GEOTECHNICAL REPORT

US 93 WIDENING

BOULDER CITY to
HOOVER DAM INTERCHANGE

E.A. 73602
May 2011

NEVADA DOT
GEOTECHNICAL ENGINEERING

MATERIALS DIVISION

STATE OF NEVADA

DEPARTMENT OF TRANSPORTATION

MATERIALS DIVISION

GEOTECHNICAL SECTION

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US 93 WIDENING
BOULDER CITY to
HOOVER DAM INTERCHANGE

May 2011

E.A. 73602

CLARK COUNTY, NEVADA

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INTRODUCTION

General

This report has been prepared for the planned widening of US 93 from Buchanan Boulevard in Boulder City to the Hoover Dam Interchange in Clark County, Nevada. The highway is currently two lanes wide, one lane each northbound and southbound (See Photo 1).

Photo 1. Looking west along US 93 across from the Hacienda Casino

The planned widening adds two lanes along the west side of the alignment, which is approximately 4.5 miles long, beginning within the Boulder City limits into National Park Service land (See Photo 2). A site plan for the project is presented as the Project Location Area Map in Appendix A.

Photo 2. Looking northeast toward Lake Mead

Purpose and Scope

The purpose of this report is to provide information regarding the subsurface soil conditions at the proposed project site. This report also provides geotechnical design recommendations for both the retaining wall foundations proposed for this project, as well as excavation of cut slopes. The scope of this report consists primarily of geotechnical investigation, analysis, and recommendations for both design and construction. The investigation included gathering information obtained from previous subsurface explorations, soil sampling, seismic testing, and analysis of field and laboratory testing data. This report includes boring logs and summaries of test results from both the field investigations and laboratory testing. These may be found in appendices B and C, respectively.

PROJECT DESCRIPTION

The project site is located north and east of Boulder City in Clark County. Preliminary plans indicate the proposed widening will be accomplished by widening two lanes on the west side of the existing roadway (to the right of the southbound lanes), to ultimately provide two lanes each, eastbound and westbound. *NOTE: Confusion has occurred due to the road's designation of running north-south. Southbound US 93 actually runs northeast out of Boulder City before turning east heading toward the Hoover Dam interchange.* The widening project is currently designed to be approximately 4.5 miles in length.

GEOLOGIC CONDITIONS and SEISMICITY

The site is founded primarily in pediment and fan deposits of the Eldorado Mountains (Qe)[1]. These deposits are primarily white to pinkish tan to gray clayey sands, interspersed with some silty sands and clayey gravels (See Photo 3).

Photo 3. Drilling sample from Borehole BC-2

Deposits in the last 1000 to 1200 feet of the southern (eastern) end of the project alignment are mostly reddish brown to dark reddish brown silty and clayey sands and gravels, influenced by dacite deposits north of the alignment (See Photo 4).

Photos 3 and 4. Drilling sample from Borehole BCR-1

This area lies at an elevation of approximately 2500 feet in Boulder City[2] to approximately 1700 feet at the southern (eastern) end of the alignment[1] and slopes predominantly downward to the north toward Lake Mead. The site is located approximately 12 miles south of the Las Vegas Valley Shear Zone and 5 to 20 miles north-northwest of the several small faults, including the Jeep Pass Fault, Hidden Valley Fault, Eldorado Fault, and Welcome Fault. These faults are no longer considered active[3]. No groundwater was found in any of the boreholes.

Seismic Coefficients are provided in the table below[4]. The coefficients provided are from the NDOT Structural Design Policies and Practices Manual, and are slightly more conservative than those found in the AASHTO Manual.

Peak Ground Acceleration (PGA) Coefficient	Short-Period Spectral Acceleration Coefficient (S_s)	Long-Period Spectral Acceleration Coefficient (S_l)
0.15	0.40	0.15

The following seismic parameters are recommended:

Site Class = C

F_{pga} = 1.2

F_a = 1.2

F_v = 1.7

FIELD INVESTIGATION

The Geotechnical Section conducted subsurface investigation at the proposed project site in February and March 2011. Subsurface soil conditions were explored in the investigation by drilling sixteen boreholes along the alignment near areas of excavation or proposed structures (See Photo 5).

Photo 5. Drill rig set up on Borehole BCR-4

The approximate location of each borehole is shown on the Borehole Location sheet in Appendix A. Boreholes BC-1 through BC-7, BCC-1 and BCC-2, and BCR-1 through BCR-7 were drilled to depths between 1.5 feet and 45.2 feet. The surface elevations were obtained for the borehole locations by surveying from a known elevation point. Drilling was accomplished with a Diedrich D-120 drill rig equipped for soil sampling, using 6-inch hollow stem auger on boreholes BC-1 through BC-7, and BCR-1 through BCR-7. Soil samples and standard penetration resistance values (N-Values) were obtained utilizing the Standard Penetration Test (SPT) procedure as set forth in AASHTO test number T206 using a calibrated automatic hammer. The energy transfer from the automatic hammer transferred into the drill rod is 87.5%. The 60% energy (N_{60}) correction factor is 1.45. Uncorrected blow counts are shown on the boring logs. All soil samples were classified, both visually and with laboratory data, using the Unified Soil Classification System (USCS) described in ASTM test number D2487. Boreholes BCC-1 and BCC-2 were drilled with bentonite slurry using a 3.5" tri-cone bit. These two boreholes were then sampled using a double-wall NQ core barrel. All boring logs are presented in Appendix B.

Seismic refraction and Refraction Microtremor (ReMi) analysis was performed in the area adjacent to the Hacienda Hotel and Casino. Four runs were recorded between Stations "US93SB" 156+63 and "US93SB" 161+03, between approximately 30 and 40 feet right of the Station line. These four runs showed seismic velocities of between 8000 feet per second (fps) and 14000 fps at the bottom of the necessary excavation. These velocities in igneous and metamorphic rock indicate competent sound rock, which will most probably not be rippable. This hard rock will probably necessitate blasting; however, some of the material at the existing surface of the area to be excavated should be rippable. The seismic refraction plots are presented in Appendix D.

LABORATORY ANALYSIS

Laboratory tests were performed on the samples collected from the boreholes. The testing program consisted of sieve analyses, moisture, Atterberg limits, and chemical analyses (chlorides, resistivity, and pH), as well as resistance values (R-Values). The

results of this testing program show that the soils consist primarily of lean clayey sands, with some silty sands and clayey gravels. Further information is presented in the summaries of test results in Appendix C.

Rock cores taken from Boreholes BCC-1 and BCC-2 were photographed in the field (See Photos 6, 7, and 8), and visually examined and described in the lab. An NDOT Geologist described the cores as generally intensely brecciated dacite and monzonite, both igneous and metamorphic rock. Iron staining and gypsum intrusion indicate heavy fluid movement. Iron and sulfur residues are present, with evidence of hydrothermal alteration. Borehole BCC-2 shows heavier sulfur and lighter iron residues than BCC-1. The intense brecciation indicates the presence of a probable fault zone.

Photo 6. Rock core sample BCC-1 C

Photo 7. Close-up photo of rock core sample BCC-1 C (top end)

Photo 8. Close-up photo of rock core sample BCC-1 C (bottom end)

DISCUSSION

Following the field investigation and laboratory testing, the soils were identified as primarily of lean clayey sands, with some silty sands and clayey gravels. The main rock constituents are altered and non-altered dacite and quartz monzonite. Boreholes BC-1 through BC-7 were drilled in the first stage of the investigation to generally characterize the on-site materials; boreholes BCC-1 and BCC-2 were drilled to characterize intact rock; and BCR-1 through BCR-7 were drilled in areas considered for retaining walls.

Liquefaction is unlikely to occur due to soil plasticity and density, as well as the depth of the water table and low seismic accelerations experienced in the region.

RECOMMENDATIONS

Excavation

All excavation shall be performed in accordance with the NDOT 2001 Standard Specifications for Road and Bridge Construction[5]. All permanent slopes should be constructed to lie at a maximum of 2:1 (Horiz:Vert) slope. The contractor shall be responsible for all necessary shoring for any excavation and/or construction. Variable site conditions include the possibility of encountering caliche, boulders, or other adverse soil conditions.

Existing soil conditions on the southbound side of US 93 south of Colorado Street show near vertical cuts near the road (See Photo 9). Slopes steeper than the recommended 2:1 may be considered for this location.

Photo 9. Existing cut slope at Colorado Street

Retaining Wall Foundations

The dense granular soils are well suited for spread footings. Spread footings for retaining walls placed in embankments and native soil planned near the Hoover Dam Interchange south bound offramp and north of Colorado Street have an allowable bearing capacity of 4000 psf (4 ksf).

Settlement

Settlement analysis was not performed due to the lack of actual design information; however, it should be of little concern due to existing bedrock and the very dense coarse-grained soils present throughout the site. Both cut and fill areas should expose either bedrock or very dense soils prior to construction, and embankment fill areas should experience little, if any, settlement. Any settlement that does occur will be immediate, occurring during construction.

Lateral Load Analysis

The following soil parameters were provided for lateral load analyses. These values are based on a soil friction angle, phi (ϕ), of 35°. Earth pressure coefficients are as follows:

$K_0 = 0.426$ for all cases

$K_a = 0.271$ for level backfill
$K_a = 0.312$ for 3:1 backfill
$K_a = 0.382$ for 2:1 backfill

$K_p = 3.69$ for level backfill
$K_p = 3.32$ for 3:1 backfill
$K_p = 2.09$ for 2:1 backfill

Animal Undercrossing

The existing animal undercrossing, located at Station "US93SB"176+50, should be lengthened by copying and continuing the existing design.

REFERENCES

1. Geologic Map of the Boulder Beach Quadrangle, Nevada, Map 81; Nevada Bureau of Mines and Geology, 1984.

2. www.city-data.com/city/Boulder-City-Nevada.html

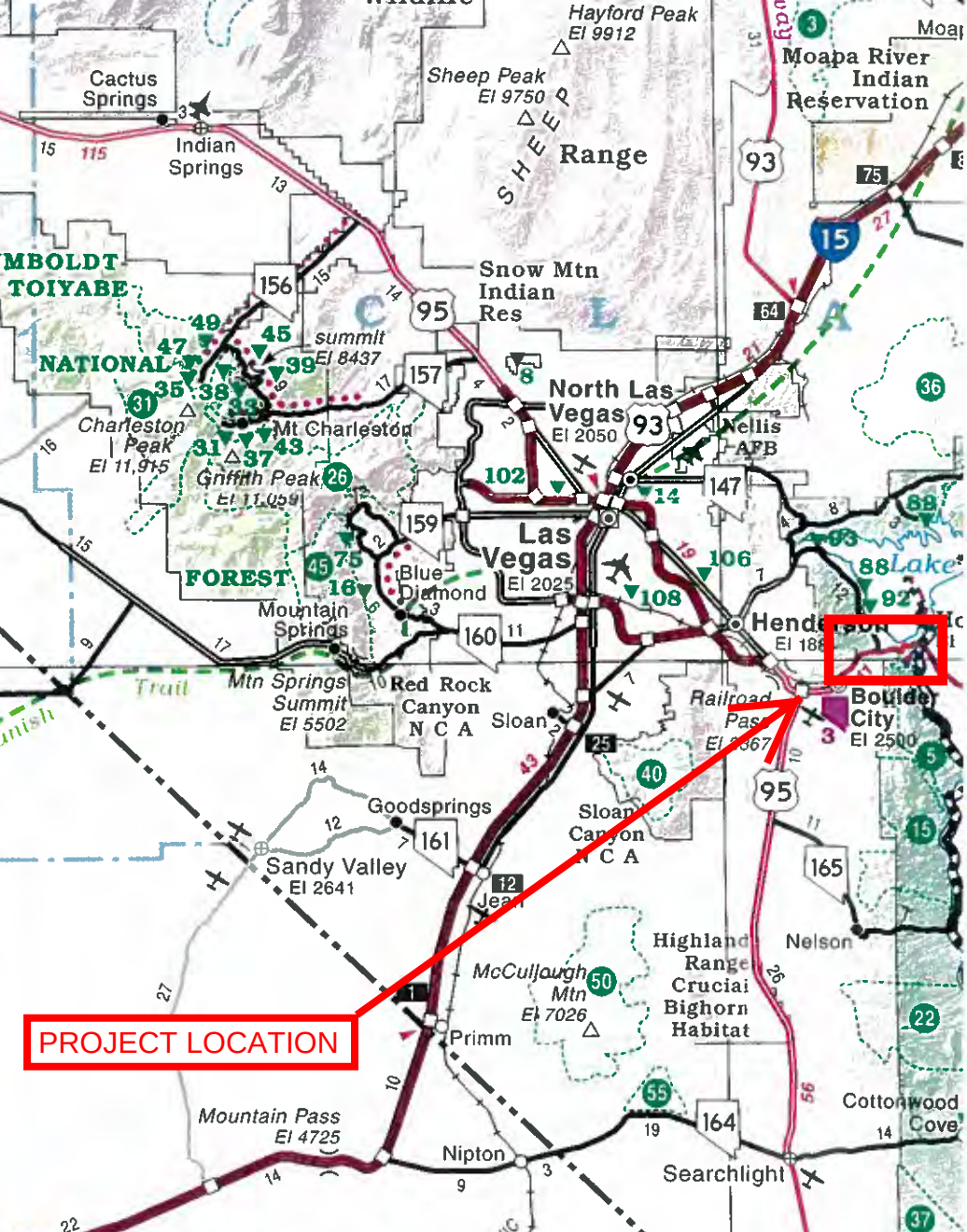
3. Tectonic Map of Clark County, Nevada; Bulletin 62, Plate 5, Nevada Bureau of Mines, 1965.

4. NDOT Structures Manual - Structural Design Policies and Practices, 2008.

5. Standard Specifications for Road and Bridge Construction, State of Nevada Department of Transportation, 2001.

APPENDIX A

Project Location Area Map
Borehole Location Sheets

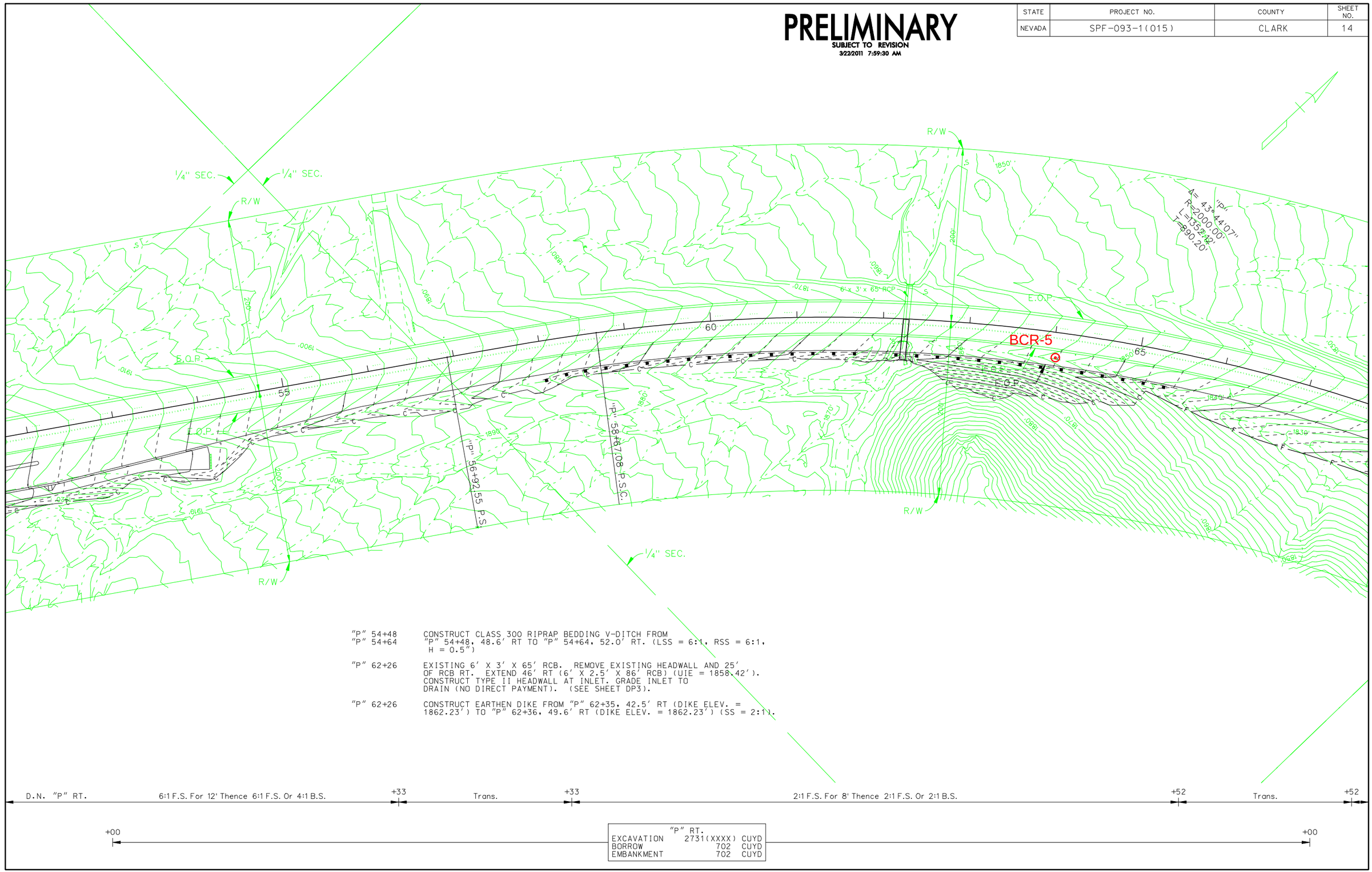

Hayford Peak
El 9912
Sheep Peak
El 9750
SHEEP
Range
Cactus
Springs
Indian
Springs
Moapa River
Indian
Reservation
93
15
75
64
Snow Mtn
Indian
Res
95
156
157
159
160
161
147
summit
El 8437
NATIONAL
FOREST
Charleston
Peak
El 11,915
Mt Charleston
Griffith Peak
El 11,059
North Las
Vegas
El 2050
Nellis
AFB
Las
Vegas
El 2025
Blue
Diamond
Mountain
Springs
Mtn Springs
Summit
El 5502
Red Rock
Canyon
N C A
Sloan
Railroad
Pass
El 3367
Boulder
City
El 2500
Lake
Mead
Goodsprings
Sandy Valley
El 2641
Sloan
Canyon
N C A
Jean
Highland
Range
Cruciai
Bighorn
Habitat
McCullough
Mtn
El 7026
Nelson
Primm
Mountain Pass
El 4725
Nipton
Searchlight
Cottonwood
Cove
Trail
PROJECT LOCATION

PRELIMINARY

SUBJECT TO REVISION

3/22/2011 7:59:30 AM

STATE	PROJECT NO.	COUNTY	SHEET NO.
NEVADA	SPF-093-1(015)	CLARK	14



"P" 54+48	CONSTRUCT CLASS 300 RIPRAP BEDDING V-DITCH FROM
"P" 54+64	"P" 54+48, 48.6' RT TO "P" 54+64, 52.0' RT. (LSS = 6:1, RSS = 6:1, H = 0.5")
"P" 62+26	EXISTING 6' X 3' X 65' RCB. REMOVE EXISTING HEADWALL AND 25' OF RCB RT. EXTEND 46' RT (6' X 2.5' X 86' RCB) (UIE = 1858.42'). CONSTRUCT TYPE II HEADWALL AT INLET. GRADE INLET TO DRAIN (NO DIRECT PAYMENT). (SEE SHEET DP3).
"P" 62+26	CONSTRUCT EARTHEN DIKE FROM "P" 62+35, 42.5' RT (DIKE ELEV. = 1862.23') TO "P" 62+36, 49.6' RT (DIKE ELEV. = 1862.23') (SS = 2:1).

D.N. "P" RT. | 6:1 F.S. For 12' Thence 6:1 F.S. Or 4:1 B.S. | +33 | Trans. | +33 | 2:1 F.S. For 8' Thence 2:1 F.S. Or 2:1 B.S. | +52 | Trans. | +52

+00 +00

"P" RT.

EXCAVATION	2731(XXXX)	CUYD
BORROW	702	CUYD
EMBANKMENT	702	CUYD

PRELIMINARY

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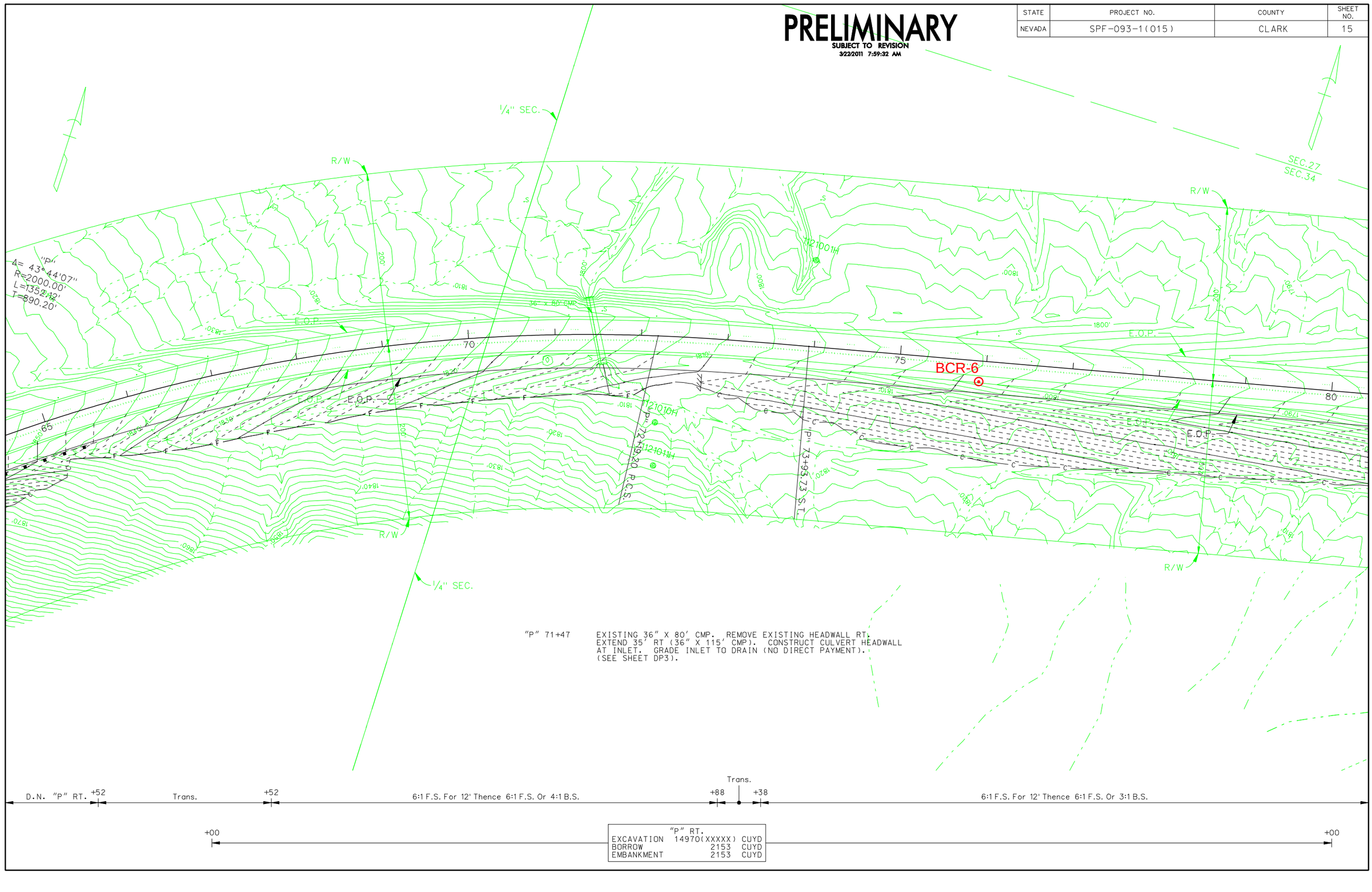


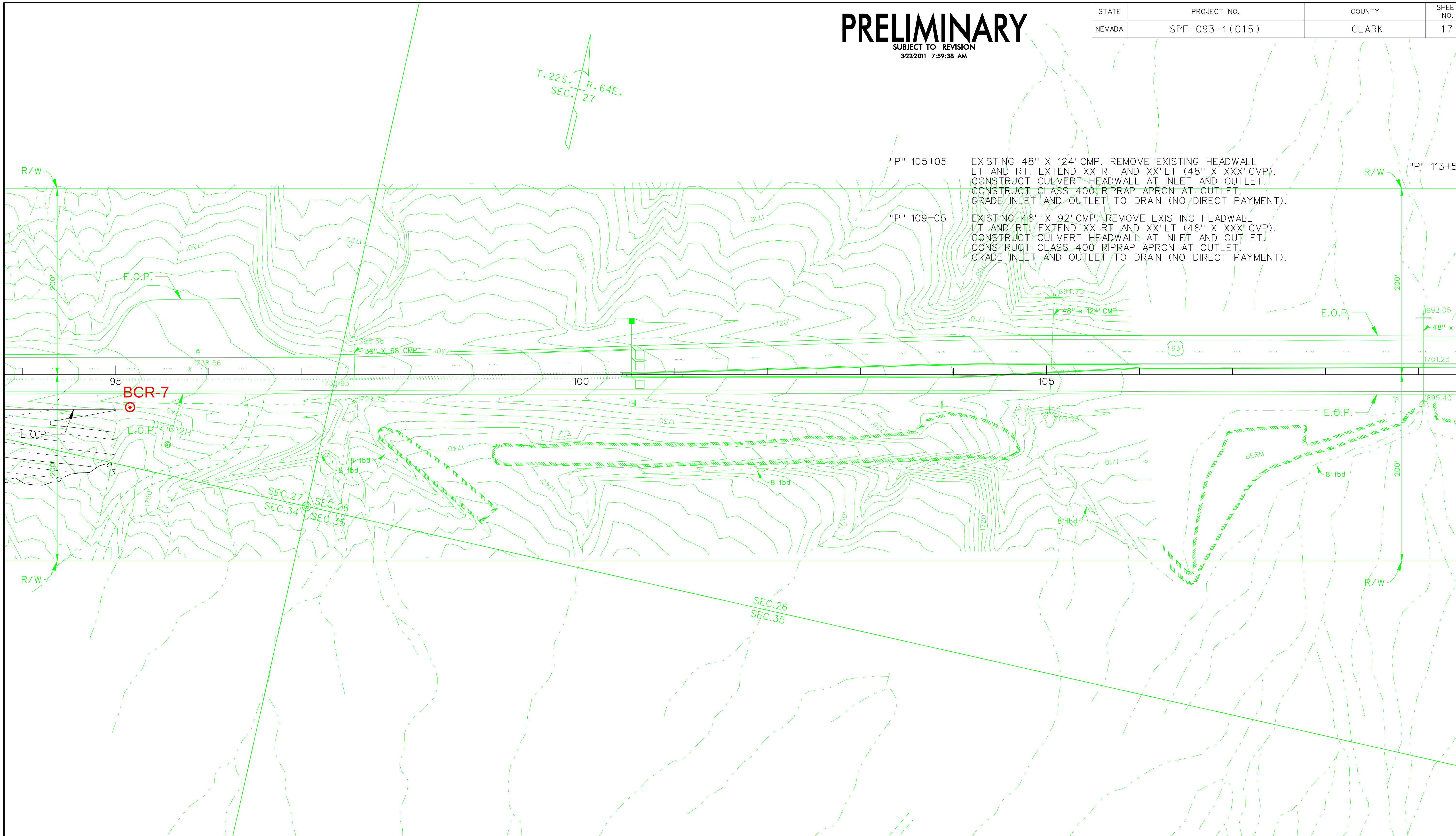
STATE	PROJECT NO.	COUNTY	SHEET NO.
NEVADA	SPF-093-1(015)	CLARK	17

PRELIMINARY

SUBJECT TO REVISION
3/22/2011 7:59:38 AM

"P" 105+05 EXISTING 48" X 124' CMP. REMOVE EXISTING HEADWALL LT AND RT. EXTEND XX' RT AND XX' LT (48" X XXX' CMP). CONSTRUCT CULVERT HEADWALL AT INLET AND OUTLET. CONSTRUCT CLASS 400 RIPRAP APRON AT OUTLET. GRADE INLET AND OUTLET TO DRAIN (NO DIRECT PAYMENT).

"P" 109+05 EXISTING 48" X 92' CMP. REMOVE EXISTING HEADWALL LT AND RT. EXTEND XX' RT AND XX' LT (48" X XXX' CMP). CONSTRUCT CULVERT HEADWALL AT INLET AND OUTLET. CONSTRUCT CLASS 400 RIPRAP APRON AT OUTLET. GRADE INLET AND OUTLET TO DRAIN (NO DIRECT PAYMENT).



D.N. "P" RT.

6:1 F.S. For 12' Thence 6:1 F.S. Or 4:1 B.S.

+00 — +93

"P" RT.		
EXCAVATION	4061(XXXX)	CUYD
BORROW	29	CUYD
EMBANKMENT	29	CUYD

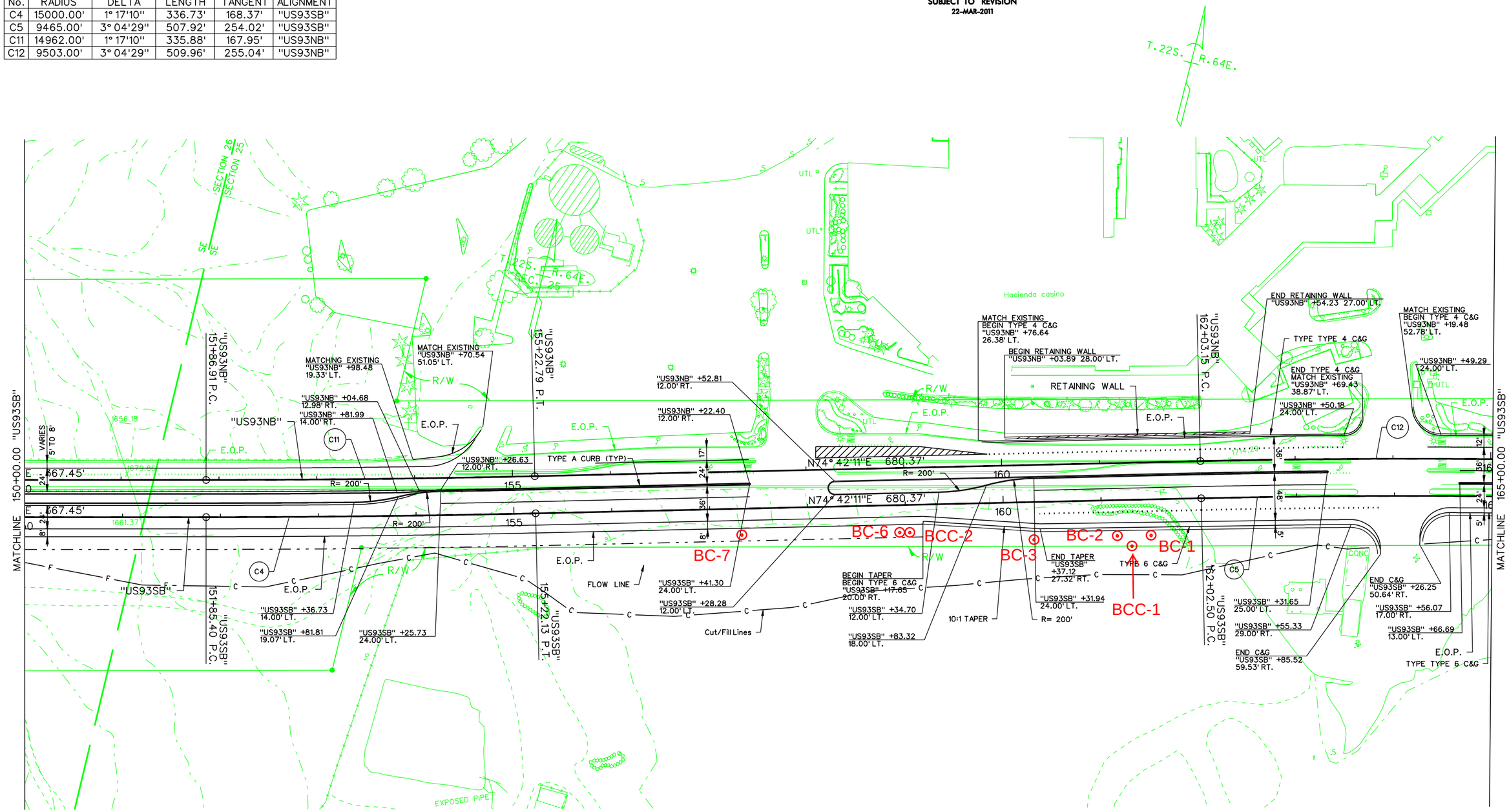
CURVE DATA					
No.	RADIUS	DELTA	LENGTH	TANGENT	ALIGNMENT
C4	15000.00'	1° 17'10"	336.73'	168.37'	"US93SB"
C5	9465.00'	3° 04'29"	507.92'	254.02'	"US93SB"
C11	14962.00'	1° 17'10"	335.88'	167.95'	"US93NB"
C12	9503.00'	3° 04'29"	509.96'	255.04'	"US93NB"

PRELIMINARY

SUBJECT TO REVISION

22-MAR-2011

STATE	PROJECT NO.	COUNTY	SHEET NO.
NEVADA	73602	CLARK	22



STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

US 93 WIDENING

US93 ROADWAY PLAN

CURVE DATA					
No.	RADIUS	DELTA	LENGTH	TANGENT	ALIGNMENT
C5	9465.00'	3° 04'29"	507.92'	254.02'	"US93SB"
C6	20038.00'	2° 41'05"	938.90'	469.53'	"US93SB"
C12	9503.00'	3° 04'29"	509.96'	255.04'	"US93NB"
C13	20000.00'	2° 29'05"	867.37'	433.75'	"US93NB"

PRELIMINARY

SUBJECT TO REVISION

22-MAR-2011

STATE	PROJECT NO.	COUNTY	SHEET NO.
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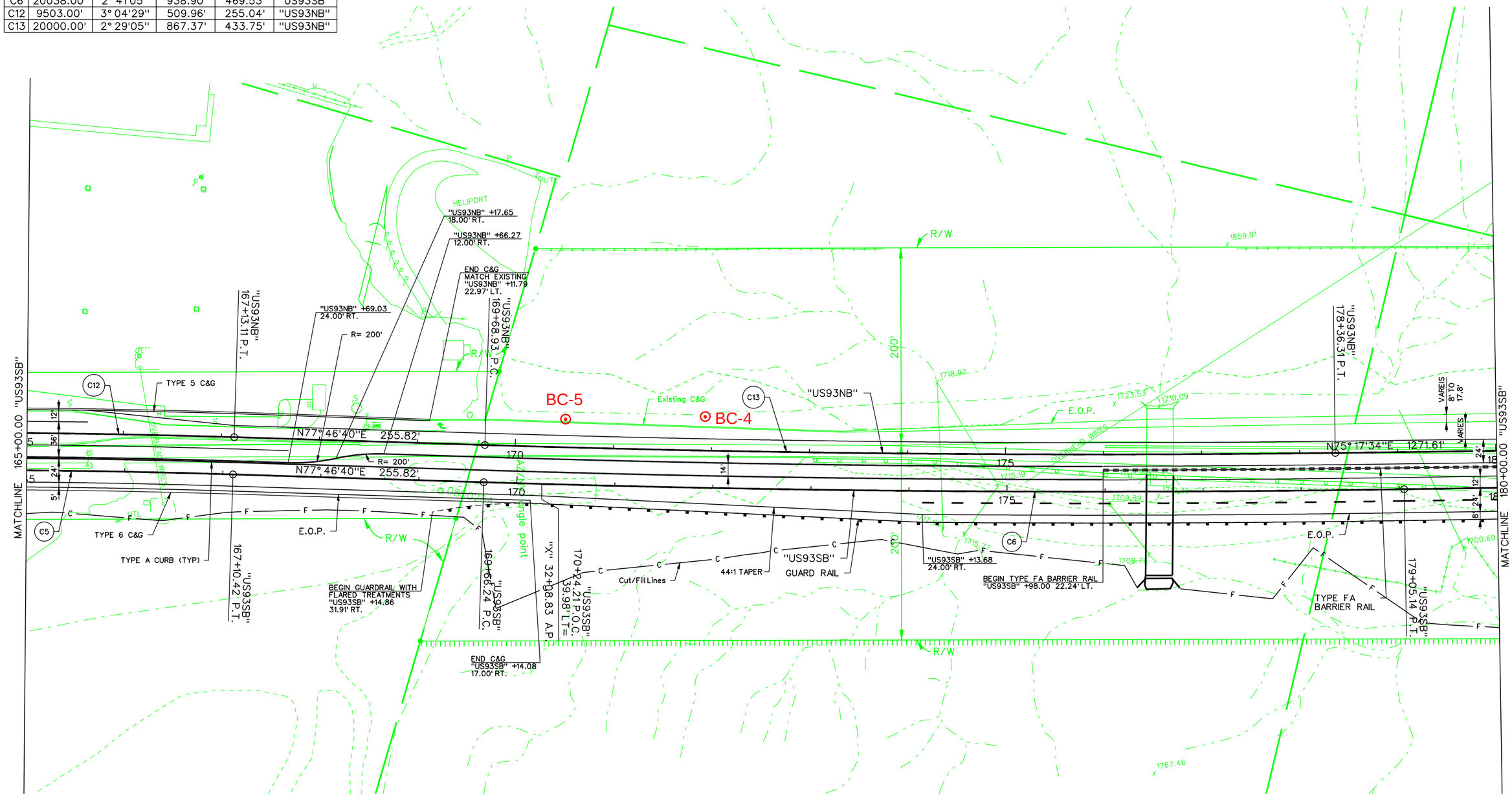

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

US 93 WIDENING

US93
ROADWAY PLAN

CURVE DATA					
No.	RADIUS	DELTA	LENGTH	TANGENT	ALIGNMENT
C7	2483.00'	1° 19'25''	57.36'	28.68'	''US93SB''
C14	2517.00'	0° 56'56''	41.69'	20.84'	''US93NB''
C15	2000.00'	5° 11'52''	181.43'	90.78'	''RAMP B''
C16	5000.00'	1° 54'50''	167.01'	83.51'	''RAMP B''

PRELIMINARY

SUBJECT TO REVISION

22-MAR-2011

STATE	PROJECT NO.	COUNTY	SHEET NO.
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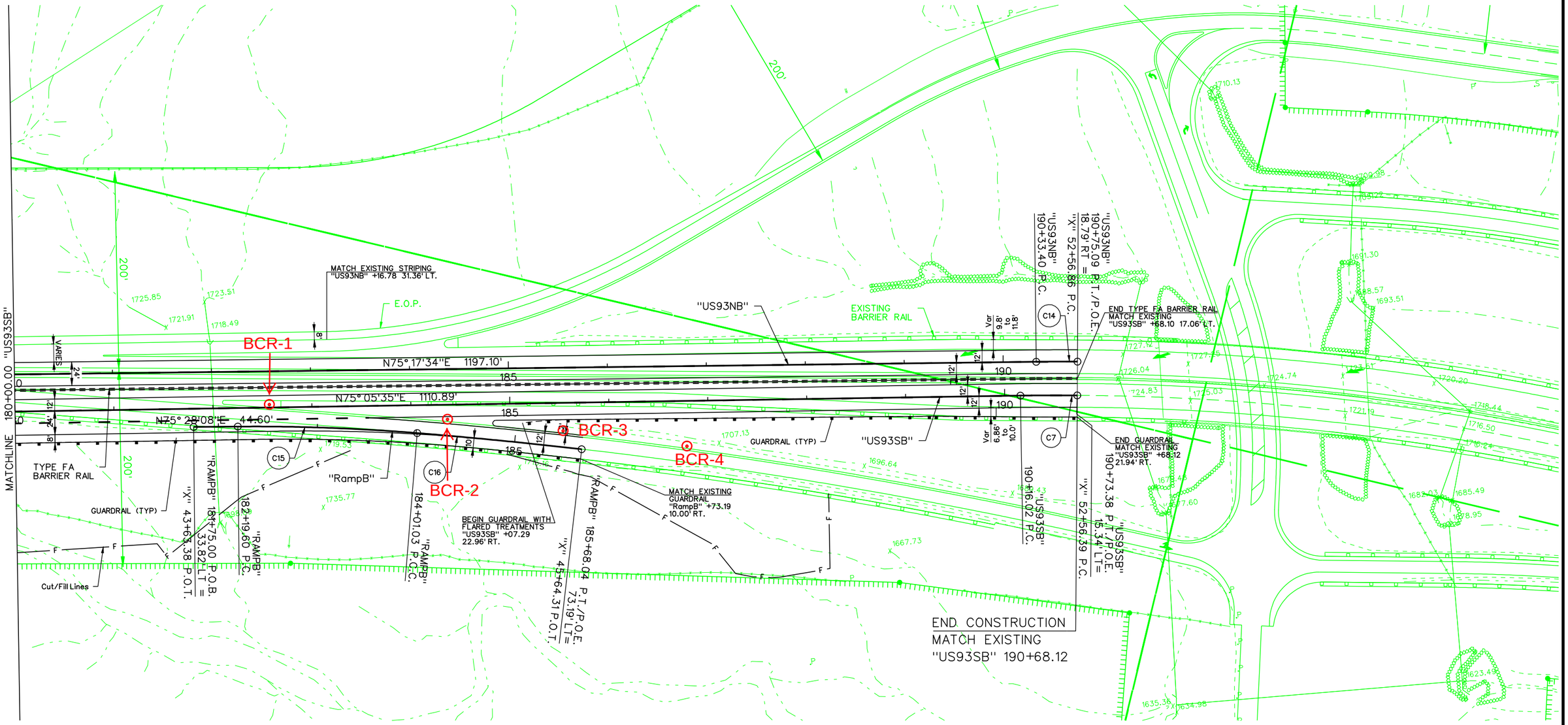


STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

US 93 WIDENING

US93
ROADWAY PLAN

APPENDIX B

Boring Log Key
Boring Logs

KEY TO BORING LOGS

PARTICLE SIZE LIMITS								
CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		FINE	MEDIUM	COARSE	FINE	COARSE		
.002 mm	#200	#40	#10	#4	3/4 inch	3 inch	12 inch	

USCS GROUP	TYPICAL SOIL DESCRIPTION
GW	Well graded gravels, gravel-sand mixtures, little or no fines
GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
GM	Silty gravels, poorly graded gravel-sand-silt mixtures
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands, little or no fines
SM	Silty sands, poorly graded sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
CS	Claystone/Siltstone
PT	Peat and other highly organic soils

MOISTURE CONDITION CRITERIA

Description	Criteria
Dry	Absence of moisture, dusty, dry to touch.
Moist	Damp, no visible free water.
Wet	Visible free water, usually below groundwater table.

SOIL CEMENTATION CRITERIA

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Won't break or crumble w/finger pressure.

▽ ▼ **Groundwater Elevation Symbols**

STANDARD PENETRATION CLASSIFICATION*

GRANULAR SOIL		CLAYEY SOIL	
BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY
0 - 4	VERY LOOSE	0 – 1	VERY SOFT
5 - 10	LOOSE	2 - 4	SOFT
11 - 30	MEDIUM DENSE	5 - 8	MEDIUM STIFF
31 - 50	DENSE	9 - 15	STIFF
OVER 50	VERY DENSE	16 - 30	VERY STIFF
		31 - 60	HARD
		OVER 60	VERY HARD

*Standard Penetration Test (N) 140 lb hammer
30 inch free-fall on 2 inch O.D. x 1.4 inch I.D. sampler

Blow counts on Calif. Modified Sampler (N_{CMS}) can be converted to N_{SPT} by:

$(N_{CMS})(0.62) = N_{SPT}$

Blow counts from Automatic or Safety Hammer can be converted to Standard SPT N_{60} by:

$(N_{AUTOMATIC})(1.30) = N_{60}$

$(N_{SAFETY})(1.17) = N_{60}$

TEST ABBREVIATIONS

CD	CONSOLIDATED DRAINED	O	ORGANIC CONTENT
CH	CHEMICAL (CORROSIVENESS)	OC	CONSOLIDATION
CM	COMPACTION	PI	PLASTICITY INDEX
CU	CONSOLIDATED UNDRAINED	RQD	ROCK QUALITY DESIGNATION
D	DISPERSIVE SOILS	RV	R-VALUE
DS	DIRECT SHEAR	S	SIEVE ANALYSIS
E	EXPANSIVE SOIL	SL	SHRINKAGE LIMIT
G	SPECIFIC GRAVITY	U	UNCONFINED COMPRESSION
H	HYDROMETER	UU	UNCONSOLIDATED UNDRAINED
HC	HYDRO-COLLAPSE	UW	UNIT WEIGHT
K	PERMEABILITY	W	MOISTURE CONTENT

SOIL COLOR DESIGNATIONS ARE FROM THE MUNSELL SOIL COLOR CHART.
EXAMPLE: (7.5 YR 5/3) BROWN

SAMPLER NOTATION

CMS	CALIF. MODIFIED SAMPLER①
CPT	CONE PENETRATION
CS	CONTINUOUS SAMPLER②
CSS	CALIFORNIA SPLIT SPOON
P	PUSHED (NOT DRIVEN)
PB	PITCHER BARREL
RC	ROCK CORE③
SH	SHELBY TUBE④
SPT	STANDARD PENETRATION TEST
TP	TEST PIT

① - I.D.= 2.421 inch
② - I.D.=3.228 inch with tube; 3.50 inch w/o tube
③ - NXB I.D.= 1.875 inch
④ - I.D.= 2.875 inch

LAST MODIFIED: October 11, 2006

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

START DATE 2/14/11
END DATE 2/14/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-1
E.A. # 73602
GROUND ELEV. 1718.70 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 161+29
OFFSET 57' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Pypkowski
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 2/14/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									light white to reddish brown sandy gravel	
									2.60	Very hard drilling 2.0'-2.6'. Terminated hole in rock.
									B.O.H.	
1713.7	5									
1708.7	10									
1703.7	15									
1698.7	20									
1693.7	25									

NV_DOT US 93 BOULDER CITY A.GPJ NV_DOT.GDT 4/22/11

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 2/14/11
END DATE 2/14/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-2
E.A. # 73602
GROUND ELEV. 1719.30 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 160+87
OFFSET 52' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Pypkowski
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 2/14/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									light tan to white sandy gravel	Bulk 1 @ 0'-3'.
										Hard drilling from 2.5' to 10'.
1714.3	5								5.00	Bulk 2 @ 5'-7.5'.
	9.50	A	SPT	50/0.1'	50/0.1'	100			**CLAYEY SAND** Pinkish gray to dark gray, dry, very dense	
1709.3	10									Bulk 3 @ 12'-15'.
1704.3	15.00 15									
	16.50	B	SPT	17 18 25	43	100			**CLAYEY SAND** Dark red, damp, dense	
	20.00									
1699.3	20							SC		
	20.90	C	SPT	30 50/0.4'	50/0.4'	100			**CLAYEY SAND** Mottled white to pinkish tan to dark gray, dry to damp, very dense	End of day 1 @ 20'.
	25.00									
1694.3	25									
	25.90	D	SPT	24 50/0.4'	50/0.4'	100			**CLAYEY SAND** Mottled white to pinkish tan to dark gray, dry to damp, very dense	
	30.00								30.00	

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 2/14/11
END DATE 2/14/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-2
E.A. # 73602
GROUND ELEV. 1719.30 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 160+87
OFFSET 52' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Pypkowski
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 2/14/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	30.40	E	SPT	50/0.4'	50/0.4'	100			**CLAYEY SAND** Pinkish tan to dark gray, dry to damp, very dense	
1684.3	35 35.00									
	35.60	F	SPT	48 50/0.1'	50/0.1'	100		SC	**CLAYEY SAND** Pinkish tan to dark gray, dry to damp, very dense	
1679.3	40 40.00 40.30	G	SPT	50/0.3'	50/0.3'	100			**CLAYEY SAND with GRAVEL** Dark reddish brown, dry, very dense	No sample recovered (H).
1674.3	45 45.00 45.20	H	SPT	50/0.2'	50/0.2'	0			45.20 **B.O.H.**	Very hard drilling from 43' to 44'.
1669.3	50									
1664.3	55									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 2/15/11
END DATE 2/15/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-3
E.A. # 73602
GROUND ELEV. 1718.30 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 160+03
OFFSET 47' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Ford
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 2/15/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									light tan to white sandy gravel, dry	Bulk 1 @ 0'-5'.
1713.3	5 5.00 / 5.80	A	SPT	44 / 50/0.3'	50/0.3'	100			**CLAYEY SAND** Light pink to pinkish gray, dry, very dense	Bulk 2 @ 5'-10'.
1708.3	10 10.00 / 10.40	B	SPT	50/0.4'	50/0.4'	100		SC	**CLAYEY SAND** Light pinkish gray, dry, very dense	Bulk 3 @ 10'-15'.
1703.3	15 15.00 / 15.30	C	SPT	50/0.3'	50/0.3'	0			15.20	No sample recovered (C).
1698.3	20 20.00 / 20.40	D	SPT	50/0.4'	50/0.4'	100		SM	**SILTY SAND** White to pinkish tan, dry, very dense	
1693.3	25 25.00 / 25.10	E	SPT	10/0.1'	10/0.1'	0				No sample recovered (E). Hard drilling from 26' to 31.5'.
									30.00	

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 2/15/11
END DATE 2/15/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-3
E.A. # 73602
GROUND ELEV. 1718.30 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 160+03
OFFSET 47' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Ford
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 2/15/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									31.50	
									B.O.H.	
1683.3	35									
1678.3	40									
1673.3	45									
1668.3	50									
1663.3	55									

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 2/16/11
END DATE 2/16/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-4
E.A. # 73602
GROUND ELEV. 1727.10 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93NB" 171+95
OFFSET 39' Left
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Ford
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 2/16/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									light tan to white sandy gravel, dry	Bulk 1 @ 0'-5'.
1722.1	5 5.00	A	SPT	22 49 50/0.4'	50/0.4'	100		CL	**LEAN CLAY with SAND** White to pinkish tan, dry, very hard	Bulk 2 @ 5'-10'.
	6.40									
1717.1	10 10.00	B	SPT	20/0.1'	20/0.1'	0			10.00	No sample recovered (B).
1712.1	15 15.00 15.20	C	SPT	50/0.2'	50/0.2'	100		SC	**CLAYEY SAND** Pinkish gray to dark gray, dry, very dense	No sample recovered (C).
									17.50	
1707.1	20 20.00 20.70	D	SPT	29 50/0.2'	50/0.2'	100		CL	**SANDY LEAN CLAY** White, dry to damp, very hard	
									23.50	
1702.1	25								**B.O.H.**	Very hard drilling at 23.5'; no progress.

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 2/16/11
END DATE 2/16/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-5
E.A. # 73602
GROUND ELEV. 1726.70 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93NB" 170+52
OFFSET 36' Left
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Ford
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 2/16/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									Tan sandy gravel, dry	Bulk 1 @ 0'-4'.
										Hard drilling at 2.5'. 400 psi down pressure; no progress.
									4.50	
1721.7	5								**B.O.H.**	
1716.7	10									
1711.7	15									
1706.7	20									
1701.7	25									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

START DATE 2/16/11
END DATE 2/16/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-6
E.A. # 73602
GROUND ELEV. 1715.50 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 158+65
OFFSET 52' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Pypkowski
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 2/16/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									White to tan sandy gravel, dry to damp	
	1.50								**B.O.H.**	45 minutes @ 300 psi down pressure; hole terminated.
1710.5	5									
1705.5	10									
1700.5	15									
1695.5	20									
1690.5	25									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 3/3/11
END DATE 3/3/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BC-7
E.A. # 73602
GROUND ELEV. (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 157+05
OFFSET 65' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Pypkowski
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/3/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									light tan to white sandy gravel	Bulk 1 @ 0'-5'.
	3.00									
	3.30	A	SPT	50/0.3'	50/0.3'	100			**CLAYEY SAND with GRAVEL** Light tan, dry, very dense	
	5.00									
5	5.40	B	SPT	50/0.4'	50/0.4'	100			**CLAYEY SAND with GRAVEL** White to light tan, dry, very dense	Bulk 2 @ 5'-10'. (B) Pulverized rock sample.
	7.50									
	8.60	C	SPT	30 20/0.1'	20/0.1'	100			**CLAYEY SAND** White to light tan to yellow, dry to damp, very dense	(C) Last 10 blows; no progress.
	10.00									
10	10.40	D	SPT	50/0.4'	50/0.4'	100			**CLAYEY SAND** White to very light pink, dry to damp, very dense	(D) Pulverized rock sample.
								SC		
	15.00									
15	15.20	E	SPT	25/0.2'	25/0.2'	0				(E) Last 10 blows; no progress; no sample recovered.
	20.00									
20	20.30	F	SPT	50/0.3'	50/0.3'	100			**CLAYEY SAND with GRAVEL** White to light tan with turquoise inclusions, dry to damp, very dense	
									22.50	
	25.00									
25	26.30	G	SPT	16 45 50/0.3'	50/0.3'	100		CH	**SANDY FAT CLAY** Very light green with black inclusions, dry to damp, very hard	Very hard drilling from 28.5-29.5'.
									29.50	
									B.O.H.	

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 3/1/11
END DATE 3/1/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCC-1
E.A. # 73602
GROUND ELEV. 1719.70 (ft)
HAMMER DROP SYSTEM None

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 161+01
OFFSET 64' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 3.5" tri-cone w/ slurry
BACKFILLED Yes DATE 3/1/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	1.00								White to light tan sandy gravel	
	3.20	A	CORE	RQD = 15%	15%	86			Intensely brecciated dacite and monzonite, both igneous and metamorphic rock. Iron staining and gypsum intrusion indicate heavy fluid movement. Iron and sulfur residues with evidence of hydrothermal alteration. Probable fault zone (brecciation).	100 to 150 psi down pressure.
1714.7	5									
	8.30	B	CORE	RQD = 92%	92%	100				
1709.7	10									
	13.30	C	CORE	RQD = 87%	87%	100				
1704.7	15									
	18.30	D	CORE	RQD = 89%	89%	98				
1699.7	20									
	23.30	E	CORE	RQD = 99%	99%	102			23.30	
									B.O.H.	
1694.7	25									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 3/1/11
END DATE 3/2/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCC-2
E.A. # 73602
GROUND ELEV. 1716.20 (ft)
HAMMER DROP SYSTEM None

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 158+52
OFFSET 52' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 3.5" tri-cone w/ slurry
BACKFILLED Yes DATE 3/2/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	1.00								White to light tan sandy gravel	
	2.50	A	CORE	RQD = 64%	64%	100				100 to 150 psi down pressure.
1711.2	5	B	CORE	RQD = 84%	84%	100			Intensely brecciated dacite and monzonite, both igneous and metamorphic rock. Light iron staining and gypsum (not silica) intrusion indicate heavy fluid movement. Heavier sulfur and lighter iron residues than BCC-1, with evidence of hydrothermal alteration. Probable fault zone (brecciation).	
	7.30									End of day 1 @ 7.3'.
1706.2	10	C	CORE	RQD = 62%	62%	100				(C) Sample very difficult to extract from sampler; damaged.
	12.30									
1701.2	15	D	CORE	RQD = 7%	7%	100				(D) Sample very difficult to extract from sampler; damaged.
	15.50									
1696.2	20	E	CORE	RQD = 42%	42%	94				(E) Sample very difficult to extract from sampler; damaged.
	20.50									
	24.80	F	CORE	RQD = 0%	0%	44				(F) water extraction from sampler; sample fragments out of order.
1691.2	25								24.80 **B.O.H.**	

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 3/29/11
END DATE 3/29/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCR-1
E.A. # 73602
GROUND ELEV. 1721.20 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 182+57
OFFSET 3' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/29/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									Light tan sandy gravel, dry	
	3.50									
		A	SPT	11 12 19	31	85			**SILTY SAND with GRAVEL** Yellowish brown to medium brown, dry to damp, dense	
1716.2	5 5.00									
		B	SPT	30 33 35	68	95		**SM**	**SILTY SAND with GRAVEL** Dark reddish brown, dry to damp, very dense	
	6.50									
	7.50								7.00	
		C	SPT	10 9 15	24	95			**SILTY CLAYEY SAND with GRAVEL** Dark reddish brown, dry to damp, medium dense	
	9.00									
1711.2	10 10.00									
		D	SPT	14 16 28	44	100			**SILTY CLAYEY SAND with GRAVEL** Dark reddish brown, dry to damp, dense	
	11.50									
	12.50									
		E	SPT	14 18 23	41	100		**SC** **SM**	**SILTY CLAYEY SAND with GRAVEL** Dark reddish brown, dry to damp, dense	
	14.00									
1706.2	15 15.00									
	15.80	F	SPT	25 30/0.3'	30/0.3'	100			**SILTY CLAYEY SAND with GRAVEL** Dark reddish brown, dry to damp, very dense	(F) Last 10 blows; no progress. Sampler wet.
	17.50									
		G	SPT	12 22 30	52	100			**SILTY CLAYEY SAND with GRAVEL** Dark reddish brown, dry to damp, very dense	
	19.00									
									19.50	
1701.2	20 20.00									
		H	SPT	12 18 21	39	95		**SM**	**SILTY SAND with GRAVEL** Dark reddish brown, damp, dense	
	21.50								21.10	
	22.50								**SILTY SAND** Light reddish brown to white, damp, dense	
		I	SPT	36 50/0.4'	50/0.4'	90		**SM**	**SILTY SAND with GRAVEL** Light reddish brown to yellowish tan to white, dry to damp, very dense	(I) Sampler wet. Rock in sampler shoe.
	23.40									
1696.2	25 25.00 25.10	J	SPT	25/0.1'	25/0.1'	0			25.10 **B.O.H.**	(J) No sample recovered.

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 3/29/11
END DATE 3/29/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCR-2
E.A. # 73602
GROUND ELEV. 1714.20 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 184+36
OFFSET 19' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/29/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									Tan sandy gravel, dry	
	3.00 3.20	A	SPT	15/0.2'	15/0.2'	0			Dark reddish brown sandy gravel, dry	(A) Last 10 blows; no progress. No sample recovered.
1709.2	5 5.00 5.20	B	SPT	15/0.2'	15/0.2'	0				(B) Last 10 blows; no progress. No sample recovered.
	8.00 8.10	C	SPT	10/0.1'	10/0.1'	0				(C) Last 10 blows; no progress. No sample recovered.
1704.2	10 10.00 10.10	D	SPT	10/0.1'	10/0.1'	0				(D) Last 10 blows; no progress. No sample recovered.
	13.00 13.10	E	SPT	15/0.1'	15/0.1'	0				(E) Last 10 blows; no progress. No sample recovered.
1699.2	15 15.00 15.10	F	SPT	10/0.1'	10/0.1'	0				(F) Last 10 blows; no progress. No sample recovered.
	18.00 18.10	G	SPT	10/0.1'	10/0.1'	0				(G) Last 10 blows; no progress. No sample recovered.
1694.2	20 20.00 20.10	H	SPT	10/0.1'	10/0.1'	0			20.10 **B.O.H.**	(H) Last 10 blows; no progress. No sample recovered.
1689.2	25									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 3/30/11
END DATE 3/30/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCR-3
E.A. # 73602
GROUND ELEV. 1706.00 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 185+52
OFFSET 34' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/30/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									Light tan sandy gravel, dry	
	3.00									
	4.50	A	SPT	12 17 17	34	85			**SILTY SAND with GRAVEL** Reddish brown, dry, dense	
	5.00									
1701.0	5							**SM**		
	6.50	B	SPT	10 12 9	21	95			**SILTY SAND with GRAVEL** Reddish brown, dry to damp, medium dense	
	7.30									
	8.00									
	8.90	C	SPT	44 50/0.4'	50/0.4'	90			**SILTY GRAVEL with SAND** Reddish brown, dry, very dense	
	10.00									
1696.0	10							**GM**		
	11.50	D	SPT	10 17 13	30	75			**SILTY GRAVEL with SAND** Reddish brown, dry, dense	
	12.30									
	13.00									
	14.50	E	SPT	12 25 29	54	95		**SC**	**CLAYEY SAND with GRAVEL** Reddish brown, dry, very dense	
	14.80									
	15.00									
1691.0	15									
	16.50	F	SPT	25 39 24	63	95			**CLAYEY GRAVEL with SAND** Reddish brown, dry, very dense	
	18.00							**GC**		
	18.20	G	SPT	30/0.2'	30/0.2'	0				(G) Last 10 blows; no progress. No sample recovered.
	18.50									
	20.00									
1686.0	20									
	21.50	H	SPT	11 11 6	17	50		**SM**	**SILTY SAND with GRAVEL** Reddish brown, dry to damp, medium dense	
	22.30									
	23.00									
	24.50	I	SPT	3 4 9	13	55		**SC** **SM**	**SILTY CLAYEY SAND with GRAVEL** Reddish brown, dry, medium dense	
	24.80									
	25.00									
1681.0	25									
	26.50	J	SPT	8 7 7	14	80			**SILTY SAND with GRAVEL** Reddish brown, dry to damp, medium dense	
	28.00							**SM**		
	29.50	K	SPT	12 11 10	21	85			**SILTY SAND with GRAVEL** Reddish brown, dry, medium dense	
	30.00									
	30.00									

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 3/30/11
END DATE 3/30/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCR-3
E.A. # 73602
GROUND ELEV. 1706.00 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 185+52
OFFSET 34' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/30/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		L	SPT	7 7 8	15	80			**SILTY SAND with GRAVEL** Reddish brown, dry, medium dense	
	31.50									
	33.00									
		M	SPT	6 8 9	17	75			**SILTY SAND with GRAVEL** Reddish brown, dry, medium dense	
	34.50									
	35.00									
1671.0	35									
		N	SPT	9 8 9	17	80		**SM**	**SILTY SAND with GRAVEL** Reddish brown, dry, medium dense	
	36.50									
	40.00									
1666.0	40									
	40.60	O	SPT	50 20/0.1'	20/0.1'	100			40.60 **SILTY SAND** Light reddish brown, dry, very dense **B.O.H.**	(O) Last 10 blows; no progress.
1661.0	45									
1656.0	50									
1651.0	55									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

START DATE 3/30/11
END DATE 3/30/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCR-4
E.A. # 73602
GROUND ELEV. 1699.00 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "US93SB" 186+80
OFFSET 45' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/30/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									Light tan sandy gravel, dry	
	3.00									
		A	SPT	8 10 9	19	75			**POORLY GRADED GRAVEL with CLAY and SAND** Light to medium brown, dry, medium dense	
	4.50									
	5.00									
1694.0	5							**GP GC**		
		B	SPT	10 13 9	22	75			**POORLY GRADED GRAVEL with SILTY CLAY and SAND** Medium to dark reddish brown, dry, medium dense	
	6.50									
									7.30	
	8.00									
		C	SPT	9 8 24	32	85		**SM**	**SILTY SAND with GRAVEL** Medium to dark reddish brown, dry, medium dense	
	9.50									
	10.00								9.80	
1689.0	10									
		D	SPT	16 12 8	20	55		**GM**	**SILTY GRAVEL with SAND** Medium to dark reddish brown, dry, medium dense	
	11.50									
									12.30	
	13.00									
		E	SPT	8 8 13	21	75			**POORLY GRADED GRAVEL with SILT and SAND** White to light pinkish tan, dry, medium dense	
	14.50									
	15.00									
1684.0	15									
		F	SPT	10 17 38	55	75		**GP GM**	**POORLY GRADED GRAVEL with SILT and SAND** White to light pinkish tan, dry, medium dense	
	16.50									
										Hard drilling 18.5' - 20.0'; 400 psi down pressure.
	20.00									
1679.0	20 20.10	G	SPT	15/0.1'	15/0.1'	0			20.10 **B.O.H.**	(G) Last 10 blows; no progress. No sample recovered.
1674.0	25									

NV_DOT US 93 BOULDER CITY A.GPJ NV_DOT.GDT 5/23/11

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 3/31/11
END DATE 3/31/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCR-5
E.A. # 73602
GROUND ELEV. 1857.00 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "P" 64+03
OFFSET 29' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/31/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									Light tan sandy gravel, dry	Bulk 1 @ 0'-5'.
	2.50									
		A	SPT	10 19 50	69	80		GM	**SILTY GRAVEL with SAND** Tan, dry, very dense	
	4.00								4.30	
	4.50	B	SPT	15/0.1'	15/0.1'	0				Hard drilling 4' - 7'; 300 psi down pressure. (B) Last 10 blows; no progress. No sample recovered.
1852.0	5									
	7.50	C	SPT	15/0.1'	15/0.1'	0				(C) Last 10 blows; no progress. No sample recovered.
1847.0	10.00 10.10	D	SPT	20/0.1'	20/0.1'	0			10.10 **B.O.H.**	
1842.0	15									
1837.0	20									
1832.0	25									

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

START DATE 3/31/11
END DATE 3/31/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCR-6
E.A. # 73602
GROUND ELEV. 1799.60 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "P" 75+94
OFFSET 24' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR Altamirano
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/31/2011

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									Asphaltic concrete	
	2.50									
		A	SPT	9 14 26	40	80		GW GM	**WELL GRADED GRAVEL with SILT and SAND** Light brown, dry, medium dense	
	4.00								4.00	
1794.6	5	B	SPT	27 29 17	46	70		SW SM	**WELL GRADED SAND with SILT and GRAVEL** Medium brown to tan, dry, dense	
	5.50									
	7.50								6.50	
		C	SPT	26 40 27	67	100			**SILTY SAND with GRAVEL** Medium brown to tan, dry, very dense	
	9.00									
1789.6	10	D	SPT	16 25 21	46	80			**SILTY SAND with GRAVEL** Medium brown to tan, dry, very dense	
	10.50							SM		
	12.50									
		E	SPT	11 14 12	26	75			**SILTY SAND with GRAVEL** Medium brown to tan, dry, very dense	
	14.00								14.00	
1784.6	15								**B.O.H.**	
1779.6	20									
1774.6	25									

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 3/31/11
END DATE 3/31/11
JOB DESCRIPTION US 93 Widening
LOCATION Boulder City to Hoover Dam Interchange
BORING BCR-7
E.A. # 73602
GROUND ELEV. 1739.70 (ft)
HAMMER DROP SYSTEM Automatic

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "P" 95+15
OFFSET 38' Right
ENGINEER Boomhower
EQUIPMENT Diedrich D-120
OPERATOR White
DRILLING METHOD 6" H.S.A.
BACKFILLED Yes DATE 3/31/2011

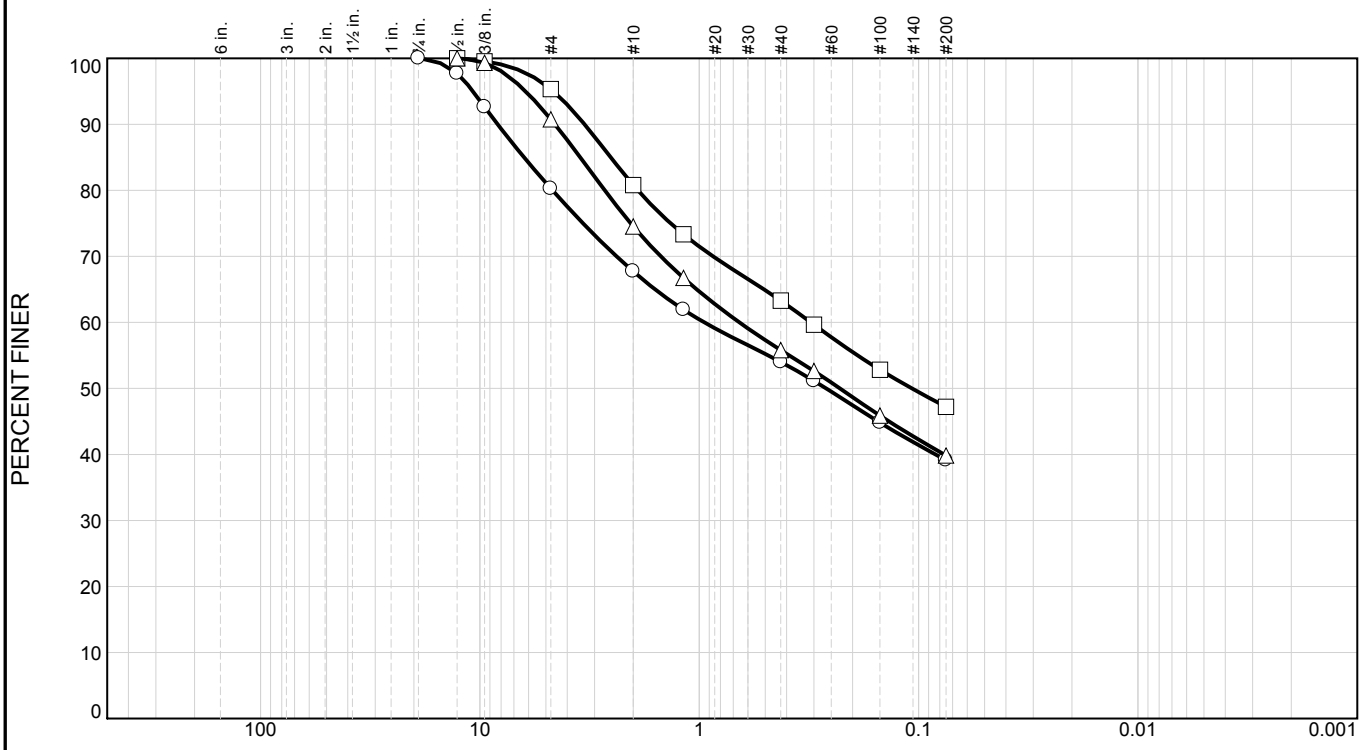
ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									Light tan sandy gravel	
	3.00									
		A	SPT	9 18 21	39	75		SW SM	**WELL GRADED SAND with SILT and GRAVEL** Light to medium brown, dry, dense	
	4.50									
	5.00								4.80	
1734.7	5	B	SPT	22 17 30/0.4'	30/0.4'	60		GW GM	**WELL GRADED GRAVEL with SILT and SAND** Light to medium brown, dry, very dense	(B) Last 10 blows; no progress. No sample recovered.
	6.40								7.40	
									B.O.H.	Hard drilling 6.4' - 7.4'; 200 psi down pressure for 40 minutes.
1729.7	10									
1724.7	15									
1719.7	20									
1714.7	25									

NV_DOT US 93 BOULDER CITY A.GPJ NV_DOT.GDT 4/22/11

APPENDIX C

Soil Particle Size Distribution Sheets
Chemical Analysis Results
Test Result Summary Sheets

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	19.7	41.2	39.1		SM	A-4(0)	NP	34
□	0.0	4.7	48.1	47.2		SM	A-4(0)	NP	33
△	0.0	9.2	51.0	39.8		SM	A-4(1)	25	34

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
1/2"	97.7	100.0	100.0
3/8"	92.6	99.5	99.3
	GRAIN SIZE		
D_{60}	0.9489	0.3098	0.6562
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	80.3	95.3	90.8
#10	67.7	80.8	74.5
#16	61.9	73.3	66.7
#40	54.0	63.3	55.8
#50	51.1	59.7	52.6
#100	44.8	52.8	45.9
#200	39.1	47.2	39.8

Material Description
○ silty sand with gravel
□ silty sand
△ silty sand

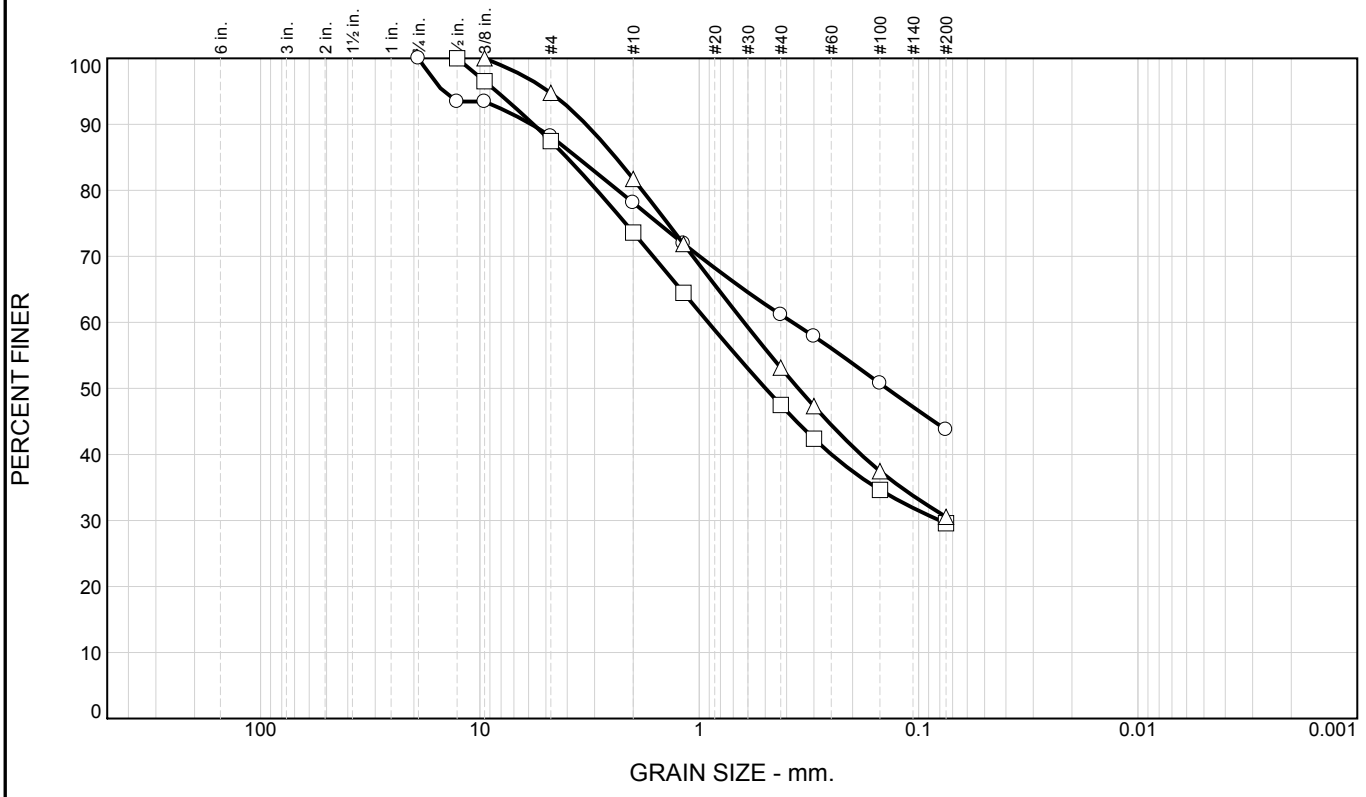
REMARKS:
○
□
△

○ Source of Sample: BC-2 Depth: 0.0 - 3.0' Sample Number: BULK 1
□ Source of Sample: BC-2 Depth: 5.0 - 7.5' Sample Number: BULK 2
△ Source of Sample: BC-2 Depth: 12.0 - 15.0' Sample Number: BULK 3

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	11.8	44.5	43.7		SC	A-6(4)	15	33
□	0.0	12.5	57.9	29.6		SC	A-2-7(1)	23	42
△	0.0	5.2	64.3	30.5		SC	A-2-6(0)	23	36

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0		
1/2"	93.5	100.0	
3/8"	93.5	96.5	100.0
	GRAIN SIZE		
D_{60}	0.3751	0.9097	0.6248
D_{30}		0.0800	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	88.2	87.5	94.8
#10	78.1	73.6	81.7
#16	71.9	64.5	71.9
#40	61.2	47.5	53.1
#50	57.9	42.4	47.3
#100	50.8	34.6	37.5
#200	43.7	29.6	30.5

Material Description
○ clayey sand
□ clayey sand
△ clayey sand

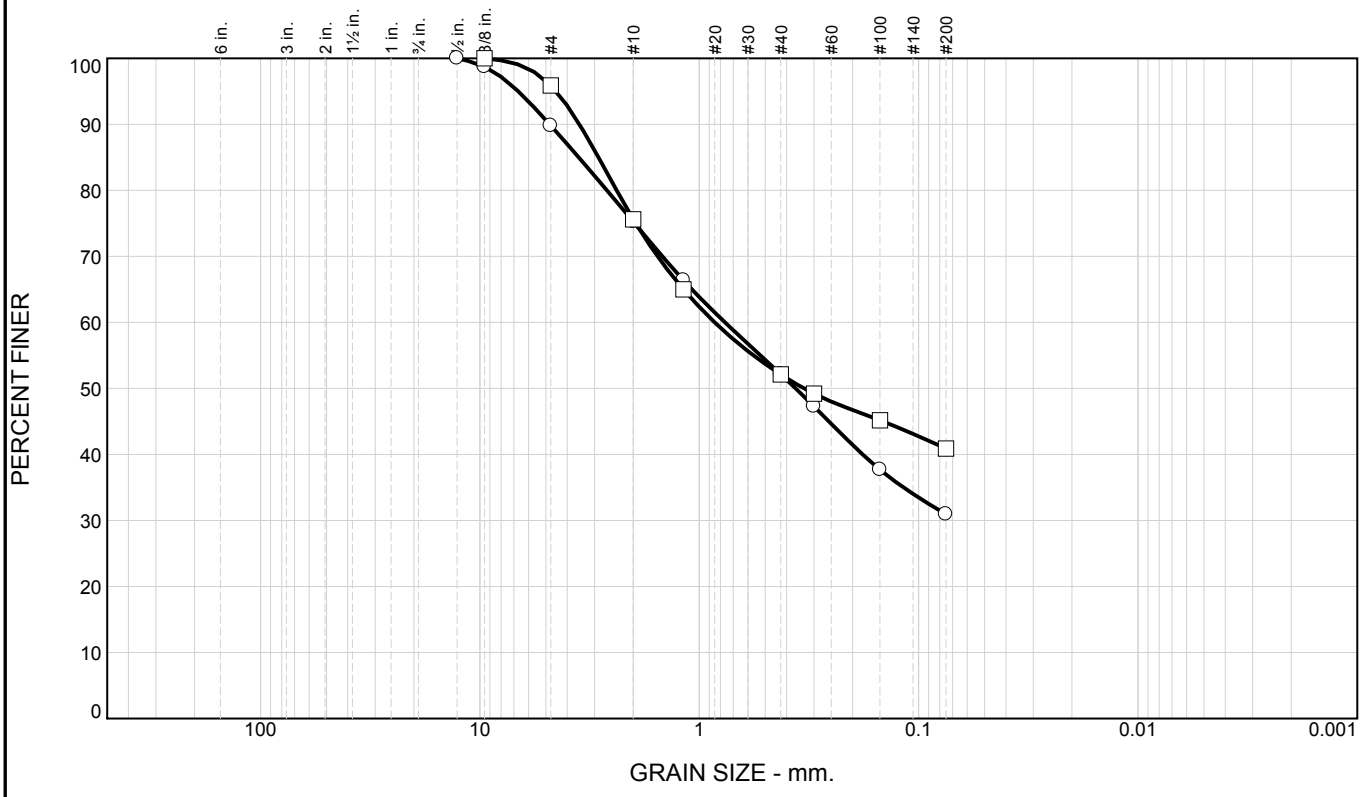
REMARKS:
○
□
△

○ Source of Sample: BC-2 Depth: 9.5 - 9.6' Sample Number: A
□ Source of Sample: BC-2 Depth: 15.0 - 16.5' Sample Number: B
△ Source of Sample: BC-2 Depth: 20.0 - 20.9' Sample Number: C

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	10.2	58.9	30.9		SC	A-2-7(2)	22	47
□	0.0	4.1	55.0	40.9					

SIEVE inches size	○	□
1/2"	100.0	
3/8"	98.7	100.0
GRAIN SIZE		
D_{60}	0.7631	0.8509
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	○	□
#4	89.8	95.9
#10	75.2	75.6
#16	66.4	65.0
#40	52.1	52.1
#50	47.3	49.2
#100	37.7	45.2
#200	30.9	40.9

Material Description
○ clayey sand
□

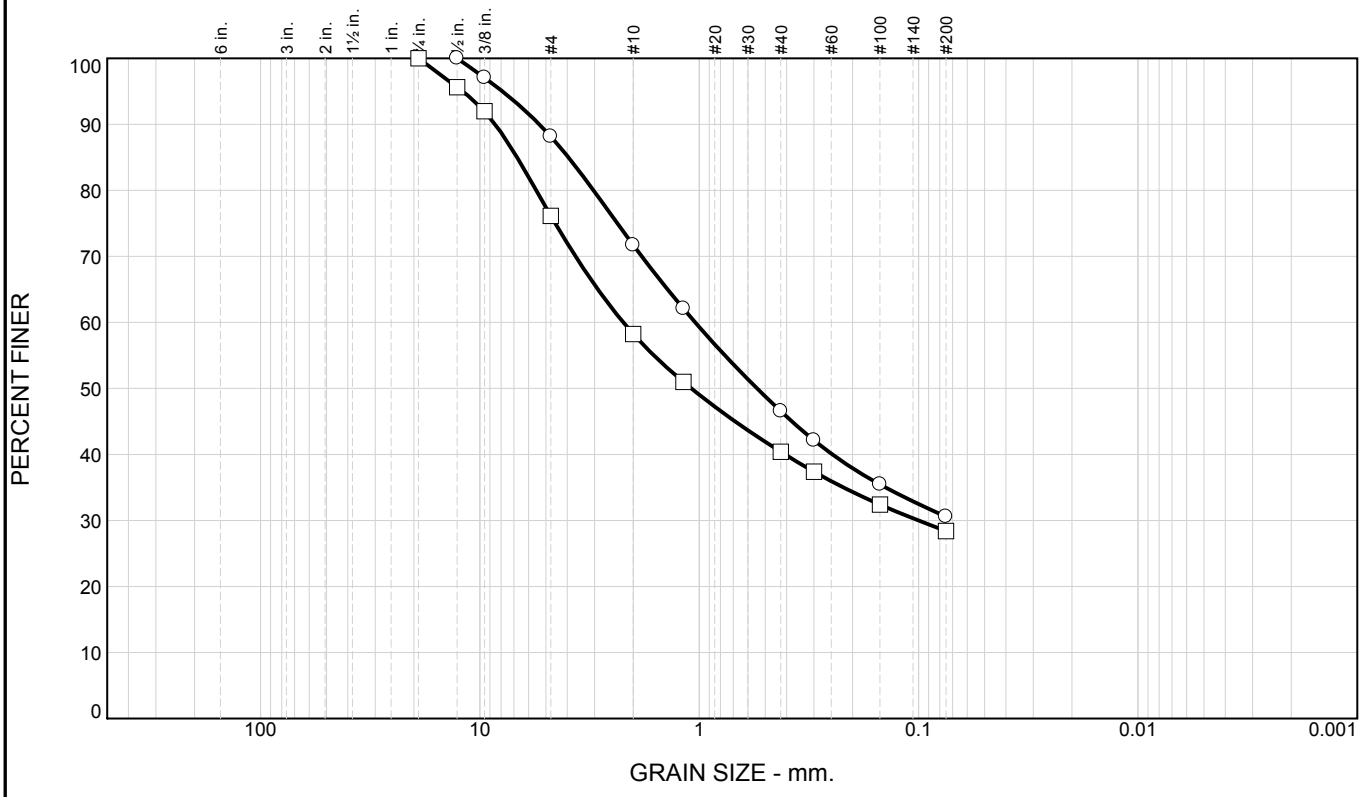
REMARKS:
○
□

○ Source of Sample: BC-2 Depth: 25.0 - 25.9' Sample Number: D
□ Source of Sample: BC-2 Depth: 30.0 - 30.4' Sample Number: E

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	11.8	57.6	30.6		SC	A-2-6(1)	22	39
□	0.0	23.9	47.7	28.4					

SIEVE inches size	○	□
3/4"		100.0
1/2"	100.0	95.6
3/8"	97.1	92.0
GRAIN SIZE		
D_{60}	1.0435	2.2227
D_{30}		0.1000
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	○	□
#4	88.2	76.1
#10	71.7	58.2
#16	62.1	51.0
#40	46.6	40.4
#50	42.1	37.4
#100	35.5	32.4
#200	30.6	28.4

Material Description
○ clayey sand
□

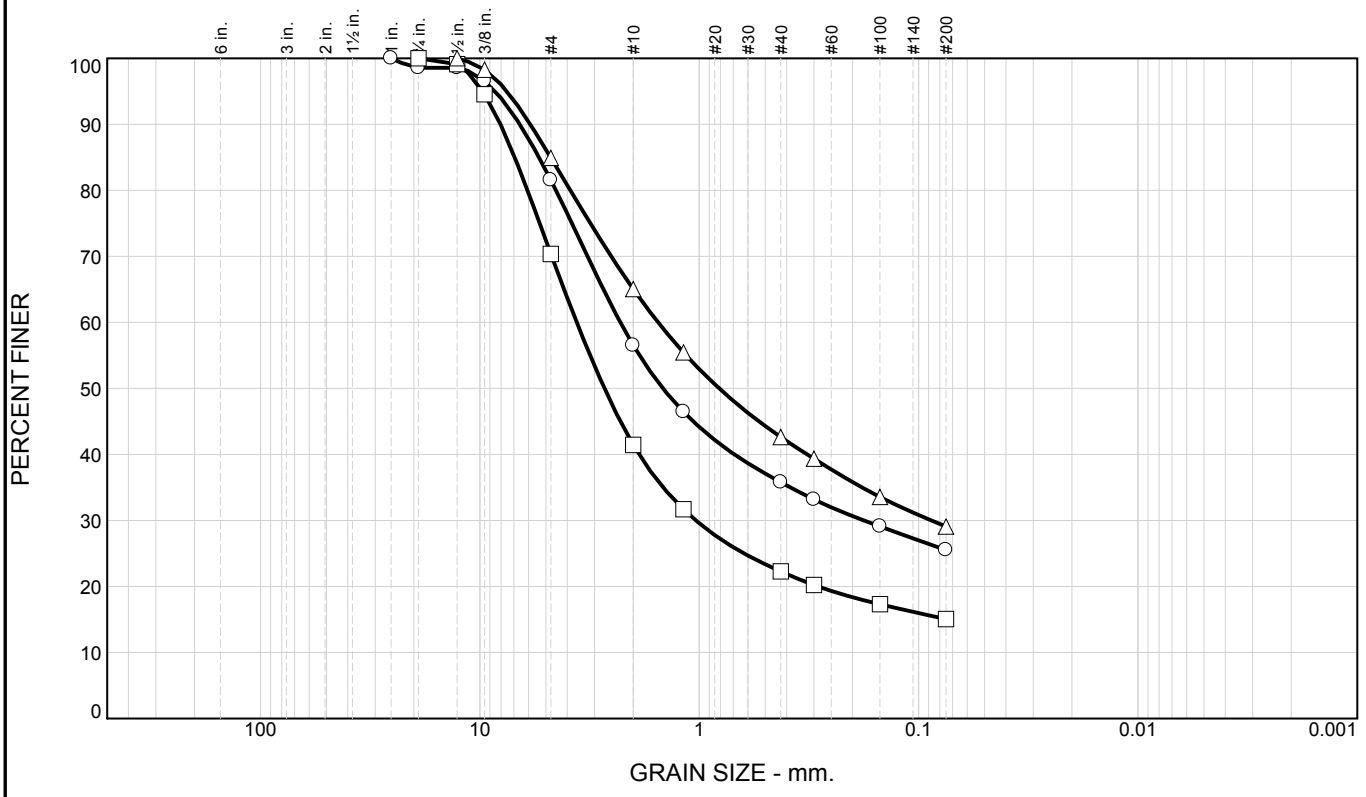
REMARKS:
○
□

○ Source of Sample: BC-2 Depth: 35.0 - 35.6' Sample Number: F
□ Source of Sample: BC-2 Depth: 40.0 - 40.3' Sample Number: G

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	18.4	56.1	25.5		SC	A-2-7(1)	21	43
□	0.0	29.6	55.3	15.1		SC	A-2-6(0)	20	37
△	0.0	15.1	55.8	29.1		SC	A-2-6(1)	20	39

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	98.6	100.0	
1/2"	98.6	99.1	100.0
3/8"	96.5	94.6	98.3
	GRAIN SIZE		
D_{60}	2.2913	3.6200	1.5410
D_{30}	0.1774	1.0356	0.0873
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	81.6	70.4	84.9
#10	56.5	41.4	65.0
#16	46.5	31.7	55.4
#40	35.8	22.3	42.6
#50	33.2	20.2	39.4
#100	29.1	17.3	33.6
#200	25.5	15.1	29.1

Material Description
○ clayey sand with gravel
□ clayey sand with gravel
△ clayey sand with gravel

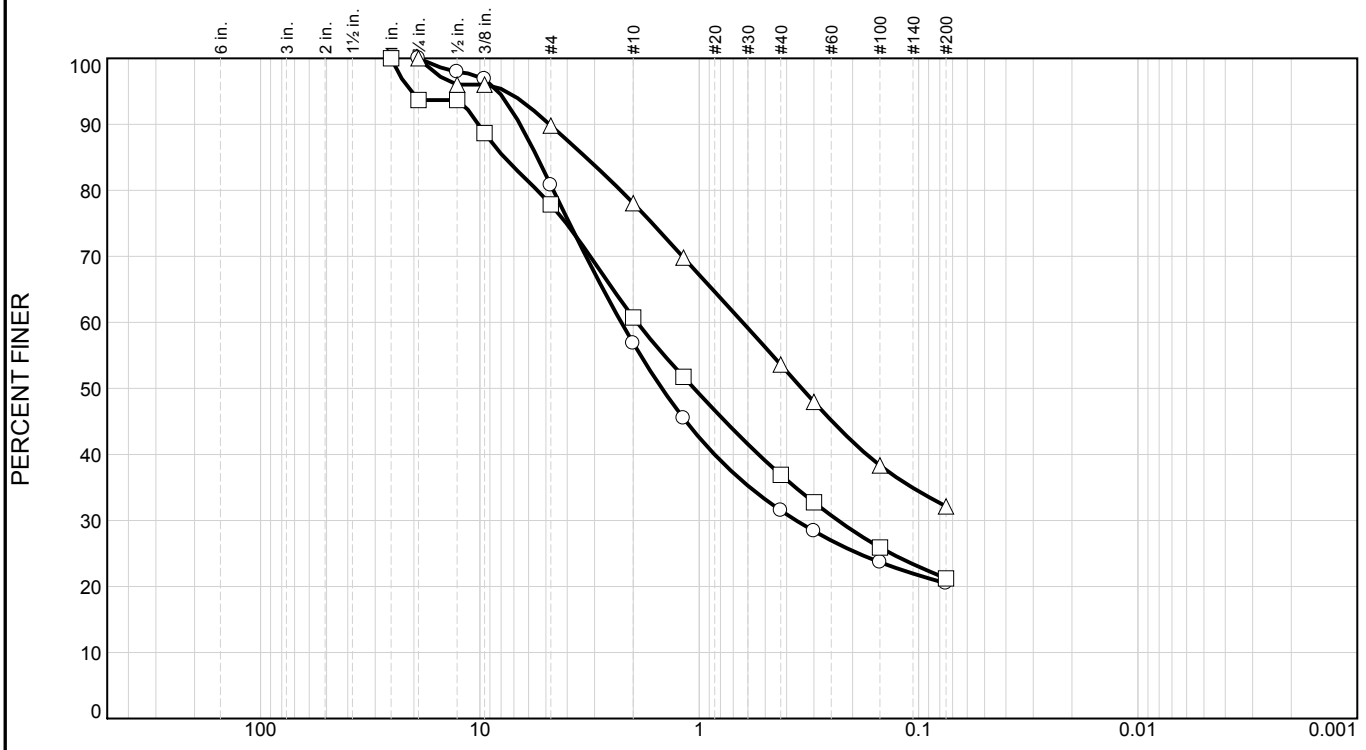
REMARKS:
○
□
△

○ Source of Sample: BC-3 Depth: 0.0 - 5.0' Sample Number: BULK 1
□ Source of Sample: BC-3 Depth: 5.0 - 10.0' Sample Number: BULK 2
△ Source of Sample: BC-3 Depth: 10.0 - 15.0' Sample Number: BULK 3

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	19.2	60.3	20.5		SC	A-2-7(1)	21	43
□	0.0	22.1	56.7	21.2					
△	0.0	10.2	57.7	32.1		SM	A-2-5(0)	33	41

SIEVE inches size	PERCENT FINER ○	□	△
1"		100.0	
3/4"	100.0	93.7	100.0
1/2"	97.9	93.7	96.0
3/8"	96.9	88.7	96.0
	GRAIN SIZE		
D_{60}	2.2688	1.9230	0.6334
D_{30}	0.3618	0.2329	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	80.8	77.9	89.8
#10	56.8	60.7	78.1
#16	45.5	51.8	69.8
#40	31.5	36.9	53.6
#50	28.4	32.7	48.0
#100	23.7	25.9	38.3
#200	20.5	21.2	32.1

Material Description
○ clayey sand with gravel
□
△ silty sand

REMARKS:
○
□
△

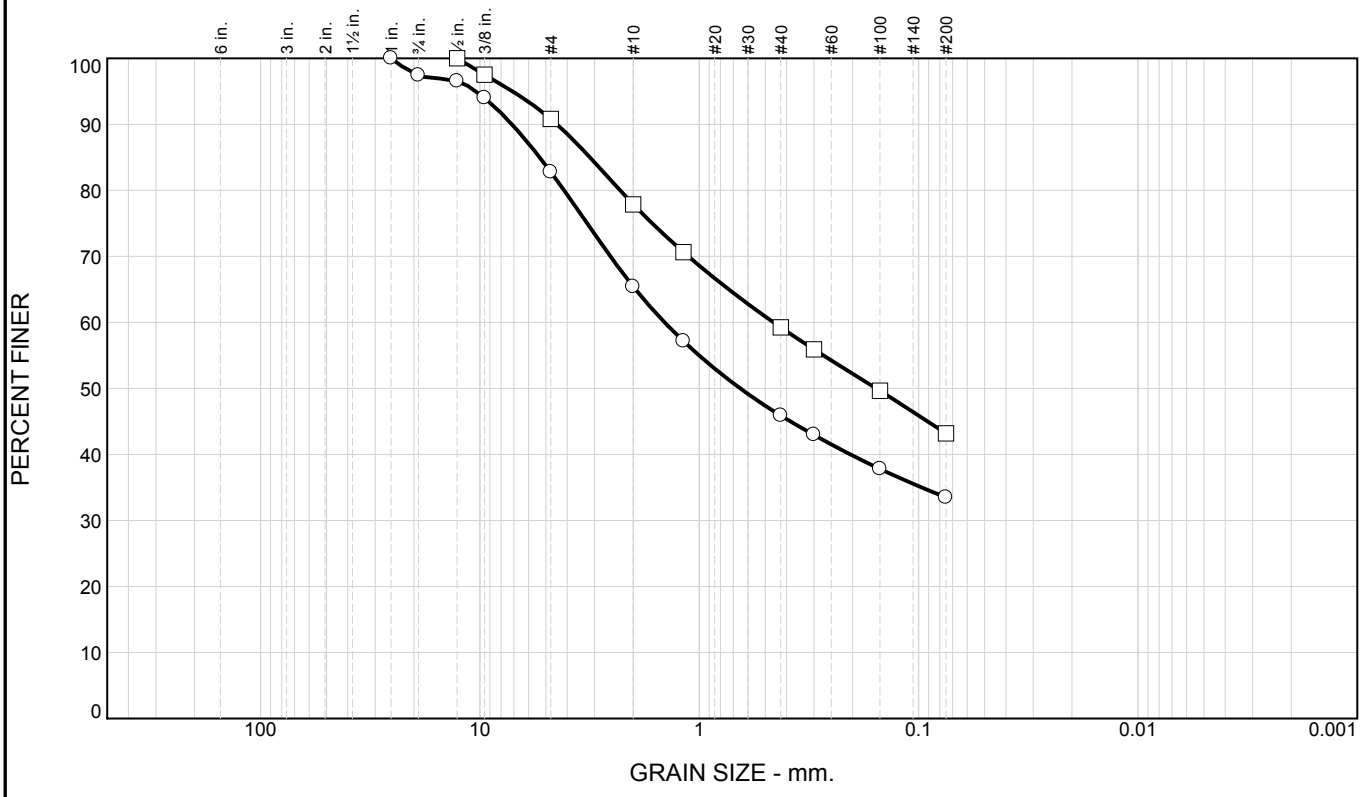
○ Source of Sample: BC-3 Depth: 5.0 - 5.8' Sample Number: A
□ Source of Sample: BC-3 Depth: 10.0 - 10.4' Sample Number: B
△ Source of Sample: BC-3 Depth: 20.0 - 20.4' Sample Number: D

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	17.2	49.3	33.5		SC	A-2-6(1)	19	32
□	0.0	9.2	47.6	43.2		SC	A-6(3)	22	38

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
1"	100.0	
3/4"	97.4	
1/2"	96.5	100.0
3/8"	94.0	97.5
GRAIN SIZE		
D_{60}	1.4393	0.4579
D_{30}		
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#4	82.8	90.8
#10	65.4	77.9
#16	57.2	70.6
#40	45.9	59.3
#50	43.0	55.9
#100	37.8	49.6
#200	33.5	43.2

Material Description

○ clayey sand with gravel

□ clayey sand

REMARKS:

○

□

○ Source of Sample: BC-4 Depth: 0.0 - 5.0' Sample Number: BULK 1

□ Source of Sample: BC-4 Depth: 5.0 - 10.0' Sample Number: BULK 2

NEVADA DEPARTMENT OF TRANSPORTATION

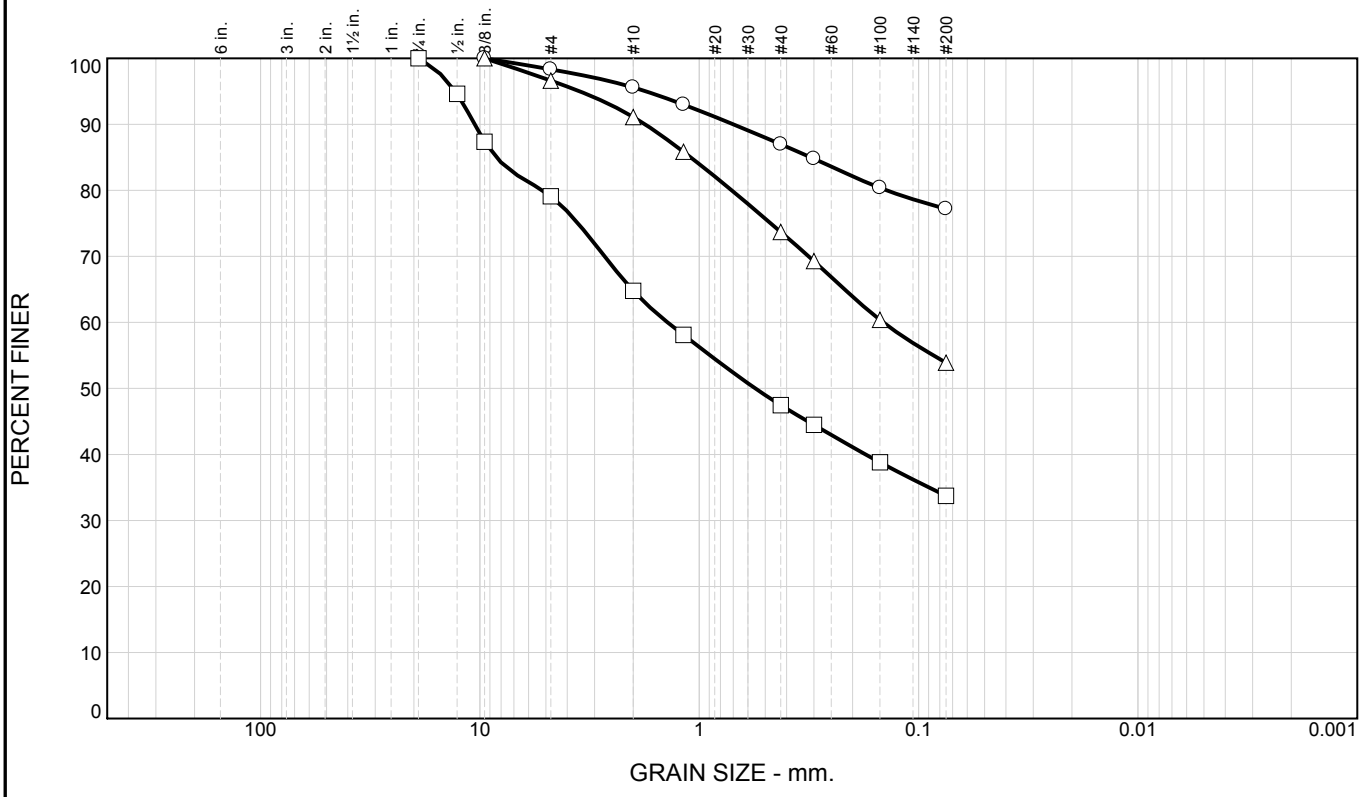
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	1.7	21.1	77.2		CL	A-6(10)	24	38
□	0.0	20.9	45.4	33.7					
△	0.0	3.4	42.7	53.9		CL	A-7-6(12)	20	49

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
1/2"		94.6	
3/8"	100.0	87.4	100.0
GRAIN SIZE			
D_{60}		1.3950	0.1448
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	98.3	79.1	96.6
#10	95.6	64.8	91.1
#16	93.0	58.1	85.8
#40	87.0	47.5	73.7
#50	84.8	44.5	69.3
#100	80.4	38.8	60.4
#200	77.2	33.7	53.9

Material Description
○ lean clay with sand
□
△ sandy lean clay

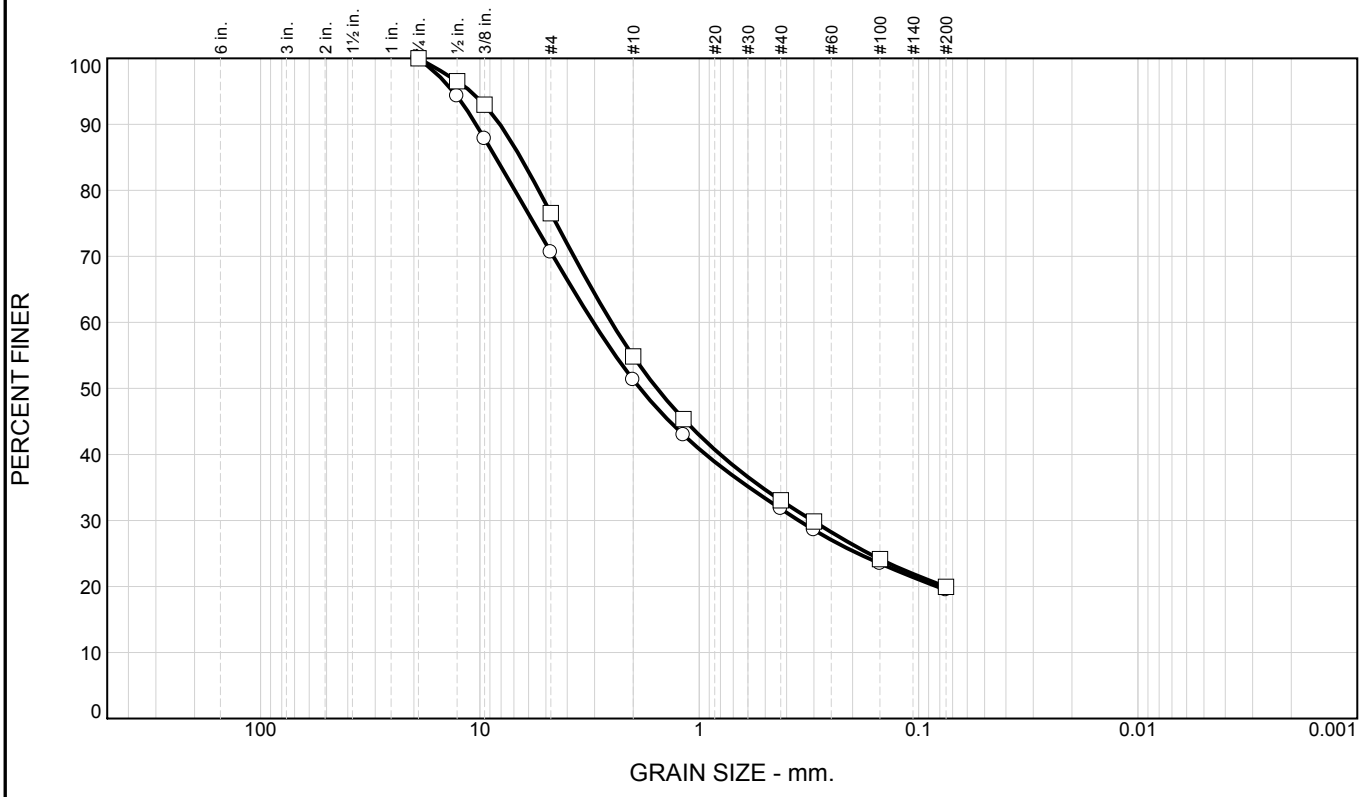
REMARKS:
○
□
△

○ Source of Sample: BC-4 Depth: 5.0 - 6.4' Sample Number: A
□ Source of Sample: BC-4 Depth: 15.0 - 15.2' Sample Number: C
△ Source of Sample: BC-4 Depth: 20.0 - 20.7' Sample Number: D

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	29.4	51.1	19.5		SM	A-2-4(0)	25	35
□	0.0	23.5	56.6	19.9		SC	A-2-6(0)	21	34

SIEVE inches size	○	□
	PERCENT FINER	
3/4"	100.0	100.0
1/2"	94.3	96.5
3/8"	87.8	93.0
	GRAIN SIZE	
D_{60}	3.0411	2.5144
D_{30}	0.3524	0.3053
D_{10}		
	COEFFICIENTS	
C_c		
C_u		

SIEVE number size	○	□
	PERCENT FINER	
#4	70.6	76.5
#10	51.3	54.9
#16	43.0	45.4
#40	31.8	33.0
#50	28.6	29.8
#100	23.5	24.1
#200	19.5	19.9

Material Description

○ silty sand with gravel

□ clayey sand with gravel

REMARKS:

○

□

○ Source of Sample: BC-7 Depth: 0.0 - 5.0' Sample Number: BULK 1

□ Source of Sample: BC-7 Depth: 5.0 - 10.0' Sample Number: BULK 2

NEVADA DEPARTMENT OF TRANSPORTATION

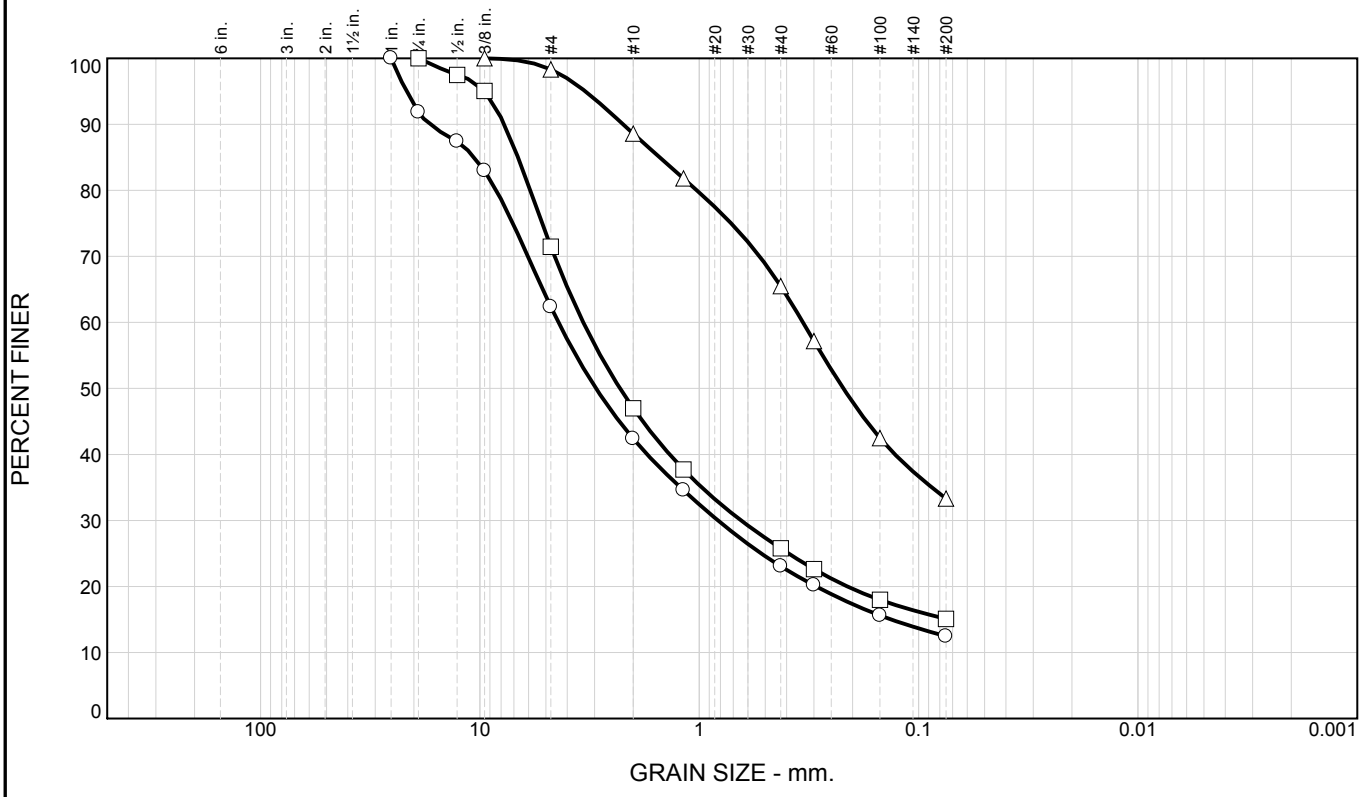
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	37.7	49.8	12.5					
□	0.0	28.5	56.4	15.1					
△	0.0	1.7	65.0	33.3		SC	A-2-7(1)	25	43

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	91.8	100.0	
1/2"	87.4	97.5	
3/8"	83.0	95.1	100.0
	GRAIN SIZE		
D_{60}	4.3874	3.3801	0.3367
D_{30}	0.8215	0.6440	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	62.3	71.5	98.3
#10	42.4	47.0	88.6
#16	34.6	37.7	81.8
#40	23.0	25.8	65.5
#50	20.2	22.6	57.2
#100	15.6	18.0	42.5
#200	12.5	15.1	33.3

Material Description

○

□

△clayey sand

REMARKS:

○

□

△

○Source of Sample: BC-7 Depth: 3.0 - 3.3' Sample Number: A

□Source of Sample: BC-7 Depth: 5.0 - 5.4' Sample Number: B

△Source of Sample: BC-7 Depth: 7.5 - 8.1' Sample Number: C

NEVADA DEPARTMENT OF TRANSPORTATION

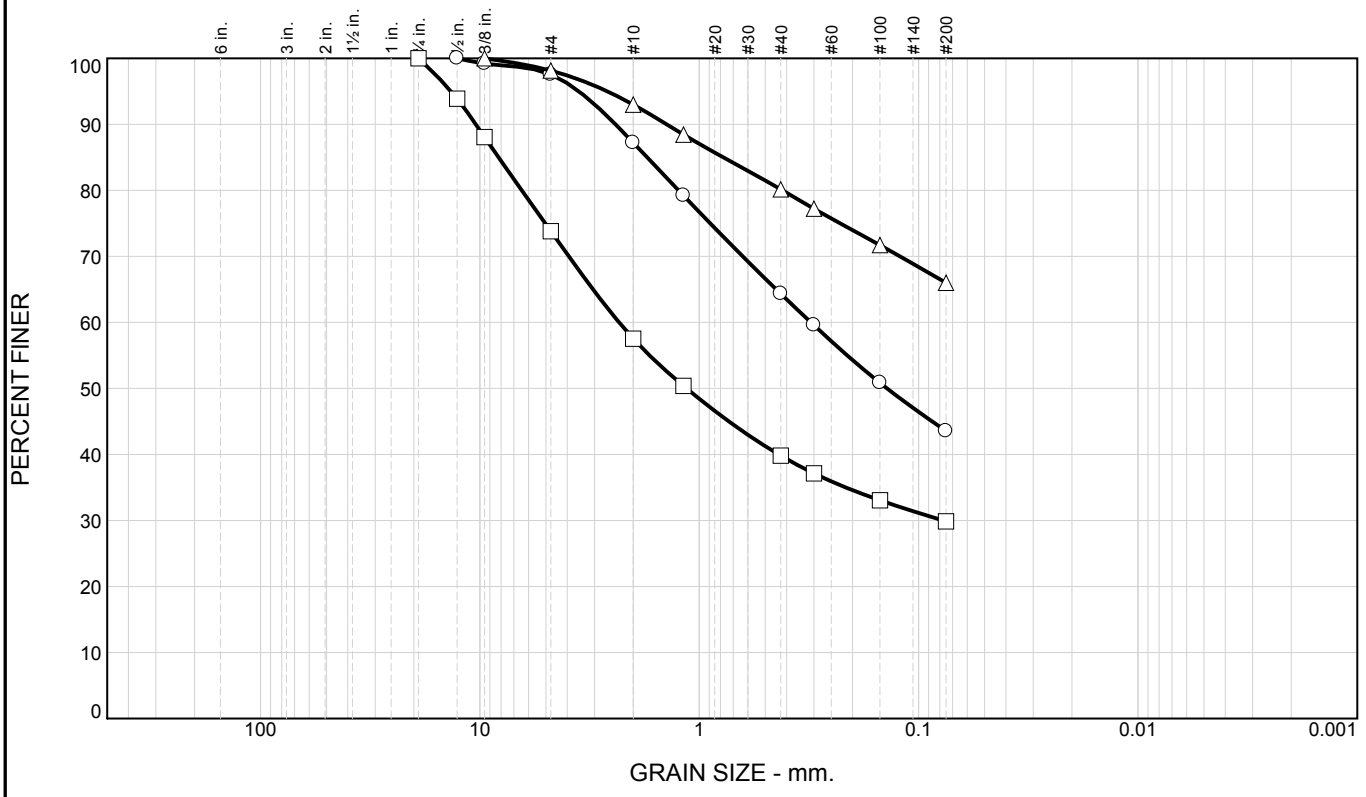
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	2.4	54.1	43.5					
□	0.0	26.2	43.9	29.9					
△	0.0	1.9	32.1	66.0		CH	A-7-6(27)	26	68

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
1/2"	100.0	93.9	
3/8"	99.2	88.1	100.0
	GRAIN SIZE		
D_{60}	0.3096	2.3220	
D_{30}		0.0773	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	97.6	73.8	98.1
#10	87.2	57.5	93.0
#16	79.2	50.4	88.4
#40	64.3	39.8	80.2
#50	59.6	37.1	77.2
#100	50.8	33.1	71.7
#200	43.5	29.9	66.0

Material Description

○

□

△sandy fat clay

REMARKS:

○

□

△

○Source of Sample: BC-7 Depth: 10.0 - 10.4' Sample Number: D

□Source of Sample: BC-7 Depth: 20.0 - 20.3' Sample Number: F

△Source of Sample: BC-7 Depth: 25.0 - 26.3' Sample Number: G

NEVADA DEPARTMENT OF TRANSPORTATION

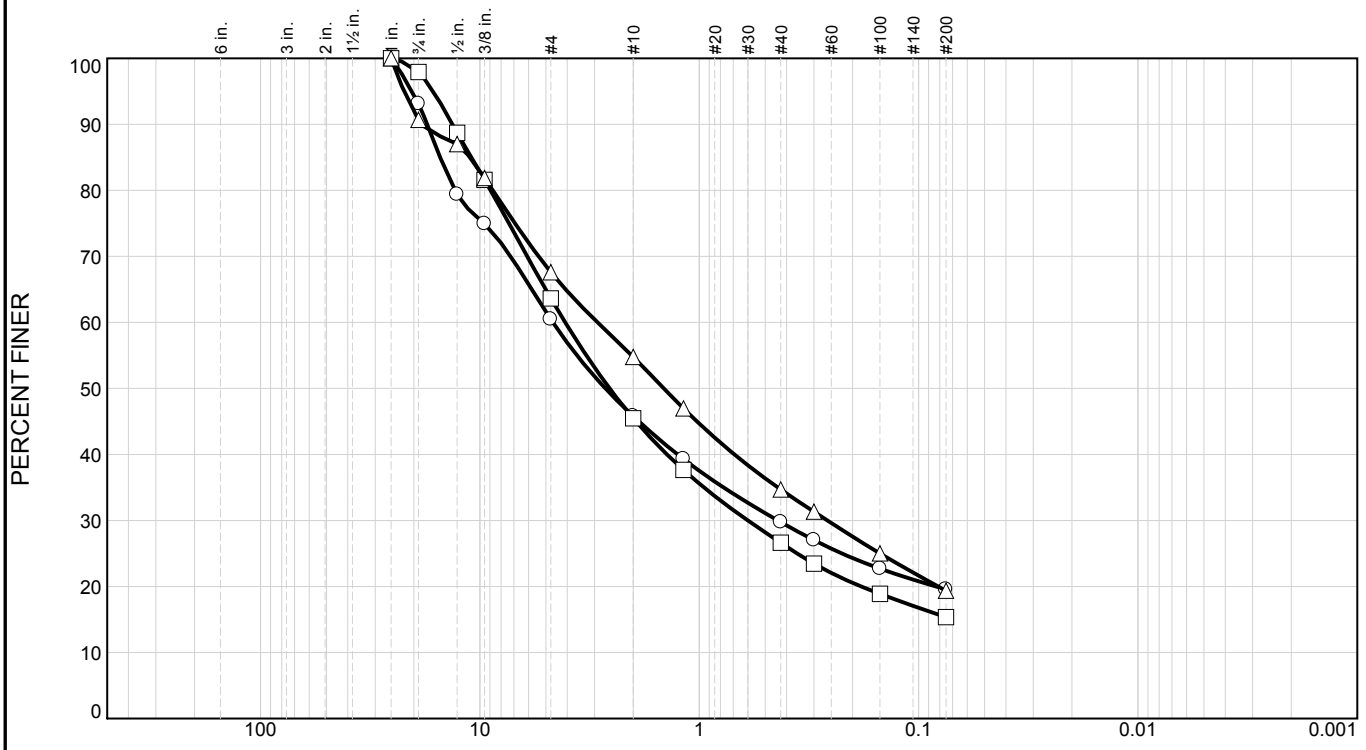
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	39.5	41.0	19.5		SM	A-2-6(0)	25	36
□	0.0	36.4	48.2	15.4					
△	0.0	32.4	48.2	19.4		SC-SM	A-2-4(0)	22	29

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0	100.0	100.0
3/4"	93.1	97.9	90.7
1/2"	79.4	88.7	87.0
3/8"	74.9	81.6	81.9
GRAIN SIZE			
D_{60}	4.6504	4.0866	2.9093
D_{30}	0.4380	0.6004	0.2604
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	60.5	63.6	67.6
#10	45.8	45.5	54.8
#16	39.3	37.7	47.0
#40	29.8	26.6	34.7
#50	27.0	23.5	31.3
#100	22.7	18.9	25.0
#200	19.5	15.4	19.4

Material Description
○ silty sand with gravel
□
△ silty, clayey sand with gravel

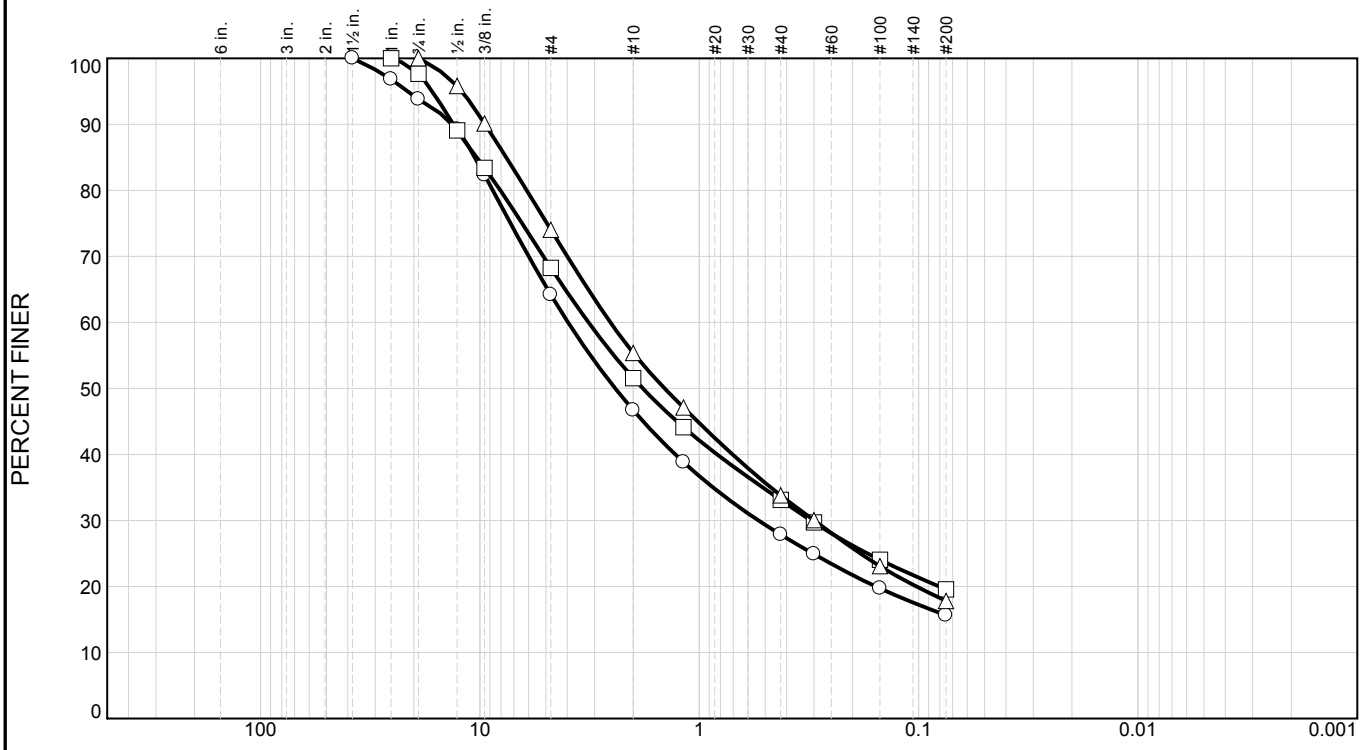
REMARKS:
○
□
△

○ Source of Sample: BCR-1 Depth: 3.5 - 5.0' Sample Number: A
□ Source of Sample: BCR-1 Depth: 5.0 - 6.5' Sample Number: B
△ Source of Sample: BCR-1 Depth: 7.5 - 9.0' Sample Number: C

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	35.8	48.6	15.6					
□	0.0	31.7	48.7	19.6					
△	0.0	26.0	56.2	17.8		SC-SM	A-2-4(0)	21	28

SIEVE inches size	PERCENT FINER ○	□	△
1.5"	100.0		
1"	96.8	100.0	
3/4"	93.8	97.7	100.0
1/2"	89.2	89.1	95.8
3/8"	82.3	83.4	90.1
	GRAIN SIZE		
D_{60}	3.9648	3.2008	2.5429
D_{30}	0.5370	0.3098	0.2988
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	64.2	68.3	74.0
#10	46.7	51.6	55.4
#16	38.8	44.1	47.1
#40	27.9	33.1	33.8
#50	24.9	29.7	30.0
#100	19.7	24.0	23.1
#200	15.6	19.6	17.8

Material Description

○

□

△silty, clayey sand with gravel

REMARKS:

○

□

△

○Source of Sample: BCR-1 Depth: 10.0 - 11.5' Sample Number: D

□Source of Sample: BCR-1 Depth: 12.5 - 14.0' Sample Number: E

△Source of Sample: BCR-1 Depth: 15.0 - 15.8' Sample Number: F

NEVADA DEPARTMENT OF TRANSPORTATION

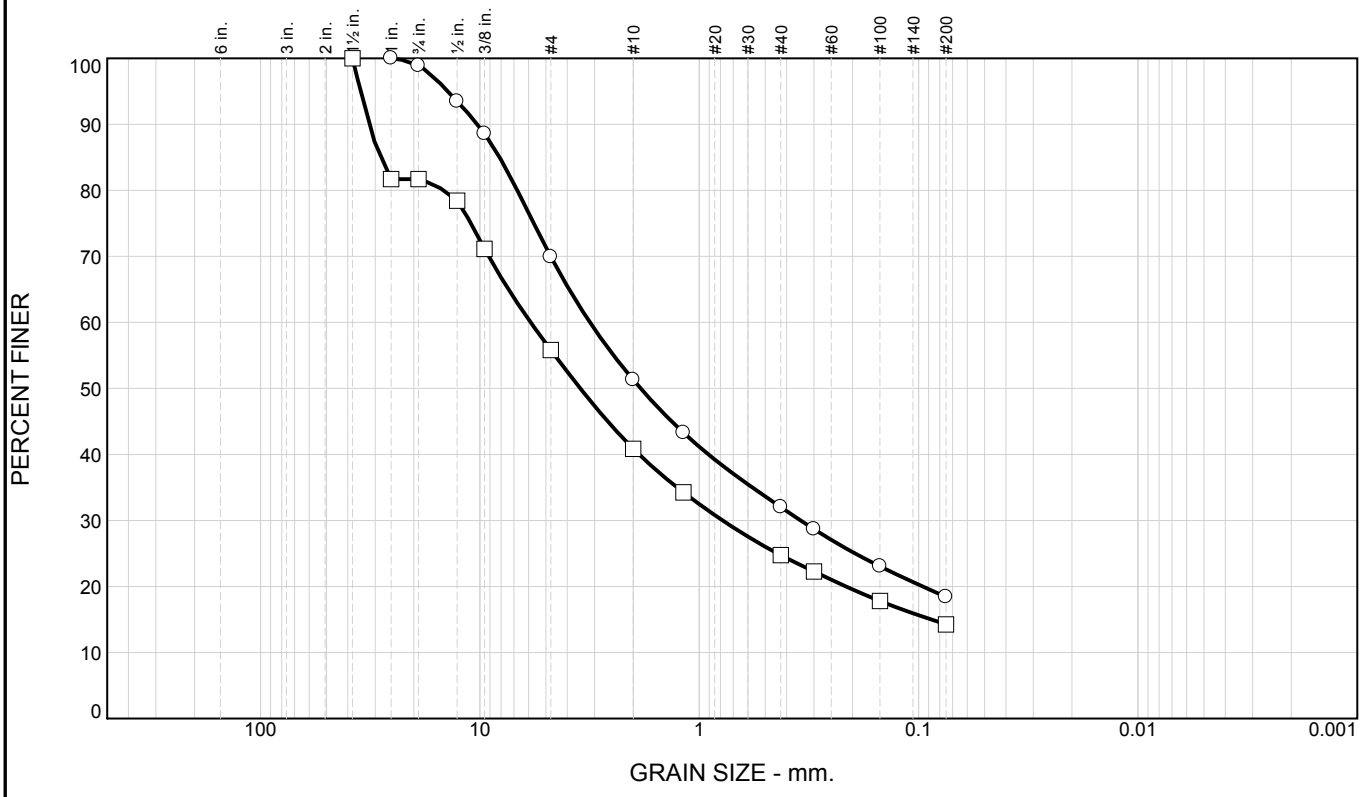
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	30.1	51.5	18.4					
□	0.0	44.2	41.5	14.3		GM	A-1-a	23	28

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
1.5"		100.0
1"	100.0	81.7
3/4"	98.9	81.7
1/2"	93.5	78.4
3/8"	88.6	71.1
GRAIN SIZE		
D_{60}	3.1527	5.8715
D_{30}	0.3451	0.7828
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#4	69.9	55.8
#10	51.3	40.9
#16	43.3	34.3
#40	32.0	24.8
#50	28.7	22.3
#100	23.1	17.8
#200	18.4	14.3

Material Description

○

□silty gravel with sand

REMARKS:

○

□

○Source of Sample: BCR-1 Depth: 17.5 - 19.0' Sample Number: G

□Source of Sample: BCR-1 Depth: 20.0 - 21.1' Sample Number: H1

NEVADA DEPARTMENT OF TRANSPORTATION

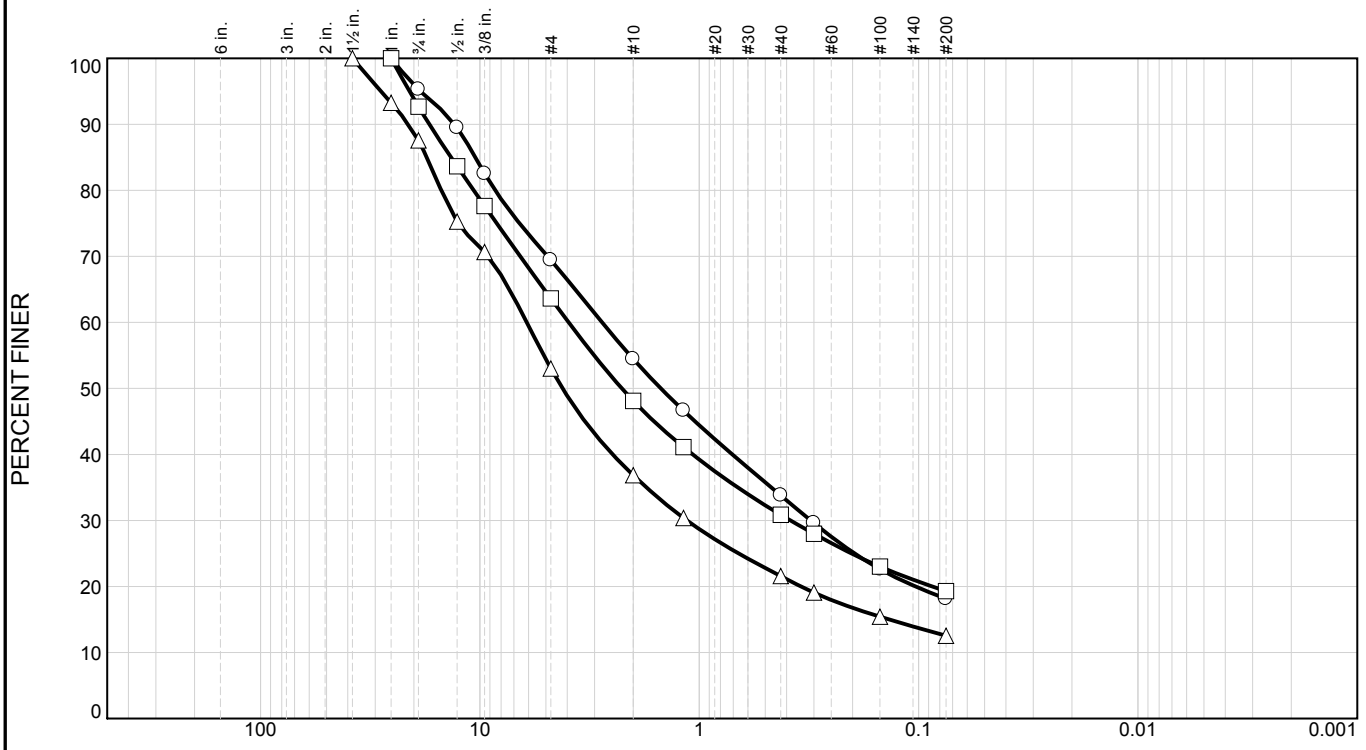
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	30.6	51.3	18.1					
□	0.0	36.4	44.3	19.3					
△	0.0	47.0	40.5	12.5					

SIEVE inches size	PERCENT FINER ○	□	△
1.5"			100.0
1"	100.0	100.0	93.3
3/4"	95.3	92.7	87.6
1/2"	89.5	83.7	75.3
3/8"	82.5	77.6	70.7
	GRAIN SIZE		
D_{60}	2.7731	3.9408	6.1123
D_{30}	0.3103	0.3839	1.1387
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	69.4	63.6	53.0
#10	54.4	48.1	36.8
#16	46.6	41.1	30.4
#40	33.8	30.9	21.6
#50	29.6	28.0	19.1
#100	22.6	23.0	15.4
#200	18.1	19.3	12.5

Material Description

○

□

△

REMARKS:

○

□

△

○ Source of Sample: BCR-3 Depth: 3.0 - 4.5' Sample Number: A

□ Source of Sample: BCR-3 Depth: 5.0 - 6.5' Sample Number: B

△ Source of Sample: BCR-3 Depth: 8.0 - 8.9' Sample Number: C

NEVADA DEPARTMENT OF TRANSPORTATION

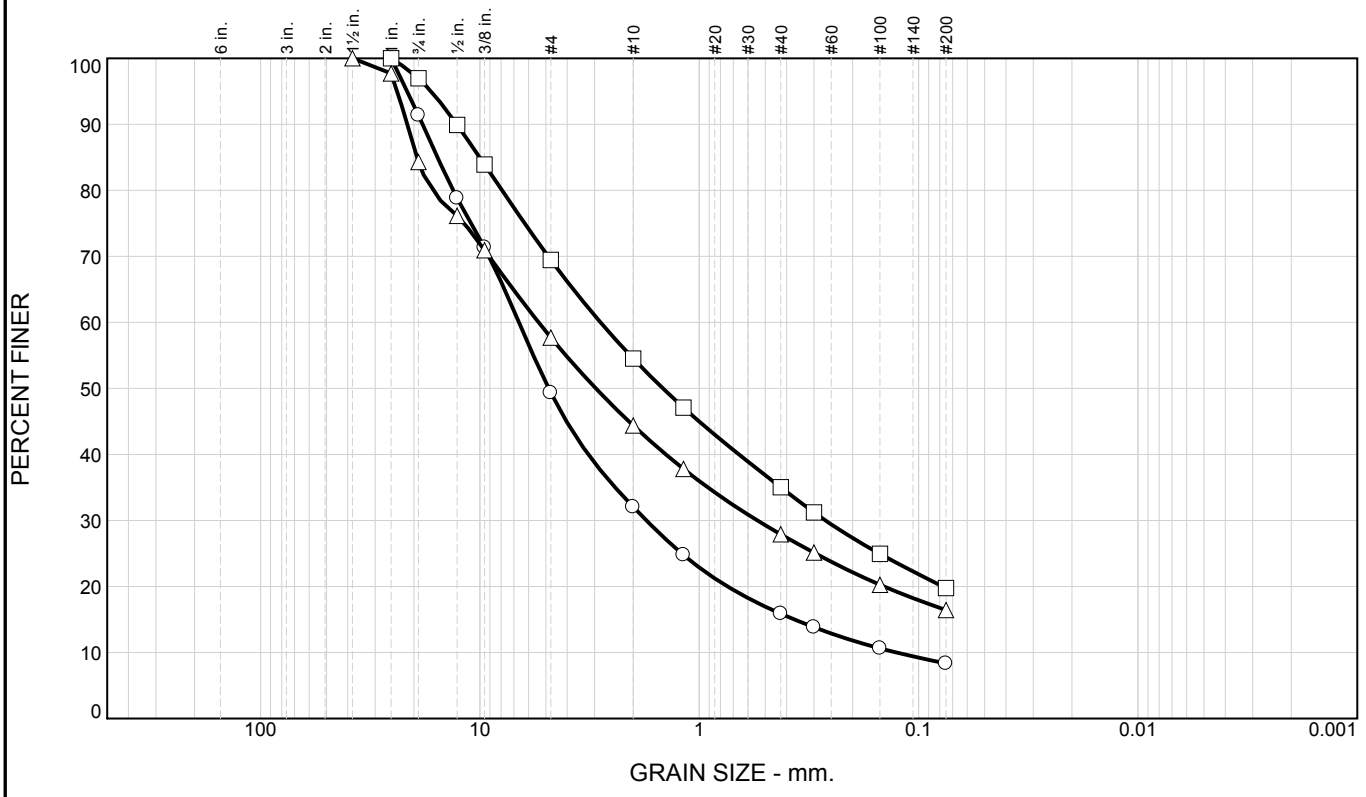
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	50.7	41.0	8.3					
□	0.0	30.5	49.7	19.8		SC	A-2-4(0)	21	29
△	0.0	42.3	41.3	16.4					

SIEVE inches size	PERCENT FINER ○	□	△
1.5"			100.0
1"	100.0	100.0	97.7
3/4"	91.4	97.0	84.3
1/2"	78.8	89.9	76.1
3/8"	71.3	83.9	70.9
	GRAIN SIZE		
D_{60}	6.6394	2.8186	5.4000
D_{30}	1.7414	0.2660	0.5435
D_{10}	0.1264		
	COEFFICIENTS		
C_c	3.61		
C_u	52.53		

SIEVE number size	PERCENT FINER ○	□	△
#4	49.3	69.5	57.7
#10	32.1	54.5	44.4
#16	24.8	47.1	37.8
#40	15.9	35.0	27.9
#50	13.8	31.2	25.1
#100	10.6	24.9	20.3
#200	8.3	19.8	16.4

Material Description

○

□clayey sand with gravel

△

REMARKS:

○

□

△

○Source of Sample: BCR-3 Depth: 10.0 - 11.5' Sample Number: D

□Source of Sample: BCR-3 Depth: 13.0 - 14.5' Sample Number: E

△Source of Sample: BCR-3 Depth: 15.0 - 16.5' Sample Number: F

NEVADA DEPARTMENT OF TRANSPORTATION

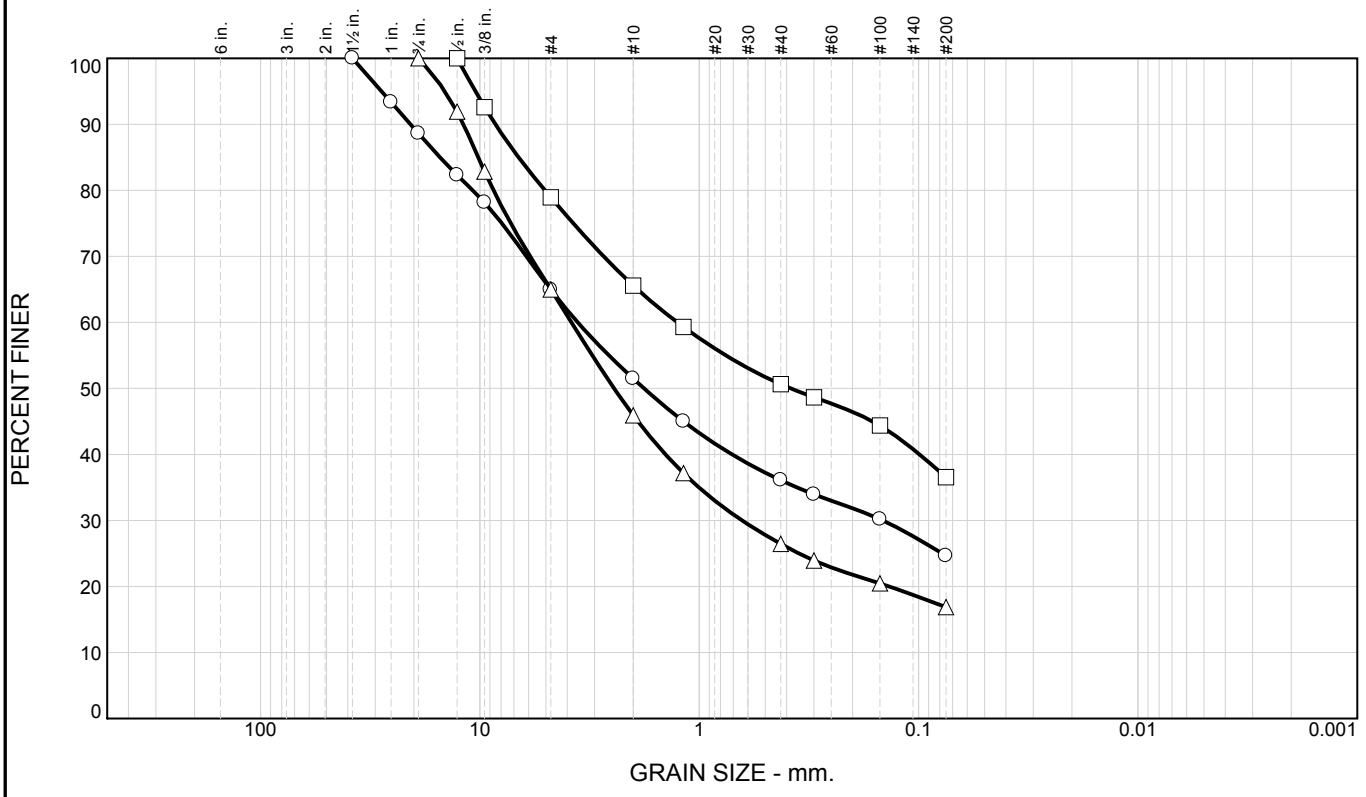
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	35.0	40.3	24.7					
□	0.0	21.1	42.3	36.6		SC-SM	A-4(0)	19	24
△	0.0	35.0	48.1	16.9					

SIEVE inches size	PERCENT FINER ○	□	△
1.5"	100.0		
1"	93.4		
3/4"	88.6		100.0
1/2"	82.3	100.0	91.9
3/8"	78.2	92.6	82.8
	GRAIN SIZE		
D_{60}	3.5830	1.2575	3.8273
D_{30}	0.1457		0.6378
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	65.0	78.9	65.0
#10	51.5	65.6	45.9
#16	45.0	59.3	37.2
#40	36.1	50.6	26.5
#50	33.9	48.6	23.9
#100	30.2	44.4	20.5
#200	24.7	36.6	16.9

Material Description

○

□silty, clayey sand with gravel

△

REMARKS:

○

□

△

○Source of Sample: BCR-3 Depth: 20.0 - 21.5' Sample Number: H

□Source of Sample: BCR-3 Depth: 23.0 - 24.5' Sample Number: I

△Source of Sample: BCR-3 Depth: 25.0 - 26.5' Sample Number: J

NEVADA DEPARTMENT OF TRANSPORTATION

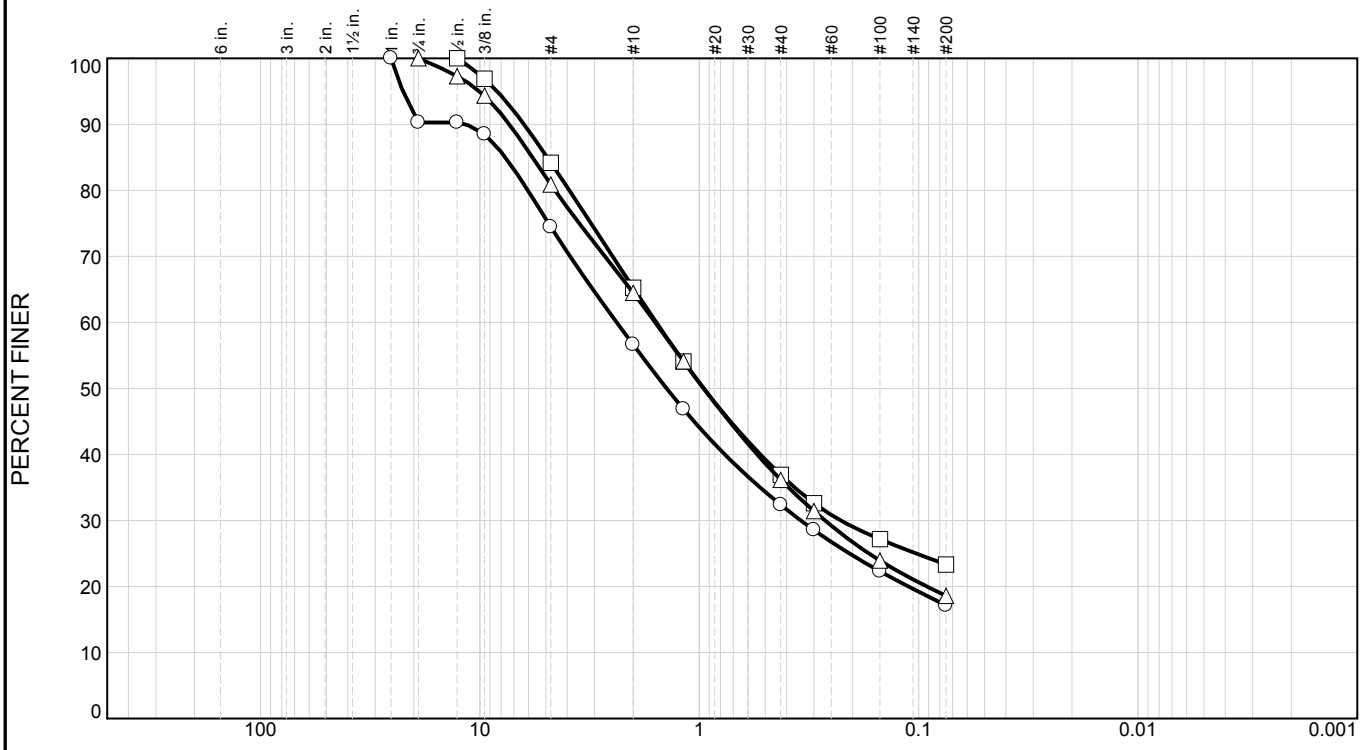
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	25.5	57.4	17.1		SM	A-1-b	21	22
□	0.0	15.8	60.9	23.3					
△	0.0	19.1	62.3	18.6		SM	A-1-b	NP	27

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	90.3		100.0
1/2"	90.3	100.0	97.3
3/8"	88.5	96.9	94.3
	GRAIN SIZE		
D_{60}	2.3795	1.5704	1.5894
D_{30}	0.3443	0.2265	0.2672
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	74.5	84.2	80.9
#10	56.6	65.2	64.5
#16	46.9	54.1	54.1
#40	32.4	36.9	36.1
#50	28.5	32.6	31.4
#100	22.3	27.2	23.9
#200	17.1	23.3	18.6

Material Description
○ silty sand with gravel
□
△ silty sand with gravel

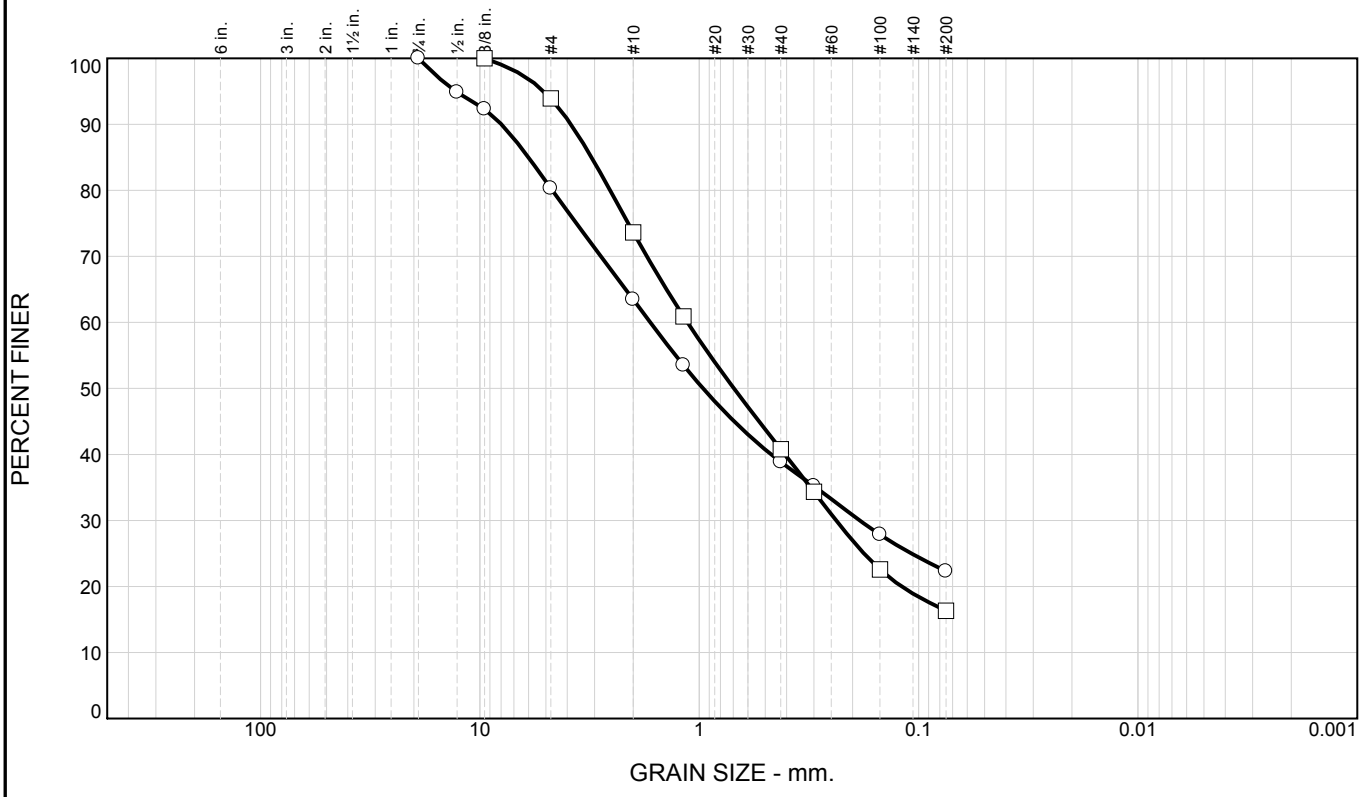
REMARKS:
○
□
△

○ Source of Sample: BCR-3 Depth: 28.0 - 29.5' Sample Number: K
□ Source of Sample: BCR-3 Depth: 30.0 - 31.5' Sample Number: L
△ Source of Sample: BCR-3 Depth: 33.0 - 34.5' Sample Number: M

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	19.7	58.0	22.3		SM	A-1-b	NP	24
□	0.0	6.1	77.6	16.3		SM	A-1-b	NP	25

SIEVE inches size	○	□
3/4"	100.0	
1/2"	94.8	
3/8"	92.3	100.0
GRAIN SIZE		
D_{60}	1.6720	1.1323
D_{30}	0.1855	0.2375
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	○	□
#4	80.3	93.9
#10	63.5	73.6
#16	53.5	60.9
#40	38.9	40.8
#50	35.2	34.3
#100	27.9	22.6
#200	22.3	16.3

Material Description

○ silty sand with gravel

□ silty sand

REMARKS:

○

□

○ Source of Sample: BCR-3 Depth: 35.0 - 36.5' Sample Number: N

□ Source of Sample: BCR-3 Depth: 40.0 - 40.6' Sample Number: O

NEVADA DEPARTMENT OF TRANSPORTATION

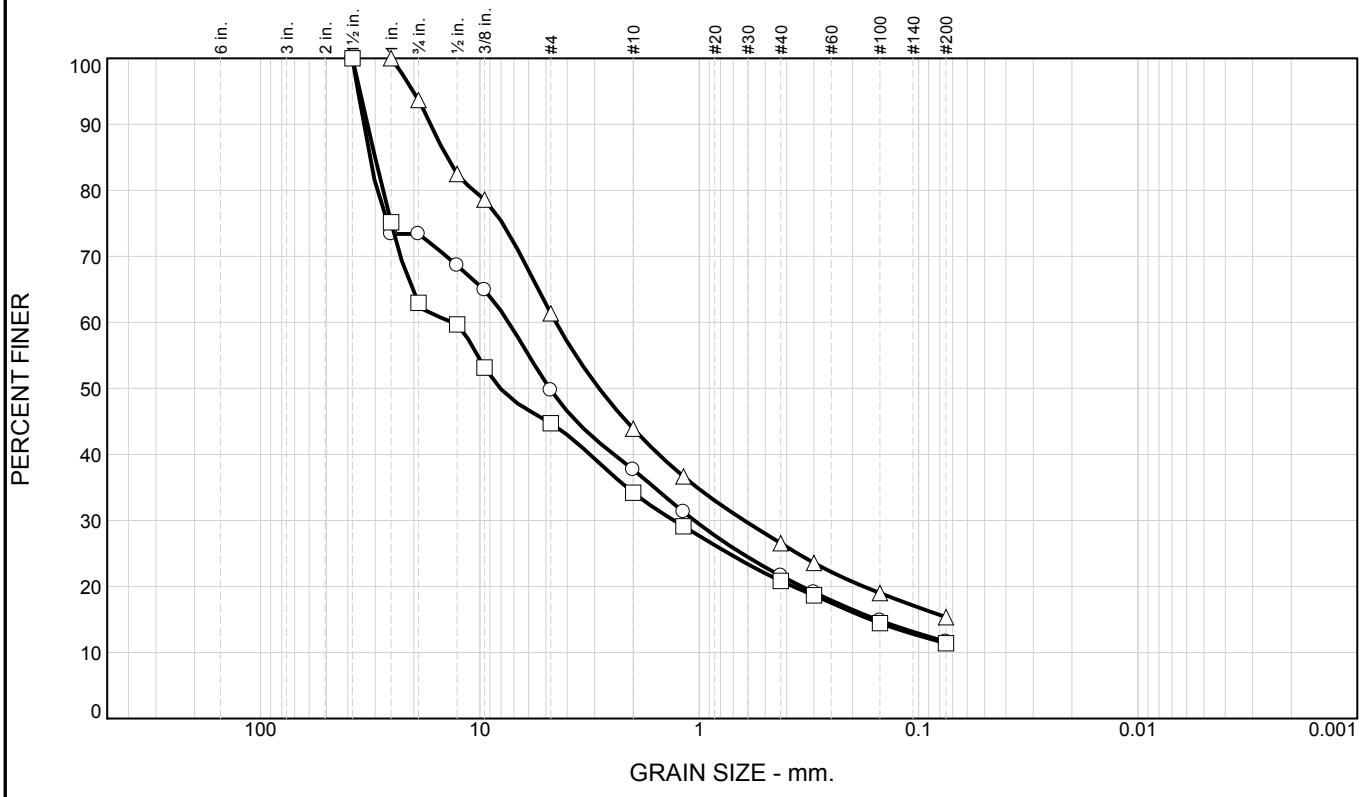
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	50.3	38.1	11.6		GP-GC	A-2-4(0)	21	30
□	0.0	55.3	33.3	11.4		GP-GC	A-2-4(0)	23	30
△	0.0	38.6	46.1	15.3					

SIEVE inches size	PERCENT FINER ○	□	△
1.5"	100.0	100.0	
1"	73.4	75.2	100.0
3/4"	73.4	63.0	93.7
1/2"	68.6	59.7	82.5
3/8"	64.9	53.2	78.6
	GRAIN SIZE		
D_{60}	7.3951	13.0354	4.5088
D_{30}	1.0534	1.3041	0.6235
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	49.7	44.7	61.4
#10	37.7	34.2	43.9
#16	31.3	29.1	36.7
#40	21.6	20.8	26.6
#50	19.1	18.7	23.6
#100	14.8	14.5	19.0
#200	11.6	11.4	15.3

Material Description
○ poorly graded gravel with clay and sand

□ poorly graded gravel with siltyclay and sand

△

REMARKS:
○

□

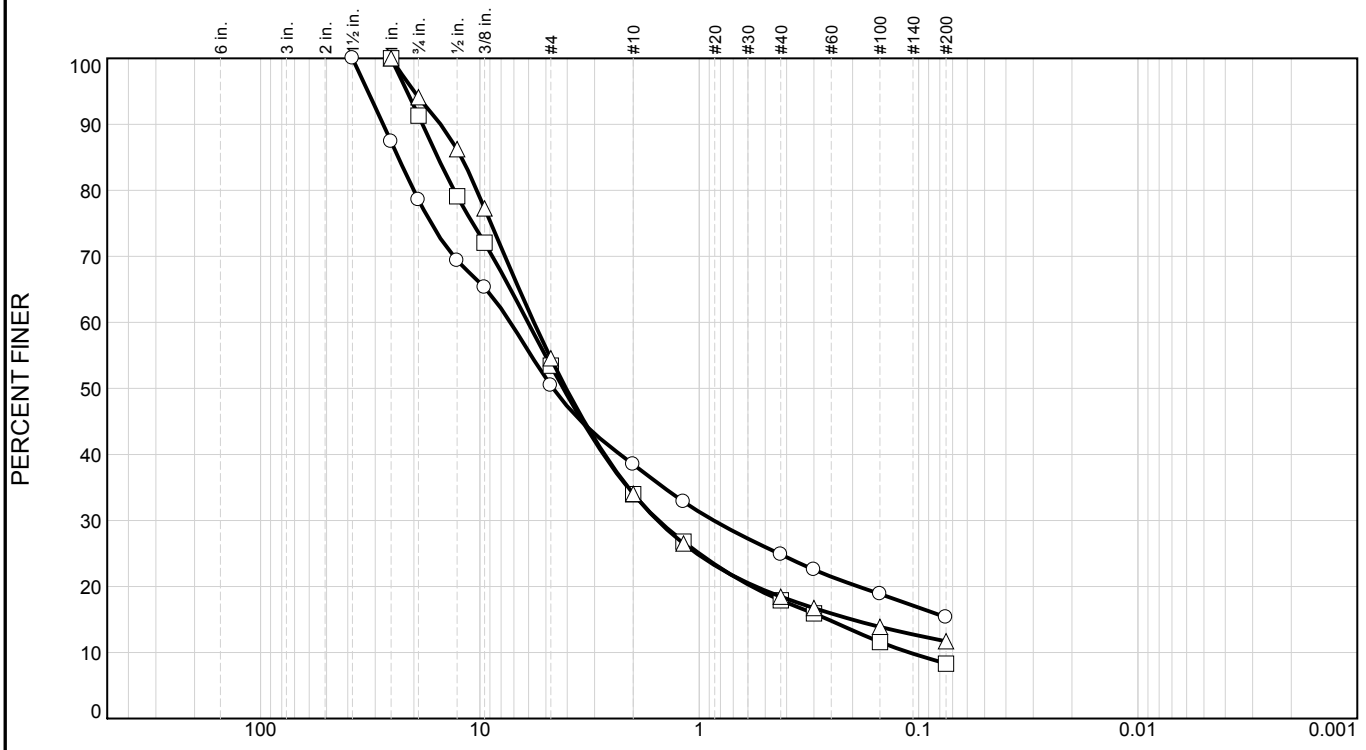
△

○ Source of Sample: BCR-4 Depth: 3.0 - 4.5' Sample Number: A
□ Source of Sample: BCR-4 Depth: 5.0 - 6.5' Sample Number: B
△ Source of Sample: BCR-4 Depth: 8.0 - 9.5' Sample Number: C

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	49.6	35.1	15.3					
□	0.0	46.6	45.1	8.3		GP-GM	A-1-a	NP	31
△	0.0	45.4	42.9	11.7					

SIEVE inches size	PERCENT FINER ○	□	△
1.5"	100.0		
1"	87.4	100.0	100.0
3/4"	78.6	91.3	94.1
1/2"	69.4	79.1	86.2
3/8"	65.3	72.1	77.3
	GRAIN SIZE		
D_{60}	7.2631	6.0374	5.6708
D_{30}	0.8595	1.5345	1.5513
D_{10}		0.1102	
	COEFFICIENTS		
C_c		3.54	
C_u		54.77	

SIEVE number size	PERCENT FINER ○	□	△
#4	50.4	53.4	54.6
#10	38.5	34.0	34.0
#16	32.8	26.8	26.5
#40	24.9	17.9	18.5
#50	22.5	15.9	16.7
#100	18.9	11.6	13.9
#200	15.3	8.3	11.7

Material Description

○

□poorly graded gravel with silt and sand

△

REMARKS:

○

□

△

○Source of Sample: BCR-4 Depth: 10.0 - 11.5' Sample Number: D

□Source of Sample: BCR-4 Depth: 13.0 - 14.5' Sample Number: E

△Source of Sample: BCR-4 Depth: 15.0 - 16.5' Sample Number: F

NEVADA DEPARTMENT OF TRANSPORTATION

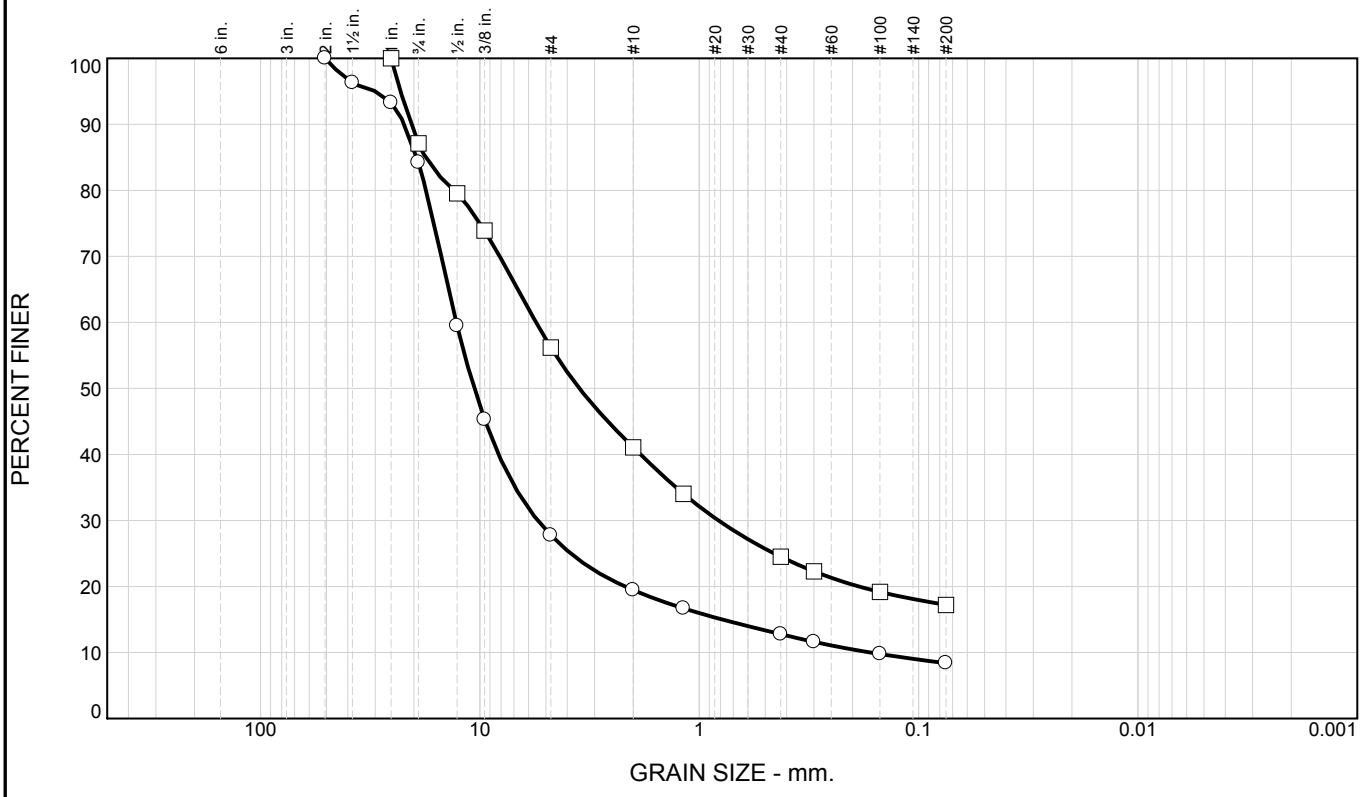
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	72.2	19.4	8.4		GP-GC	A-2-6(0)	20	33
□	0.0	43.8	39.0	17.2		GM	A-1-b	36	40

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
2"	100.0	
1.5"	96.3	
1"	93.3	100.0
3/4"	84.2	87.1
1/2"	59.5	79.6
3/8"	45.3	73.9
GRAIN SIZE		
D_{60}	12.8104	5.5489
D_{30}	5.4547	0.8177
D_{10}	0.1662	
COEFFICIENTS		
C_c	13.97	
C_u	77.07	

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#4	27.8	56.2
#10	19.5	41.1
#16	16.7	34.0
#40	12.8	24.5
#50	11.6	22.3
#100	9.8	19.2
#200	8.4	17.2

Material Description

○ poorly graded gravel with clay and sand

□ silty gravel with sand

REMARKS:

○

□

○ Source of Sample: BCR-5 Depth: 0.0 - 5.0' Sample Number: BULK 1

□ Source of Sample: BCR-5 Depth: 2.5 - 4.0' Sample Number: A

NEVADA DEPARTMENT OF TRANSPORTATION

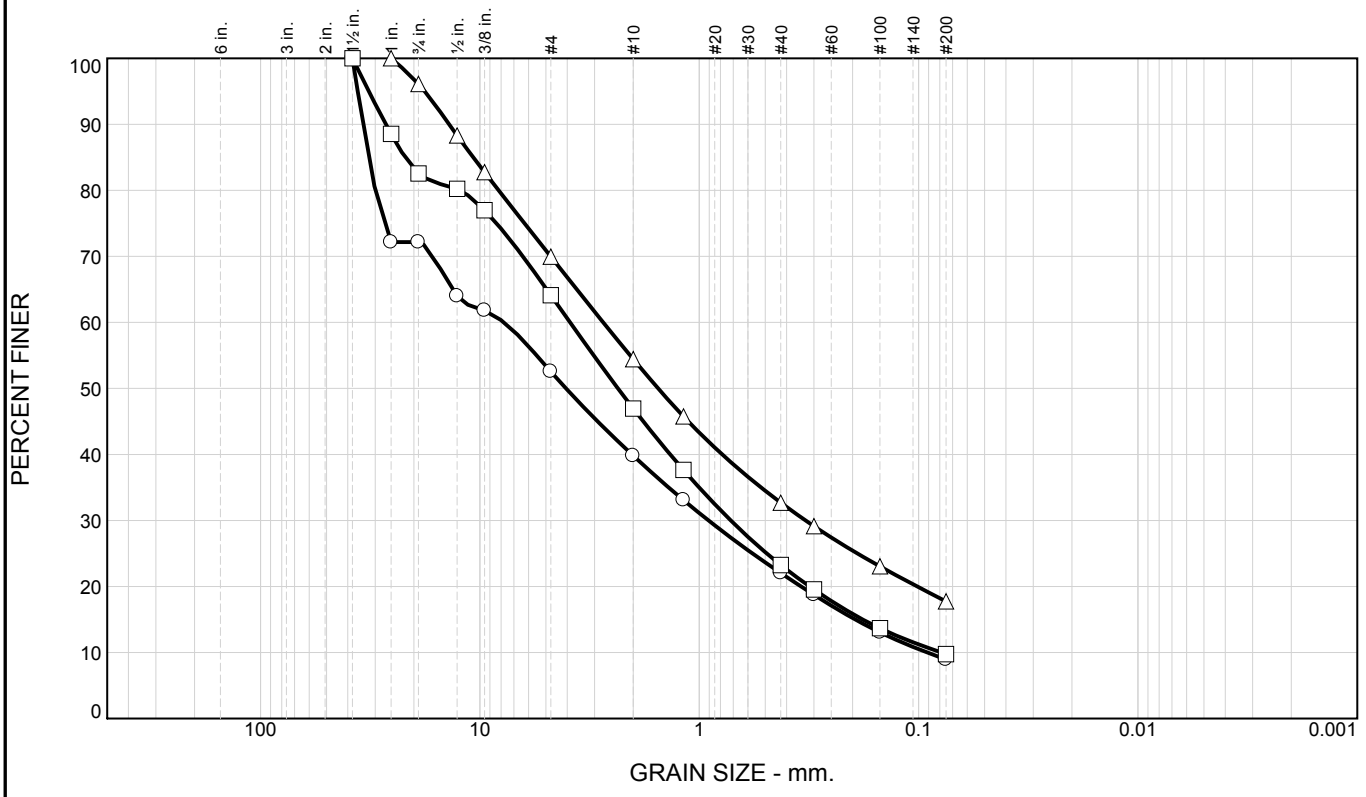
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	47.5	43.6	8.9		GW-GM	A-1-a	NP	21
□	0.0	35.9	54.3	9.8					
△	0.0	30.0	52.3	17.7					

SIEVE inches size	PERCENT FINER ○	□	△
1.5"	100.0	100.0	
1"	72.2	88.6	100.0
3/4"	72.2	82.5	96.1
1/2"	64.0	80.2	88.3
3/8"	61.8	77.0	82.8
	GRAIN SIZE		
D_{60}	7.7659	3.8815	2.7421
D_{30}	0.9073	0.7178	0.3278
D_{10}	0.0912	0.0787	
	COEFFICIENTS		
C_c	1.16	1.69	
C_u	85.18	49.32	

SIEVE number size	PERCENT FINER ○	□	△
#4	52.5	64.1	70.0
#10	39.8	46.9	54.4
#16	33.1	37.7	45.8
#40	22.0	23.2	32.7
#50	18.7	19.6	29.1
#100	13.0	13.7	23.1
#200	8.9	9.8	17.7

Material Description
○ well-graded gravel with silt and sand
□
△

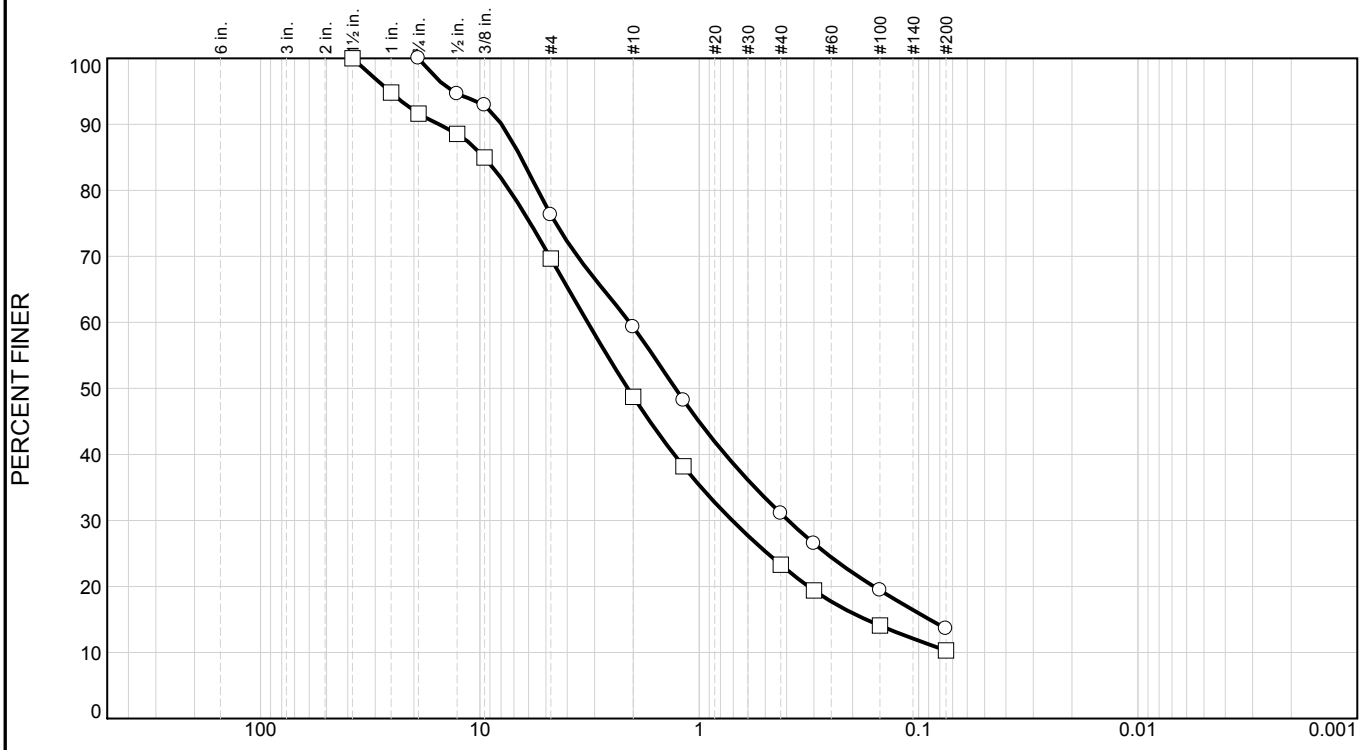
REMARKS:
○
□
△

○ Source of Sample: BCR-6 Depth: 2.5 - 4.0' Sample Number: A
□ Source of Sample: BCR-6 Depth: 4.0 - 5.5' Sample Number: B
△ Source of Sample: BCR-6 Depth: 7.5 - 9.0' Sample Number: C

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower
Project: US 93 Boulder City to Hacienda
Project No.: EA 73602, FL-2-11
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	23.7	62.7	13.6		SM	A-1-b	NP	20
□	0.0	30.3	59.4	10.3					

SIEVE inches size	○ PERCENT FINER	□ PERCENT FINER
1.5"		100.0
1"		94.8
3/4"	100.0	91.6
1/2"	94.6	88.6
3/8"	92.9	85.0
GRAIN SIZE		
D_{60}	2.0759	3.2278
D_{30}	0.3931	0.7073
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	○ PERCENT FINER	□ PERCENT FINER
#4	76.3	69.7
#10	59.3	48.7
#16	48.2	38.2
#40	31.1	23.3
#50	26.5	19.4
#100	19.4	14.1
#200	13.6	10.3

Material Description

○ silty sand with gravel

□

REMARKS:

○

□

○ Source of Sample: BCR-6 Depth: 9.0 - 10.5' Sample Number: D

□ Source of Sample: BCR-6 Depth: 12.5 - 14.0' Sample Number: E

NEVADA DEPARTMENT OF TRANSPORTATION

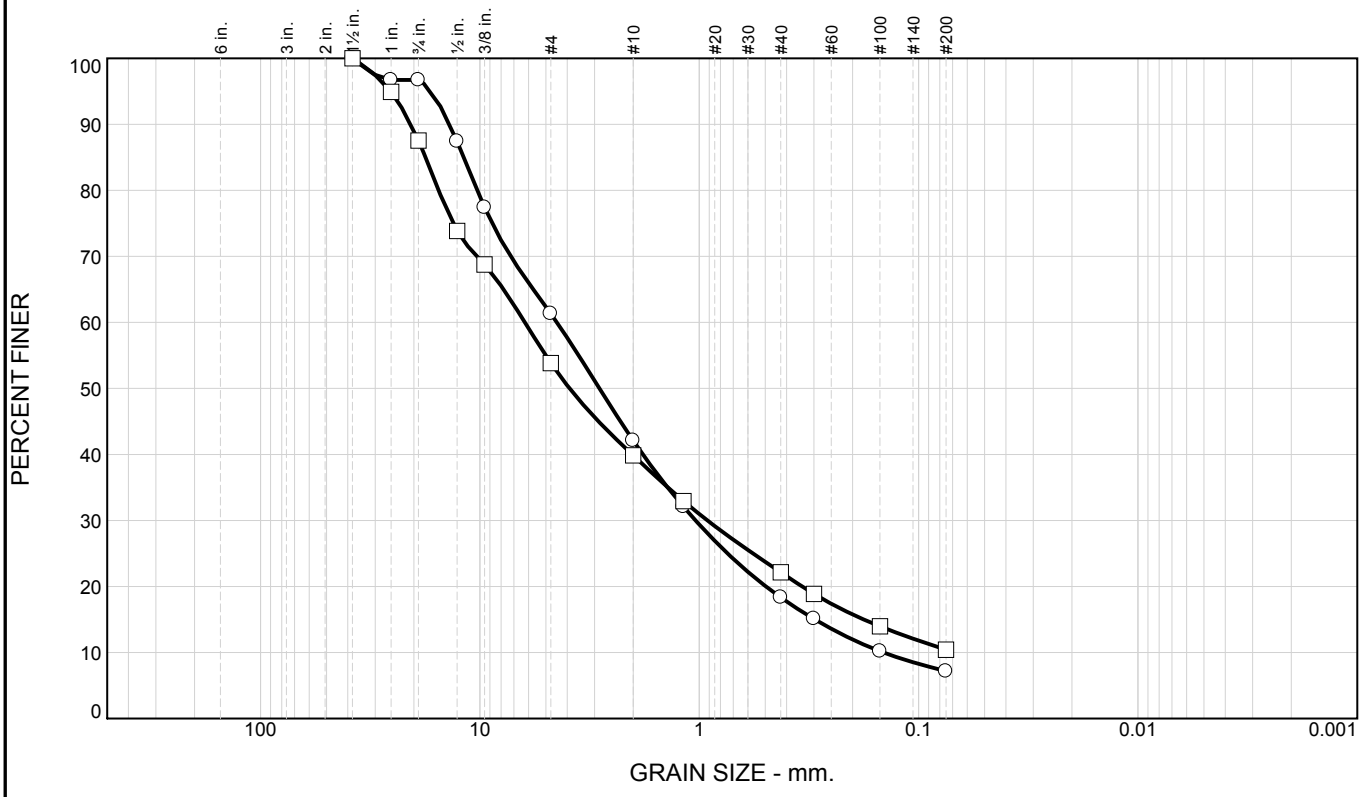
Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	38.7	54.1	7.2					
□	0.0	46.2	43.4	10.4					

SIEVE inches size	○	□
1.5"	100.0	100.0
1"	96.7	94.9
3/4"	96.7	87.5
1/2"	87.4	73.9
3/8"	77.4	68.8
GRAIN SIZE		
D_{60}	4.4560	6.2392
D_{30}	1.0399	0.9175
D_{10}	0.1447	
COEFFICIENTS		
C_c	1.68	
C_u	30.80	

SIEVE number size	○	□
#4	61.3	53.8
#10	42.1	39.9
#16	32.1	32.9
#40	18.3	22.1
#50	15.1	18.9
#100	10.2	14.0
#200	7.2	10.4

Material Description

○

□

REMARKS:

○

□

○ Source of Sample: BCR-7 Depth: 3.0 - 4.5' Sample Number: A

□ Source of Sample: BCR-7 Depth: 5.0 - 6.4' Sample Number: B

NEVADA DEPARTMENT OF TRANSPORTATION

Client: D. Boomhower

Project: US 93 Boulder City to Hacienda

Project No.: EA 73602, FL-2-11

Figure

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION

CHEMICAL ANALYSIS

E.A. No.: 73602

Project: US 93 Boulder City to Hacienda

Date: 2/15/11

Sample ID	Chlorides ppm AASHTO T 291 A	Sulfates ppm AASHTO T 290 B	pH AASHTO T 289	Resistivity ohm - cm AASHTO T 288
BC - 2, BULK 1	130	4,749	7.2	480
BC - 2, BULK 2	75	4,242	6.9	480
BC - 2, BULK 3	110	7,327	6.9	450
BC - 3, BULK 1	1,090	4,306	6.8	303
BC - 3, BULK 2	530	2,024	6.4	410
BC - 3, BULK 3	210	6,630	6.6	384
BC - 4, BULK 1	510	6,883	8.5	263
BC - 4, BULK 2	540	10,306	8.1	233
BC - 7, BULK 1	50	5,256	5.7	457
BC - 7, BULK 2	70	4,475	8.1	390
BCR - 5, BULK 1	50	6,270	6.9	540

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BC - 2 **Elevation (ft)** **Station** "P" 161 + 12, 60' Rt. **Date** 02/14/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
BULK 1	0.0 - 3.0	Bulk		SM			39.1	34	NP	NP						Ch, RV = 78
BULK 2	5.0 - 7.5	Bulk		SM			47.2	33	NP	NP						Ch, RV = 77
BULK 3	12.0 - 15.0	Bulk		SM			39.8	34	25	9						Ch, RV = 45
A	9.5 - 9.6	SPT	R	SC			43.7	33	25	8						
B	15.0 - 16.5	SPT	43	SC			29.6	42	23	19						
C	20.0 - 20.9	SPT	R	SC			30.5	36	23	13						
D	25.0 - 25.9	SPT	R	SC			30.9	47	22	25						
E	30.0 - 30.4	SPT	R				40.9									
F	35.0 - 35.6	SPT	R	SC			30.6	39	22	17						
G	40.0 - 40.3	SPT	R				28.4									
H		SPT	R													No Sample Recovered

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BC - 3 **Elevation (ft)** **Station** "P" 160 + 28, 55' Rt. **Date** 02/15/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
BULK 1	0.0 - 5.0	Bulk		SC			25.5	43	21	22						Ch, RV = 24
BULK 2	5.0 - 10.0	Bulk		SC			15.1	37	20	17						Ch, RV = 58
BULK 3	10.0 - 15.0	Bulk		SC			29.1	39	20	19						Ch, RV = 25
A	5.0 - 5.8	SPT	R	SC			20.5	43	21	22						
B	10.0 - 10.4	SPT	R				21.2									
C	15.0 - 15.3	SPT	R													No Sample Recovered
D	20.0 - 20.4	SPT	R	SM			32.1	41	33	8						
E	25.0 - 25.1	SPT	R													No Sample Recovered

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BC - 4 **Elevation (ft)** **Station** "P" 171 + 88, 28' Lt. **Date** 02/16/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
BULK 1	0.0 - 5.0	Bulk		SC			33.5	32	19	13						Ch, RV = 18
BULK 2	5.0 - 10.0	Bulk		SC			43.2	38	22	16						Ch, RV = 35
A	5.0 - 6.4	SPT	R	CL			77.2	38	24	14						
B		SPT	R													No Sample Recovered
C	15.0 - 15.2	SPT	R				33.7									
D	20.0 - 20.7	SPT	R	CL			53.9	49	20	29						

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BC - 7 **Elevation (ft)** **Station** "P" 157 + 30, 73' Rt. **Date** 03/03/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
BULK 1	0.0 - 5.0	Bulk		SM			19.5	35	25	10						Ch, RV = 74
BULK 2	5.0 - 10.0	Bulk		SC			19.9	34	21	13						Ch, RV = 64
A	3.0 - 3.3	SPT	R				12.5									
B	5.0 - 5.4	SPT	R				15.1									
C	7.5 - 8.1	SPT	R	SC			33.3	43	25	18						
D	10.0 - 10.4	SPT	R				43.5									
E	15.0 - 15.2	SPT	R													No Sample Recovered
F	20.0 - 20.3	SPT	R				29.9									
G	25.0 - 26.3	SPT	R	CH			66.0	68	26	42						

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BCR - 1 **Elevation (ft)** 1721.2 **Station** "US93SB" 182 + 57, 3' Rt. **Date** 03/29/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
A	3.5 - 5.0	SPT	23	SM			19.5	36	25	11						
B	5.0 - 6.5	SPT	63				15.4									
C	7.5 - 9.0	SPT	19	SC-SM			19.4	29	22	7						
D	10.0 - 11.5	SPT	30				15.6									
E	12.5 - 14.0	SPT	32				19.6									
F	15.0 - 15.8	SPT	R	SC-SM			17.8	28	21	7						
G	17.5 - 19.0	SPT	34				18.4									
H1	20.0 - 21.1	SPT	30	GM			14.3	28	23	5						
H2	21.1 - 21.5	SPT						40	NP	NP						
I	22.5 - 23.4	SPT	R					38	NP	NP						

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BCR - 3 **Elevation (ft)** 1706.0 **Station** "US93SB" 185 + 52, 34' Rt. **Date** 03/30/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
A	3.0 - 4.5	SPT	29				18.1									
B	5.0 - 6.5	SPT	22				19.3									
C	8.0 - 8.9	SPT	R				12.5									
D	10.0 - 11.5	SPT	27				8.3									
E	13.0 - 14.5	SPT	37	SC			19.8	29	21	8						
F	15.0 - 16.5	SPT	64				16.4									
G	18.0 - 18.2	SPT	R													No Sample Recovered
H	20.0 - 21.5	SPT	22				24.7									
I	23.0 - 24.5	SPT	7	SC-SM			36.6	24	19	5						
J	25.0 - 26.5	SPT	15				16.9									
K	28.0 - 29.5	SPT	23	SM			17.1	22	21	1						
L	30.0 - 31.5	SPT	14				23.3									

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT $N = (N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BCR - 3 **Elevation (ft)** 1706.0 **Station** "US93SB" 185 + 52, 34' Rt. **Date** 03/30/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
M	33.0 - 34.5	SPT	14	SM			18.6	27	NP	NP						
N	35.0 - 36.5	SPT	17	SM			22.3	24	NP	NP						
O	40.0 - 40.6	SPT	R	SM			16.3	25	NP	NP						

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT $N = (N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BCR - 4 **Elevation (ft)** 1699.0 **Station** "US93SB" 186 + 76, 48' Rt. **Date** 03/30/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
A	3.0 - 4.5	SPT	18	GP-GC			11.6	30	21	9						
B	5.0 - 6.5	SPT	23	GP-GC			11.4	30	23	7						
C	8.0 - 9.5	SPT	17				15.3									
D	10.0 - 11.5	SPT	28				15.3									
E	13.0 - 14.5	SPT	16	GP-GM			8.3	31	NP	NP						
F	15.0 - 16.5	SPT	27				11.7									
G	20.0 - 20.1	SPT	R													No Sample Recovered

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BCR - 5 **Elevation (ft)** 1857.0 **Station** "P" 64 + 03, 29' Rt. **Date** 03/31/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
BULK 1	0.0 - 5.0	Bulk		GP-GC			8.4	33	20	13						Ch, RV = 77
A	2.5 - 4.0	SPT	29	GM			17.2	40	36	4						
B	4.5 - 4.6	SPT	R													No Sample Recovered
C	7.5 - 7.6	SPT	R													No Sample Recovered
D	10.0 - 10.1	SPT	R													No Sample Recovered

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BCR - 6 **Elevation (ft)** 1799.6 **Station** "P" 75 + 94, 24' Rt. **Date** 03/31/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
A	2.5 - 4.0	SPT	23	GW-GM			8.9	21	NP	NP						
B	4.0 - 5.5	SPT	56				9.8									
C	7.5 - 9.0	SPT	66				17.7									
D	9.0 - 10.5	SPT	41	SM			13.6	20	NP	NP						
E	12.5 - 14.0	SPT	25				10.3									

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

SUMMARY OF RESULTS
N.D.O.T. GEOTECHNICAL SECTION

EA/Cont # 73602 **Job Description** US 93 Boulder City to Hacienda

Boring No. BCR - 7 **Elevation (ft)** 1739.7 **Station** "P" 95 + 15, 38' Rt. **Date** 03/31/2011

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMP-LER TYPE	N BLOWS per ft.	SOIL GROUP	W%	DRY UW pcf	% PASS #200	LL %	PL %	PI %	STRENGTH TEST					COMMENTS
											TEST TYPE	Φ deg.	C psi	Φ deg.	C psi	
												Peak		Residual		
A	3.0 - 4.5	SPT	27				7.2									
B	5.0 - 6.4	SPT	R				10.4									

CMS = California Modified Sampler 2.42" ID
SPT = Standard Penetration 1.38" ID
CS = Continuous Sample 3.23" ID
RC = Rock Core
PB = Pitcher Barrel
CSS = Calif. Split Spoon 2.42" ID
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87" ID

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler

N = Field SPT N = $(N_{css})(0.62)$

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value
MD = Moisture Density

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction
HCpot = Hydro-Collapse Potential

*** = Average of subsamples**

APPENDIX D

Seismic Refraction Location Sheet
Seismic Refraction Plots

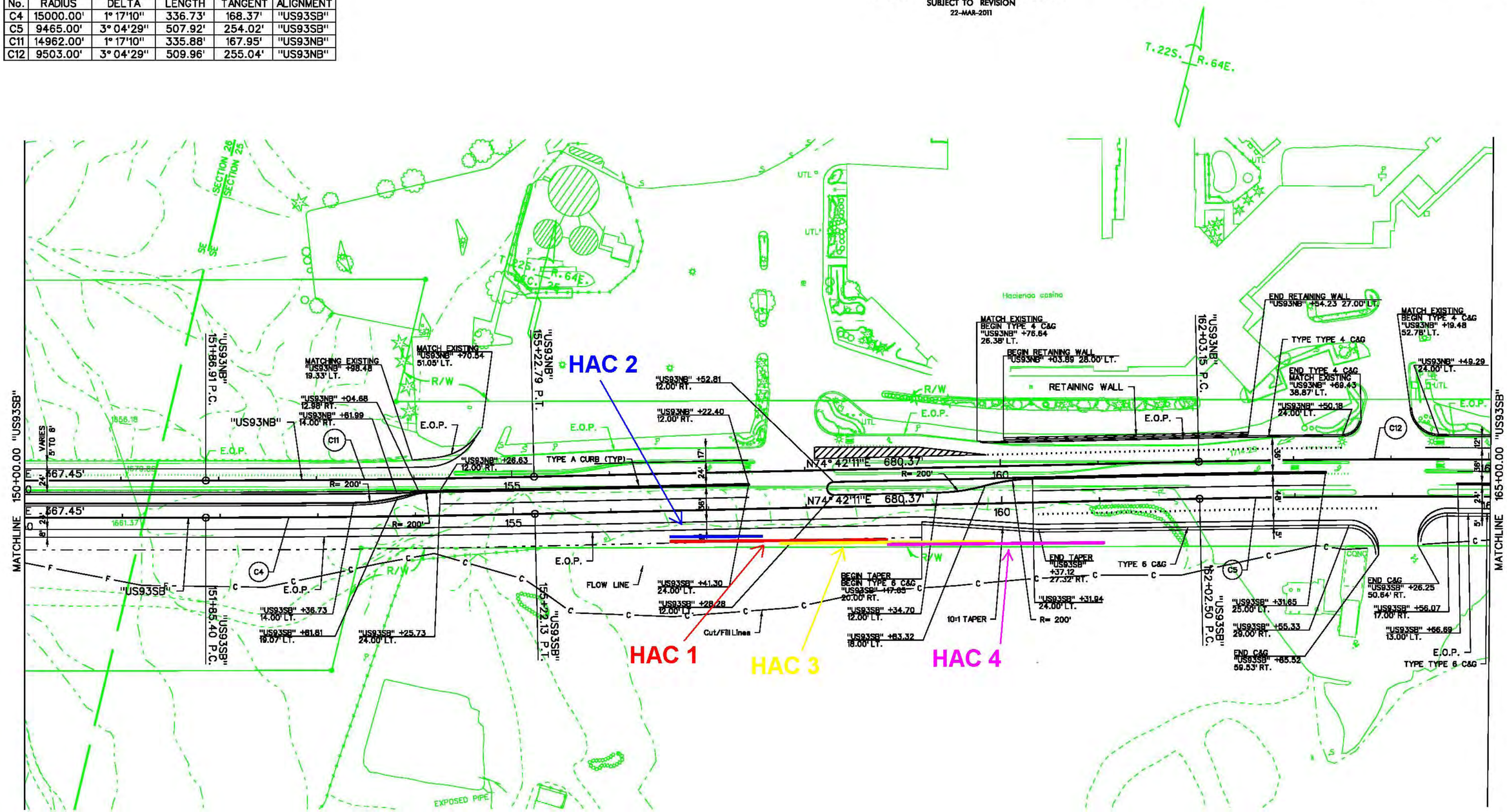
CURVE DATA					
No.	RADIUS	DELTA	LENGTH	TANGENT	ALIGNMENT
C4	15000.00'	1°17'10"	336.73'	168.37'	"US93SB"
C5	9465.00'	3°04'29"	507.92'	254.02'	"US93SB"
C11	14962.00'	1°17'10"	335.88'	167.95'	"US93NB"
C12	9503.00'	3°04'29"	509.96'	255.04'	"US93NB"

PRELIMINARY

SUBJECT TO REVISION

22-MAR-2011

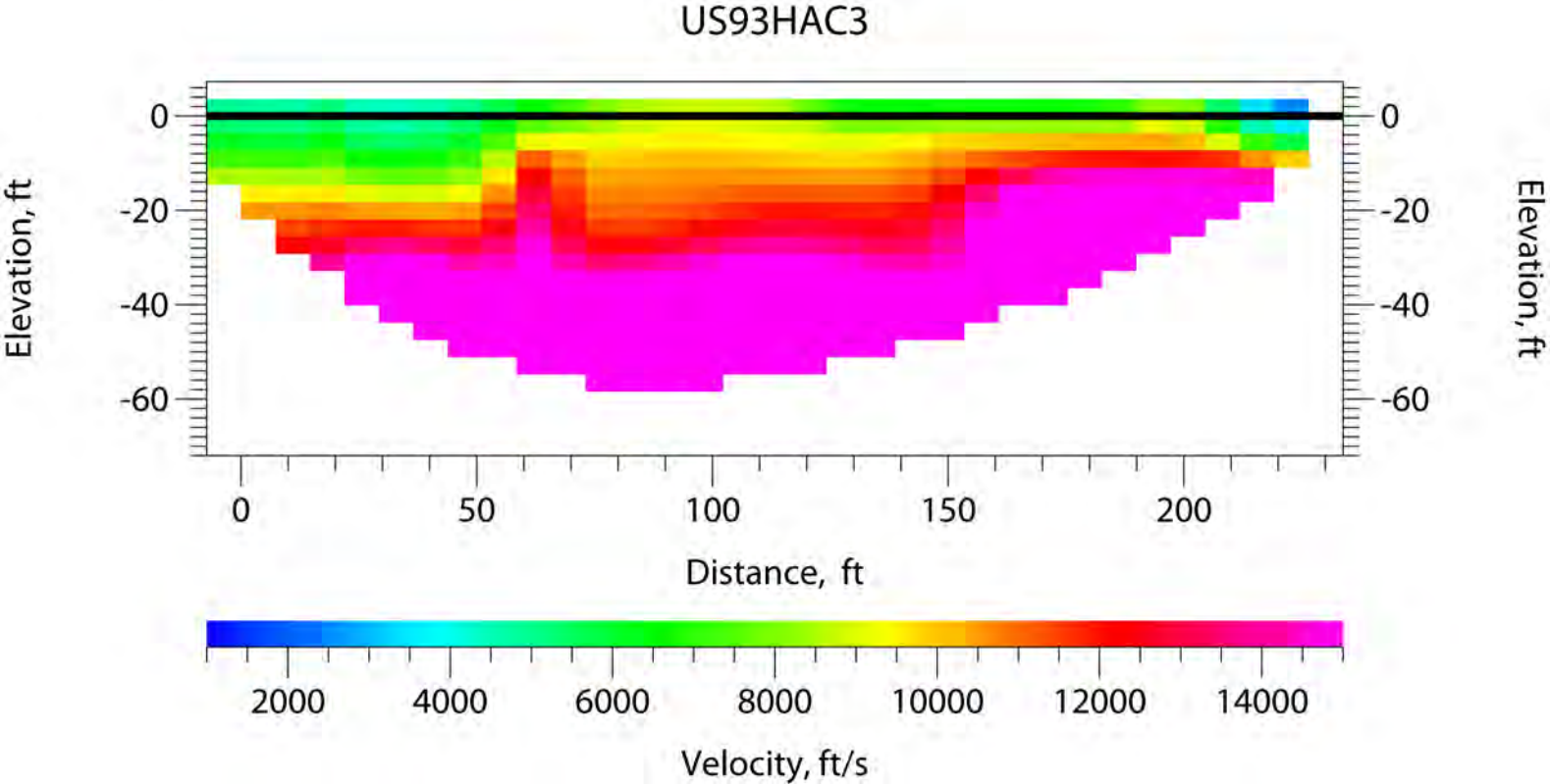
STATE	PROJECT NO.	COUNTY	SHEET NO.
NEVADA	73602	CLARK	22



STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

US 93 WIDENING

US93 ROADWAY PLAN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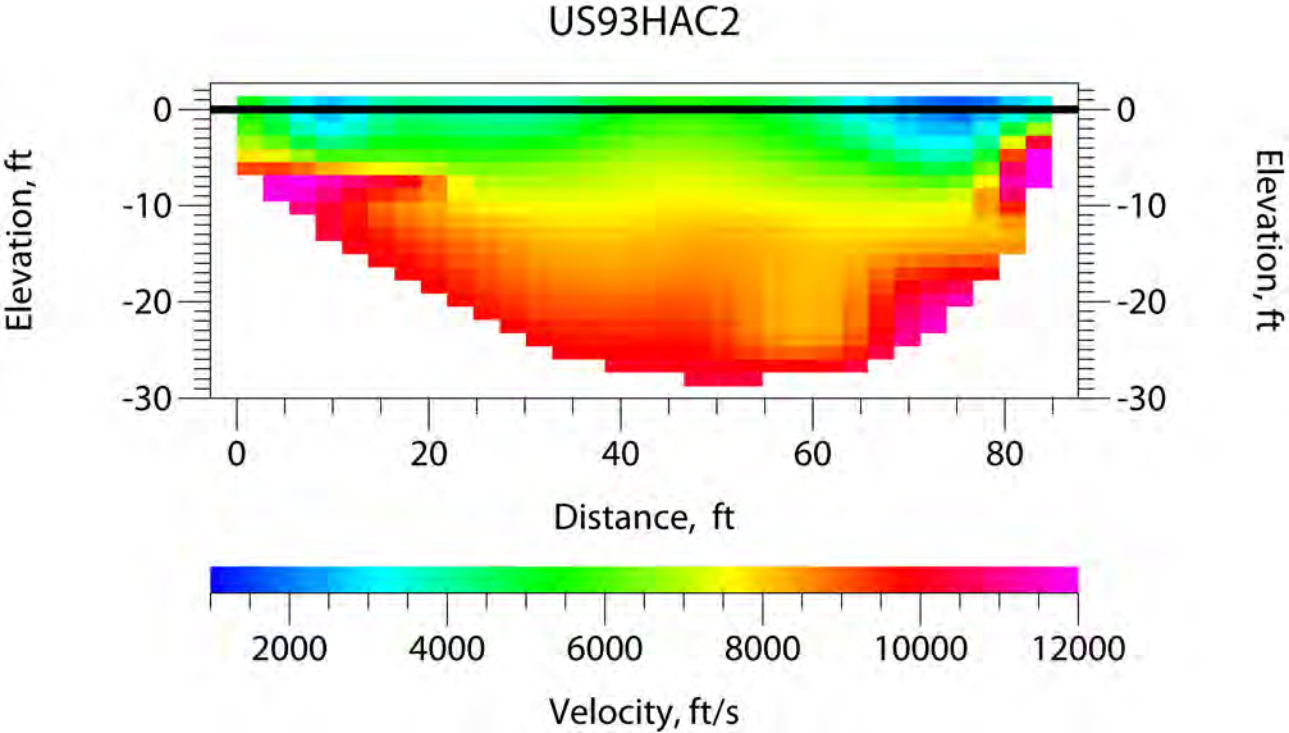
Elevation, ft
0
-20
-40
-60
0
50
100
150
200
Distance, ft
2000
4000
6000
8000
10000
12000
14000
Velocity, ft/s


US93HAC2
Elevation, ft
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-10
-20
-30
0
20
40
60
80
Distance, ft
2000
4000
6000
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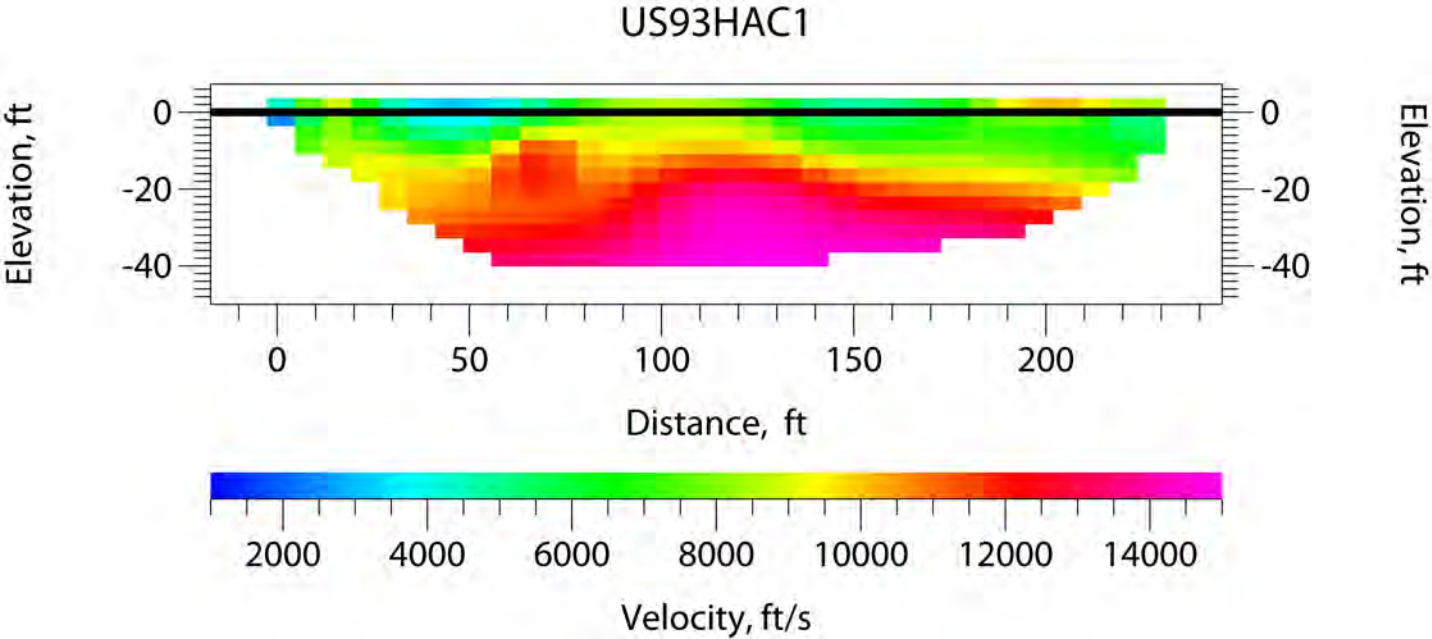
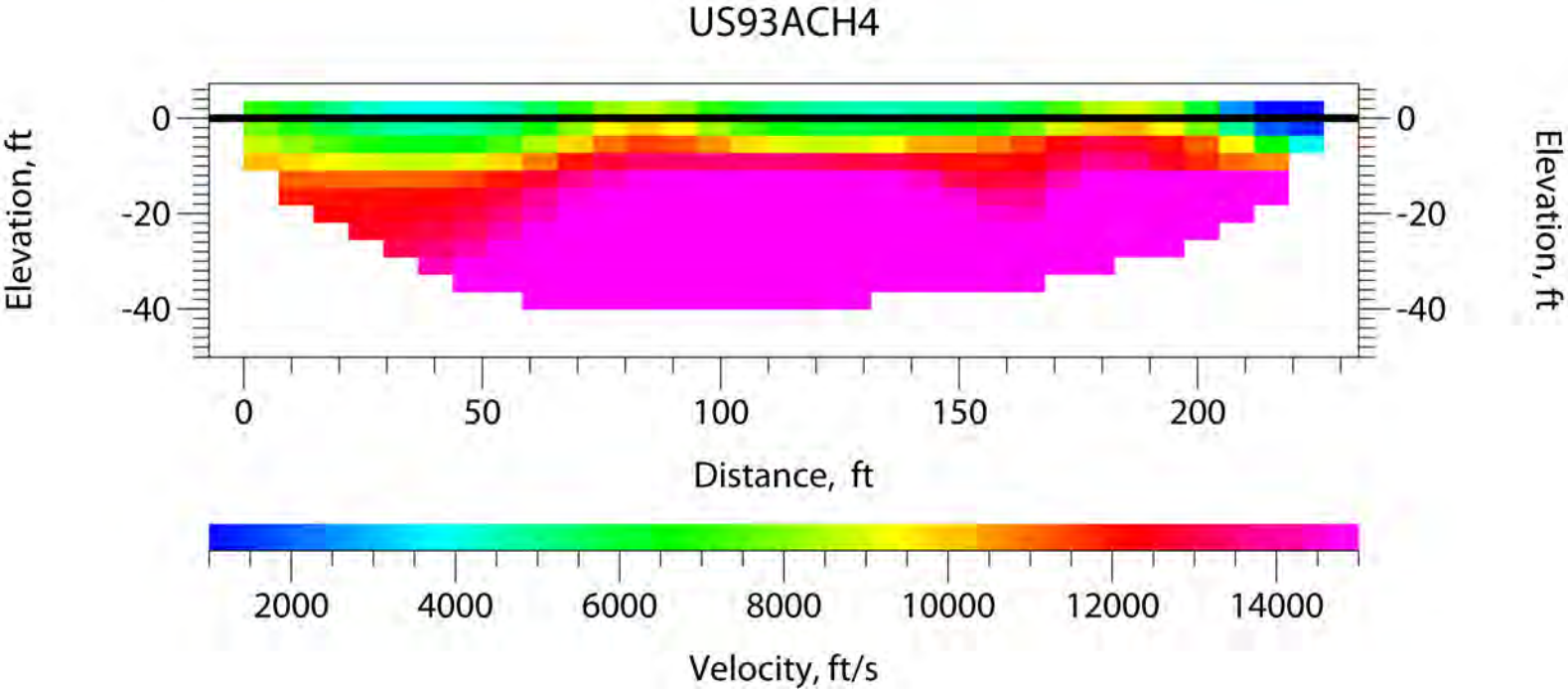
12000
Velocity, ft/s


US93HAC1
Elevation, ft
0
-20
-40
0
50
100
150
200
Distance, ft
2000
4000
6000
8000
10000
12000
14000
Velocity, ft/s


US93ACH4
Elevation, ft
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-40
0
50
100
150
200
Distance, ft
2000
4000
6000
8000
10000
12000
14000
Velocity, ft/s