GEOTECHNICAL DATA REPORT

STRUCTURE B-639 REPLACEMENT

JACK CREEK BRIDGE ON SR 226

ELKO COUNTY, NEVADA

NOVEMBER 2018

NEVADA DOT
GEOTECHNICAL ENGINEERING

STATE OF NEVADA

DEPARTMENT OF TRANSPORTATION

MATERIALS DIVISION

GEOTECHNICAL SECTION

STRUCTURE B-639

REPLACEMENT JACK CREEK BRIDGE ON SR 226 ELKO COUNTY, NEVADA

November 2018

EA 74025

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APPENDICES

1.0 INTRODUCTION

1.1 Project Location

The Nevada Department of Transportation (NDOT) will be replacing the bridge structure B-639 on State Route 226, milepost EL32.70 to EL32.90, Elko County, Nevada. The bridge project location is in Township 42 North, Range 52 East, in the southwest quarter of Section 35, M.D.B.&M at coordinates 41°29'36" N, 116°05'60" W. The structure crosses over Jack Creek approximately one-eighth of a mile south of Jack Creek Road.

1.2 Project Description

Structure B-639 was built in 1956 and was originally designed and built as a two-cell Reinforced Concrete Box (RCB) Culvert. According to the August 2016 Inspection Report, the bridge is in poor condition, with a sufficiency rating of 63.8. As stated in the report, the culvert condition consists of large spalls, heavy scaling, wide cracks and considerable efflorescence. Opened construction joints permit the loss of backfill. Considerable misalignment exists, possibly due to settlement. Considerable scouring or erosion exists at curtain walls, wingwalls and pipes. Metal parts have significant distortion and deflection throughout, extensive corrosion and deep pitting.

The project plan is to replace the existing RCB culvert structure with a larger RCB culvert structure. New and larger wing walls will be constructed on all four corners. The structure will continue to have the same length parallel to the road, which is skewed 45.27 degrees relative to the creek.

The completed bridge will continue to convey one lane of traffic in each direction over the waterway. The project includes removing and replacing the entire RCB culvert and wing walls. The final dimensions of the RCB culvert will be 86 feet long by 22.65 feet wide. The completed structure will have an increased footprint and will retain the same road surface elevation as the current structure.

2.0 SCOPE OF WORK

2.1 Purpose and Scope

The purpose of the work is to replace the current bridge structure with a new RCB culvert and wingwalls. The purpose of the geotechnical investigation is to provide data regarding the subsurface soil and groundwater conditions at the proposed bridge site and provide recommended geotechnical design values.

The scope of the geotechnical investigation is to:

- review published maps and reports
- gather data from past field explorations and reports

- perform field reconnaissance
- conduct subsurface explorations consisting of two borings
- obtain soil samples from field tests
- analyze field and laboratory testing data.

This report includes boring logs and summaries of test results from the field investigations and the laboratory testing regimen. The boring logs and summaries are in Appendices B and C.

3.0 GEOLOGIC CONDITIONS AND SEISMICITY

3.1 Geologic Setting

The project site is in the Columbia Basin watershed and within the Basin and Range Province, which encompasses the majority of the State of Nevada. The Basin and Range province is generally composed of north-trending mountain ranges separated by alluvial, normal-fault bounded basins. Regionally, the project falls within a narrow valley alluvial deposit between the Tuscarora Mountains to the west and the Independence Mountains to the east.

The site is in a narrow valley at the very north end of Independence Valley. The site is mapped as the Qya geologic unit (Quaternary Younger Alluvium). A geologic map is shown in Appendix A. Locally, the Qya geologic unit consist of many alluvial deposits emanating from the nearby mountains to the west and east. Surface exposure of the Qya geologic unit at the site shows an abundance of sub-round to round quartzite gravels, cobbles and boulders. Historic Jack Creek channel meander and erosion is somewhat limited within the narrow valley (approximately 600’ wide) at the site location. This causes variability in the near surface soil deposits both laterally and vertically.

3.2 Seismicity and Faulting

The Independence, Tuscarora and Bull Run Mountains contain numerous quaternary faults within a six-mile radius from the project site. These faults are comprised of the Eastern Independence Mountains Fault Zone and the Tuscarora Fault Zone. At the Tuscarora Fault Zone, the fault activity is older than 15,000 years. Most local faults are located at alluvial basin edges at the base of the mountains. An earthquake fault map of the area is in Appendix A.

3.3 Site Classification and Seismic Parameters

The seismic provisions of the AASHTO LRFD Bridge Design Specifications (AASHTO) Article 3.10 are applied to bridge design in Nevada. Earthquake force effects were determined in accordance with AASHTO Article 3.10. The seismic coefficients used must meet or exceed the minimum seismic coefficients shown in Figure 12.3-H of the NDOT Structures Manual. Three sets of coefficients are provided in the table below from different sources for Elko County. We recommend using the NDOT coefficients, as they are the minimum allowed, to develop an acceleration response spectrum.

	PGA	S_s	S_1
AASHTO	0.11	0.25	0.085
USGS	0.108	0.257	0.085
NDOT Minimum for Elko County from NDOT Structures Manual	0.15	0.40	0.15

Table 1. Seismic Design Parameters

AASHTO Article 3.10.1 recommends selecting peak ground acceleration (PGA) based on the horizontal peak ground acceleration coefficient with seven percent probability of exceedance in 75 years (approximately 1000-year return period). The PGA, short-period response spectral acceleration (S_S) and long-period response spectral accelerations (S_1) for the site were obtained using AASHTO figure 3.10.2.1, USGS U.S. Seismic Design Maps online tool (2009 AASHTO) and NDOT Structure Manual Figure 12.3-H.

The site class for the project location is Site Class B (AASHTO Table 3.10.3.1-1) based on V_{s100}, the average shear wave velocity. The average shear wave velocity was obtained utilizing the Refraction MicroTremor (ReMi^{TM}) geophysical testing method. ReMi^{TM} V_{s100} results for the site were 2,821 feet per second.

4.0 FIELD INVESTIGATION

4.1 Exploratory Borings

The NDOT Geotechnical Section performed a site investigation at the project site in September 2017 at the locations shown on the boring location map in Appendix A. The subsurface exploration consisted of two exploratory borings drilled with a Diedrich D-120 truck-mounted drill rig (NDOT #1082) utilizing six-inch hollow-stem auger without drilling fluid. Soil samples and standard penetration resistance values (N-values) were obtained utilizing the Standard Penetration Test (SPT, ASTM D1586) and ring-lined Modified California Sampler (CMS, ASTM D3550). The uncorrected field blow counts are shown on the boring logs in Appendix B. The uncorrected blow counts have not been corrected for hammer energy, sampler type, rod length or hammer type. The Energy Transfer Ratio (ER) for NDOT #1082 is 86%. Field CMS N-values are converted to field SPT N-values by a multiplication factor of 0.62, as stated in the Key to Boring Logs found in Appendix B. All soil samples were either classified using Unified Soil Classification System (USCS, ASTM D2487) laboratory testing or described and identified according to Visual-Manual Procedures (ASTM D2488).

The borings were made on the banks on both sides of the creek. No borings were made in the channel bottom, which is at a depth of eight to ten feet in the borings. It is possible that the channel soils are different from the soils in the boring logs. The soils encountered while drilling include medium dense to dense silty sand and silty sand with gravel. The water table in the boring logs are at a depth of 8 feet (elevation 6130.0) in boring 3S and 8.5 feet (elevation 6131.5) in boring 1N-2N. Below ten and one-half feet in boring 3S and nineteen and one-half feet in boring 1N-2N, the soils became too hard to sample and the down pressure required to drill increased from 300 psi to 500 psi. It is interpreted that this material is weak bedrock.

4.2 Geophysical Site Investigation

Seismic Data Collection

The ReMi^{TM} seismic survey was performed using a twelve-geophone set with each geophone spaced 20 feet apart. The ReMi seismic line started near Boring 3S and ran along SR226 to the east, parallel to the road. See the map of seismic line layout in Appendix A. Background 'noise' consisting of roadway traffic and walking the seismic line were used to generate seismic waves during the ReMi^{TM} survey. The field exploration, noise data acquisition, location survey and preliminary data verification was performed by NDOT geotechnical staff.

ReMi Seismic Data Analysis

The analysis and interpretation of the seismic data collected for this project was performed by Optim, Incorporated of Reno, Nevada. Ten total 30-second data acquisition recordings were made and processed by Optim. The noise data collected for ReMi^{TM} was analyzed using the proprietary SeisOpt ReMi^{TM} software developed by Optim. See the geophysical test results in Appendix D. This plot depicts variation in the shear wave velocity profile to a depth of 100 feet and provides the average shear wave velocity for the upper 100 feet (Vs100) of the soil profile.

4.3 Laboratory Analysis

Laboratory analyses were performed on soil samples collected from the boreholes. The testing program consisted of sieve, hydrometer, specific gravity, Atterberg limits, moisture content and dry unit weights analyses. Test result summary information is presented in Appendix C.

5.0 FOUNDATION

5.1 Structure Loads

Anticipated structure loads, including the wing walls, were provided by the NDOT Structures Division. The Service I load for the structure is 1.89 ksf and the Strength I load is 2.56 ksf.

5.2 Construction Platform

The RCB culvert shall be bedded on 4 inches of Class C Bedding material (2017 NDOT Standard Plans, Drawing R-1.1.6) and backfilled in accordance with 2017 NDOT Standard Plans, Drawing R-1.1.4. It is likely that unstable foundation conditions will be encountered during construction due to migration of saturated sands, seepage, and/or yielding conditions, which prevent proper compaction of the foundation soils. Therefore, both the RCB culvert and wingwall footings, including the 4 inches of Class C Bedding material, shall be founded on top of construction platforms consisting of Class 150 Riprap Bedding wrapped in Nonwoven Geotextile Class 1 fabric. The minimum thickness of the wrapped Riprap Bedding is 36 inches under the RCB culvert and 18 inches under the wingwalls. Place Riprap Bedding, for the construction platforms, in lifts and properly compact in accordance with Section 208. The initial lift of Riprap Bedding should be approximately 12 inches and following lifts should be no more than 8 inches. Locations and elevations of the construction platforms are depicted in the construction plans.

5.3 Geotextile Specifications

NDOT Nonwoven Geotextile Class 1 as specified for the construction platforms shall be in conformance with Sections 203 and 731.

5.4 Soil Bearing Resistance

Bearing resistances of the soil under the RCB culvert were analyzed using the entire structure founded on top of a forty-inch-thick sand layer and construction platform with elevation of 6128 feet. Bearing resistances of the soil under the structure and on top of the sand and construction platform, are summarized in Table 1 and are further explained in the following sections.

Table 1. Reinforced Concrete Box Culvert Foundation Bearing Resistances

Service Limit State		Strength Limit State		Extreme Limit State	
Nominal Resistance (ksf)	Factored Resistance (ksf)	Nominal Resistance (ksf)	Factored Resistance (ksf)	Nominal Resistance (ksf)	Factored Resistance (ksf)
4.0	4.0	48	22	70	70

Service Limit State

The resistance factor for the service limit state shall be taken as 1.0 in accordance with AASHTO Article 10.5.5.1. Therefore, nominal and factored resistances at the service limit states are equal. For this project, the factored bearing resistance at the Service I Limit State is defined as the net bearing pressure that is estimated to produce 1 inch of total settlement.

Bearing resistance of the soil was calculated by using an elastic half-space settlement equation in accordance with AASHTO Article 10.6.2.4 with the maximum allowed settlement of 1 inch for the proposed RCB culvert. From the equation, this settlement would occur by applying a net bearing pressure of approximately 4 ksf. Therefore, the nominal and factored bearing resistances of the soil at the Service I Limit State are both 4 ksf.

Strength Limit State

Nominal bearing resistance at the Strength Limit State was calculated using the nominal bearing resistance equation in accordance with AASHTO Article 10.6.3.1.2a. The bearing resistance factor for the Strength Limit state is 0.45, which is used in our analysis based on the theoretical method, in sand, using SPT from AASHTO Table 10.5.5.2.2-1. Therefore, the nominal bearing resistance at the Strength Limit State for the proposed RCB culvert is calculated to be 48 ksf, and the factored bearing resistance is 22 ksf.

Extreme Event Limit State

The bearing resistance factor for the Extreme Event Limit State is equal to 1.0 according to AASHTO Article 10.5.53 and is applicable to both scour and earthquake loading. The nominal bearing resistance at the Extreme Event Limit State is calculated to be 70 ksf, in accordance with AASHTO 10.6.3.1.3 and the factored bearing resistance is also 70 ksf.

5.5 Settlement

A settlement analyses for the RCB culvert on top of the sand layer and construction platform was made using the elastic half-space settlement equation with actual loads provided by NDOT Structures Division. Settlement analyses using computational methods based on the results of laboratory and in situ testing were performed in accordance with AASHTO Article 10.6.2.4. The maximum total settlement calculated was 0.47 inches and consisted entirely of immediate settlement. Long term consolidation settlement was negligible.

5.6 Wingwall Lateral Earth Pressure

The at-rest earth pressure coefficient Ko is 0.44 and equivalent fluid unit pressure is 53 pcf for horizontal backfill conditions for the wingwalls. These values are based on the assumption that the wingwalls will be backfilled with on-site excavated materials. These materials have soil strength parameters of friction angle of 34 degrees, a cohesion of 0 and a unit weight of 120 pcf in the calculations. Little movement is expected with the wingwalls and the following active and passive lateral wingwall pressure coefficients of Ka = 0.28 and Kp = 3.5 are appropriate for use. The total force is applied at one-third of the wall height.

6.0 REFERENCES

1. Seismic Hazards in the Reno-Carson City Urban Corridor:
http://www.nbmg.unr.edu/_docs/Newsletters/nl14.htm

2. Quaternary Fault and Fold Database of the United States (U.S. Geological Survey):
https://earthquake.usgs.gov/cfusion/qfault/show_report_AB_archive.cfm?fault_id=1286&section_id

3. Hydrologic Data
https://pubs.usgs.gov/of/1996/0464/report.pdf

4. Geologic Map of Elko County, Nevada

5. United State Geological Survey (USGS) Data Series 249: Geologic Map of Nevada (digital)

6. Geologic map of the Gardnerville Quadrangle, Elko County, Nevada; 1:24,000; 2000

7. Geologic map of the Freel Peak 15' quadrangle, California and Nevada; 1:62,500; 1983

8. Reconnaissance Surficial Geologic Map of the Mt. Siegel Quadrangle, Nevada - California; 1:62,500; 1981

9. United States Department of Agriculture Web Soil Survey (USDA-WSS)

10. AASHTO LRFD Bridge Design Specifications, 8th Edition

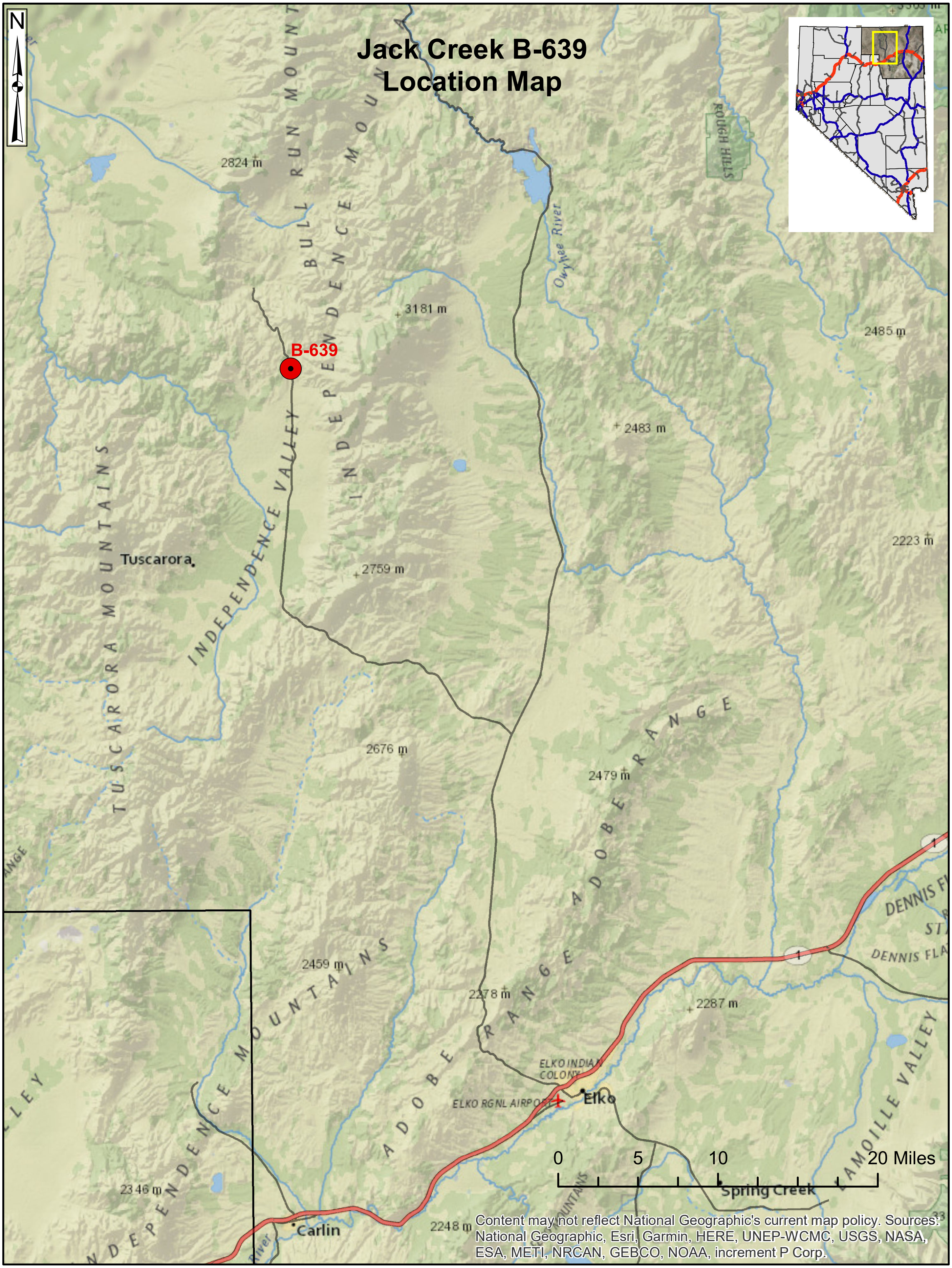
11. NDOT Structures Manual 2008

12. 2017 NDOT Standard Plans

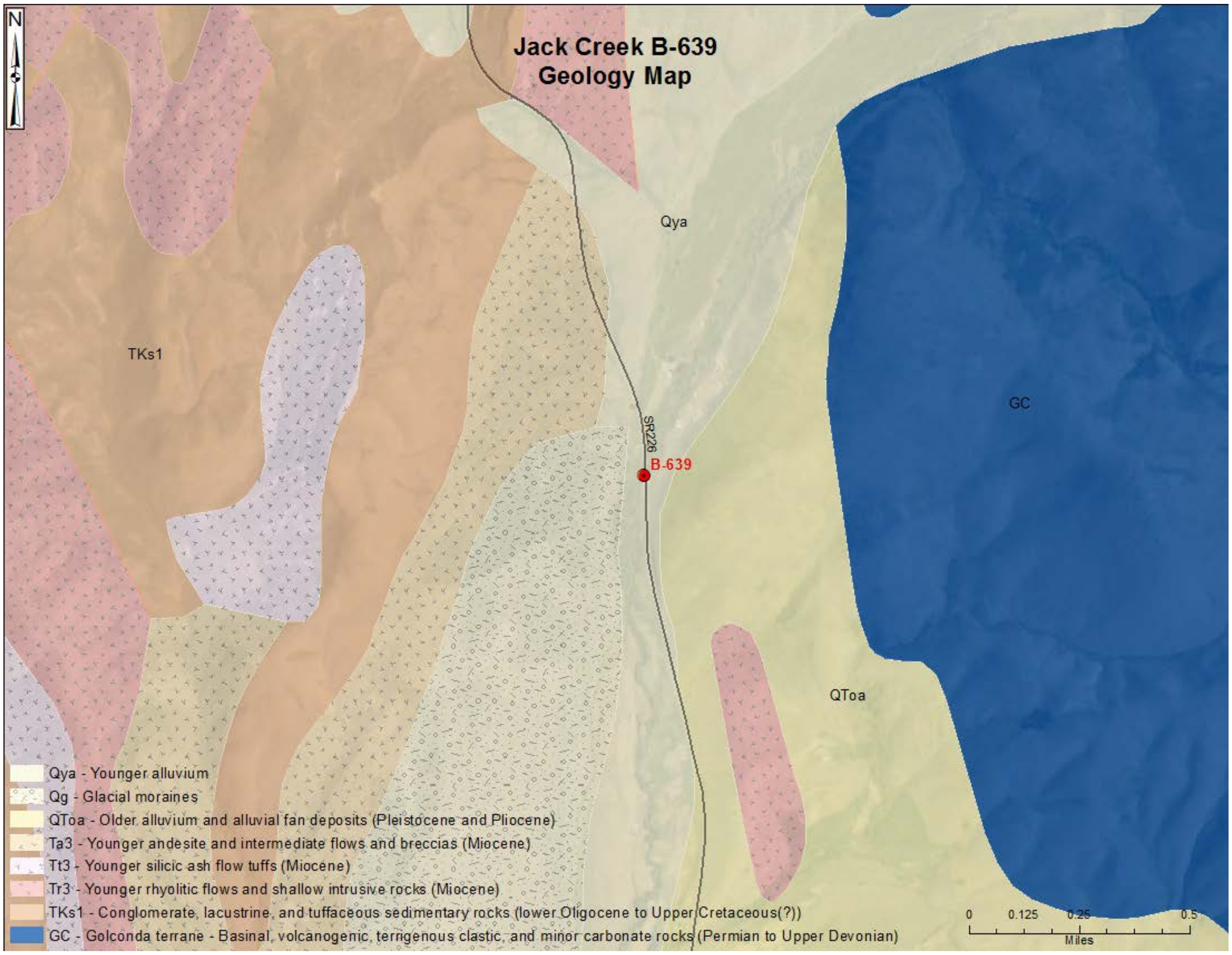
APPENDIX A:

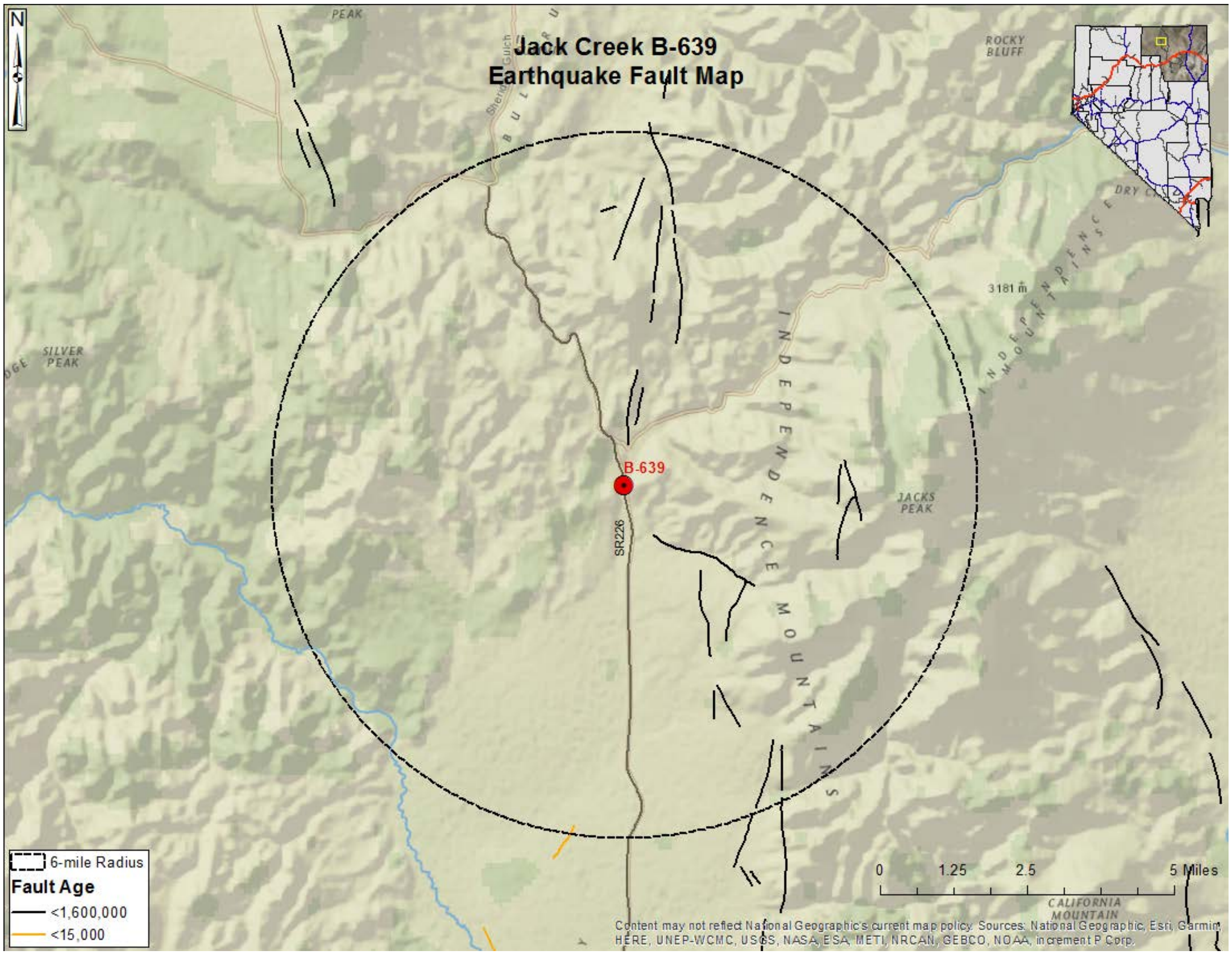
Site Location Map
Geology Map
Earthquake Fault Map
Boring and ReMi Location Map

Jack Creek B-639 Location Map



Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.


Jack Creek B-639
Geology Map
N
Qya
TKs1
SR226
B-639
GC
QToa
Qya - Younger alluvium
Qg - Glacial moraines
QToa - Older alluvium and alluvial fan deposits (Pleistocene and Pliocene)
Ta3 - Younger andesite and intermediate flows and breccias (Miocene)
Tt3 - Younger silicic ash flow tuffs (Miocene)
Tr3 - Younger rhyolitic flows and shallow intrusive rocks (Miocene)
TKs1 - Conglomerate, lacustrine, and tuffaceous sedimentary rocks (lower Oligocene to Upper Cretaceous(?))
GC - Golconda terrane - Basinal, volcanogenic, terrigenous clastic, and minor carbonate rocks (Permian to Upper Devonian)
0
0.125
0.25
0.5
Miles



Jack Creek B-639
Earthquake Fault Map

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Borings and ReMi Location Map

⊕ ReMi Geophone Locations

🔴 Borehole Locations

APPENDIX B:

Boring Log Key
Boring Logs

KEY TO EXPLORATION LOGS

PARTICLE SIZE LIMITS

CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		FINE	MEDIUM	COARSE	FINE	COARSE		

.002 mm #200 #40 #10 #4 ¾ 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
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
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.
∇ ▼	Groundwater Elevation Symbols

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

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.

Field Blow counts on California Modified Sampler (N_{CMS}) can be converted to $N_{SPT\ field}$ by:

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

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

Rig #1627: $(N_{SPT\ field})(1.2) = N_{60}$

Rig #1082: $(N_{SPT\ field})(1.45) = N_{60}$

TEST ABBREVIATIONS

CD	CONSOLIDATED DRAINED	OC	ORGANIC CONTENT
CH	CHEMICAL (CORROSIVENESS)	C	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/ROCK COLOR CHARTS.

EXAMPLE: (7.5 YR 5/3) BROWN

SAMPLER NOTATION

CMS	CALIF. MODIFIED SAMPLER[1]
CPT	CONE PENETRATION TEST
CS	CONTINUOUS SAMPLER[2]
PB	PITCHER BARREL
RC	ROCK CORE[3]
SH	SHELBY TUBE[4]
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

Revised August 2010

EXPLORATION LOG

SHEET 1 OF 2

START DATE 9/26/17
END DATE 9/26/17
JOB DESCRIPTION Structure B-639, SR 226, Jack Creek
LOCATION Elko County
BORING 1N-2N
E.A. # 74025
GROUND ELEV. 6140 Feet
HAMMER DROP SYSTEM Auto

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft
9/27/17	8.5	6131.5

STATION L 138+03
OFFSET 18 Feet Right
ENGINEER K. Conrad
EQUIPMENT Dietrich D-120 Truck Mount
OPERATOR O.J. Altamirano
DRILLING METHOD Hollow Stem Auger
BACKFILLED Yes DATE 9/27/2017

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
									Asphalt Pavement 0.50	
								GC	Base and Fill 1.80	
								SC	Clayey Sand with Gravel, Medium Dense Dark Brown, Dry	Down Pressure at 300 psi
6135.0	5 5.00									
	6.50	A1	CMS	4 6 6	12	67	W,UW,S, LL,PL,PI			
	8.00	B1	SPT	8 30 27	57	47	W,S		7.00	
								SC	Silty Sand with Gravel, Very Dense Dark Gray, Wet	
∇	9.00	C1	CMS	54 105/5.5"		70	W,S			
6130.0	10 10.00 10.50	D1	SPT	60 42 46	88	0	W,S		10.50	Split Spoon sampler broke off in hole. Moved 3 feet and started a new hole (2N).
	11.50	A	SPT	7 4 10	14	100	W,S,LL, PL,PI	SM	Silty Sand, Medium Dense Brown, Wet 11.50	
	13.00	B	CMS	28 30 54	84	100	W,UW,S, PL,LL,PI		Silty Sand, Very Dense Brown, Wet	
	14.50	C	SPT	40 48 60	108	100	W,S,LL,PL, PI,OC	SM		
	15.00									

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

SHEET 2 OF 2

START DATE 9/26/17
END DATE 9/26/17
JOB DESCRIPTION Structure B-639, SR 226, Jack Creek
LOCATION Elko County
BORING 1N-2N
E.A. # 74025
GROUND ELEV. 6140 Feet
HAMMER DROP SYSTEM Auto

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft
9/27/17	8.5	6131.5

STATION L 138+03
OFFSET 18 Feet Right
ENGINEER K. Conrad
EQUIPMENT Dietrich D-120 Truck Mount
OPERATOR O.J. Altamirano
DRILLING METHOD Hollow Stem Auger
BACKFILLED Yes DATE 9/27/2017

ELEV. (ft)	DEPTH (ft)	SAMPLE		BLOW COUNT		Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		NO.	TYPE	6 inch Increments	Last 1 foot					
	16.50	D	CMS	46 40 22	62	100	W, UW, S, PL, LL, PI, UW	SM	Silty Sand, Very Dense Brown, Wet 16.00 Silty Sand, Medium Dense Brown, Wet	
	18.00	E	SPT	6 8 15	23	100	W, S, LL, PL, PI	SM		
	19.50	F	CMS	15 19 29	48	100	W, UW, LL, PL, PI, G, CU	MH SM	18.30 Sandy Silt, Dense 18.80 Dark Gray, Wet Silty Sand, Dense Dark Gray 19.50	
6120.0	20.00 20	G	SPT	150/6"		100	W, S		Weak Bedrock Dark Gray Refusal after 6 inches	
6115.0	25.00 25									
	25.50	H	SPT	100/6"		100	W, S		25.50	Bottom of hole at 25.5 feet

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GEOTECHNICAL ENGINEERING

EXPLORATION LOG

SHEET 1 OF 2

START DATE 9/27/17
END DATE 9/27/18
JOB DESCRIPTION Structure B-639, SR 226, Jack Creek
LOCATION Elko County
BORING 3S
E.A. # 74025
GROUND ELEV. 6138 Feet
HAMMER DROP SYSTEM Auto

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft
9/28/17	8.0	6130.0

STATION L 137+00
OFFSET 18 Feet Right
ENGINEER K. Conrad
EQUIPMENT Dietrich D-120 Truck Mount
OPERATOR O. J. Altimirano
DRILLING METHOD Hollow Stem Auger
BACKFILLED Yes DATE 9/28/2017

ELEV. (ft)	DEPTH (ft)	SAMPLE		BLOW COUNT			LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		NO.	TYPE	6 inch Increments	Last 1 foot	Percent Recov'd				
	1.00								Asphalt 0.50	
								GC	Base and Fill, Dense Dark Brown, Dry	
	1.30	A1	CMS	15		100	W,S			
	1.80	A2	CMS	17		100	W,S,LL,PL,PI		1.80	
	2.30	A3	CMS	12	29	100	W,UW,S,LL PL,PI,G	SM	Silty Sand with Gravel, Medium Dense Dark Brown, Wet	Down Pressure at 300 psi
	2.50									
	4.00	B	SPT	12 11 16	27	100	W,S,LL,PL,PI		3.50	
								SM	Silty Sand with Gravel, Dense Dark Gray, Moist	
	4.30									
6133.0	5									
	5.50	C	CMS	16 13 17	30	87	W,S,LL,PL,PI		5.50	
	7.00	D	SPT	5 5 24	29	73	W,S,LL,PL,PI	SM	Silty Sand with Gravel, Loose Brown, Moist 6.50	
								SM	Silty Sand with Gravel, Very Dense 7.00 Brown, Moist	
	▽									
	8.50	E	CMS	34 37 57	94	40	W,S,LL,PL,PI	GP-GM	Poorly Graded Gravel with Silt and Sand, Very Dense Dark Gray, Wet	
6128.0	10 10.00	F	SPT	28 29 50	79	73	W,S		10.50	
	13.50								Weak Bedrock	Down Pressure at 400 psi at 10.5 feet
	15.00		SPT	25/1"					Refusal, no sample recovered. 15.00	

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EXPLORATION LOG

SHEET 2 OF 2

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END DATE 9/27/18
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EQUIPMENT Dietrich D-120 Truck Mount
OPERATOR O. J. Altimirano
DRILLING METHOD Hollow Stem Auger
BACKFILLED Yes DATE 9/28/2017

ELEV. (ft)	DEPTH (ft)	SAMPLE		BLOW COUNT		Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
		NO.	TYPE	6 inch Increments	Last 1 foot					
	16.00		SPT	25/1.5"					Refusal, no sample recovered.	
			SPT	25/2.5"					Refusal, no sample recovered.	
									Weak Bedrock	Shoe bent at at tip Down Pressure at 500 psi at 20 feet
6118.0	20 20.00									
	20.50	G	SPT	70/6"		100	W, S		20.50 Damp Brown, 6 inches recovered. Refusal after 6 inches.	
										Bottom of Hole at 20.5 feet
6113.0	25									

APPENDIX C:

Laboratory Test Summary
Laboratory Test Results

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

EA/Cont # 74025 **Job Description** Jack Creek B-639 Replacement

Boring No. 1N **Elevation (ft)** 6139.85 **Station** **Date** 9/26/2017

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		
A1, A2	5.0 - 5.7	CMS_{bag}		SC	18.6		45.9	36	22	14						
A3	5.7 - 6.2	CMS			25.3	90.6		34	19	15						CU
AS	6.2 - 6.5	CMS_{bag}			17.5		22.5									
B	6.5 - 8.0	SPT			7.6		10.8									
C	8.0 - 9.0	CMS_{bag}			10.8		8.2									

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 # 74025 **Job Description** Jack Creek B-639 Replacement

Boring No. 2N **Elevation (ft)** 6139.80 **Station** **Date** 9/27/2017

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	4.0 - 10.0			SC	25.6		47.5	36	22	14						H
A	10.0 - 11.5	SPT		SM	32.3		24.5	38	32	6						
B1	11.8 - 11.8	CMS_{bag}		SM	30.0		25.0	35	32	3						
B2	11.8 - 12.3	CMS		SM	34.4	84.8	21.8	39	33	6						OC
B3	12.3 - 12.8	CMS		SM	28.8	90.4	23.7	37	34	3						OC
C	13.0 - 14.5	SPT		SM	21.9		22.2	36	33	3						
D1, D2	15.0 - 15.8	CMS_{bag}		SM	23.4		24.6	37	NP	NP						
D3	15.8 - 16.3	CMS		SM	27.0	70.0	20.1	40	NP	NP						
E	16.5 - 18.0	SPT		SM	29.8		24.6	39	NP	NP						
F1	18.0 - 18.3	CMS_{bag}		SM	37.9		37.1	39	NP	NP						
F2	18.3 - 18.8	CMS		MH			54.1	59	55	4						
F3	18.8 - 19.3	CMS		SM	43.8	73.7	31.8	49	42	7						CU, G = 2.648

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
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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
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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 # 74025 **Job Description** Jack Creek B-639 Replacement

Boring No. 2N **Elevation (ft)** 6139.80 **Station** **Date** 9/27/2017

SAMPLE NO.	SAMPLE DEPTH (ft)	SAMPLER 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		
G	19.5 - 20.0	SPT			26.9		20.4									
H	25.0 - 25.5	SPT			11.3		15.0									

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
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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
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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 # 74025 **Job Description** Jack Creek B-639 Replacement

Boring No. 3S **Elevation (ft)** 6138.46 **Station** **Date** 9/27/2017

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		
A1	1.0 - 1.3	CMS_{bag}			3.8		23.2									
A2	1.3 - 1.8	CMS_{bag}		GC	4.7		14.6	22	14	8						
A3	1.8 - 2.3	CMS		SM	25.2	88.7	35.6	49	31	18						G = 2.591
B	2.5 - 4.0	SPT		SM	17.8		24.5	41	31	10						
C2,C3,CS	4.3 - 5.5	CMS_{bag}		SM	14.9		19.0	41	29	12						
D	5.5 - 7.0	SPT		SM	19.4		39.1	37	27	10						
E1-E3,ES	7.0 - 8.5	CMS_{bag}		GP-GM	6.9		8.3	22	20	2						
F	8.5 - 10.0	SPT			10.7		10.7									
G	20.0 - 20.5	SPT			10.8		18.2									

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

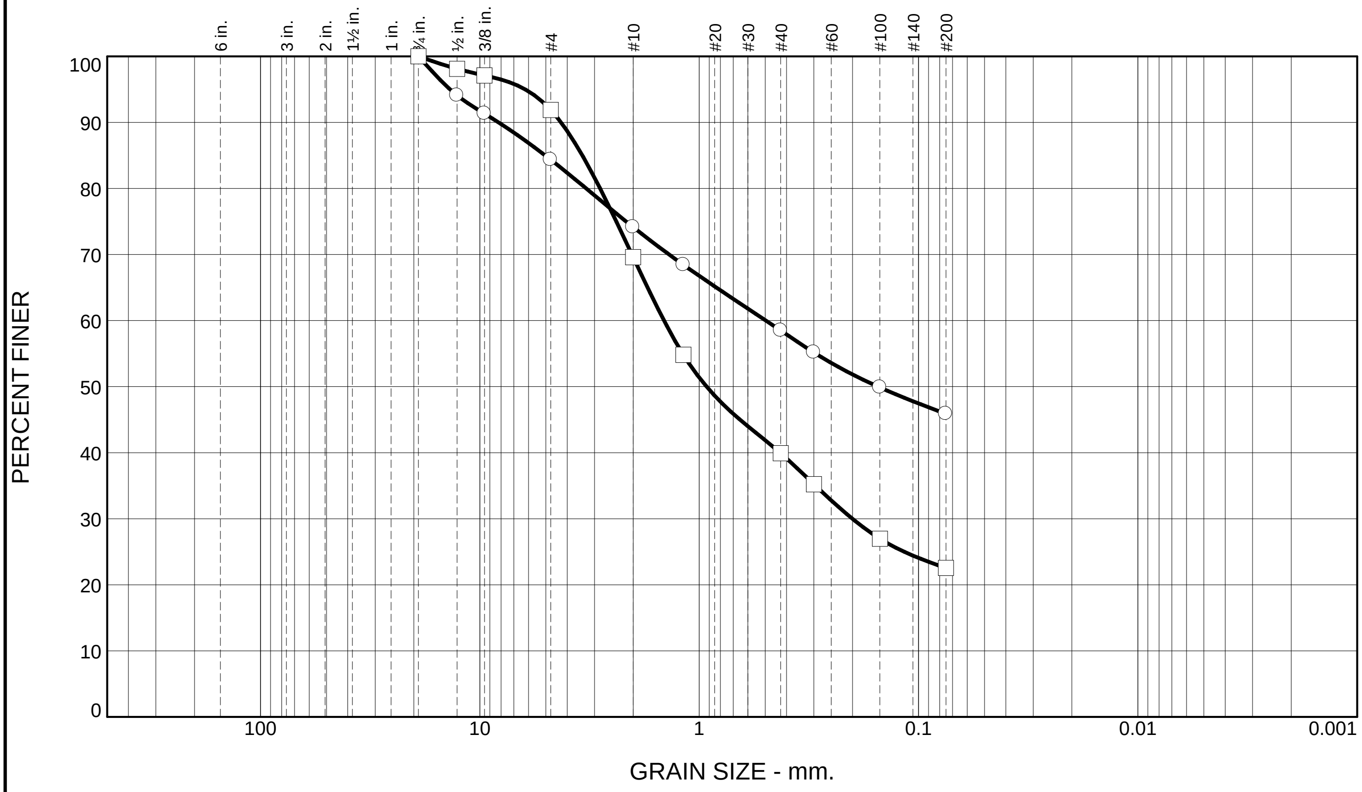
U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
Φ = Friction
C = Cohesion
N = No. of blows per ft., sampler
N = Field SPT N = $(N_{css})(0.62)$

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**

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	15.7	38.4	45.9		SC	A-6(3)	22	36
☐	0.0	8.1	69.4	22.5					

SIEVE inches size	PERCENT FINER ○	☐	
3/4"	100.0	100.0	
1/2"	94.1	98.1	
3/8"	91.3	97.1	
	GRAIN SIZE		
D_{60}	0.4967	1.4464	
D_{30}		0.2002	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	☐	
#4	84.3	91.9	
#10	74.1	69.6	
#16	68.4	54.8	
#40	58.5	39.9	
#50	55.2	35.2	
#100	49.9	27.0	
#200	45.9	22.5	

Material Description

○ clayey sand with gravel

☐

REMARKS:

○

☐

○ Source of Sample: 1N Depth: 5.0' - 5.7' Sample Number: A1,A2

☐ Source of Sample: 1N Depth: 6.2' - 6.5' Sample Number: AS

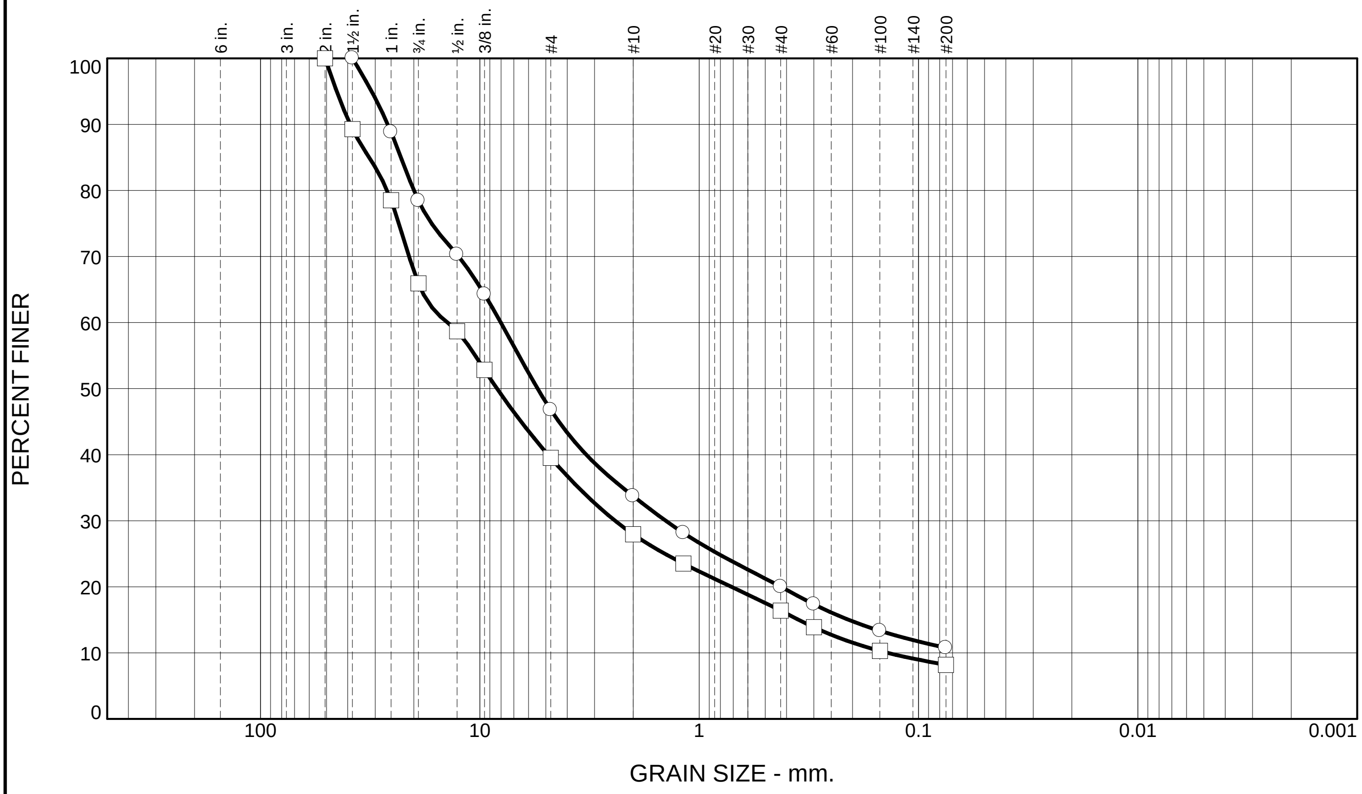
NEVADA DEPARTMENT OF TRANSPORTATION

Client: K. Conrad

Project: Jack Creek B-639 Replacement

Project No.: EA 74025 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	53.2	36.0	10.8					
□	0.0	60.5	31.3	8.2					

SIEVE inches size	PERCENT FINER ○	□	
2"		100.0	
1.5"	100.0	89.3	
1"	88.8	78.5	
3/4"	78.5	65.9	
1/2"	70.3	58.7	
3/8"	64.3	52.8	
	GRAIN SIZE		
D_{60}	8.0262	14.0387	
D_{30}	1.4203	2.4175	
D_{10}		0.1383	
	COEFFICIENTS		
C_c		3.01	
C_u		101.51	

SIEVE number size	PERCENT FINER ○	□	
#4	46.8	39.5	
#10	33.7	28.0	
#16	28.2	23.5	
#40	20.0	16.4	
#50	17.4	13.9	
#100	13.3	10.3	
#200	10.8	8.2	

Material Description

○

□

REMARKS:

○

□

○ Source of Sample: 1N Depth: 6.5' - 8.0' Sample Number: B

□ Source of Sample: 1N Depth: 8.0' - 9.0' Sample Number: C

NEVADA DEPARTMENT OF TRANSPORTATION

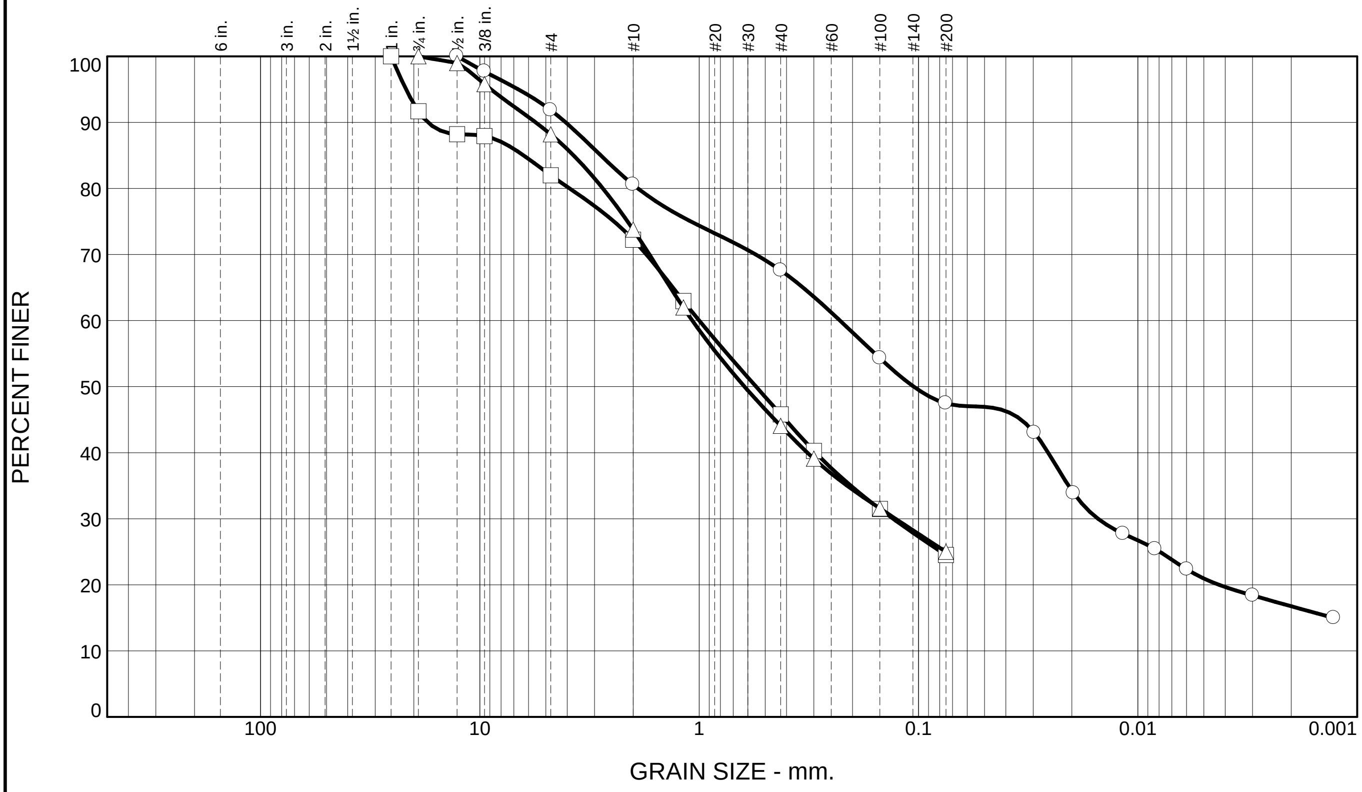
Client: K. Conrad

Project: Jack Creek B-639 Replacement

Project No.: EA 74025

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	8.2	44.3	30.7	16.8	SC	A-6(4)	22	36
□	0.0	18.0	57.5	24.5		SM	A-1-b	32	38
△	0.0	11.8	63.2	25.0		SM	A-1-b	32	35

SIEVE inches size	PERCENT FINER ○	□	△
1"		100.0	
3/4"		91.7	100.0
1/2"	100.0	88.2	99.0
3/8"	97.7	87.9	95.8
	GRAIN SIZE		
D_{60}	0.2281	1.0000	1.0744
D_{30}	0.0152	0.1306	0.1274
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	91.8	82.0	88.2
#10	80.6	72.2	73.8
#16		63.0	62.0
#40	67.6	45.8	44.1
#50		40.3	39.1
#100	54.3	31.5	31.6
#200	47.5	24.5	25.0

Material Description
○ clayey sand

□ silty sand with gravel

△ silty sand

REMARKS:
○

□

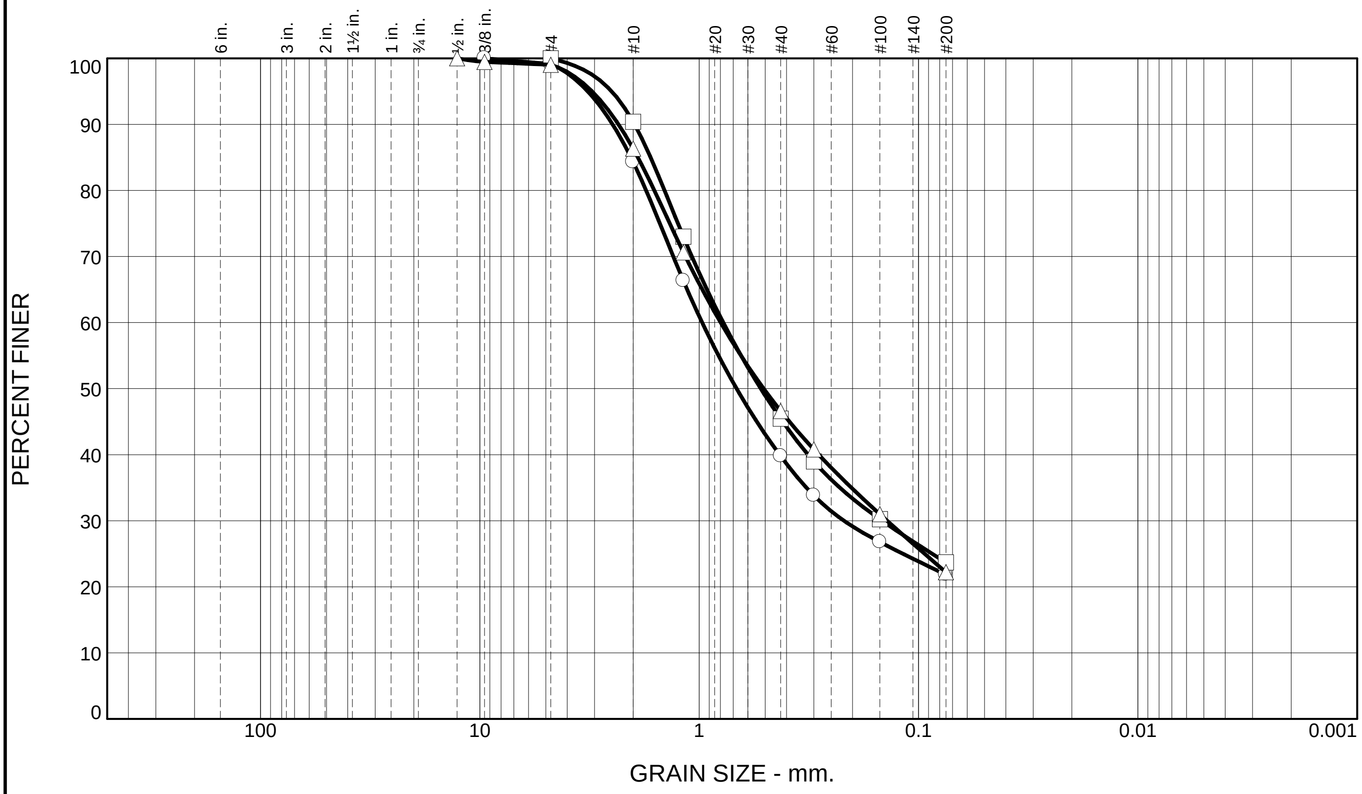
△

○ Source of Sample: 2N Depth: 4.0' - 10.0' Sample Number: BULK
□ Source of Sample: 2N Depth: 10.0' - 11.5' Sample Number: A
△ Source of Sample: 2N Depth: 11.8' - 11.8' Sample Number: B1

NEVADA
DEPARTMENT OF
TRANSPORTATION

Client: K. Conrad
Project: Jack Creek B-639 Replacement
Project No.: EA 74025
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.9	77.3	21.8		SM	A-1-b	33	39
□	0.0	0.0	76.3	23.7		SM	A-1-b	34	37
△	0.0	1.0	76.8	22.2		SM	A-1-b	33	36

SIEVE inches size	PERCENT FINER ○	□	△
1/2"			100.0
3/8"	100.0		99.5
	GRAIN SIZE		
D_{60}	0.9694	0.7769	0.7983
D_{30}	0.2188	0.1465	0.1390
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	99.1	100.0	99.0
#10	84.3	90.4	86.3
#16	66.3	73.0	70.6
#40	39.8	45.4	46.6
#50	33.8	39.0	40.8
#100	26.8	30.2	31.0
#200	21.8	23.7	22.2

Material Description

○ silty sand

□ silty sand

△ silty sand

REMARKS:

○

□

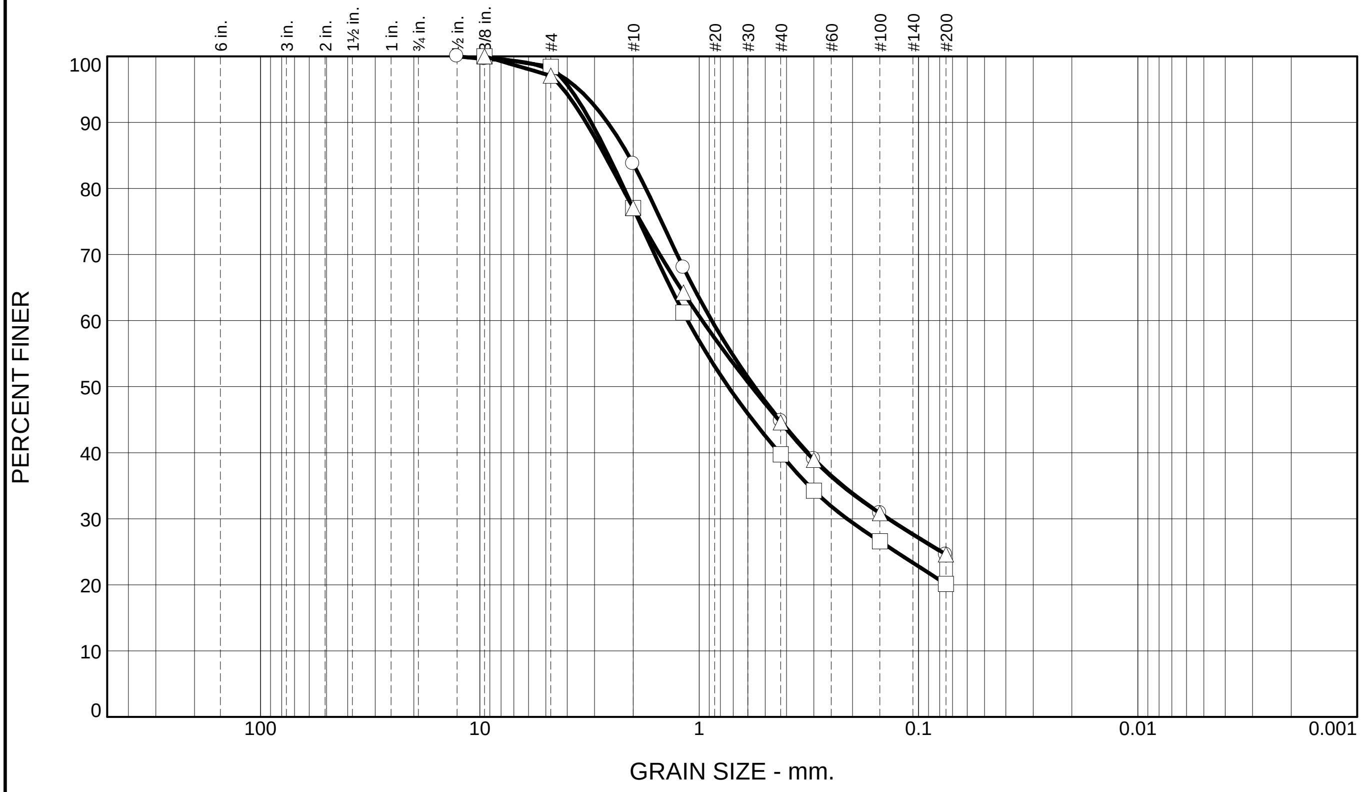
△

○ Source of Sample: 2N	Depth: 11.8' - 12.3'	Sample Number: B2
□ Source of Sample: 2N	Depth: 12.3' - 12.8'	Sample Number: B3
△ Source of Sample: 2N	Depth: 13.0' - 14.5'	Sample Number: C

**NEVADA
DEPARTMENT OF
TRANSPORTATION**

Client: K. Conrad
Project: Jack Creek B-639 Replacement
Project No.: EA 74025
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	2.1	73.3	24.6		SM	A-1-b	NP	37
□	0.0	1.6	78.3	20.1		SM	A-1-b	NP	40
△	0.0	2.9	72.5	24.6		SM	A-1-b	NP	39

SIEVE inches size	PERCENT FINER ○	□	△
1/2"	100.0		
3/8"	99.6	100.0	100.0
	GRAIN SIZE		
D_{60}	0.8766	1.1281	0.9689
D_{30}	0.1370	0.2118	0.1372
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	97.9	98.4	97.1
#10	83.7	77.0	77.0
#16	68.0	61.2	64.2
#40	44.8	39.7	44.6
#50	39.0	34.2	38.9
#100	30.9	26.6	30.8
#200	24.6	20.1	24.6

Material Description

○ silty sand

□ silty sand

△ silty sand

REMARKS:

○

□

△

○ Source of Sample: 2N Depth: 15.0' - 15.8' Sample Number: D1,D2

□ Source of Sample: 2N Depth: 15.8' - 16.3' Sample Number: D3

△ Source of Sample: 2N Depth: 16.5' - 18.0' Sample Number: E

NEVADA DEPARTMENT OF TRANSPORTATION

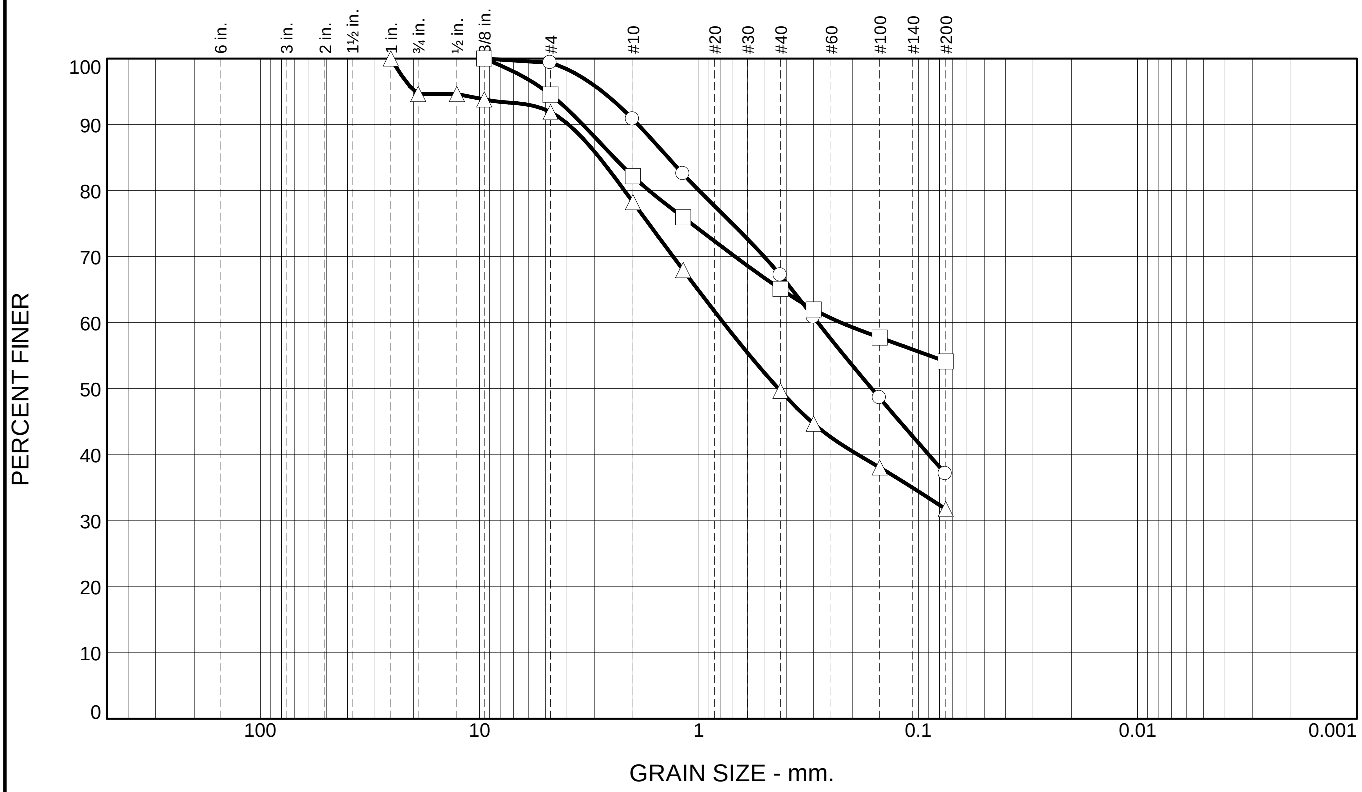
Client: K. Conrad

Project: Jack Creek B-639 Replacement

Project No.: EA 74025

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.6	62.3	37.1		SM	A-4(0)	NP	39
□	0.0	5.5	40.4	54.1		MH	A-5(3)	55	59
△	0.0	8.1	60.1	31.8		SM	A-2-5(0)	42	49

SIEVE inches size	PERCENT FINER ○	□	△
1"			100.0
3/4"			94.6
1/2"			94.6
3/8"	100.0	100.0	93.8
	GRAIN SIZE		
D_{60}	0.2871	0.2252	0.7743
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	99.4	94.5	91.9
#10	90.8	82.2	78.3
#16	82.5	76.0	68.0
#40	67.2	65.1	49.7
#50	60.8	62.0	44.7
#100	48.6	57.7	38.1
#200	37.1	54.1	31.8

Material Description
○ silty sand

□ sandy elastic silt

△ silty sand

REMARKS:
○

□

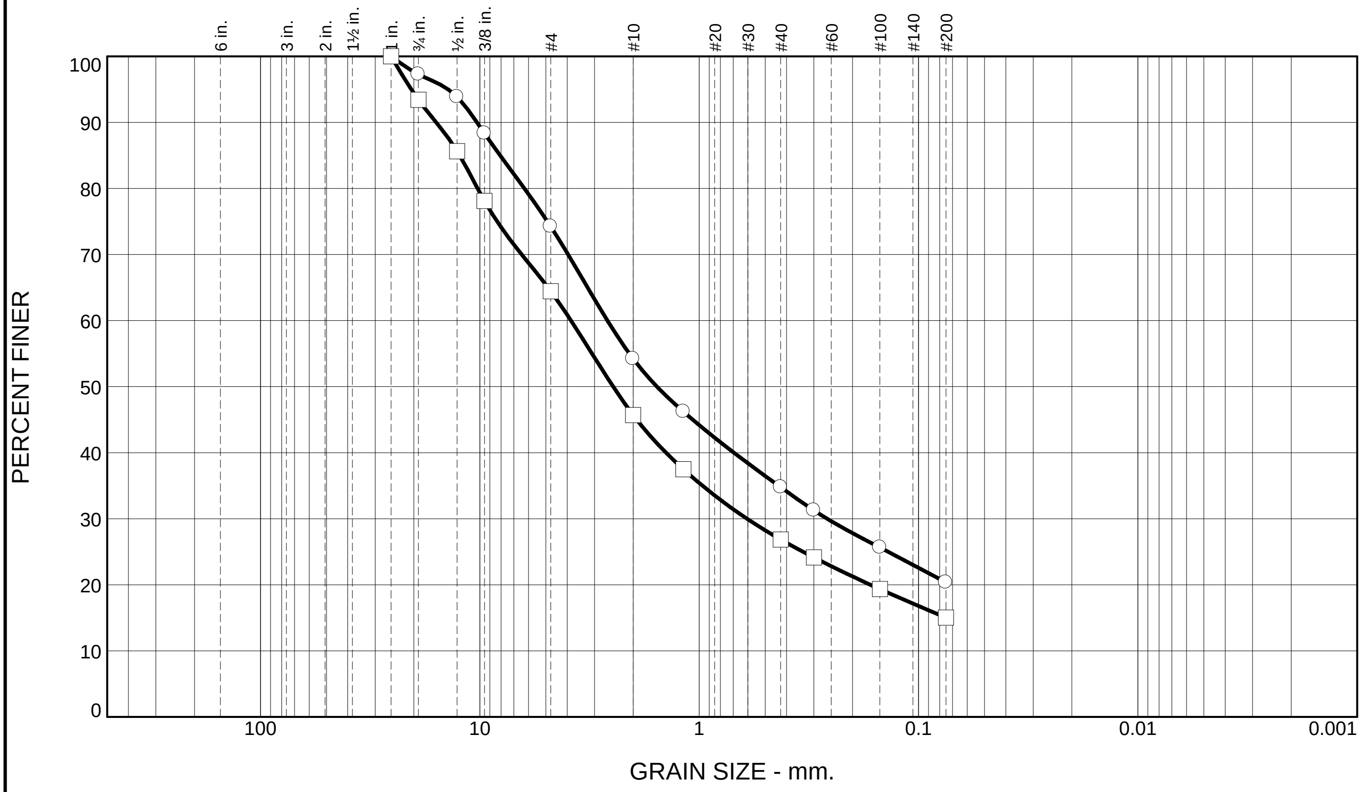
△

○ Source of Sample: 2N Depth: 18.0' - 18.3' Sample Number: F1
□ Source of Sample: 2N Depth: 18.3' - 18.8' Sample Number: F2
△ Source of Sample: 2N Depth: 18.8' - 19.3' Sample Number: F3

NEVADA
DEPARTMENT OF
TRANSPORTATION

Client: K. Conrad
Project: Jack Creek B-639 Replacement
Project No.: EA 74025 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	25.8	53.8	20.4					
□	0.0	35.6	49.4	15.0					

SIEVE inches size	PERCENT FINER ○	□	
1"	100.0	100.0	
3/4"	97.3	93.4	
1/2"	93.9	85.6	
3/8"	88.3	78.1	
	GRAIN SIZE		
D_{60}	2.6204	3.8429	
D_{30}	0.2608	0.6053	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	
#4	74.2	64.4	
#10	54.2	45.7	
#16	46.2	37.5	
#40	34.8	26.9	
#50	31.3	24.1	
#100	25.6	19.4	
#200	20.4	15.0	

Material Description

○

□

REMARKS:

○

□

○Source of Sample: 2N Depth: 19.5' - 20.0' Sample Number: G

□Source of Sample: 2N Depth: 25.0' - 25.5' Sample Number: H

**NEVADA
DEPARTMENT OF
TRANSPORTATION**

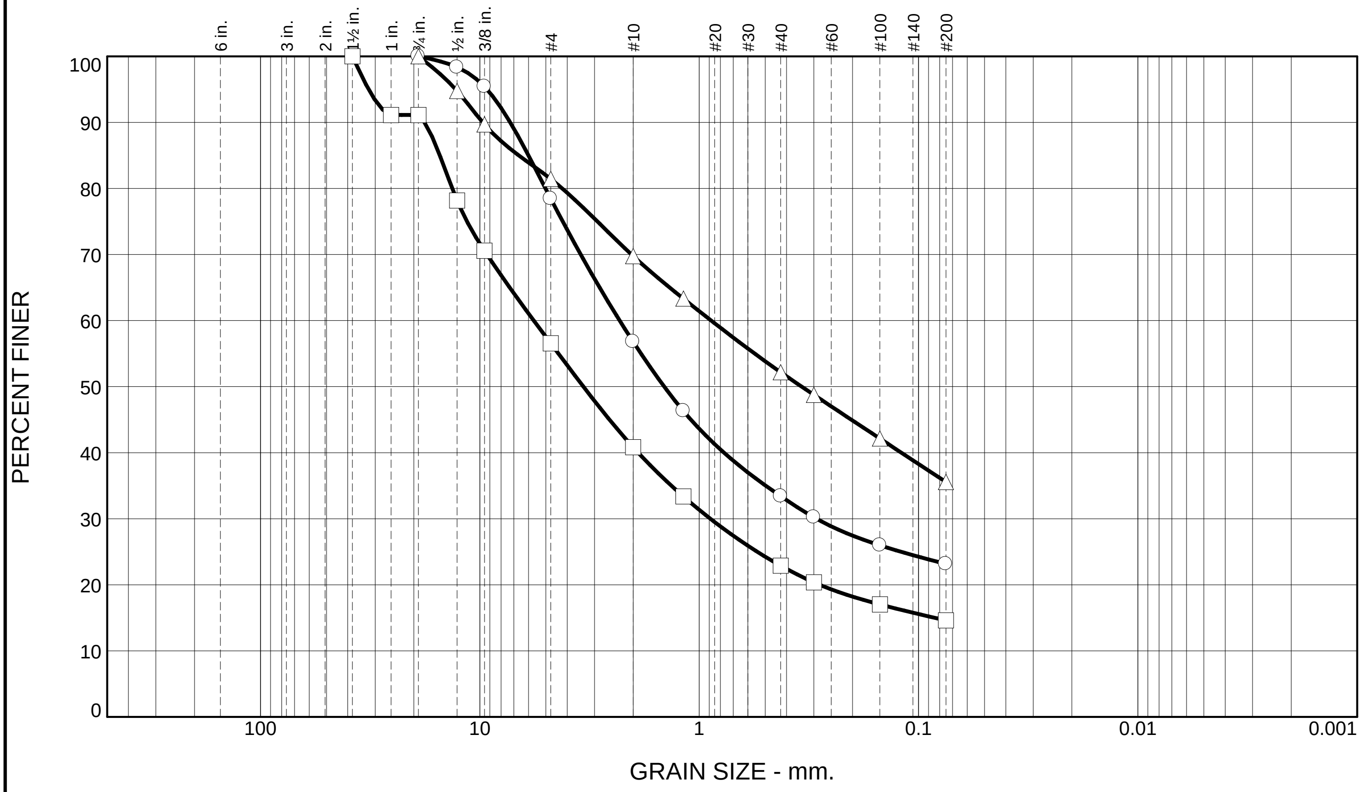
Client: K. Conrad

Project: Jack Creek B-639 Replacement

Project No.: EA 74025

Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	21.6	55.2	23.2					
□	0.0	43.4	42.0	14.6		GC	A-2-4(0)	14	22
△	0.0	18.6	45.8	35.6		SM	A-7-5(2)	31	49

SIEVE inches size	PERCENT FINER ○	□	△
1.5"		100.0	
1"		91.1	
3/4"	100.0	91.1	100.0
1/2"	98.3	78.2	94.8
3/8"	95.4	70.6	89.7
	GRAIN SIZE		
D_{60}	2.3048	5.6781	0.8819
D_{30}	0.2921	0.8890	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	78.4	56.6	81.4
#10	56.8	40.8	69.8
#16	46.3	33.4	63.3
#40	33.4	22.9	52.2
#50	30.2	20.4	48.8
#100	26.0	17.0	42.1
#200	23.2	14.6	35.6

Material Description

○

□clayey gravel with sand

△silty sand with gravel

REMARKS:

○

□

△

○Source of Sample: 3S Depth: 1.0' - 1.3' Sample Number: A1
□Source of Sample: 3S Depth: 1.3' - 1.8' Sample Number: A2
△Source of Sample: 3S Depth: 1.8' - 2.3' Sample Number: A3

NEVADA
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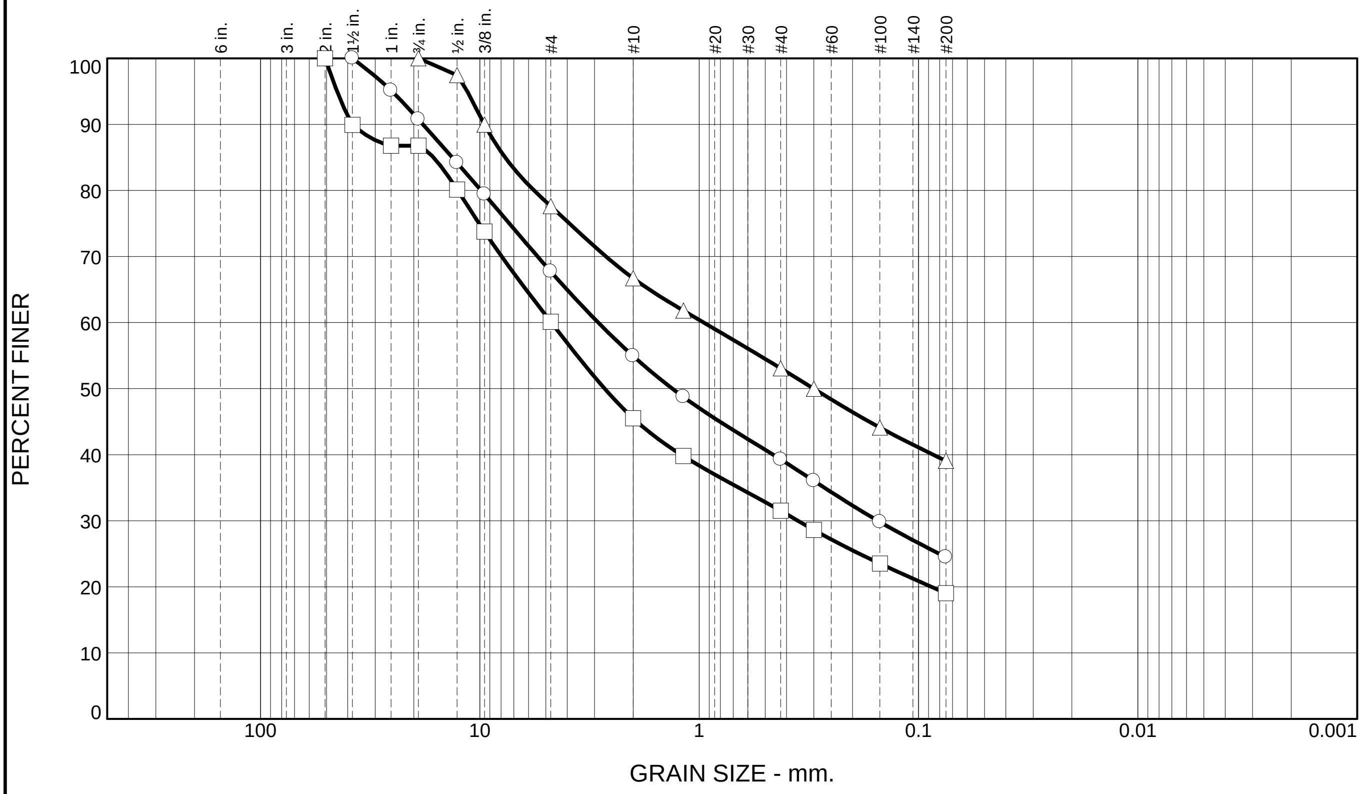
TRANSPORTATION

Client: K. Conrad
Project: Jack Creek B-639 Replacement
Project No.: EA 74025
Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	32.3	43.2	24.5		SM	A-2-5(0)	31	41
□	0.0	39.9	41.1	19.0		SM	A-2-7(0)	29	41
△	0.0	22.4	38.5	39.1		SM	A-4(1)	27	37

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER △
2"		100.0	
1.5"	100.0	89.9	
1"	95.1	86.8	
3/4"	90.7	86.8	100.0
1/2"	84.2	80.1	97.5
3/8"	79.4	73.8	90.0
	GRAIN SIZE		
D_{60}	2.8862	4.7194	0.9537
D_{30}	0.1534	0.3547	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER △
#4	67.7	60.1	77.6
#10	54.9	45.5	66.7
#16	48.7	39.8	61.8
#40	39.3	31.5	53.1
#50	36.0	28.6	50.0
#100	29.8	23.5	44.1
#200	24.5	19.0	39.1

Material Description

○ silty sand with gravel

□ silty sand with gravel

△ silty sand with gravel

REMARKS:

○

□

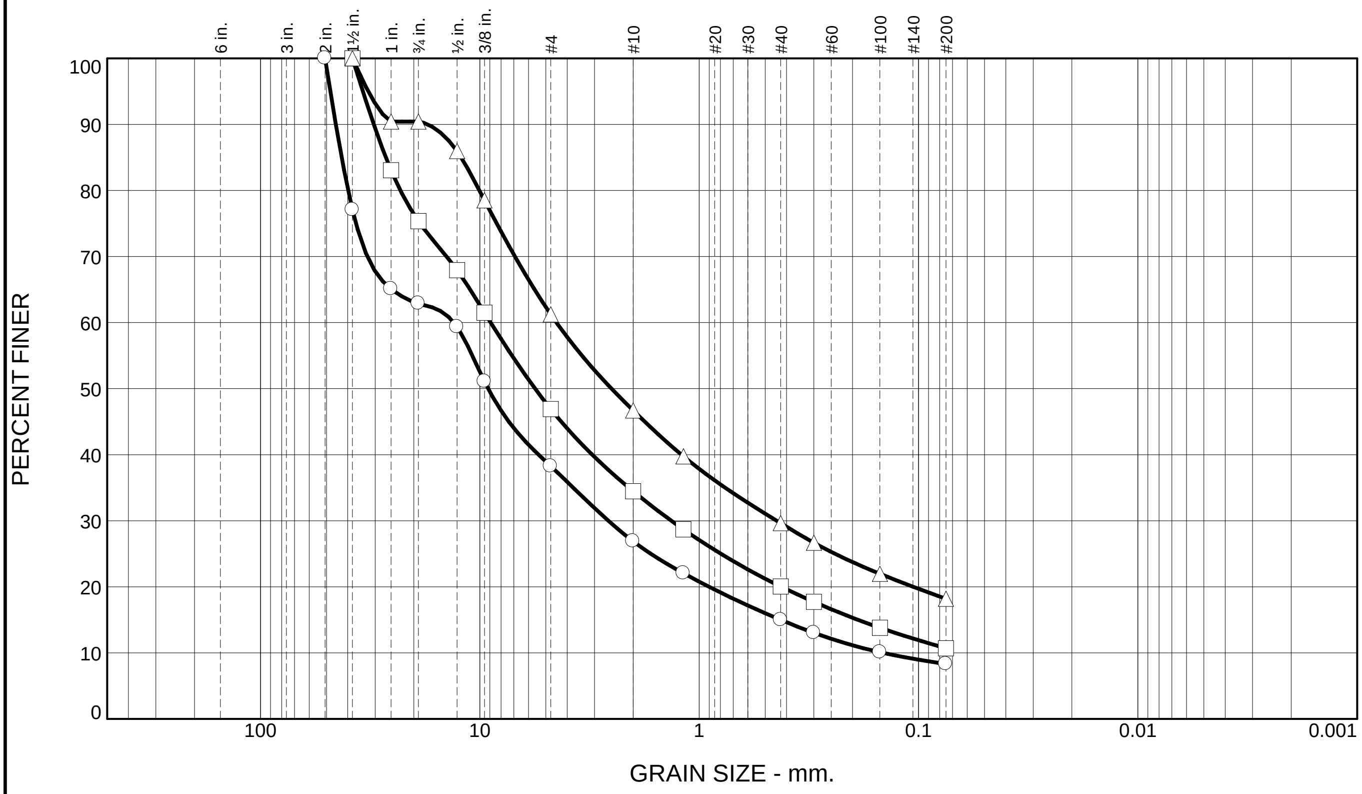
△

○ Source of Sample: 3S Depth: 2.5' - 4.0' Sample Number: B
□ Source of Sample: 3S Depth: 4.3' - 5.5' Sample Number: C2,C3,CS
△ Source of Sample: 3S Depth: 5.5' - 7.0' Sample Number: D

**NEVADA
DEPARTMENT OF
TRANSPORTATION**

Client: K. Conrad
Project: Jack Creek B-639 Replacement
Project No.: EA 74025 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	61.7	30.0	8.3		GP-GM	A-1-a	20	22
□	0.0	53.1	36.2	10.7					
△	0.0	38.8	43.0	18.2					

SIEVE inches size	PERCENT FINER ○	□	△
2"	100.0		
1.5"	77.1	100.0	100.0
1"	65.1	83.1	90.4
3/4"	62.9	75.4	90.4
1/2"	59.3	67.9	86.0
3/8"	51.1	61.5	78.5
	GRAIN SIZE		
D_{60}	13.1365	8.9281	4.4732
D_{30}	2.5941	1.3390	0.4431
D_{10}	0.1454		
	COEFFICIENTS		
C_c	3.52		
C_u	90.33		

SIEVE number size	PERCENT FINER ○	□	△
#4	38.3	46.9	61.2
#10	26.9	34.5	46.7
#16	22.1	28.7	39.7
#40	15.0	20.0	29.6
#50	13.0	17.7	26.7
#100	10.1	13.8	22.0
#200	8.3	10.7	18.2

Material Description

○ poorly graded gravel with silt and sand

□

△

REMARKS:

○

□

△

○ Source of Sample: 3S Depth: 7.0' - 8.5' Sample Number: E1,E2,E3,ES

□ Source of Sample: 3S Depth: 8.5' - 10.0' Sample Number: F

△ Source of Sample: 3S Depth: 20.0' - 20.5' Sample Number: G

**NEVADA
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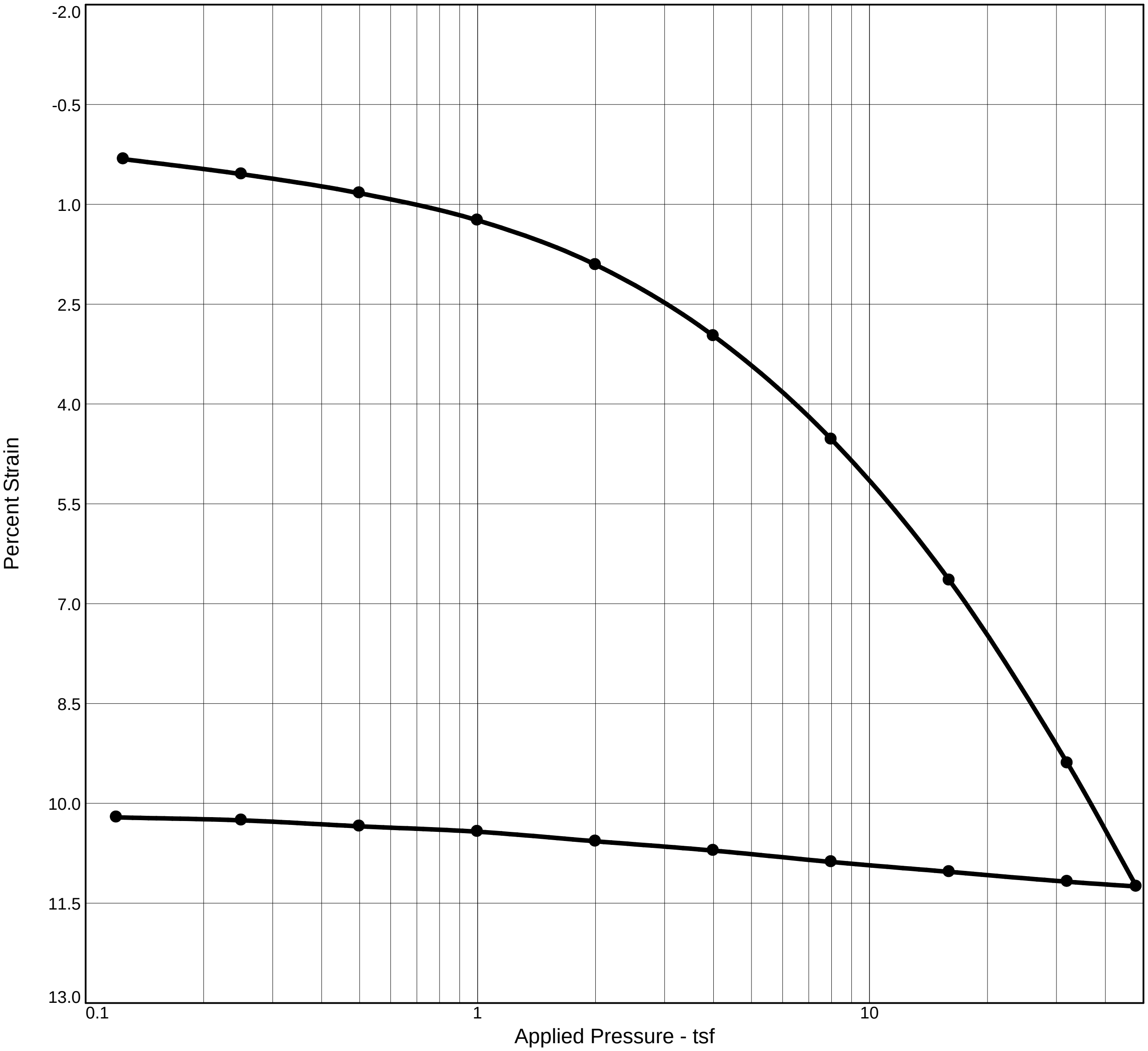
Client: K. Conrad

Project: Jack Creek B-639 Replacement

Project No.: EA 74025

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
89.3 %	33.5 %	84.4	39	6	2.743	0.6	7.1	0.21		1.028

MATERIAL DESCRIPTION	USCS	AASHTO
silty sand	SM	A-1-b

Project No. EA 74025 **Client:** K. Conrad

Project: Jack Creek B-639 Replacement

Source of Sample: 2N **Depth:** 11.8' - 12.3' **Sample Number:** B2 a

Remarks:

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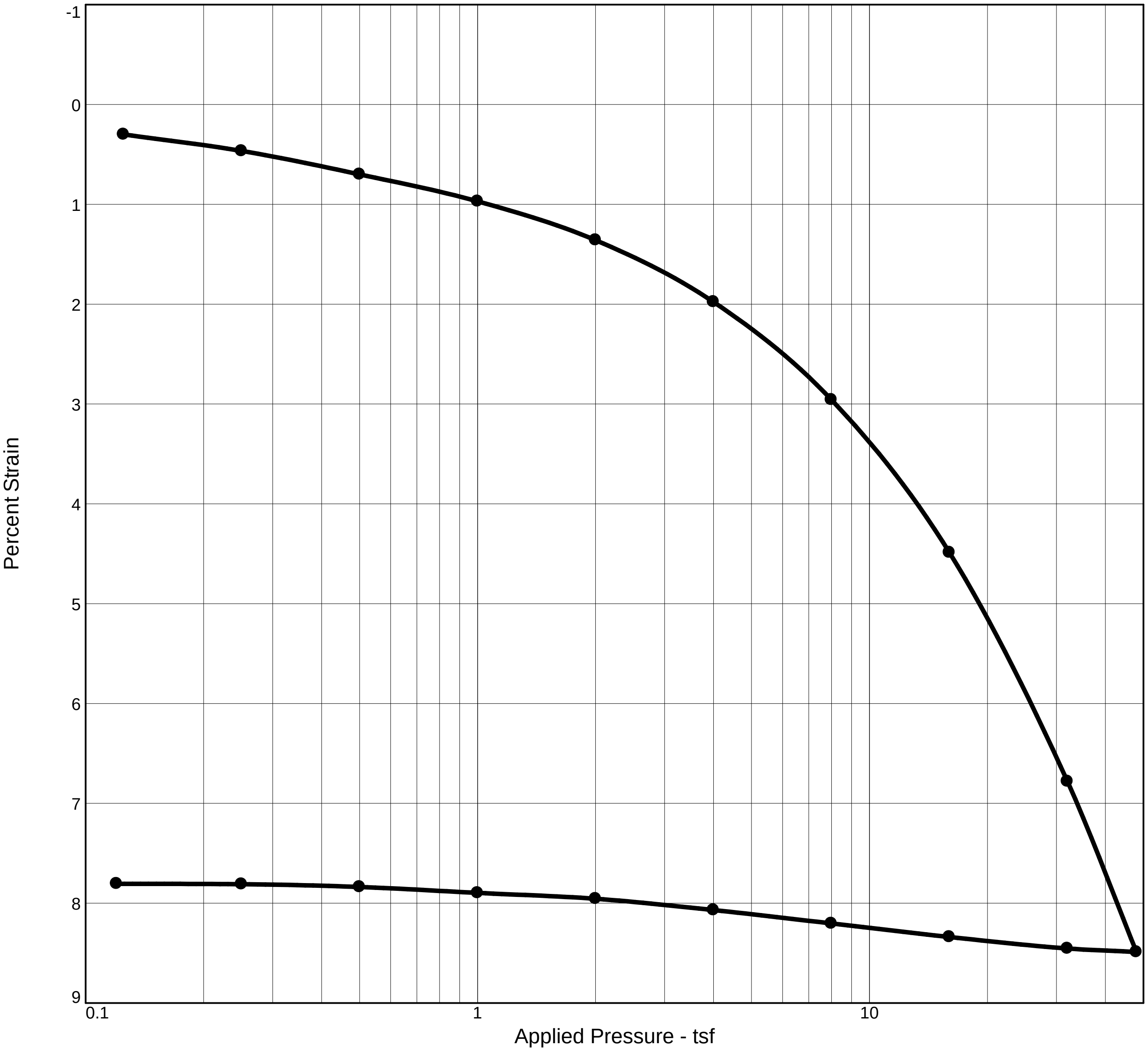
Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
90.9 %	31.5 %	87.8	39	6	2.743	0.6	11.1	0.19		0.950

MATERIAL DESCRIPTION	USCS	AASHTO
silty sand	SM	A-1-b

Project No. EA 74025 **Client:** K. Conrad

Project: Jack Creek B-639 Replacement

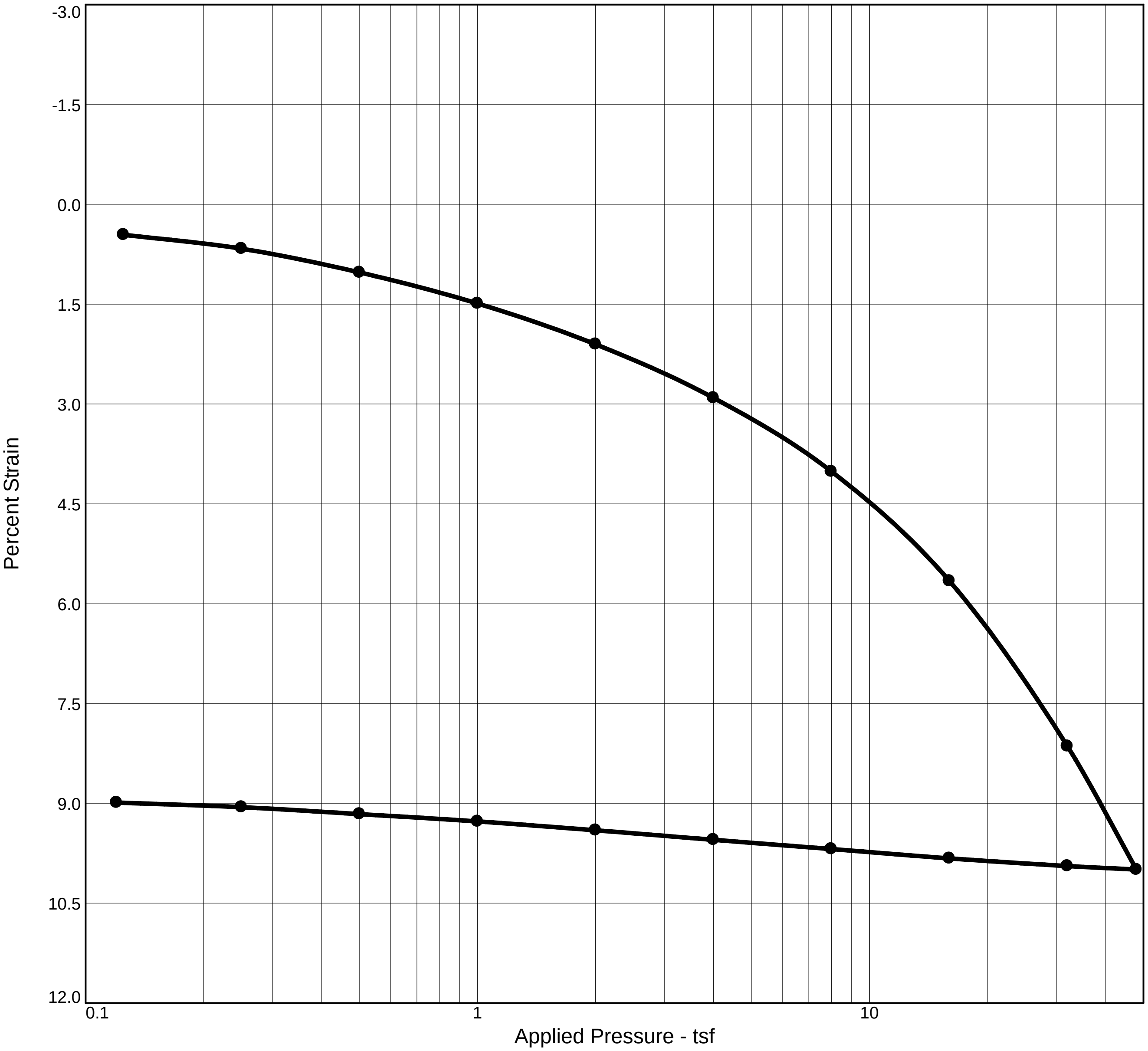
Source of Sample: 2N **Depth:** 11.8' - 12.3' **Sample Number:** B2 b

NEVADA DEPARTMENT OF TRANSPORTATION

Remarks:

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
80.5 %	28.0 %	87.1	37	3	2.710	0.6	7.3	0.21		0.942

MATERIAL DESCRIPTION	USCS	AASHTO
silty sand	SM	A-1-b

Project No. EA 74025 **Client:** K. Conrad

Project: Jack Creek B-639 Replacement

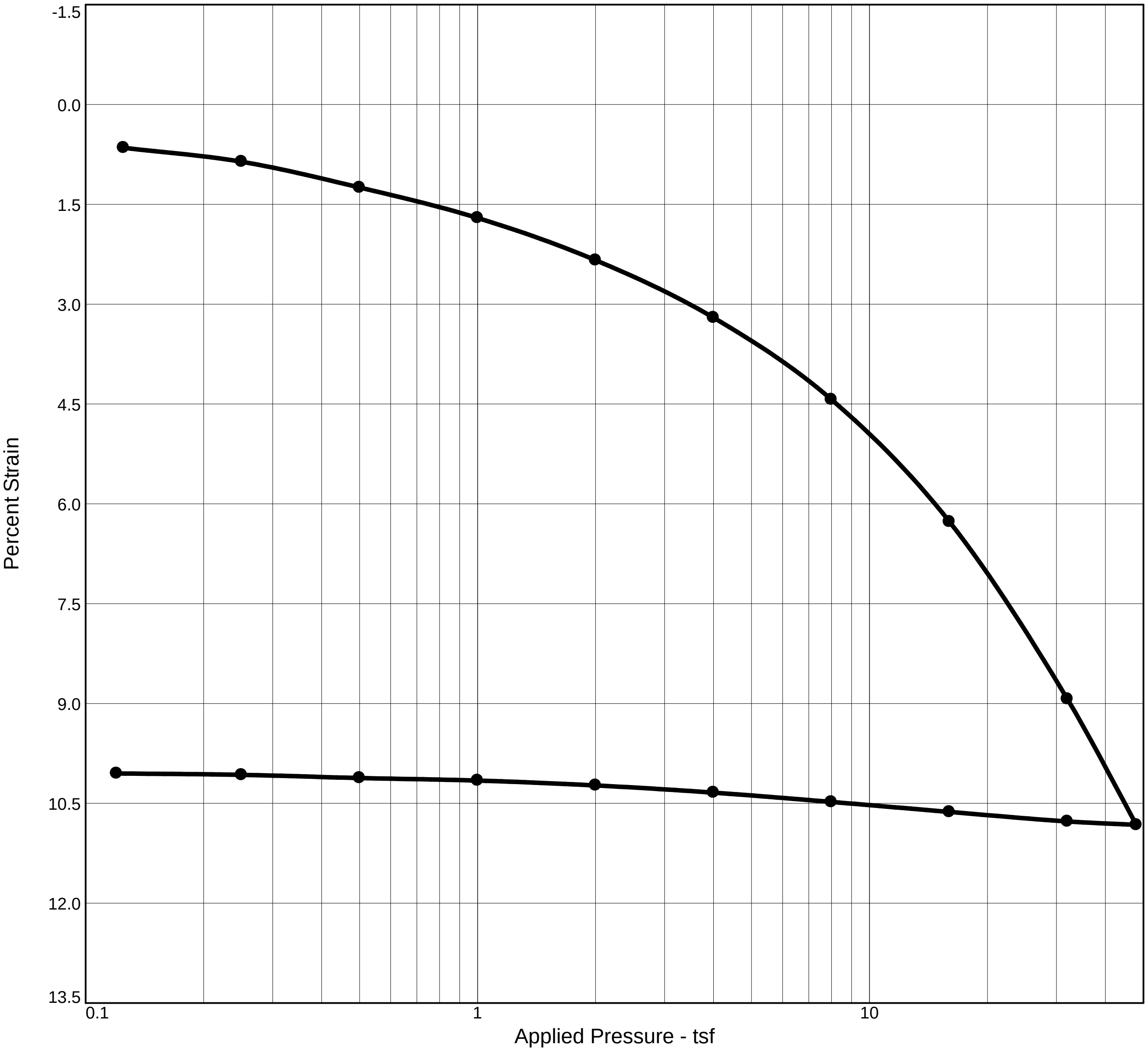
Source of Sample: 2N **Depth:** 12.3' - 12.8' **Sample Number:** B3 a

Remarks:

NEVADA DEPARTMENT OF TRANSPORTATION

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
88.1 %	30.0 %	87.9	37	3	2.710	0.6	0.3	0.03		0.924

MATERIAL DESCRIPTION	USCS	AASHTO
silty sand	SM	A-1-b

Project No. EA 74025 **Client:** K. Conrad

Project: Jack Creek B-639 Replacement

Source of Sample: 2N **Depth:** 12.3' - 12.8' **Sample Number:** B3 b

Remarks:

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Figure

APPENDIX D:

Geophysical Test Results

Shear Wave Velocity Profile

Jack Creek Bridge