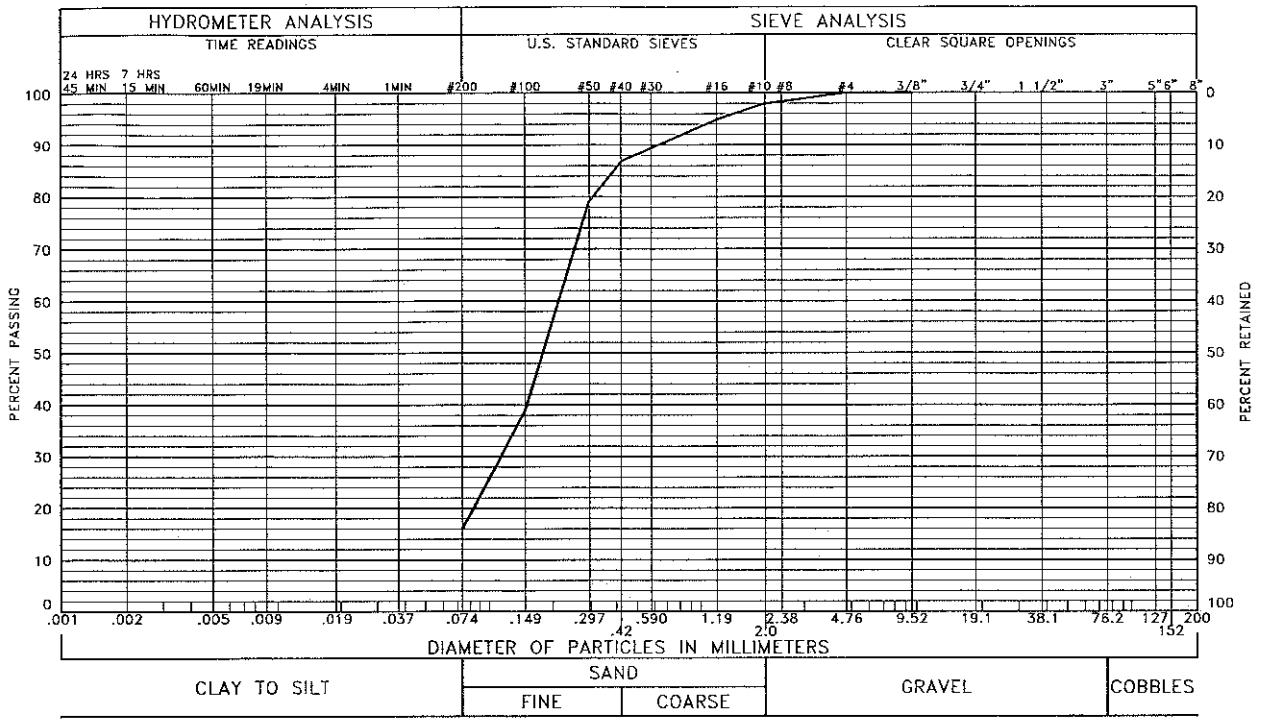
GRAVEL 30% SAND 46% SILT AND CLAY 24%

LIQUID LIMIT 21% PLASTICITY INDEX 4%

SAMPLE OF: Fill: Silty Gravelly Sand FROM: Boring 40 @ 2'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 31

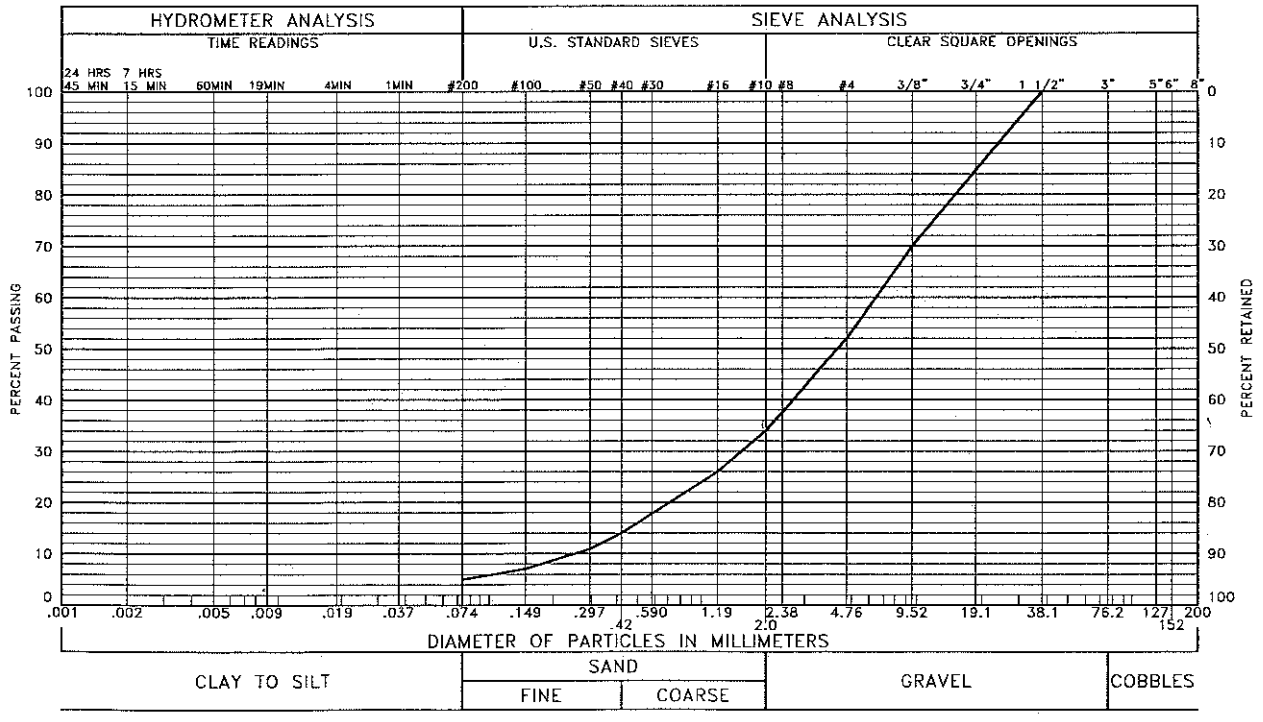


GRAVEL 3% SAND 81% SILT AND CLAY 16%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Silty Sand FROM: Boring 42 @ 4'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



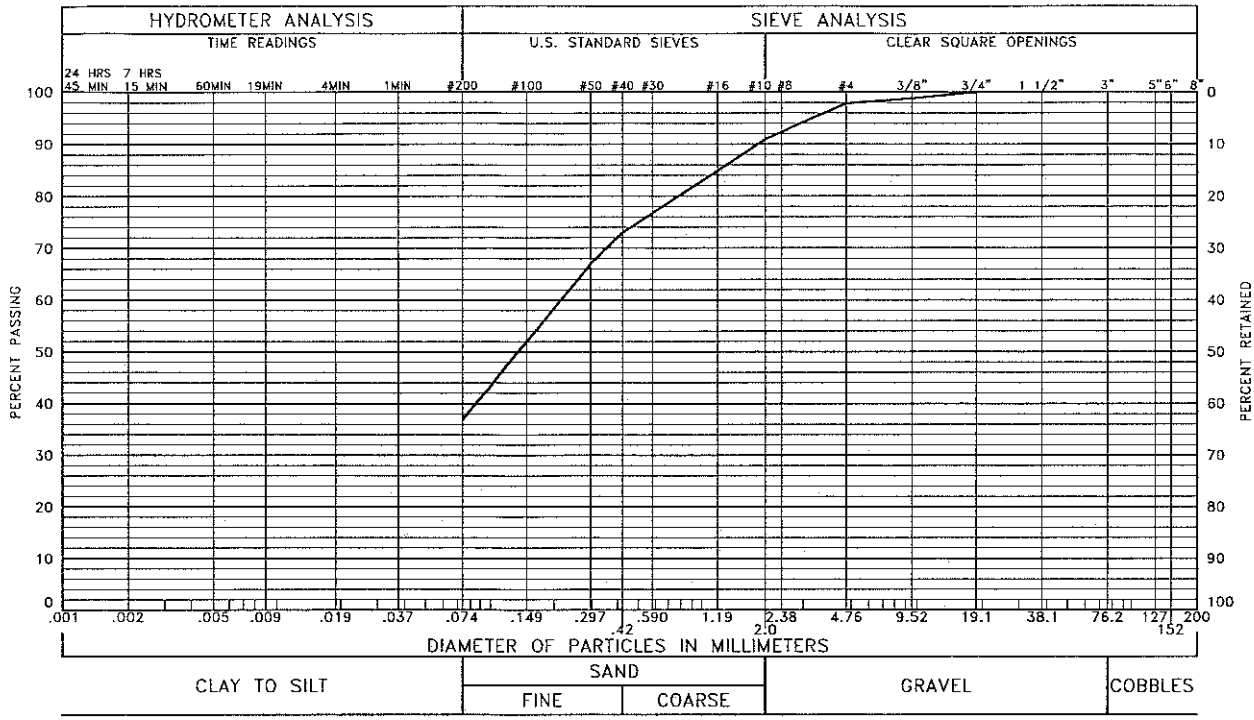
GRAVEL 66% SAND 29% SILT AND CLAY 5%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Slightly Silty, Sandy gravel FROM: Boring 43 @ 2'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 32

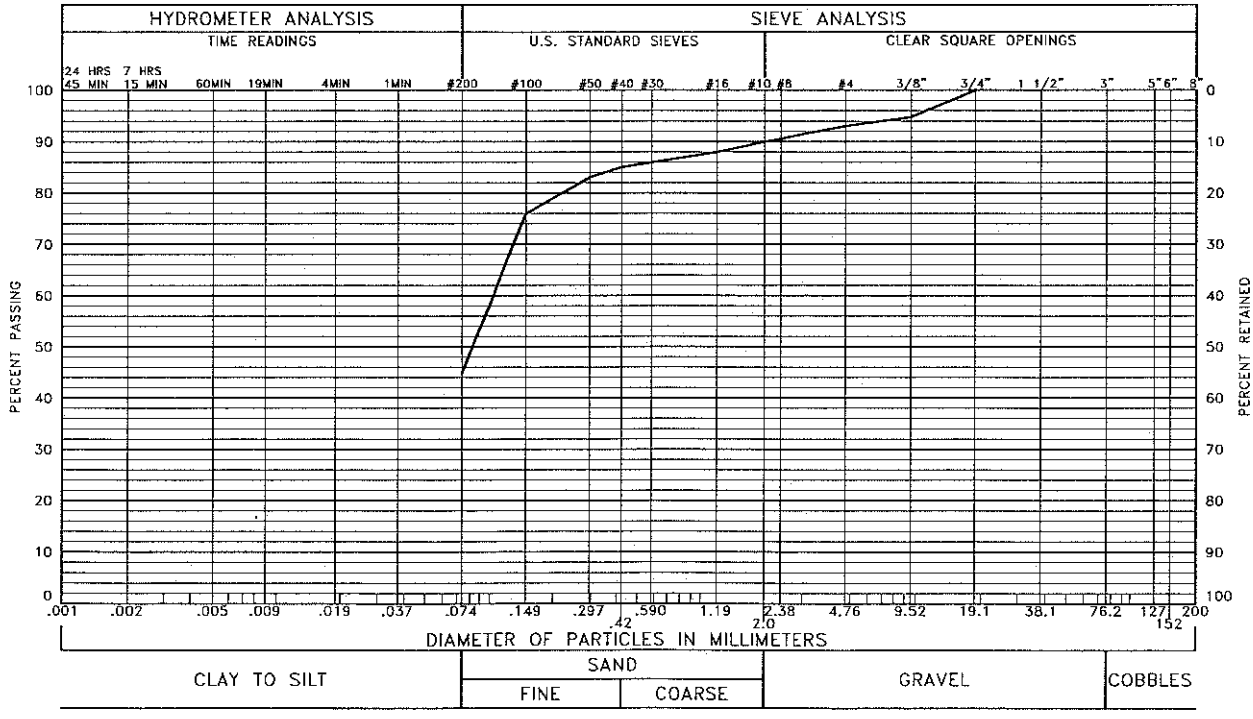


GRAVEL 9% SAND 54% SILT AND CLAY 37%

LIQUID LIMIT 25% PLASTICITY INDEX 9%

SAMPLE OF: Slightly Gravelly, Clayey Sand FROM: Boring 45 @ 9'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



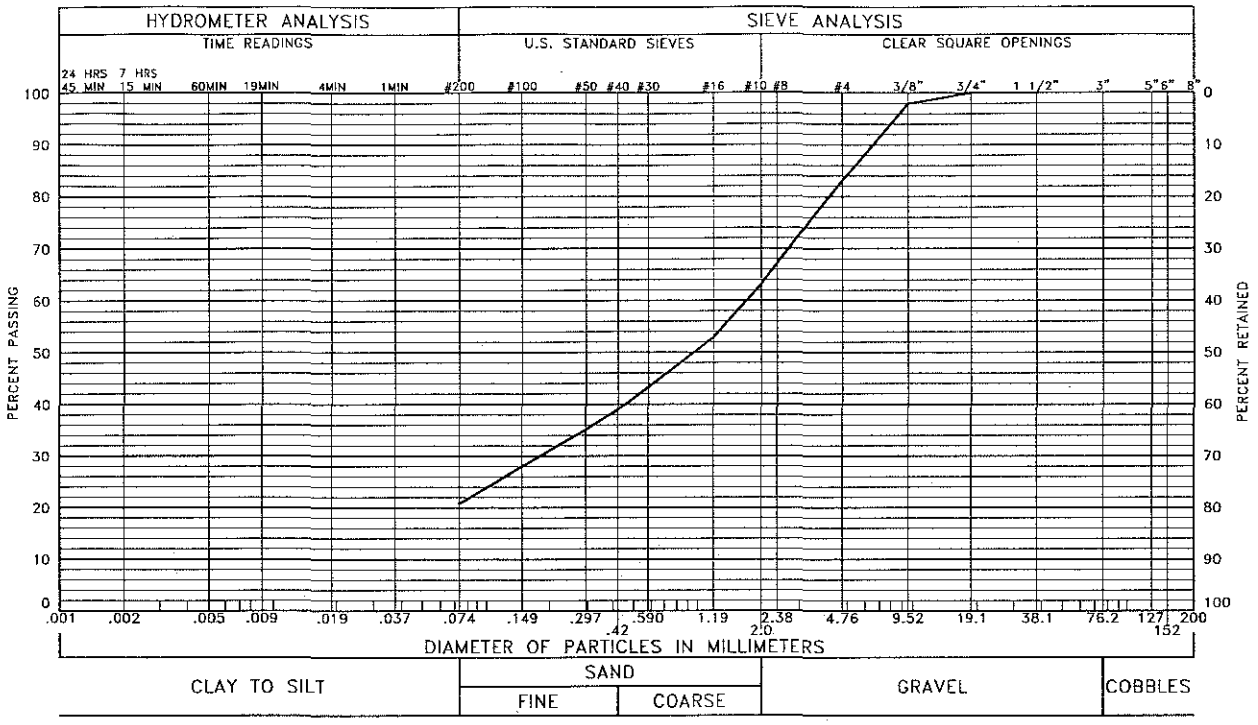
GRAVEL 10% SAND 45% SILT AND CLAY 45%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Fill: Slightly Gravelly, Silt and Sand FROM: Boring 48 @ 2'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 33

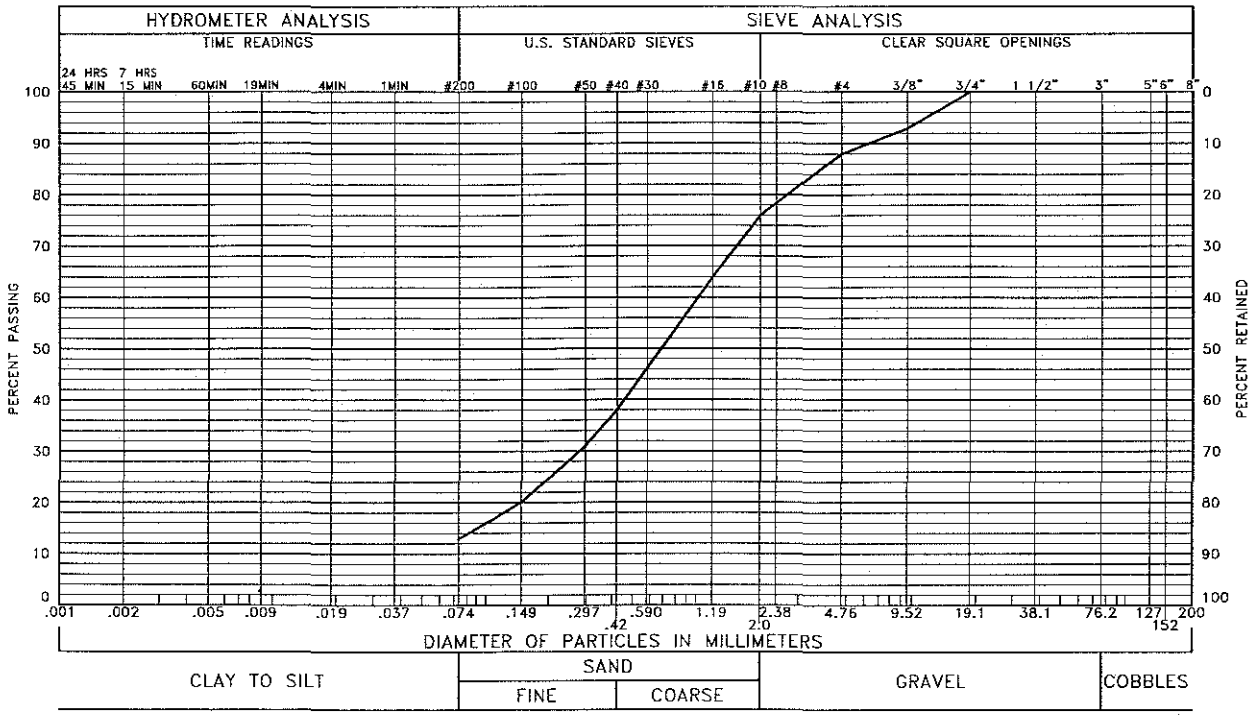


GRAVEL 38% SAND 41% SILT AND CLAY 21%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Silty Gravelly Sand FROM: Boring 48 @ 4'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).



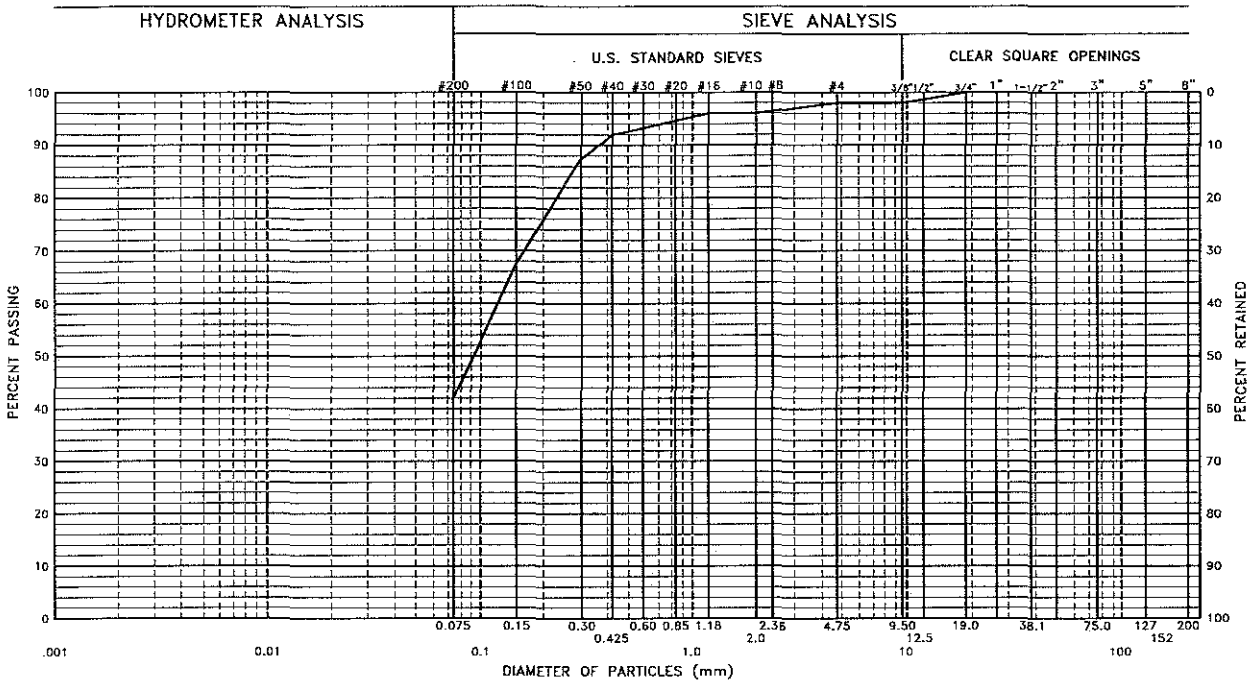
GRAVEL 24% SAND 63% SILT AND CLAY 13%

LIQUID LIMIT PLASTICITY INDEX NP

SAMPLE OF: Silty Gravelly Sand FROM: Boring 49 @ 19'

Percent constituents based on AASHTO; classification based on ASTM (Unified Soil Classification System).

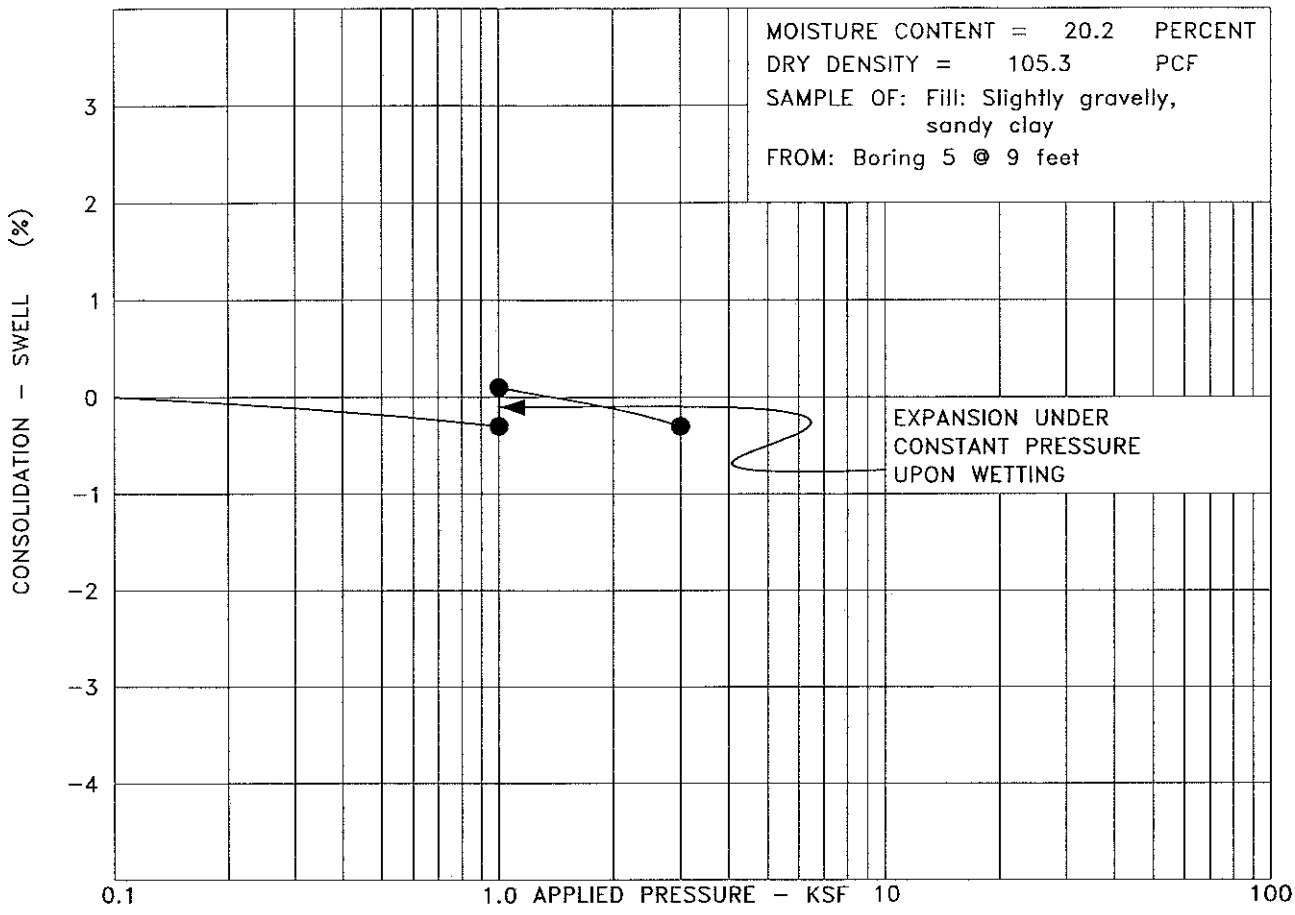
012-266	Kumar & Associates	GRADATION TEST RESULTS	Fig. 34

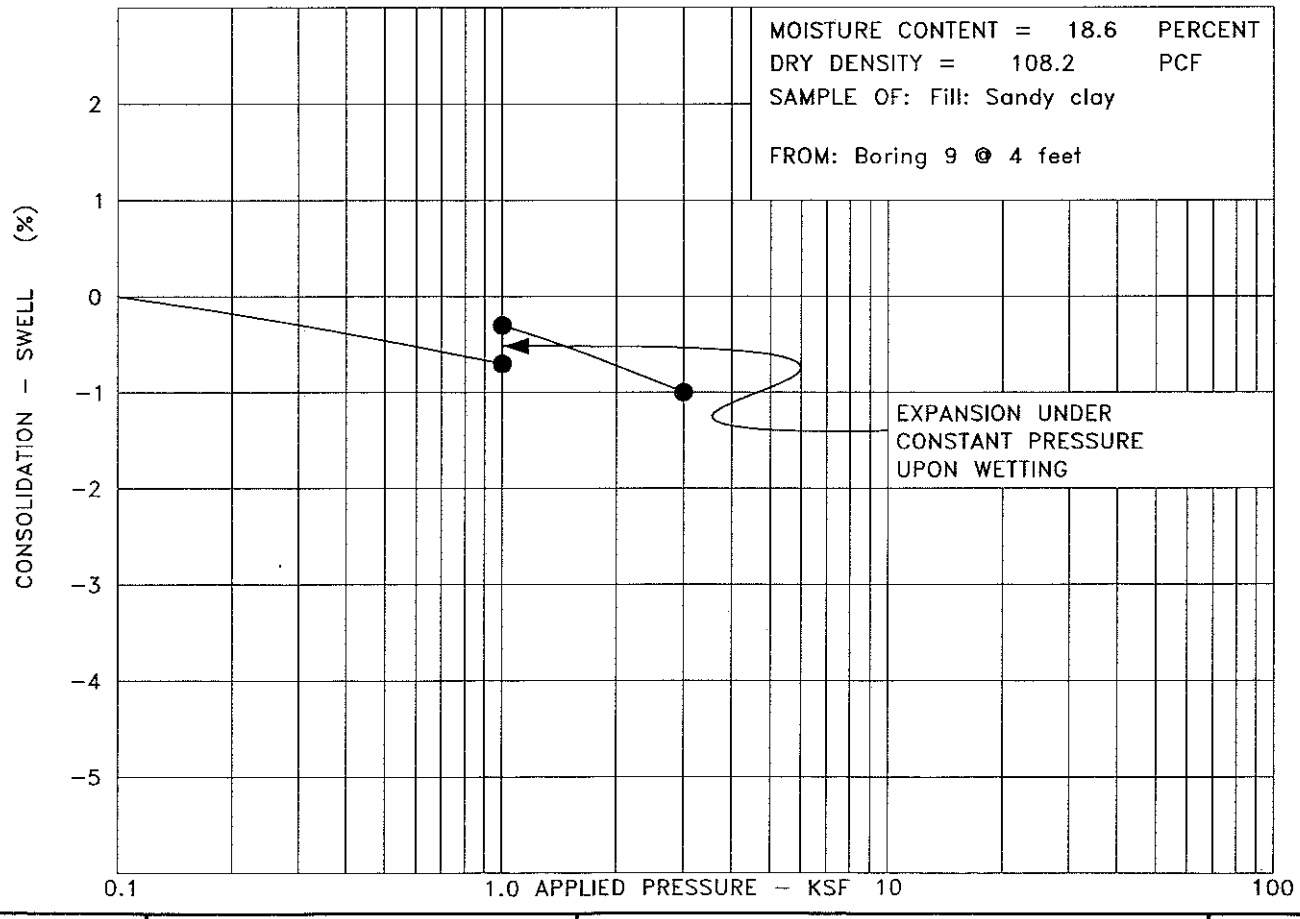


GRAVEL: 4 %
SAND: 55 %
SILT AND CLAY: 41 %

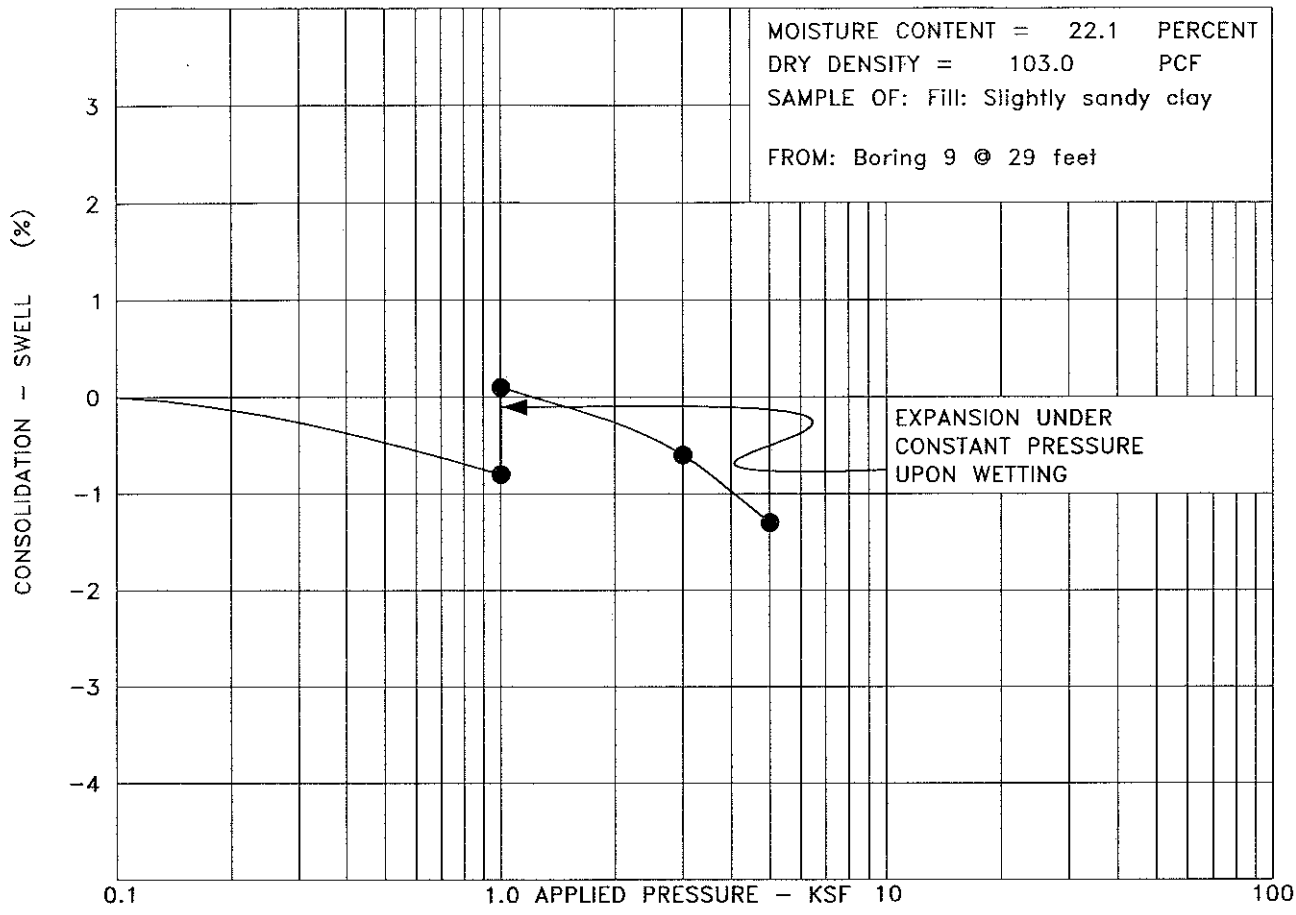
LIQUID LIMIT: 21
PLASTICITY INDEX: 2

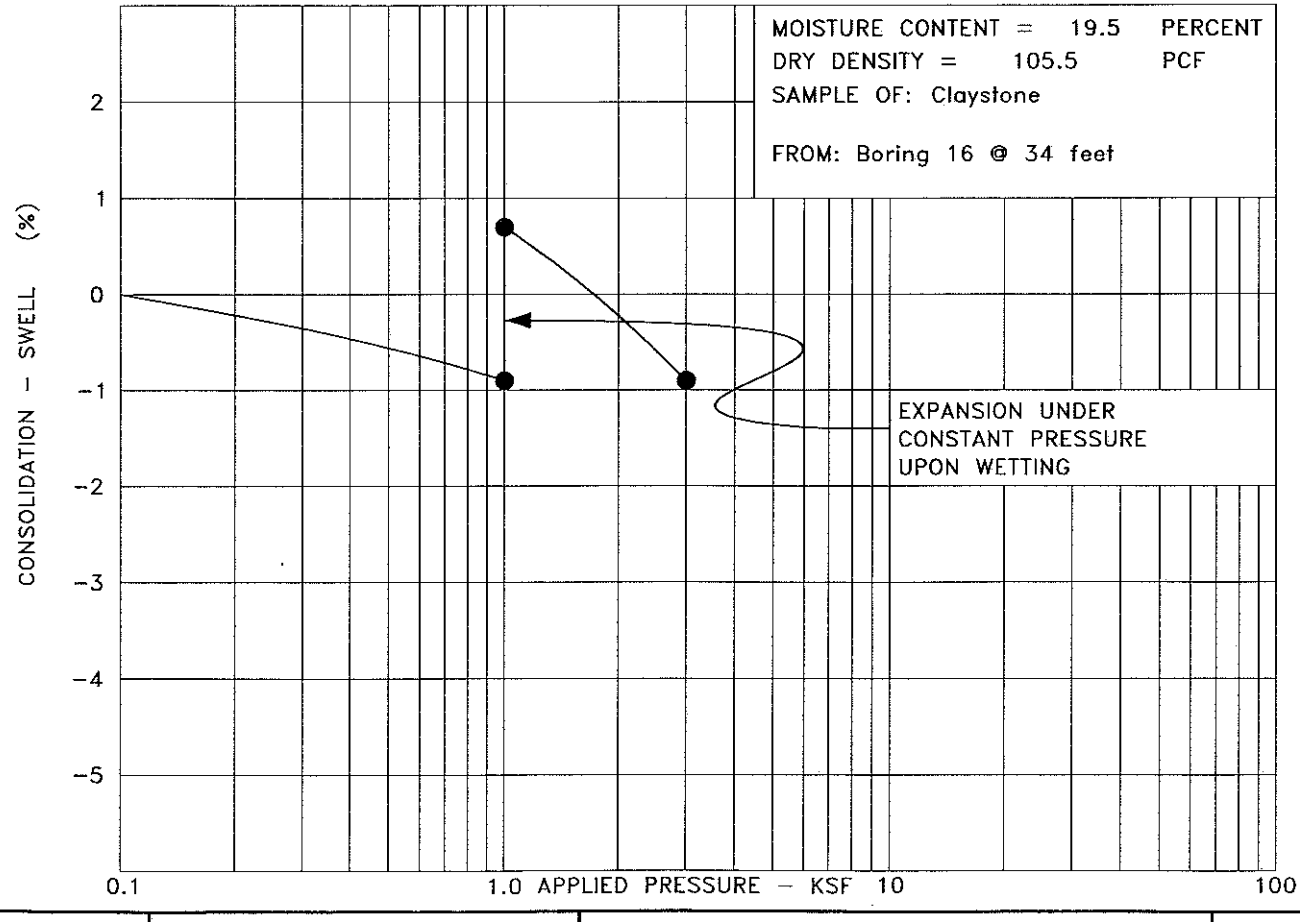
SAMPLE OF: Very silty sand
FROM: Boring 50 @ 24 feet



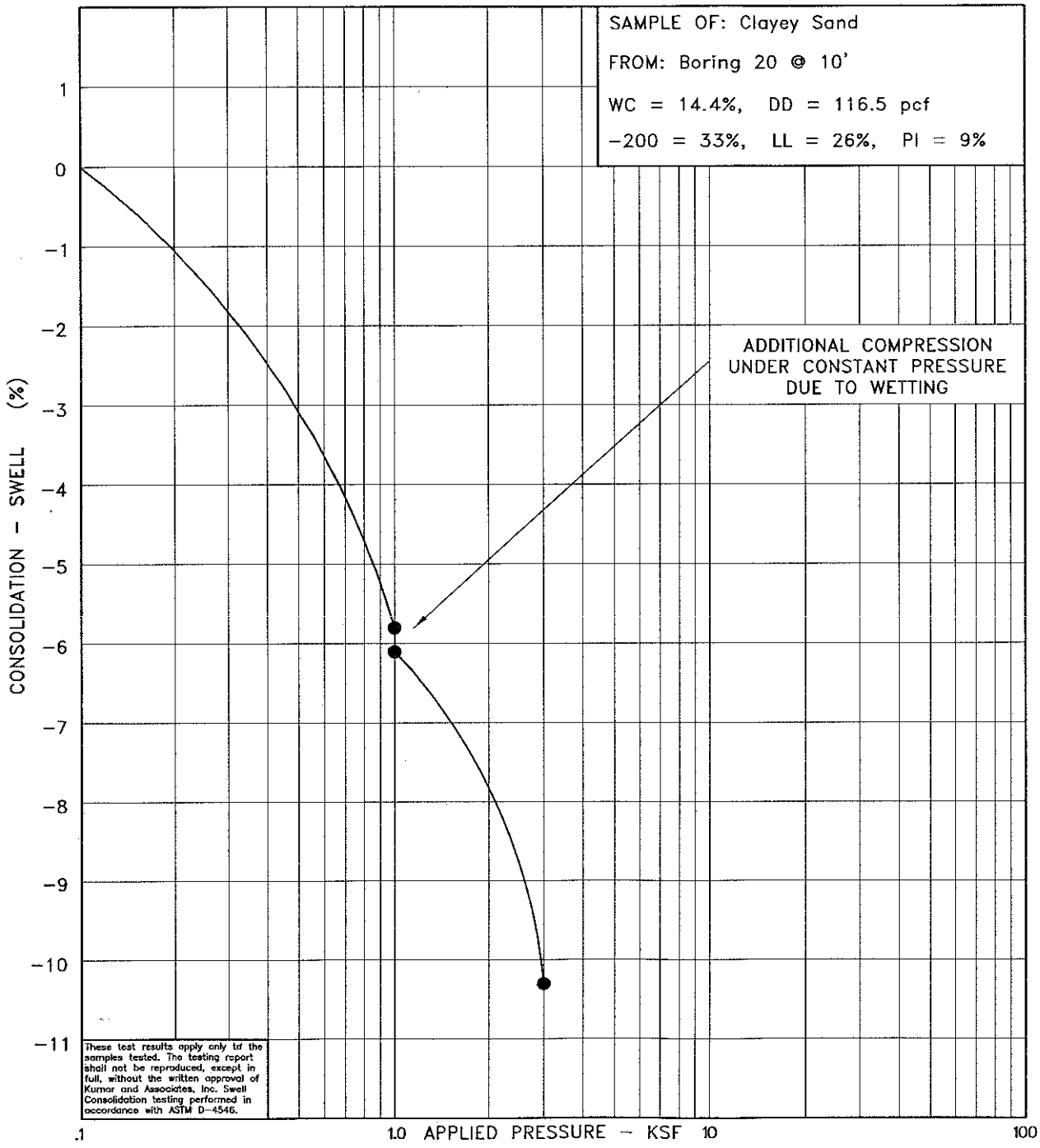


012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 36

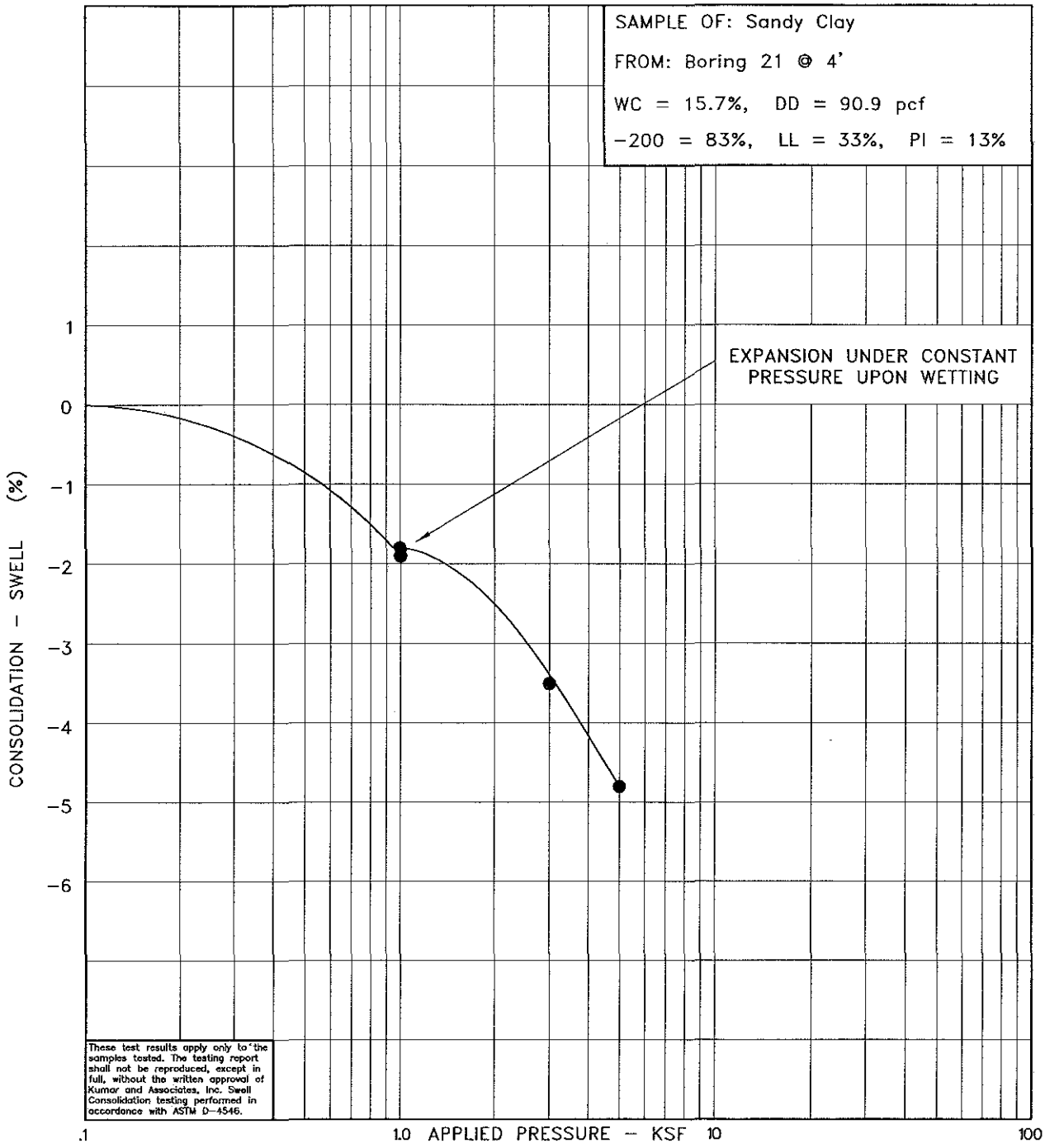




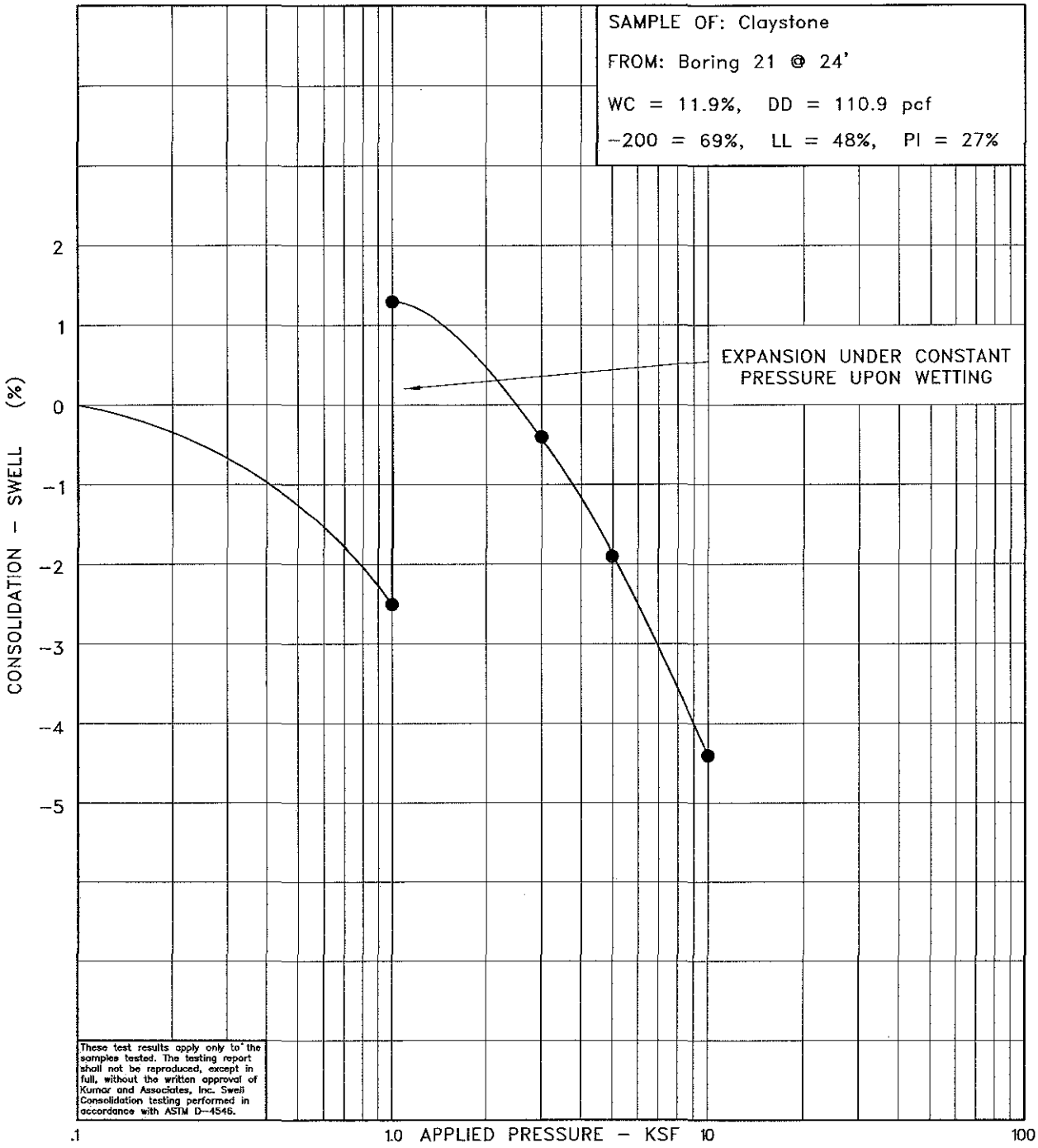
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 37



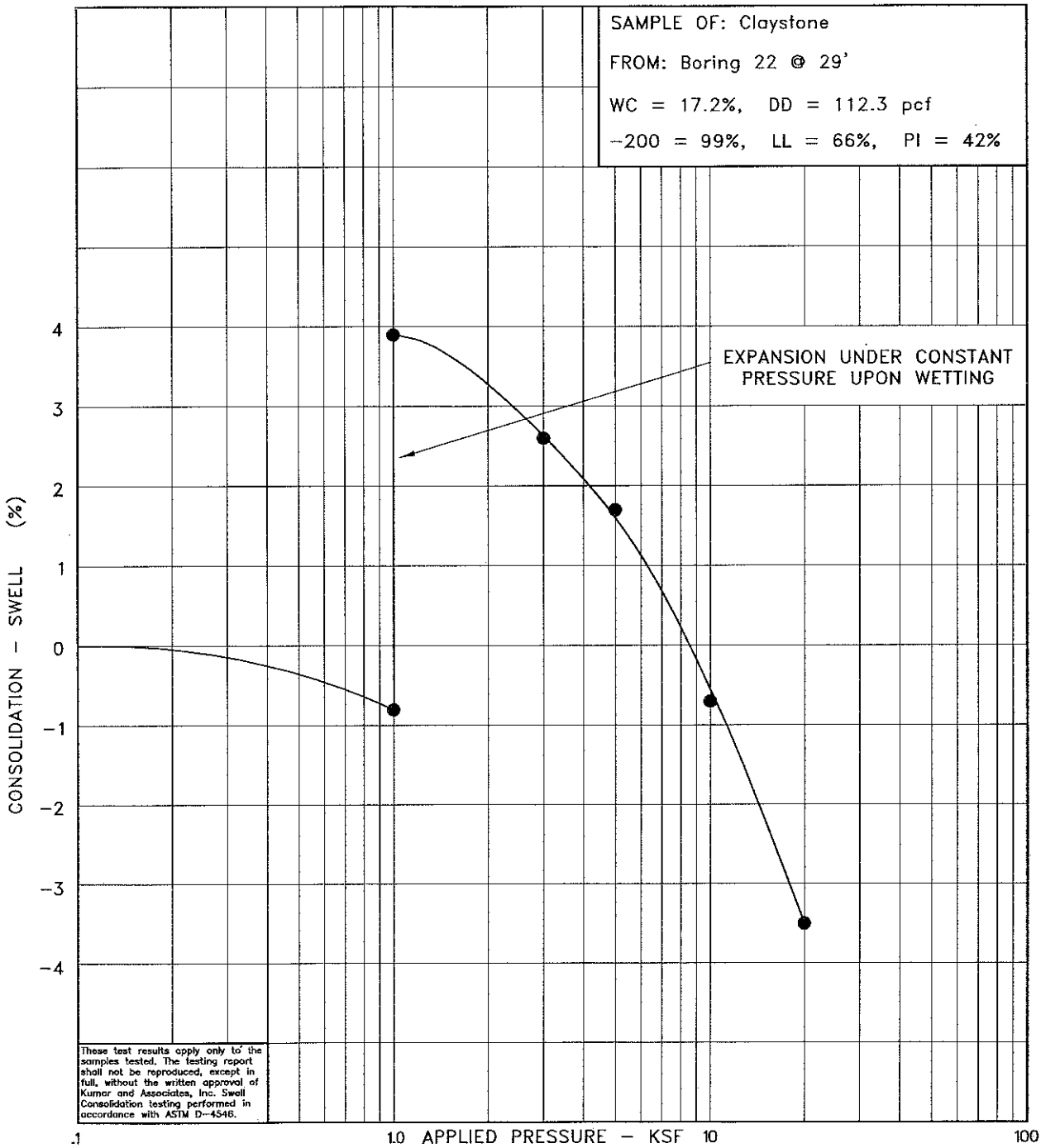
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 38



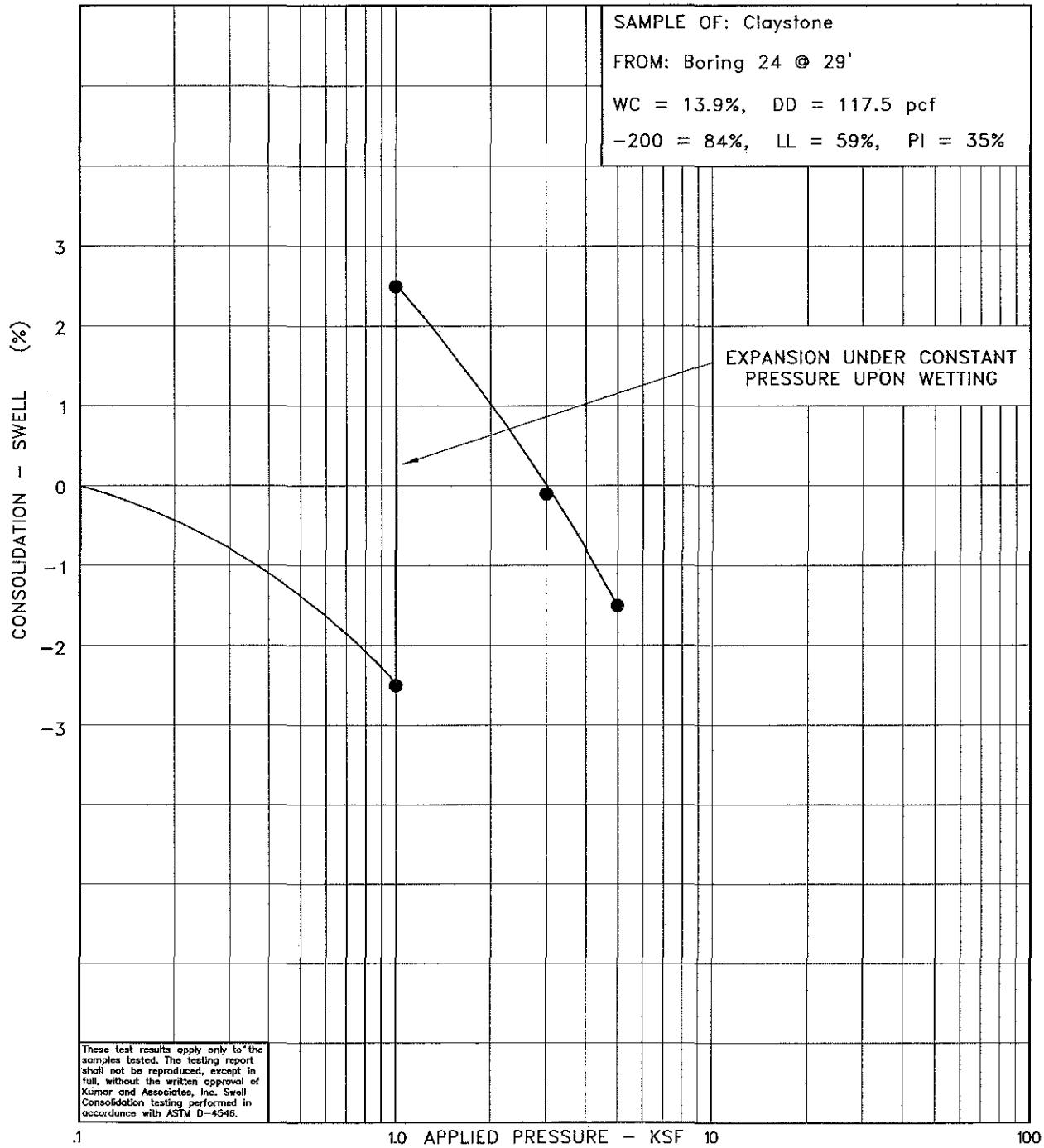
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 39



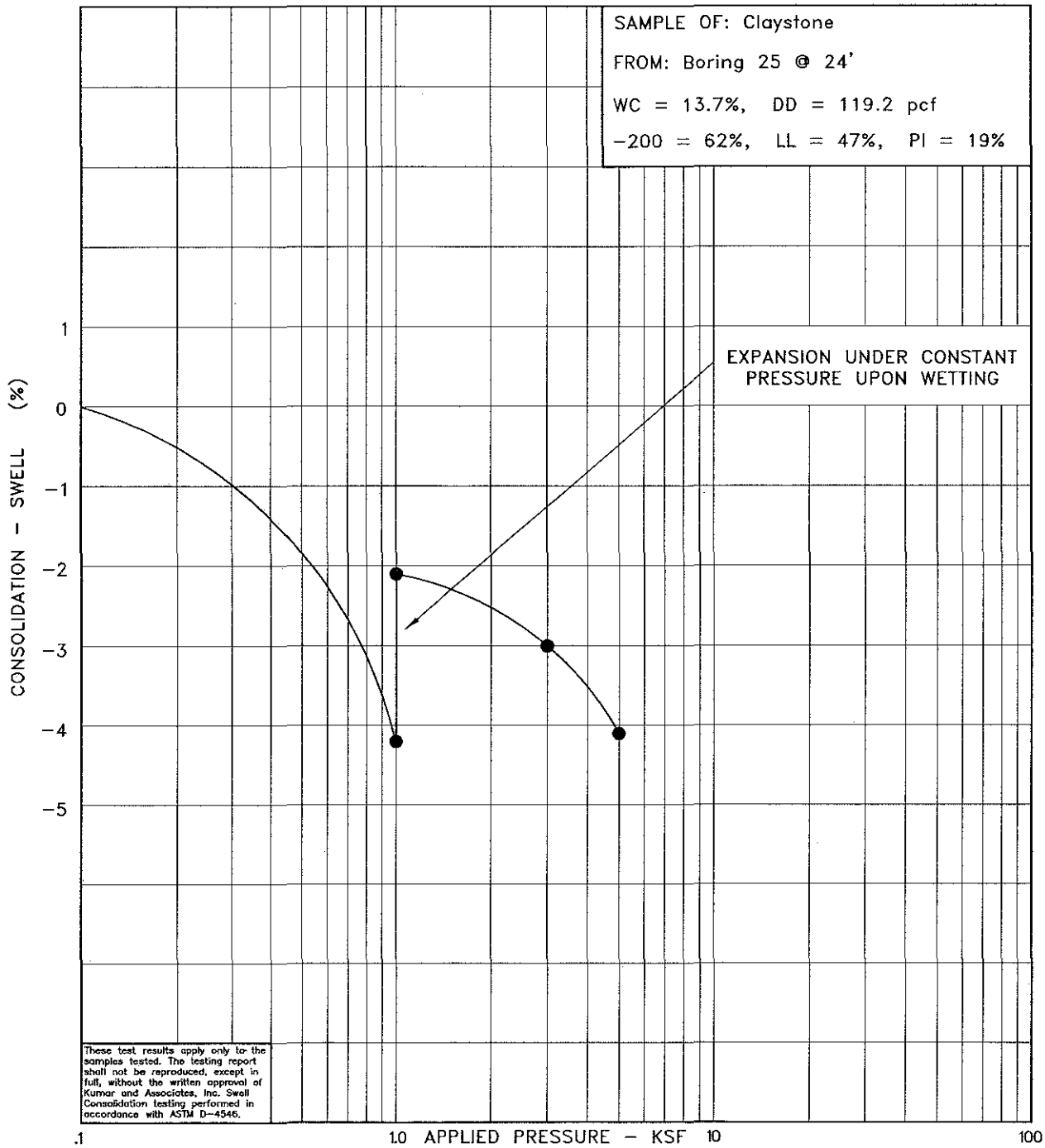
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 40



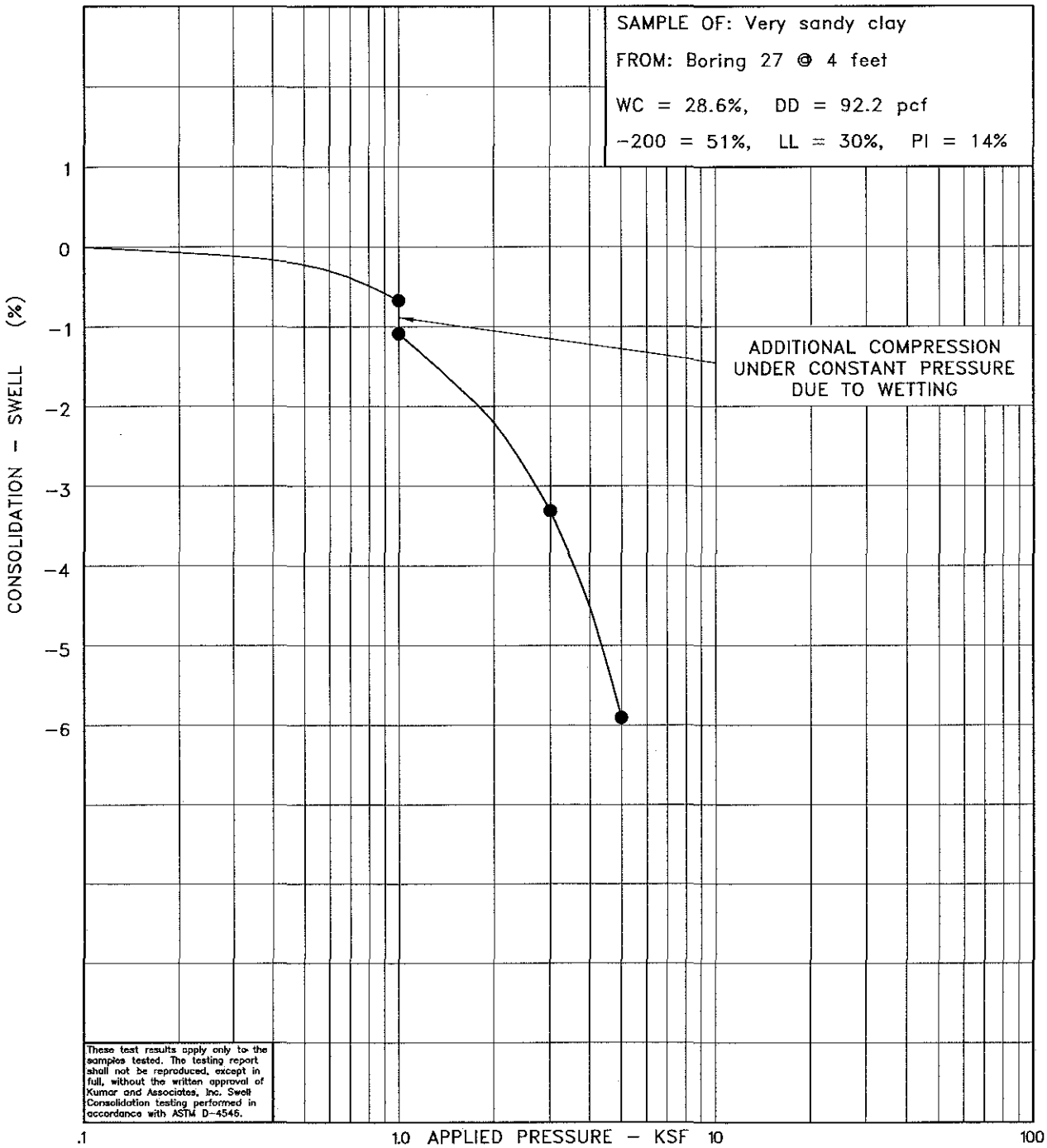
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 41



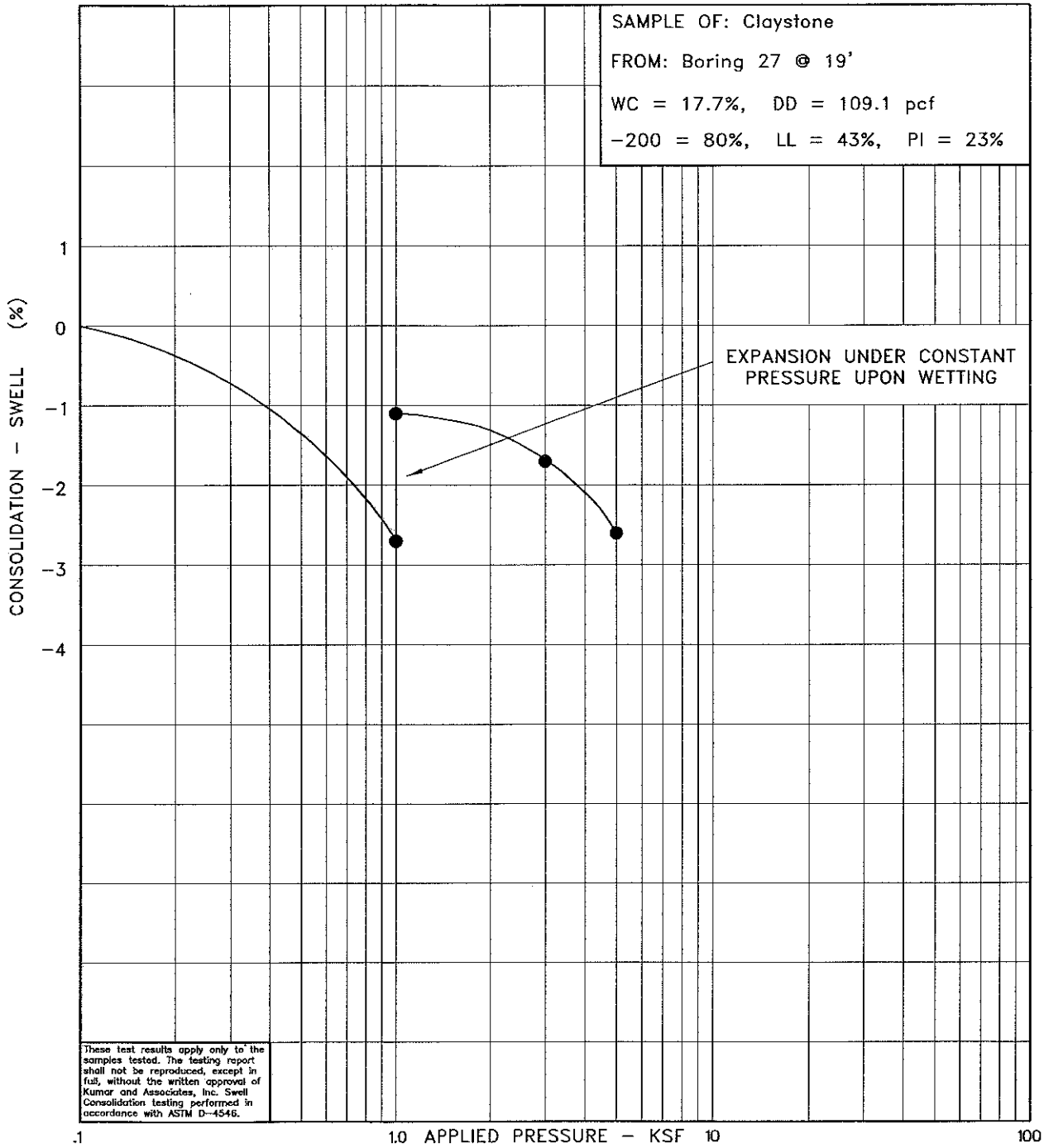
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 42



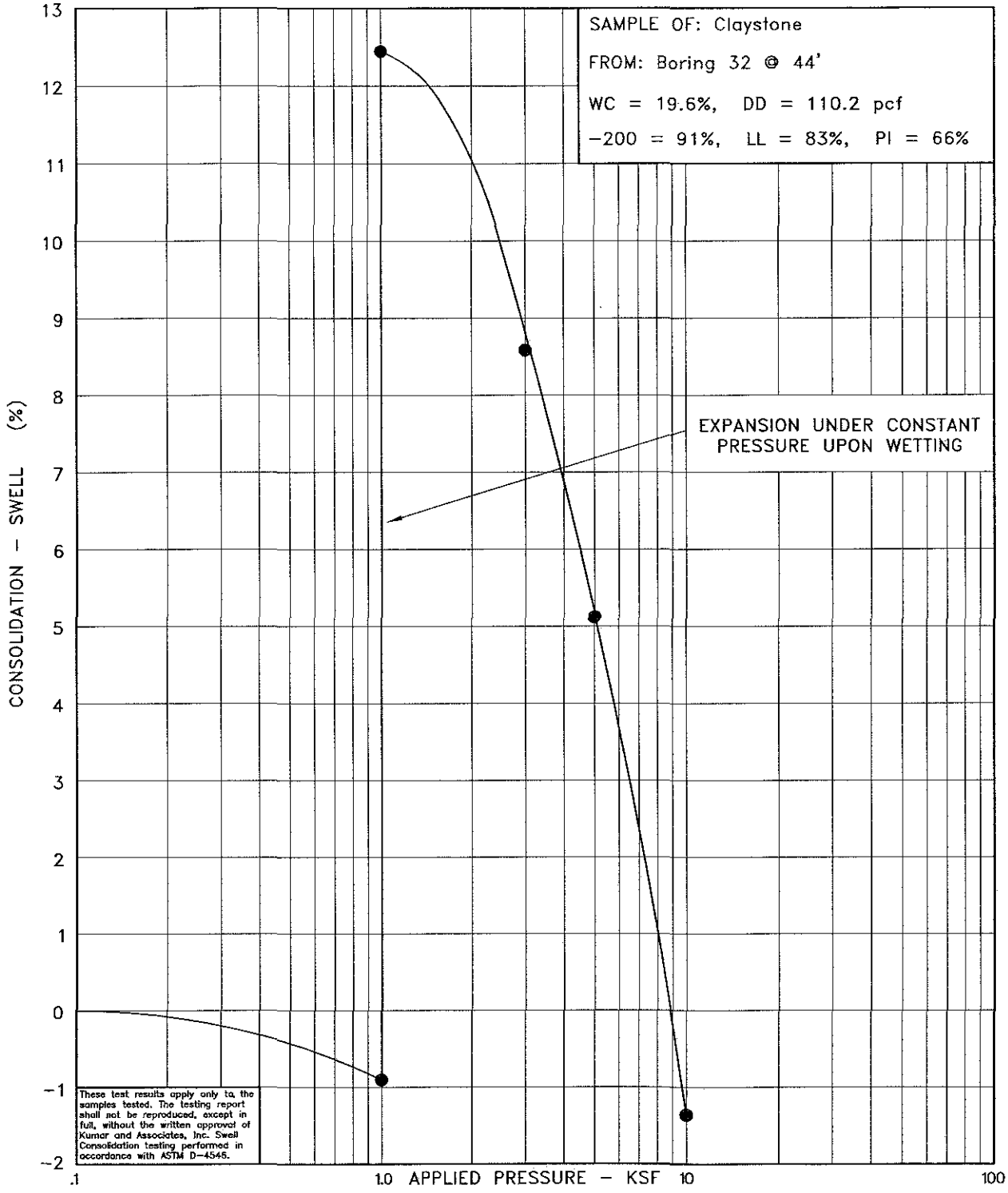
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 43



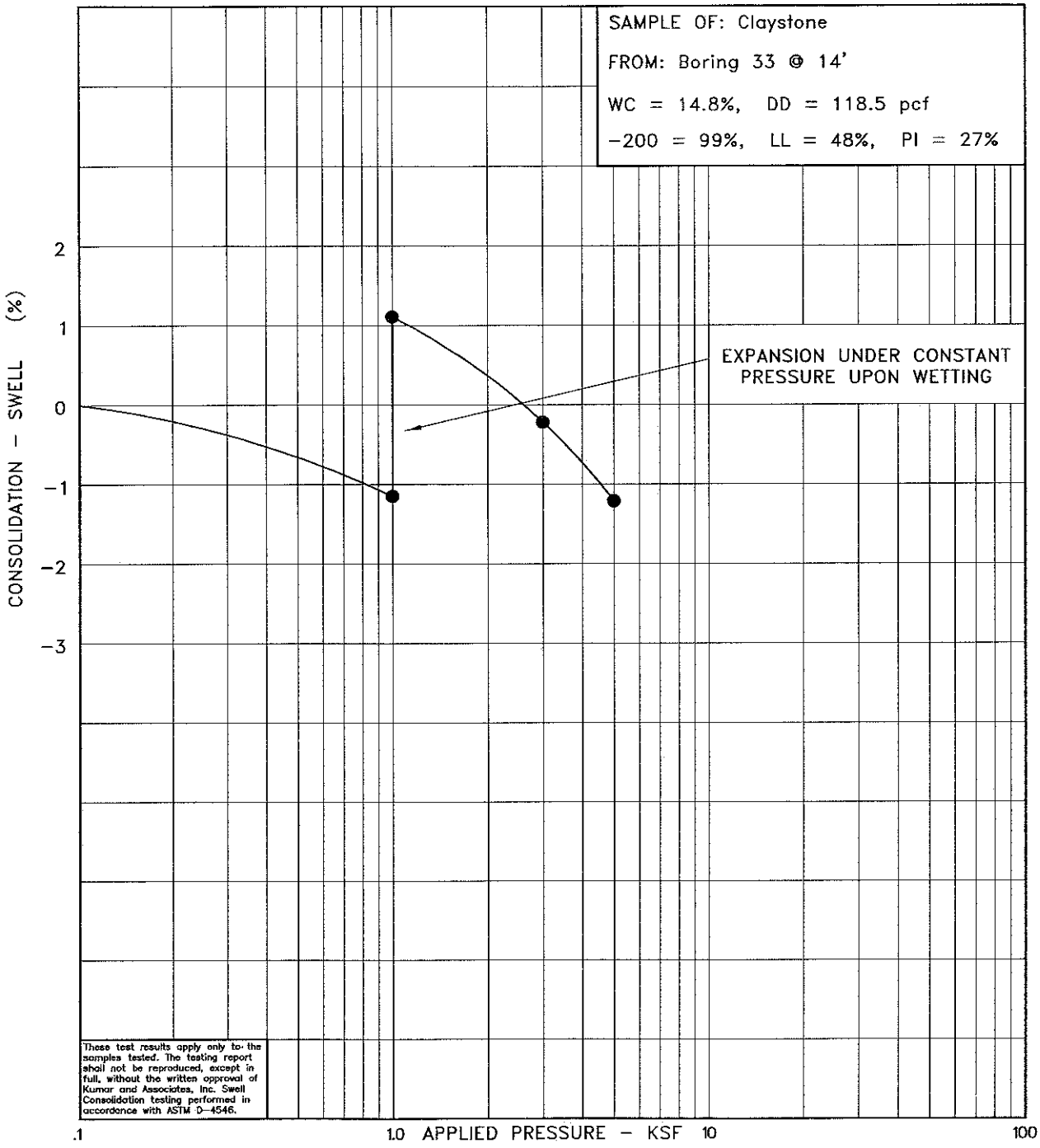
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 44



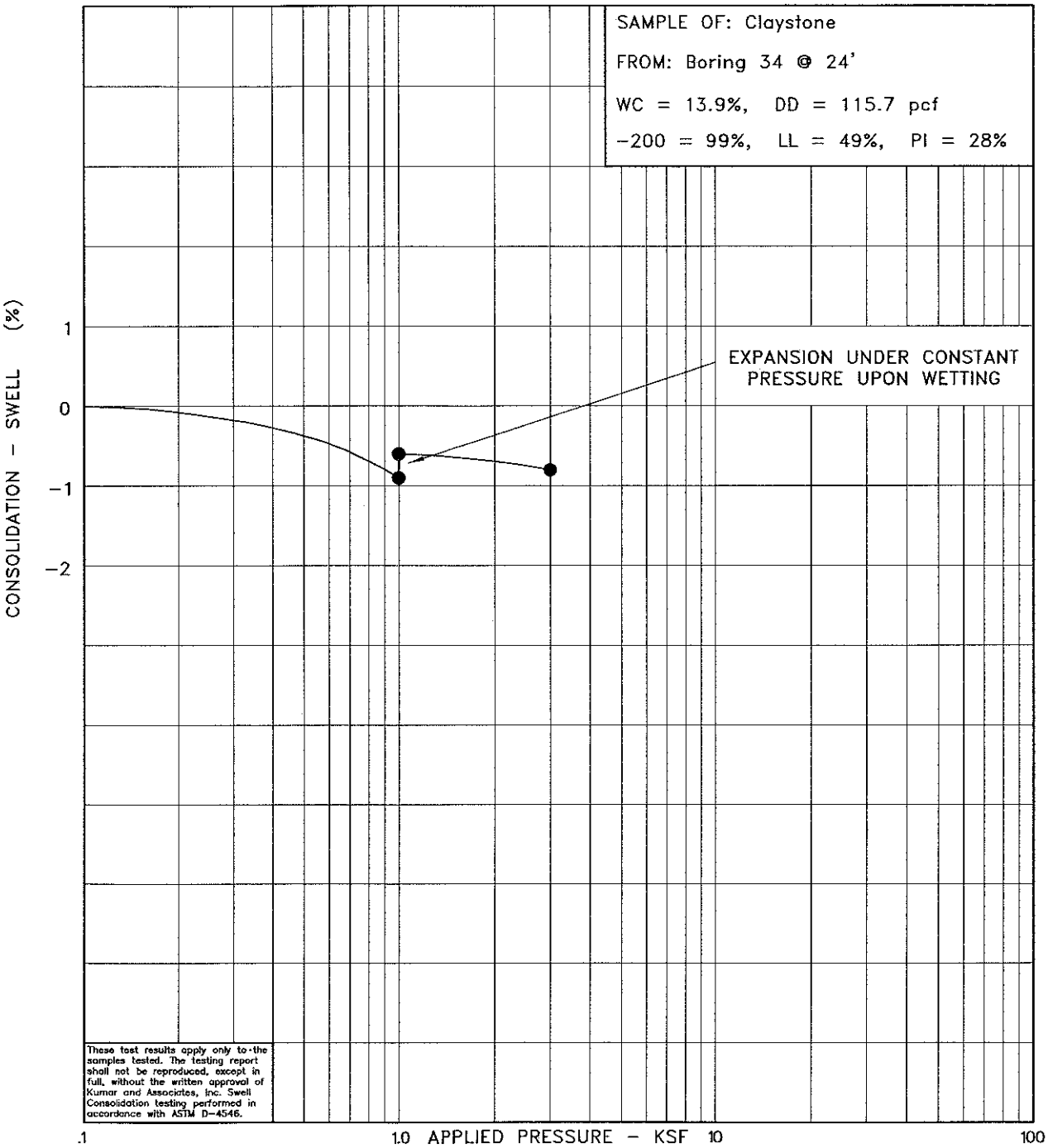
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 45



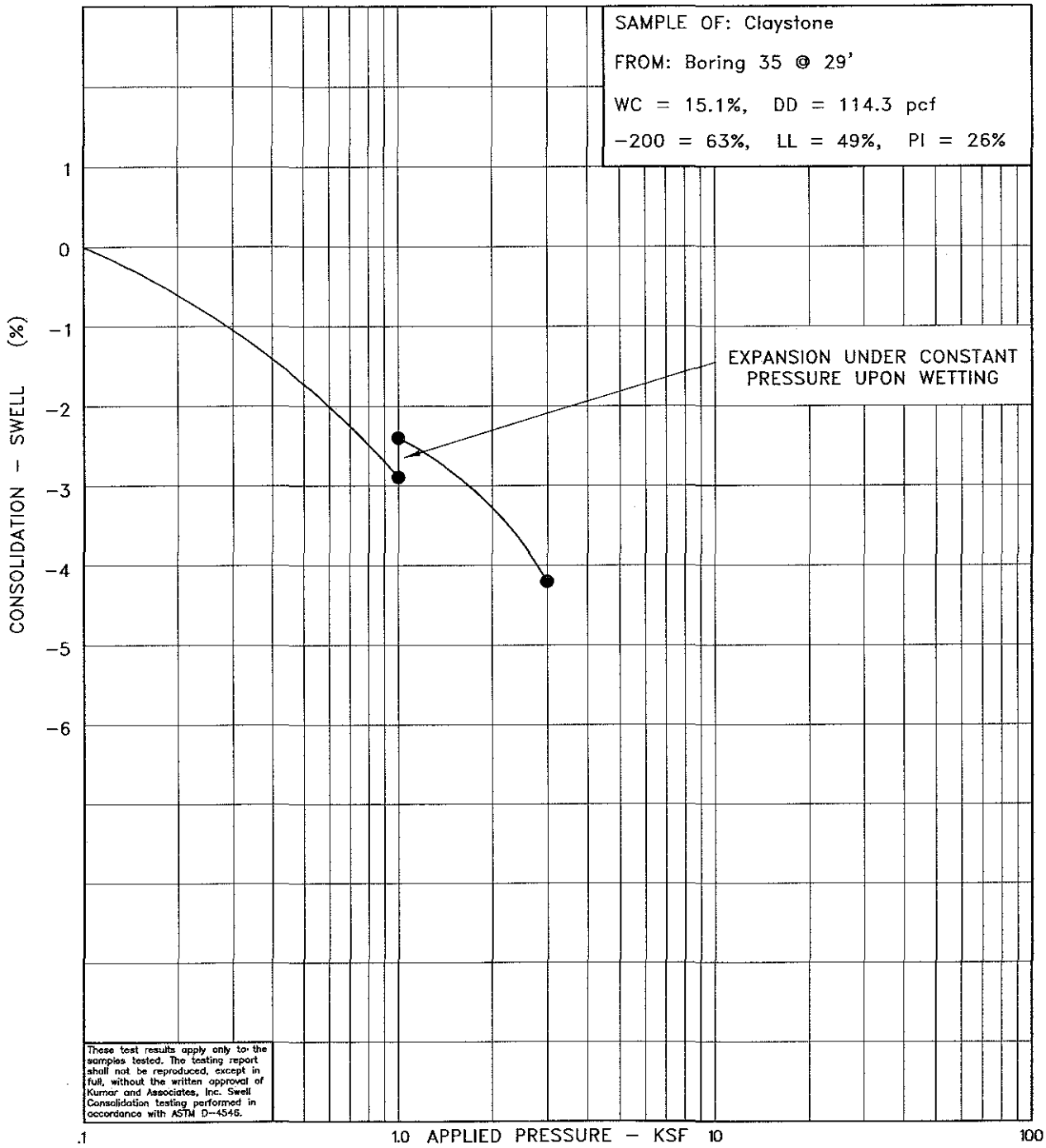
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 46



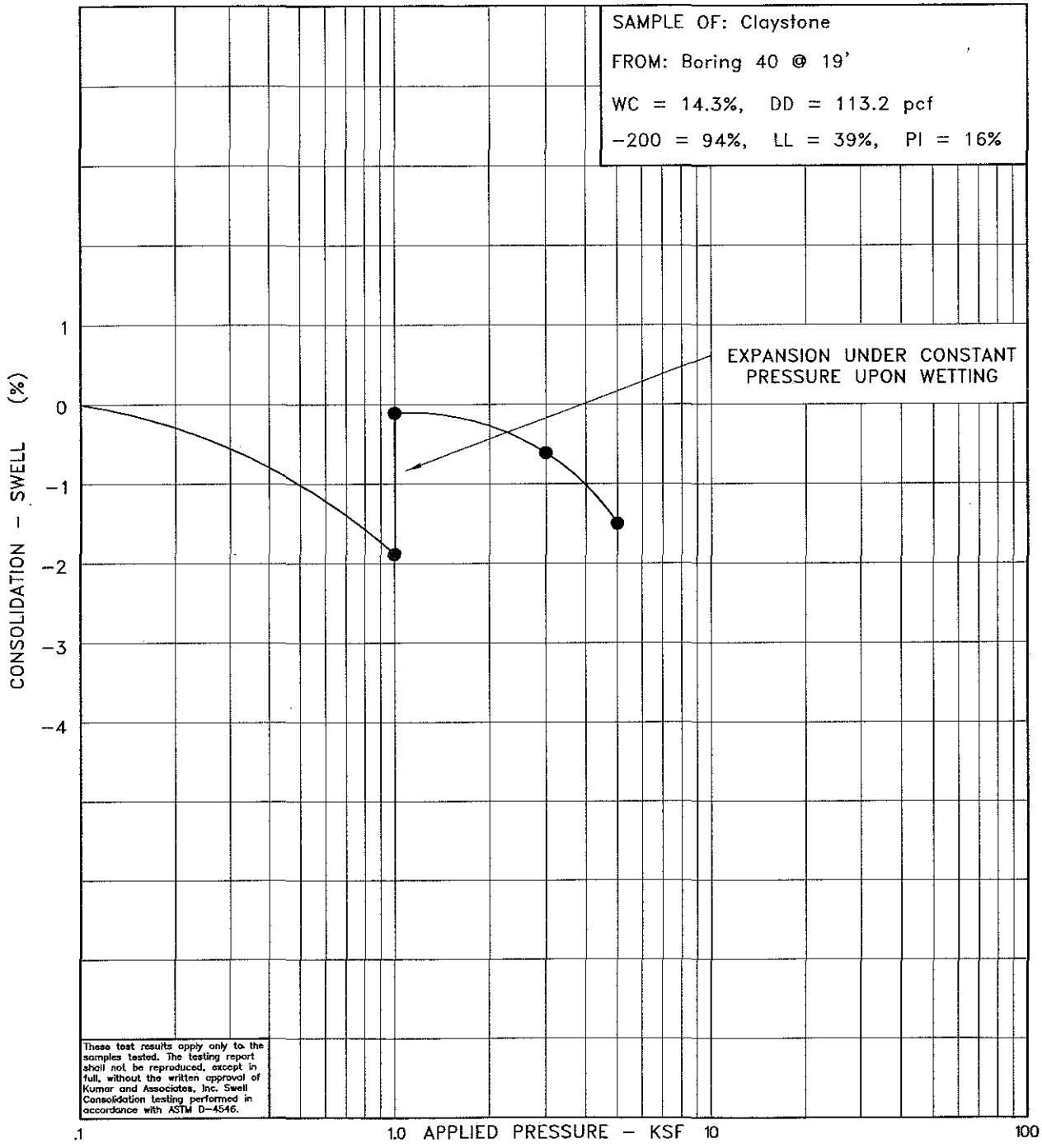
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 47



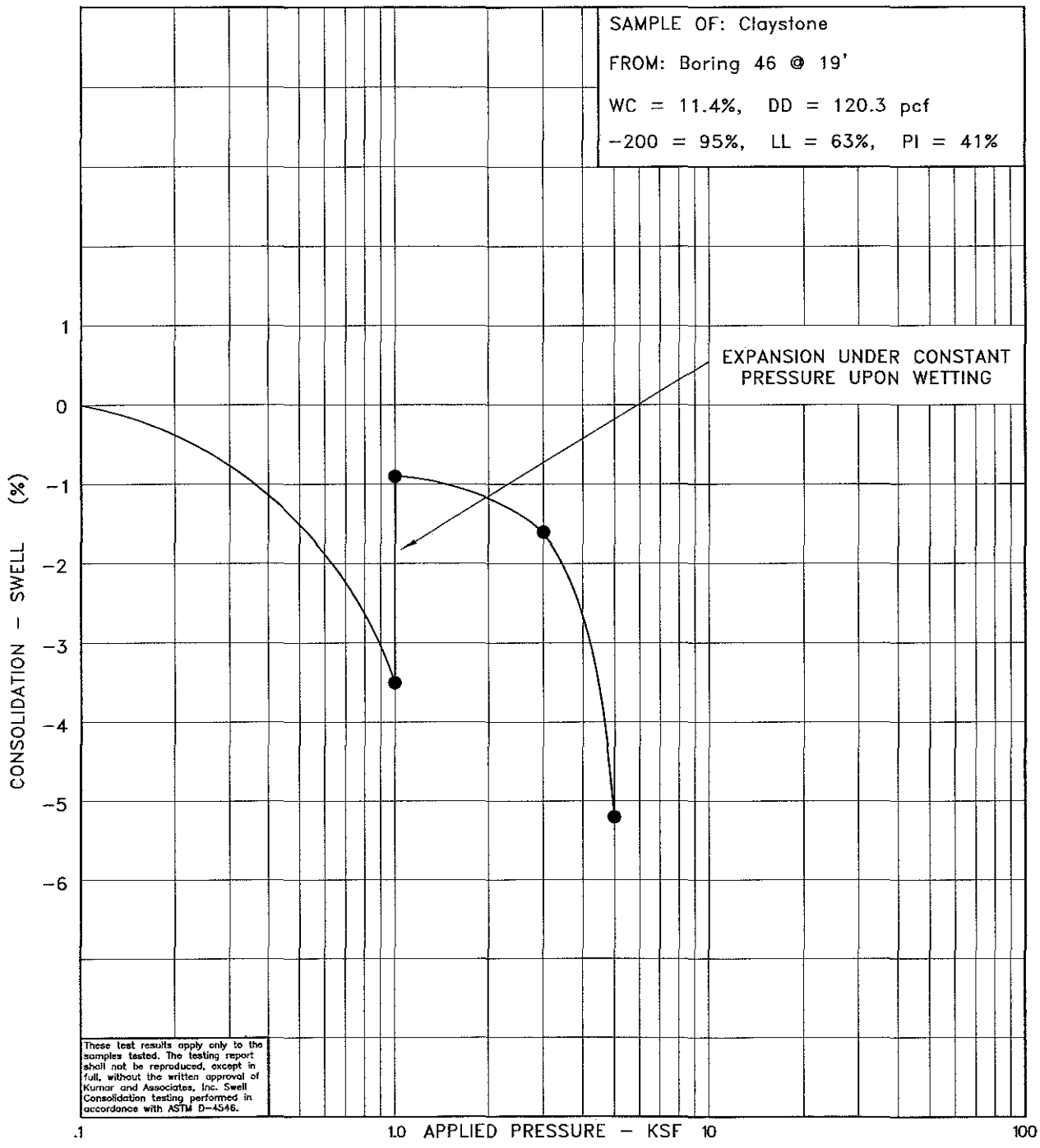
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 48



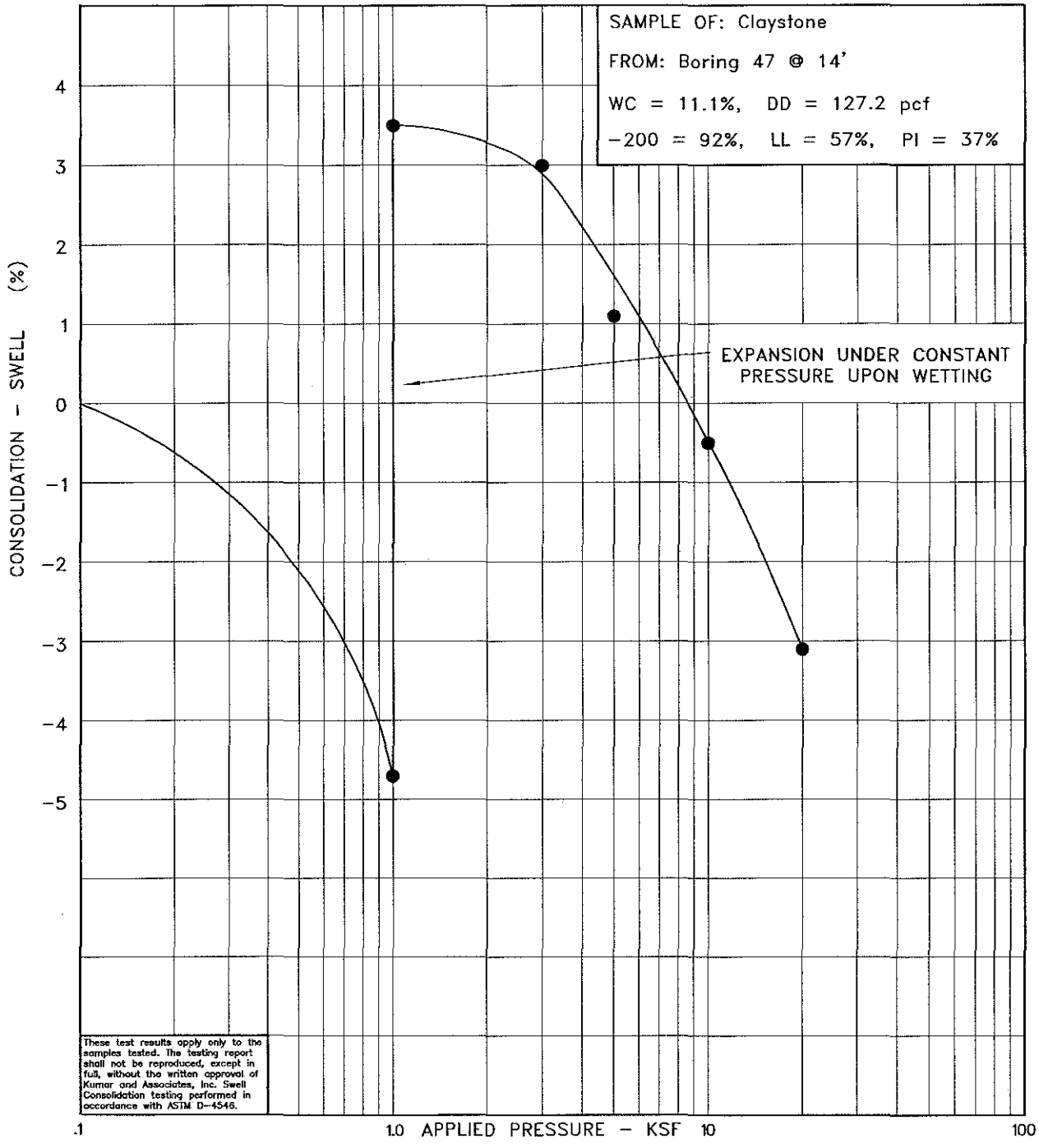
012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 49



012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 50



012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 51



012-266	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 52

Kumar & Associates, Inc.

TABLE I

SUMMARY OF EXISTING PAVEMENT SECTIONS

Project No. 012-266

Boring No.	SECTION THICKNESS (in)		
	ASPHALT	AGGREGATE BASE COURSE	CONCRETE
1	6	18	
2	5		
3	8.5	15.5	
4	4.5	19.5	
5	6.5	35.5	
6	6	33.6	
7	8.25	15.75	
9	8.5	15.5	
12	6	27.6	
13		18	
14	5	13	
16	4	20	
17			5
31	5.25	6	
44	7.5	10	
46	6.25	12	
47	6.5	18	
48	7.75	7.5	
49	8	14	
51	12	10	

TABLE II

DEEP- FOUNDATION LATERAL LOAD PARAMETERS

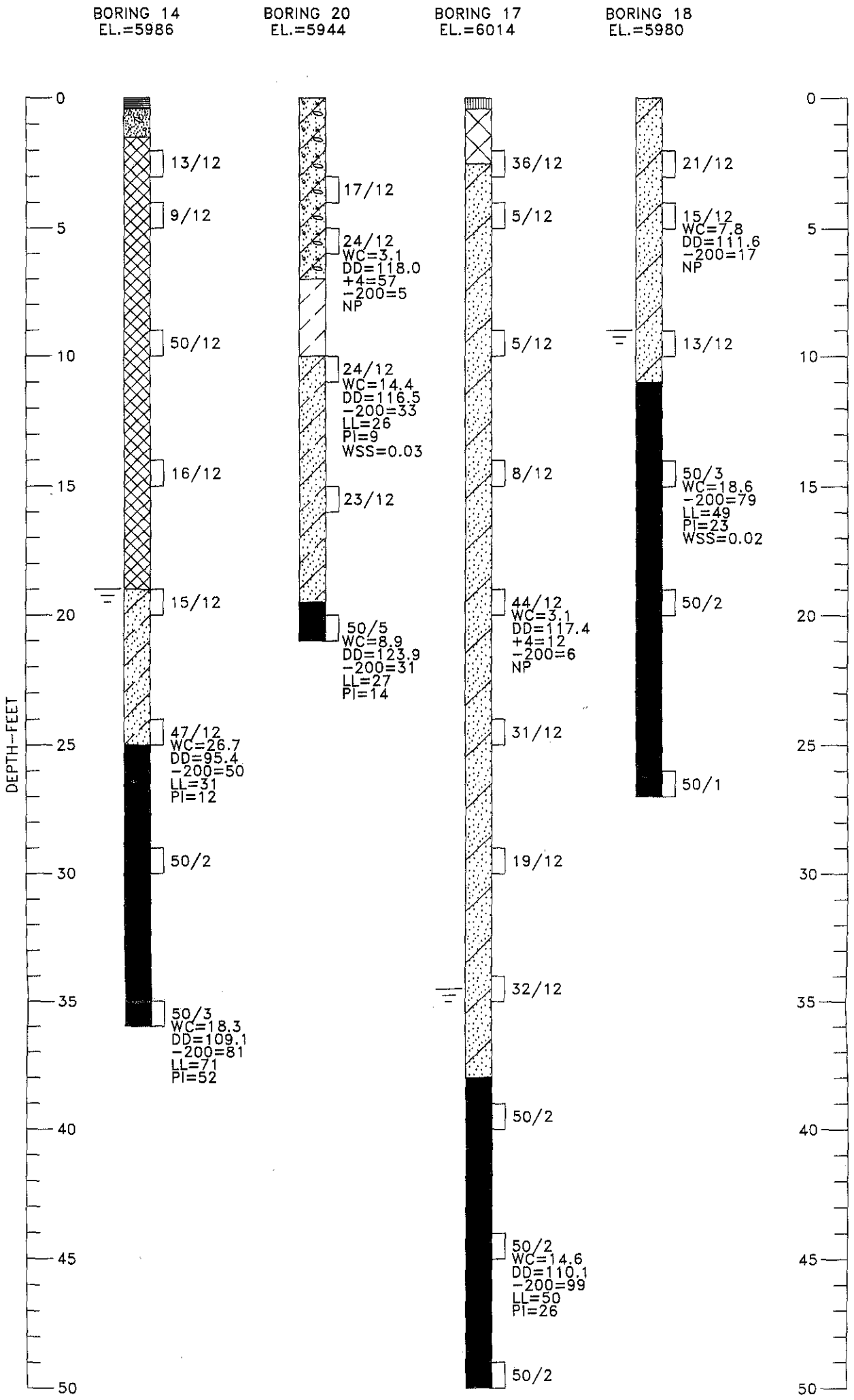
STRUCTURE	MATERIAL	k_m/ k_b (psi/in)	k_s (psi/in)	k_c (psi/in)	ϕ (degrees)	c (psi)	ε_{50}	γ_m/γ_b (pcf)
ALL	New Fill	90/60	--	--	32	--	--	120/60
	Bedrock	--	2,000	800	--	60	0.004	135/75
I-25 over Bear Creek	Sand Fill, SP-SM, GC	90/60	--	--	32	--	--	120/60
I-25 over Cimarron Street	Clay Fill	--	1,000	400	--	20	0.005	125/65
	Native Clay	--	100	100	--	5	0.01	120/60
	SM	25/20	--	--	30	--	--	120/60
	SP-SM	90/60	--	--	32	--	--	120/60
	SM-SC, GP	225/125	--	--	34	--	--	130/70
I-25 over Colorado Ave.	Clay Fill (B50), SC-CL	--	100	100	--	5	0.01	120/60
	Clay Fill (B12)	--	1,000	400	--	20	0.005	125/65
	SP-SM, SM	25/20	--	--	30	--	--	120/60
Ramp C-2 over Fountain Creek	Existing Fill & SM-SC	90/60	--	--	32	--	--	120/60
Ramp C-3 over Fountain Creek	Clay Fill, SC-SM	--	1,000	400	--	20	0.005	125/65
	Sand Fill, SM	25/20	--	--	30	--	--	120/60
Cimarron Street WB & EB over Fountain Creek	Sand Fill, SM	225/125	--	--	34	--	--	130/70
	SC-CL	--	1,000	400	--	20	0.005	125/65
Bijou Street over I-25	Clay Fill	--	500	200	--	10	0.007	125/165
	SC-CL	--	100	100	--	5	0.01	120/60
	SM	25/20	--	--	30	--	--	120/60
Bijou Street over RR & Monument Creek	Sand Fill, GP, SP-SM	90/60	--	--	32	--	--	120/60
Retaining Walls 2 & 3	Clay Fill, CL	--	1000	400	--	20	0.005	105/-
	SP-SM, SM, GP	90/60	--	--	32	--	--	120/60
Retaining Wall C-3	Sand Fill	90/60	--	--	32	--	--	120/60
	CL	--	100	100	--	5	0.01	120/60
	SM	25/20	--	--	30	--	--	120/60

k_m = modulus of subgrade reaction for moist sands
k_b = modulus of subgrade reaction for submerged sands
k_s = modulus of subgrade reaction for static loading, clays
k_c = modulus of subgrade reaction for cyclic loading, clays
ϕ = angle of internal friction
c = undrained shear strength
ε_{50} = strain at 50% of peak strength
γ_m = moist unit weight
γ_b = buoyant unit weight

APPENDIX

012-266

Kumar & Associates



LOGS OF EXPLORATORY BORINGS

Fig.A-1

LEGEND


ASPHALT.


BASE COURSE.


CONCRETE.


FILL: CLAYEY SAND, MOIST, REDDISH-BROWN.


FILL: SANDY CLAY, MOIST, BROWN TO REDDISH-BROWN.


GRAVEL (GM), SILTY, SANDY, MEDIUM DENSE, MOIST, BROWN.


SAND (SM-SC), SILTY AND CLAYEY, STIFF TO VERY STIFF, MOIST TO WET, BROWN AND GRAY.


SAND (SP-SM/SM), SLIGHTLY SILTY TO SILTY, LOOSE TO DENSE, MOIST TO WET, REDDISH-BROWN TO TAN.


CLAY (CL), SANDY, SOFT, MOIST, BROWN.


CLAYSTONE BEDROCK, VERY HARD, SLIGHTLY MOIST TO MOIST, GRAY.


DRIVE SAMPLE, 2-INCH I.D. CALIFORNIA LINER SAMPLER.

13/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 13 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.


DEPTH TO WATER LEVEL AT THE TIME OF DRILLING.

LABORATORY TEST RESULTS

WC = NATURAL WATER CONTENT (%);
DD = NATURAL DRY DENSITY (pcf);
+4 = PERCENTAGE RETAINED ON NO. 4 SIEVE;
-200 = PERCENTAGE PASSING NO. 200 SIEVE;
LL = LIQUID LIMIT;
PI = PLASTICITY INDEX;
NP = NONPLASTIC;
WSS = WATER SOLUBLE SULFATES (%).

NOTES

1. BORINGS 14, 17, AND 18 WERE DRILLED IN JANUARY AND FEBRUARY, 2002 AND BORING 20 IN AUGUST, 2003, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATIONS AND ELEVATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY FROM WILSON AND COMPANY.
3. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
4. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME OF DRILLING. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

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