RockSol
Consulting Group, Inc.

July 27, 2015

J.F. Sato and Associates
5878 South Rapp Street
Littleton, CO 80120

Attention: Mr. Gaurav Vasisht, PE, PTOE

Subject: Soil Investigation Report, US 50 West – Westbound Preliminary Design, Purcell Boulevard to Wills Boulevard, CDOT Project No. STA 0503-088 (20448), Task Order No.7, Pueblo County, Colorado, RockSol Project Number 302.02

Dear Mr. Vasisht:

RockSol Consulting Group, Inc. (RockSol) has performed a geotechnical investigation for the US 50 West Westbound Preliminary Design Project in Pueblo County, Colorado (See Figure 1, Site Vicinity Map). This Soil Investigation Report presents information on the subsurface soil, groundwater, and bedrock conditions obtained from soil borings performed within the project limits from Purcell Boulevard (western project limit) to Wills Boulevard (eastern project limit). A brief discussion of local geologic conditions and the subsurface conditions encountered are presented in this report. Also presented is a summary of the lab testing performed on recovered soil and bedrock samples recovered from the project site. RockSol performed a geotechnical evaluation for eastbound US 50 within the project limits in 2013 that included Falling Weight Deflectometer (FWD) testing along WB US50. Results of the 2013 geotechnical evaluation are presented in the Foundation Investigation, Pavement Design, and Soil Investigation Reports dated July 31, 2014 (See References 1 through 3, listed at the end of this report).

Surface and groundwater hydrology, hydraulic engineering, and environmental studies including contaminant characterization were not included in RockSol's scope of work.

Project Description

Project descriptions are based on information provided in the Colorado Department of Transportation (CDOT) *Scope of Work Task Order 7* Memorandum dated September 24, 2014, *U.S. 50 Westbound Wills to Purcell WB Realignment (20448)* plan sheets dated March 5, 2015 and April 8, 2015, provided by J.F.Sato and Associates (J.F. Sato) and discussions with JF Sato.

The purpose of Task Order No. 7 is to develop a conceptual level of design for the US 50 PEL Preferred Alternative between Wills Boulevard and Purcell Boulevard, including grade separation at Pueblo Boulevard and preliminary level design for the improvement projects identified in the US 50 PEL Preferred Alternative Implementation Plan. Based on the information provided in the *CDOT Scope of Work Task Order No. 7*, these improvements include:

- Widening westbound US 50 from 2 to 3 lanes from Wills Boulevard to approximately 1,500 ft west of Purcell Boulevard.
- Realigning westbound US 50 to be parallel to the eastbound lanes in the vicinity of Pueblo Blvd. (Approximately 3,000 feet to the east and west of Pueblo Boulevard).
- Modifying the existing eastbound and westbound US50 and Pueblo Boulevard intersections.
- Widening Pueblo Boulevard south of US 50 to accommodate additional turn lanes.
- Modifying the intersections at US 50 and Purcell Boulevard and US 50 and Wills Boulevard.
- Constructing a westbound US 50 acceleration lane between Wills Boulevard and the Burlington Northern Santa Fe (BNSF) railroad bridge.

- Replacing the existing WB US 50 bridge over Wild Horse Dry Creek.
- Adding a temporary connection lane between the new westbound US 50 lanes and the existing US 50 westbound lanes.
- Modifying the slope paving, adjacent to the westbound US 50 lanes, at the BNSF underpass to accommodate the additional westbound US 50 through lane.
- Extending the Williams Creek Box Culvert (CBC) under US 50 to accommodate US 50 widening.
- Analyzing the Williams Creek CBC under Pueblo Blvd with regards to future grade separation at the US 50 and Pueblo Boulevard intersection.
- Providing a bike/pedestrian trail between Wills Boulevard and Pueblo Boulevard.
- Providing pedestrian access along the west side of Purcell Boulevard between Haley Lane and Kimble Drive.
- Extending the CBC under Purcell Boulevard to accommodate the proposed bike/pedestrian trail as well as future widening of US 50.

The new westbound US 50 bridge over Wild Horse Creek is proposed as a three span structure with approximate 60 foot to 70 foot span lengths and will be a multi-lane bridge approximately 60 feet in width. Construction for the new westbound US 50 bridge over Wild Horse Creek will also include placement of approximately 2 feet to 8 feet of embankment fill material within the existing center median area to match the existing eastbound US 50 roadway elevation.

Existing Site Conditions

Undeveloped land and a mix of commercial and residential development borders the project area and includes a CDOT maintenance facility located near the northwest corner of westbound US 50 and Pueblo Boulevard and a wastewater treatment plant located south of US 50, between Pueblo Boulevard and Purcell Boulevard. Topography at the site generally consists of flat to mild slopes with a general trend of decreasing elevation toward Wild Horse Creek and Williams Creek. Moderate to steep bank slopes were noted along both Wild Horse Creek and Williams Creek. Low water flow conditions were noted within both Wild Horse Creek and Williams Creek during our field work.

The current alignment of westbound US 50 was the original route for both eastbound and westbound US 50 until two new lanes were constructed for eastbound US 50 in the mid 1970's, diverging from westbound US 50 approximately 3,000 feet to the east and west of Pueblo Boulevard. The existing eastbound US 50 bridge over Wild Horse Creek is a three span structure consisting of a continuous concrete girder and slab (poured in place) with two continuous concrete wall center piers. The existing bridge carries two lanes of traffic over Wild Horse Creek and is approximately 42 feet in width. The eastbound bridge is being widened at this time to accommodate 3 lanes of traffic. The existing approach embankments (fill placement) are approximately 16 to 18 feet in height at the EB and WB bridge abutments. Rip-rap is present at each abutment with embankment side slopes approximately 2H:1V.

The existing Williams Creek CBC structure beneath Pueblo Boulevard is duel celled and approximately 21 feet in width and 320 feet in length with approximately 12 feet of embankment cover material above it. The existing CBC structure beneath Purcell Boulevard, located south of US 50, is a single cell CBC approximately 108 feet in length and 15 feet wide.

Geologic Conditions

The project area lies between the High Plains and the Colorado Piedmont, east of the eastern foothills of the Front Range of the Southern Rocky Mountains. The eastern project site limit is located approximately two miles west of the geologic floodplain of the Arkansas River. The

western project site limit is located approximately twelve miles east of the Front Range foothills. Based on the 1964 USGS *Geology Map of the Northwest and Northeast Pueblo Quadrangles, Colorado* by Glenn R. Scott (See Figure 2, Site Geology Map), the site is underlain by surficial soils and sedimentary bedrock.

The surficial soils encountered and mapped within the project generally consist of sandy clay and silty to clayey sand fill material with gravel associated with US 50 roadway construction and native soils consisting of Piney Creek Alluvium (Qp), Slocum Alluvium (Qs), Broadway Alluvium (Qb) deposits of generally consisting of silt, clay and sand with pebbles and limestone fragments, gravel and cobbles in parts. Colluvium (Qc) deposits are also mapped within the project limits and generally consist of silt and clay with pebbles and blocks of limestone and sandstone in parts. The surficial soils at the project comprise a relatively thin cover, typically less than 20 feet, over bedrock.

Bedrock of the Pierre Shale (Kpt) Formation and the seven members of the Niobrara (Ksus, Ksuc, Ksmc, Ksll, Ksls, Kssl, and Kf) Formation (both formations are Upper Cretaceous in age) are mapped at or near the surface within portions of the project limits. The Pierre Shale Formation generally consists of shale, siltstone sandstone and claystone and appears to be located near the eastern limits of the project. The Niobrara Formation generally consists of silty to chalky shale and chalky to fossiliferous limestone and appears to be under the majority of the project. Bentonite lenses within the bedrock formations have potential for swelling which can pose a risk to structures, roadways and utilities.

The sedimentary bedrock contained calcareous and/or gypsum minerals/crystals in parts. A slight hydrocarbon odor was also noted within the shale bedrock during RockSol's 2013 drilling operations/investigation. This odor is believed to be from a naturally occurring process associated with the organic content of the shale, primarily comprised of marine organisms, algae, and plant material deposited millions of years ago in an inland seaway.

Subsurface Investigation

RockSol drilled 18 boreholes to evaluate the subsurface conditions for the US 50 West – Westbound Preliminary Design, Purcell Boulevard to Wills Boulevard Improvements Project. The borehole locations are identified as BR-1, BR-2, CBC-1, CBC-2, WC-1, WC-2 and PV-1 through PV-12, as shown on Figures 3A through 3G, Borehole Location Plans. RockSol also obtained four pavement cores at borehole locations PV-3, PV-5, PV-10, and PV-11. The boreholes drilled for RockSol's 2013 investigation are also shown on the Borehole Location Plans.

Boreholes BR-1 and BR-2 were drilled at the approximate location of a future grade separation at the US 50 and Pueblo Boulevard intersection. Boreholes WC-1 and WC-2 were drilled at the approximate location of the proposed culvert extension at Williams Creek for the future widening of Pueblo Boulevard, between the current alignment of westbound and eastbound US 50. Boreholes CBC-1 and CBC-2 were drilled to assist with the proposed extension of the CBC under Purcell Boulevard to accommodate a proposed bike/pedestrian trail as well as future widening of US 50. Boreholes PV-1 through PV-12 were drilled to assist with pavement thickness recommendations for westbound US 50 and a temporary connection lane between the new westbound US 50 lanes and the existing US 50 westbound lanes. After drilling operations, the boreholes were located by field survey provided by CDOT. Horizontal and vertical locations were then provided to RockSol for inclusion on the Borehole Location Plan and on the borehole logs.

A truck mounted CME-45 drill rig was used for drilling and sampling. The boreholes were advanced using 4-inch and 6-inch outside diameter solid stem augers to maximum depths

ranging from approximately 5 feet to 30 feet below existing grades. The boreholes were logged in the field by a representative of RockSol then backfilled at the completion of drilling and groundwater level checks. Boreholes drilled within existing pavement were patched with an asphalt patch mix.

Subsurface materials were sampled using modified California barrel and standard split spoon samplers. The modified California barrel sampler has an outside diameter of approximately 2.5 inches and an inside diameter of 2 inches. The standard split spoon sampler used had an outside diameter of 2 inches and an inside diameter of 1⅜-inches. Brass tube liners are used with the modified California barrel sampler to retain samples for density, swell, and unconfined compressive strength testing. Sample retaining liners are not used with the standard split spoon sampler.

Penetration Tests were performed at selected intervals using an automatic lift system with a hammer weighing 140 pounds and falling 30 inches. The standard split spoon sampling method is the Standard Penetration Test (SPT) described by ASTM Method D-1586. Penetration Tests were performed using the modified California barrel sampler with a standard hammer weighing 140 pounds falling 30 inches per ASTM D3550.The modified California Barrel sampling method is similar to the SPT test with the difference being the sampler dimensions and the number of 6-inch intervals driven with the hammer. Correlation of blow counts obtained from a modified California sampler to blow counts obtained from a standard split spoon sampler is not available. However, it is RockSol's experience that blow counts obtained with the modified California sampler tend to be slightly greater than a standard split spoon sampler. Penetration resistance values (blow counts) were recorded for each sampling event. Blow counts, when properly evaluated, indicate the relative density or consistency of the soils. Depths at which the samples were taken, the type of sampler used, and the blow counts that were obtained are shown on the Boring Logs for each borehole.

Laboratory Testing

Soil samples retrieved from the borehole locations were examined by the project geotechnical engineer in the RockSol laboratory. Selected samples were tested and classified according to the Unified Soil Classification System (USCS). The following laboratory tests were performed in accordance with the American Society for Testing and Materials (ASTM), American Association of State Highway and Transportation Officials (AASHTO), and current local practices:

- Natural Moisture Content (ASTM D-2216)
- Percent Passing No. 200 Sieve (ASTM D-1140)
- Liquid and Plastic Limits (ASTM D-4318)
- Dry Density (ASTM D-2937)
- Gradation (ASTM D6913)
- Water Soluble Sulfates (CDOT CP-L 2103)
- Soil Classification (ASTM D-2487, ASTM D-2488, and AASHTO M145)
- Swell Test (ASTM D-4546)
- Water Soluble Chloride Content (AASHTO T291-91)
- Standard Test Method for pH of Soils (ASTM D4972-01 and AASHTO T289)
- Soil Resistivity (ASTM G187 - Soil Box)
- Resistance Value (CP-L 3101)

Resistance Value (R-Value) tests were performed by Cesare, Inc. Water Soluble Chloride Ion Content tests were performed by Colorado Analytical Laboratories. All other laboratory tests were performed by RockSol. Laboratory test results are presented in Appendix B and are also summarized on the Borehole Logs presented in Appendix A.

Surface and Subsurface Conditions

Where flexible hot mix asphalt (HMA) roadway pavement was encountered in our boreholes along westbound US 50 between Purcell Boulevard and the western edge of where US 50 diverges (approximately 3,200 feet west of Pueblo Boulevard), the pavement section thickness generally averaged 10.5 inches of HMA. Approximately 6 inches of aggregate base course (ABC) was noted beneath the HMA at Boreholes PV-1 and PV-5 within this area. Where HMA roadway pavement was encountered along westbound US 50 between Wills Boulevard and the eastern edge of where US 50 diverges (approximately 3,000 feet east of Pueblo Boulevard), the pavement section thickness generally averaged 7.25 inches of HMA. Approximately 6 inches of aggregate base course (ABC) was noted beneath the HMA at Borehole PV-10 within this area. A summary of the existing pavement structure measurements is presented in Table 1.

Table 1 – Existing Pavement Structure Measurements

Borehole	Approximate Station No.	Westbound US50 Location	HMA Thickness (Inches)	Aggregate Base Course Thickness (Inches)
PV-1	277+40	Outside Turn Lane to Purcell Blvd	11.0	6.0
PV-2	256+80	Lane 2	10.0	NE
PV-3	236+50	Lane 2	10.0	NE
		Outside Shoulder (pavement core)	10.0	NM
PV-4	216+80	Lane 1	11.0	NE
PV-5	196+80	Lane 1 (pavement core)	10.5	NM
		Inside Shoulder	10.5	6.0
PV-10	128+00	Center Median (pavement core)	6.0	6.0
PV-11	109+50	Outside Turn Lane to Business (pavement core)	8.5	NE

NE=Not Encountered; NM=Not Measured (core thickness only, aggregate base course not measured).

Topsoil was encountered at the ground surface at nine borehole locations. The topsoil encountered was generally lightly organic silty to clayey sand and sandy clay which supported a sparse covering of grasses and weeds. A topsoil thickness of approximately 6 inches was estimated based on field observations. Beneath the pavement and topsoil, subsurface conditions encountered generally consisted of fill material, native soils, and sedimentary bedrock.

Fill material was encountered in eleven of the boreholes to approximate depths ranging from 2.5 feet to 13 feet below existing grades. The fill material is associated with roadway embankment and culvert backfill for the construction of US 50 and Purcell Boulevard. The fill material encountered generally consisted of loose to dense silty to clayey sand with gravel and sandy clay (reworked shale) in parts, medium stiff to very stiff sandy clay with gravel in parts, and medium dense slightly silty to gravelly sand.

Native soils encountered below the fill material or ground surface generally included medium stiff to very stiff sandy clay with silty to clayey sand and gravel in parts, loose to dense silty to clayey sand and gravelly sand. The native soils extended to depths ranging from 3 feet 18 feet below existing grades. The majority of the fill and native soils tested were classified as sandy

clay and clayey sand soils (AASHTO A-6) with an average Plasticity Index of 14. AASHTO A-2-4, A-2-6, and A-4 soils were also encountered within the project limits.

Sedimentary bedrock was encountered beneath the fill material and native soils at depths varying from approximately 3 feet to 18 feet below existing grades. Sedimentary bedrock consisting of hard to very hard claystone, sandstone and shale was encountered in Boreholes BR-1, BR-2, WC-1 and WC-2 (US 50 and Pueblo Boulevard) at elevations ranging from 4,800 feet to 4,824 feet (approximate depths ranging from 3 feet to 18 feet below existing grades) during drilling operations.

The bedrock generally consisted of very hard silty to clayey shale. Very hard shale was also encountered in Boreholes CBC-1 and CBC-2 (Purcell Boulevard and US 50) at an approximate elevation of 4,968 feet (approximate depths of 8 feet and 12 feet below existing grades). Sedimentary bedrock consisting of very hard claystone and shale was also encountered in Boreholes PV-2, PV-7, PV-8, and PV-10 at elevations of 4,784 feet to 4,957 feet (approximate depths of 3 feet to 9 feet below existing grades) between Purcell Boulevard and Wills Boulevard along the existing and proposed westbound US 50 alignment.

Groundwater was encountered in four of the boreholes at elevations ranging from 4,804 feet to 4,971 feet (approximate depths ranging from 7 feet to 23 feet below existing grades) and is perched above the shale and claystone bedrock. Groundwater generally appears to be at an elevation consistent with the water elevations of Williams Creek and the drainage at the Purcell Boulevard CBC structure. However, it should be noted that groundwater elevations are subject to change depending on climatic conditions, stream stages, local irrigation practices, changes in local topography, and changes in surface storm water management.

A summary of the bedrock and groundwater elevations encountered in RockSol's 2015 evaluation is presented in Table 2. In addition, a summary of the bedrock and groundwater elevations encountered in RockSol's 2013 evaluation is presented in References 1 through 3. The approximate groundwater and bedrock elevations are rounded to the nearest foot and are based on the depth to groundwater and bedrock noted during drilling and sampling operations and the ground surface elevations provided by the project surveyor.

Table 2 – Approximate Groundwater and Bedrock Elevations

Borehole	Ground Elevation (feet)	Groundwater Elevation (feet)	Bedrock Elevation (feet)
BR-1	4,827	4,804	4,824
BR-2	4,827	NE	4,824
CBC-1	4,980	4,971	4,968
CBC-2	4,976	4,969	4,968
PV-2	4,965	NE	4,957
PV-7	4,864	NE	4,861
PV-8	4,834	NE	4,825
PV-10	4,792	NE	4,784
WC-1	4,823	4,806	4,805
WC-2	4,814	NE	4,800

Note: NE indicates not encountered.

Individual logs are included in Appendix A. A summary of laboratory test results is presented in Appendix B.

Expansive Soil Discussion

Swell potential in the subgrade soils obtained within the upper 5 feet below existing grades ranged from -1.0 percent (consolidation) to 7.5 percent (swell), when tested with a 200 pound per square foot (psf) surcharge. The average swell potential in the subgrade soils obtained within the upper 5 feet below existing grades is 1.3 percent and the average consolidation potential is 0.6 percent, based on the samples tested. One sample (Borehole PV-7 at 2 feet below existing grade) exhibited a swell potential (7.5 percent) greater than two percent, when tested with a 200-psf surcharge. Six samples of the subgrade soils and bedrock material obtained within the upper 15 feet below existing grades exhibited an average swell potential of 0.7 percent when tested with a 500-psf or 1,000 psf surcharge.

Thirteen samples obtained within the upper 5 feet below existing grades were tested for plasticity (Atterberg Limits) and all but one sample (PV-2) resulted in a plasticity index (PI) of less than 20, with an average PI of 13.

Based on the swell test data and plasticity index test data, the majority of the subgrade soils appear to possess low swell potential and low consolidation potential. Based on the PI data and swell test results, RockSol recommends the upper 2 feet of roadway subgrade be considered for excavation and recompaction with moisture and density control or replacement with non-expansive soil. Further discussion of subgrade improvement is presented in the Pavement Design Report.

Cement Type Discussion

Cementitious material requirements for concrete in contact with site soils or groundwater are based on the percentage of water soluble sulfate in either soil or groundwater that will be in contact with concrete constructed for this project. Mix design requirements for concrete exposed to water soluble sulfates in soils or water is considered by CDOT as shown in Table 3 and in the Standard Specifications for Road and Bridge Construction, dated 2011 (CDOT Table 601-2).

Table 3 - Requirements to Protect Against Damage to Concrete by Sulfate Attack from External Sources of Sulfate

Severity of sulfate exposure	Water-soluble sulfate (SO_4), in dry soil, percent	Sulfate (SO_4), in water, ppm	Water Cementitious Ratio, maximum	Cementitious Material Requirements
Class 0	0.00 to 0.10	0 to 150	0.45	Class 0
Class 1	0.11 to 0.20	151 to 1,500	0.45	Class 1
Class 2	0.21 to 2.0	1,500 to 10,000	0.45	Class 2
Class 3	2.01 or greater	10,001 or greater	0.40	Class 3

The average concentration of water soluble sulfates measured in 21 soil samples obtained from RockSol's exploratory boreholes was 0.39 percent by weight. The water soluble sulfate concentrations ranged from 0.00 percent by weight to 1.72 percent by weight. Only one test result exceeded 1 percent (1.72 percent at Borehole PV-10). Based on the results of the water soluble sulfate testing, Exposure Class 2 is considered appropriate for concrete in contact with subgrade materials for this project. Additional testing is recommended for future phases of the ultimate design. Based on the water soluble sulfate test results, stabilization of subgrade soils through the use of lime, cement, or calcium-rich flyash is discouraged.

Subgrade Support Testing

In order to test subgrade support characteristics, an R-Value laboratory test was performed on a composite bulk sample obtained within the upper 5 feet below the top of existing grade from Boreholes PV-3, PV-4, PV-8 and PV-10, which were classified as AASHTO A-6 material. The

R-Value test for the composite bulk sample indicated an R-Value of 17. The result of the R-Value laboratory test is presented in Appendix B.

Corrosion Resistance Discussion

Water soluble chloride content, pH and electrical resistivity tests were performed on 12 bulk samples obtained from Boreholes PV-1 through PV-12 and are summarized in Table 4.

Table 4 – Corrosivity Test Results

Borehole Location	Sample Depth (ft)	Water Soluble Chloride (%)	Saturated Resistivity (ohm-cm) at Moisture content (%)	Water Soluble Sulfate (% by weight)	pH	CR Level
PV-1	0.91 – 5	0.0111	1,150 @ 19.5	0.03	6.9	CR 0
PV-2	0.83 – 5	**0.1455**	385 @ 19.5	0.06	7.3	CR 2
PV-3	0.83 – 5	0.0081	900 @ 19.3	**0.20**	8.0	CR 2
PV-4	0.91 – 5	0.0179	860 @ 20.5	**0.67**	7.1	CR 4
PV-5	0.875 – 5	0.0132	920 @ 17.9	**0.62**	7.5	CR 4
PV-6	0 – 5	0.0012	1,800 @ 16.8	**0.18**	7.6	CR 2
PV-7	0 – 5	0.0029	880 @ 25.7	**0.14**	7.8	CR 2
PV-8	0 – 5	0.0462	610 @ 21.6	**0.08**	7.3	CR 1
PV-9	0 – 5	0.0044	1,300 @ 18.6	0.02	8.0	CR 0
PV-10	0.5 – 5	0.0130	770 @ 22.5	**1.72**	8.0	CR 4
PV-11	0.7 – 5	0.0226	890 @ 19.8	**0.56**	7.3	CR 4
PV-12	0 – 5	0.0023	1,200 @ 16.0	**0.38**	6.7	CR 3

Comparison of the test results of the sulfate, chloride, and pH testing performed with *Table 1 - Guidelines for Selection of Corrosion Resistance Levels as presented in the CDOT Pipe Materials Selection Guide,* dated April 30, 2015*,* suggests corrosion resistance (CR) levels of CR 0, CR 2, CR 3 and CR 4 are present within the project limits.

Of the three variables (water soluble sulfate, water soluble chloride, and pH) that are used in determining the CR level, the water soluble sulfate content appears to be the predominant component affecting the CR level selection. One water soluble chloride test indicated elevated chloride level at 0.01455 percent. The pH tests are all within the 6.0 to 8.5 range.

In addition, electrical resistivity analyses were performed in the RockSol laboratory using the soil box method (ASTM G-187). Comparison of the results of the electrical resistivity testing performed with *Table 2 – Minimum Pipe Thickness For Metal Pipes Based On The Resistivity And pH Of The Adjacent Soil* as presented in the *CDOT Pipe Materials Selection Guide,* effective April 30, 2015*,* suggests the minimum required gauge thickness for metal pipe material, if used, for this project is *0.052 inches (18 Gauge) Polymer Coated*.

Limitations

This geotechnical field investigation and laboratory results were conducted in general accordance with the scope of work. The testing was performed to provide preliminary design level information. Additional testing is suggested for final design. The geotechnical practices are similar to that used in the Colorado Front Range area with similar soil conditions and our understanding of the proposed work. This report has been prepared by RockSol for use by J.F. Sato and CDOT for the US 50 West Westbound Preliminary Design project. RockSol understands that additional boreholes and geotechnical evaluation will be performed for the final design phase.

The information presented is based on our exploratory boreholes and does not take into account variations in the subsurface conditions that may exist between boreholes. Additional investigation is required to address such variation. RockSol is not responsible for liability associated with interpretation of subsurface data by others.

Prepared by RockSol Consulting Group, Inc.:

COLORADO REGISTERED DONALD GORDON HUNT 4-13-16 35249 PROFESSIONAL ENGINEER

Ryan Lepro
Geological Engineer

Donald G. Hunt, P.E.
Senior Geotechnical Engineer

Attachments:

Figure 1 - Site Vicinity Map
Figure 2 – Site Geology Map
Figure 3 – Borehole Location Figure Index
Figures 3A through 3G – Borehole Location Plans
Figure 4 – Engineering Geology Sheet (Purcell CBC)
Figure 5 – Engineering Geology Sheet (Williams Creek CBC)
Figure 6 – Engineering Geology Sheet (Wild Horse Dry Creek Bridge)

Appendix A – Legend and Individual Borehole Logs
Appendix B – Laboratory Test Results
Appendix C – FWD Test Results

References:

(1) *Foundation Investigation Report, US 50 Preliminary Design, Purcell Boulevard to Wills Boulevard, CDOT Project No. STA 050A-022 (Project Code 19056), Task Order No.4, Construction Project No. FSA 0503-081 (Project Code 19751), Pueblo County, Colorado,* RockSol Project Number 302.01, dated July 31, 2014
(2) *Pavement Design Report, US 50 Preliminary Design, Purcell Boulevard to Wills Boulevard, CDOT Project No. STA 050A-022 (Project Code 19056), Task Order No.4, Construction Project No. FSA 0503-081 (Project Code 19751), Pueblo County, Colorado,* RockSol Project Number 302.01, dated July 31, 2014
(3) *Soil Investigation Report, US 50 Preliminary Design, Purcell Boulevard to Wills Boulevard, CDOT Project No. STA 050A-022 (Project Code 19056), Task Order No.4, Construction Project No. FSA 0503-081 (Project Code 19751), Pueblo County, Colorado,* RockSol Project Number 302.01

IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY, NORTHWEST PUEBLO, COLORADO QUADRANGLE, 2010

Print Date: 7/28/2015	US 50 WEST PURCELL BLVD. TO WILLIS BLVD. SITE VICINITY MAP	Project No./Code
File Name: 20448_F1 Site Vicinity.dgn		STA 0503-088
Horiz. Scale: 1:1	0 2000 4000 6000 (FEET)	20448
RockSol Consulting Group, Inc. 6510 W 91st Ave, Ste 130 Westminster, CO 80031	Designer: R. Lepro Detailer: D. Knight Sheet Subset:	Figure 1

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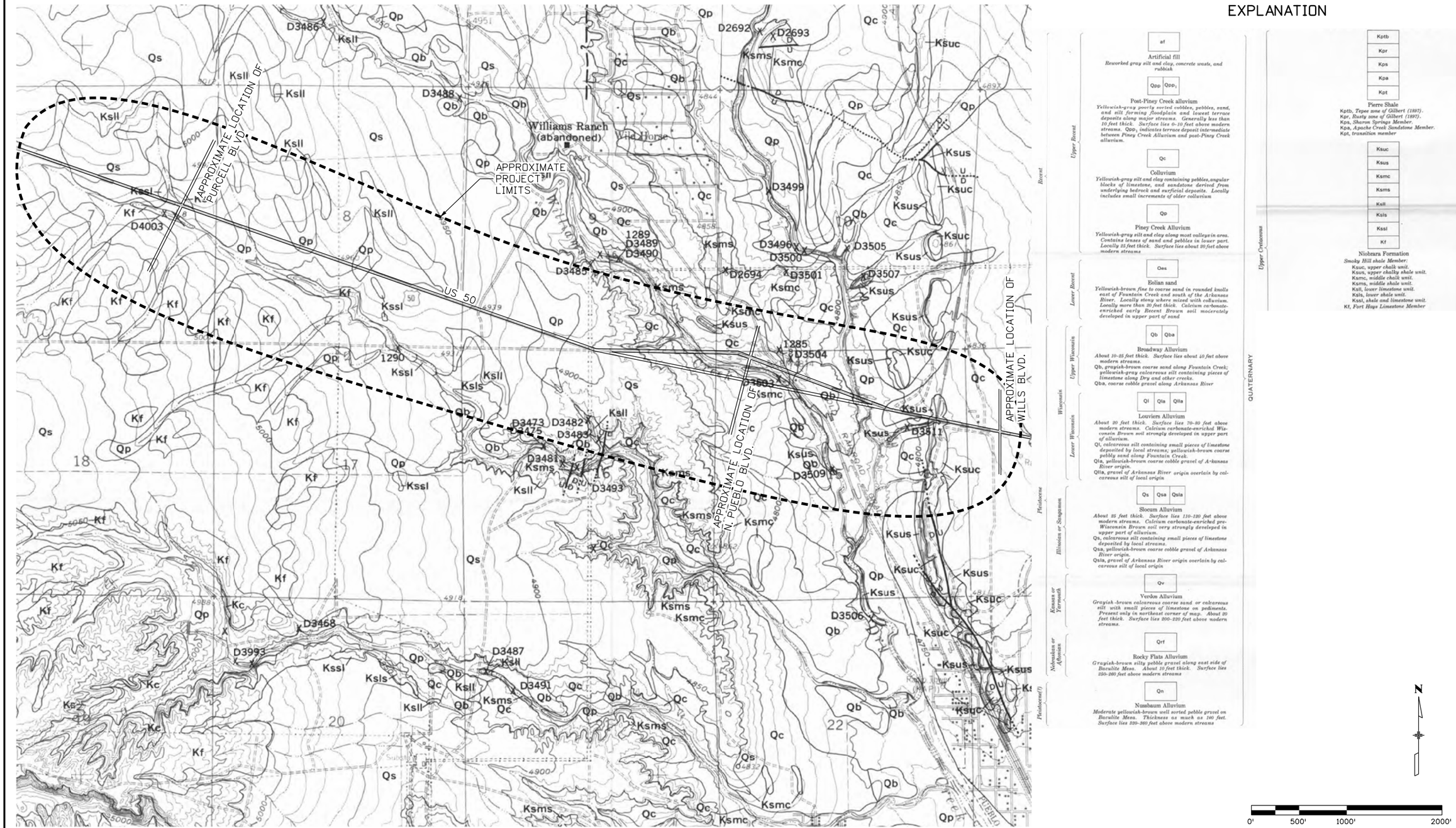

GEOLOGY MAP COMPILED FROM THE USGS GEOLOGY OF THE NORTHWEST AND NORTHEAST PUEBLO QUADRANGLES, COLORADO BY GLENN R. SCOTT, DATED 1964 AND MODIFIED BY ROCKSOL

Print Date: 7/28/2015
File Name: 20448GEO_F2 Site Geology.dgn
Horiz. Scale: As Noted Vert. Scale: As Noted

JFS&A RockSol Consulting Group, Inc.

Sheet Revisions		
Date:	Comments	Init.

Colorado Department of Transportation
902 Erie Avenue
Pueblo, CO 81001
Phone: 719-562-5509 FAX: 719-546-5702
Region 2 DTD

As Constructed
No Revisions:
Revised:
Void:

US 50 WEST
PURCELL BLVD. TO WILLS BLVD
SITE GEOLOGY MAP

Designer:
Detailer:
Subset:
Structure Numbers
Subset Sheets: of

Project No./Code
STA 0503-088
20448
Figure

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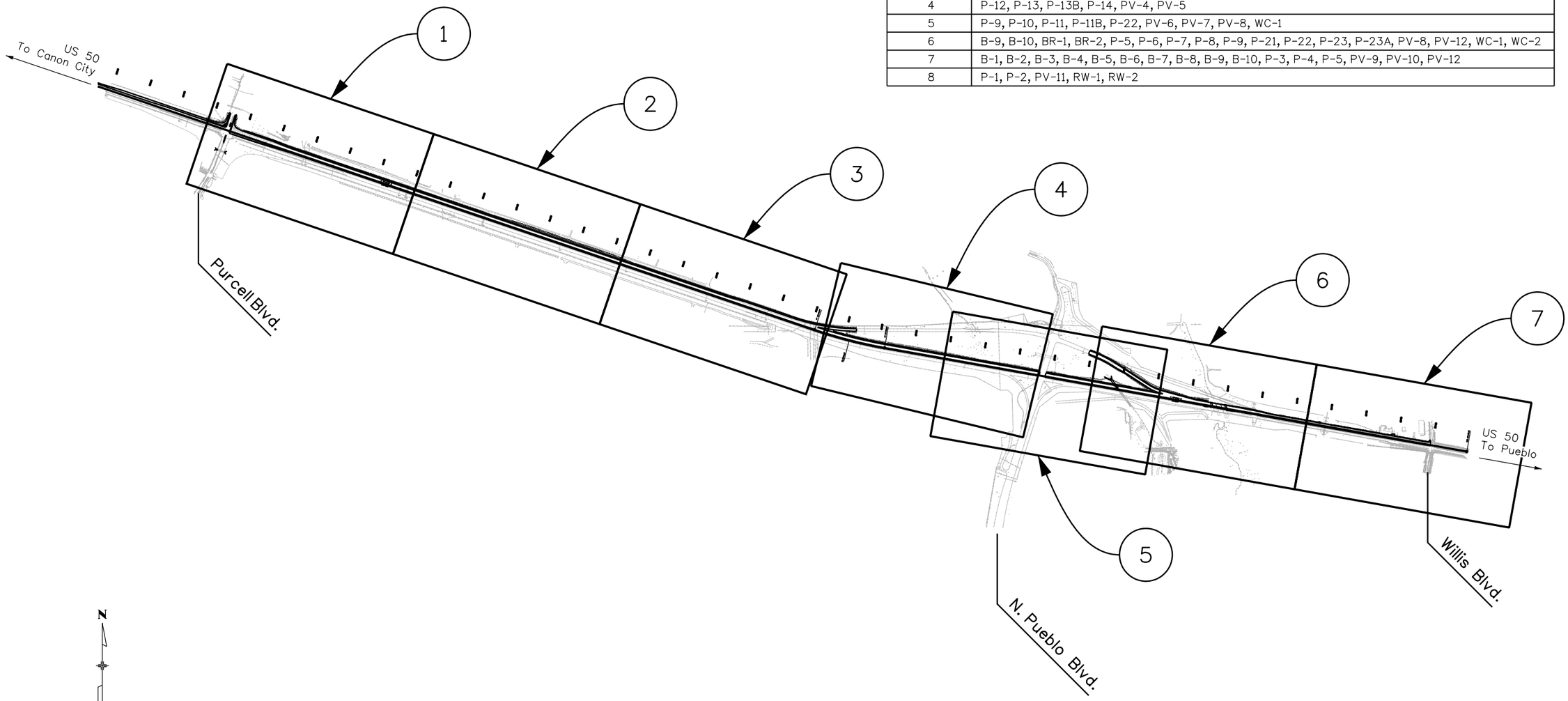
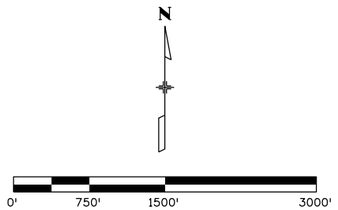
SUBSET SHEET NO.	BOREHOLES
2	CBC-1, CBC-2, P-18, P-19, P-20, PV-1, PV-2
3	P-15, P-16, P-17, PV-3
4	P-12, P-13, P-13B, P-14, PV-4, PV-5
5	P-9, P-10, P-11, P-11B, P-22, PV-6, PV-7, PV-8, WC-1
6	B-9, B-10, BR-1, BR-2, P-5, P-6, P-7, P-8, P-9, P-21, P-22, P-23, P-23A, PV-8, PV-12, WC-1, WC-2
7	B-1, B-2, B-3, B-4, B-5, B-6, B-7, B-8, B-9, B-10, P-3, P-4, P-5, PV-9, PV-10, PV-12
8	P-1, P-2, PV-11, RW-1, RW-2





LEGEND:

(1) Indicates Borehole Location Plan sheet

Print Date: 7/28/2015
File Name: 20448GEO_F3 Key Plan.dgn
Horiz. Scale: As Noted Vert. Scale: As Noted

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Sheet Revisions		
Date:	Comments	Init.

Colorado Department of Transportation
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902 Erie Avenue
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DTD

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No Revisions:
Revised:
Void:

US 50 WEST
PURCELL BLVD. TO WILLS BLVD
BOREHOLE LOCATION - KEY PLAN

Designer:	R. Lepro	Structure Numbers	
Detailer:	D. Knight		
Subset:	Geotech	Subset Sheets: 1 of 11	

Project No./Code
STA 0503-088
20448
Figure 3

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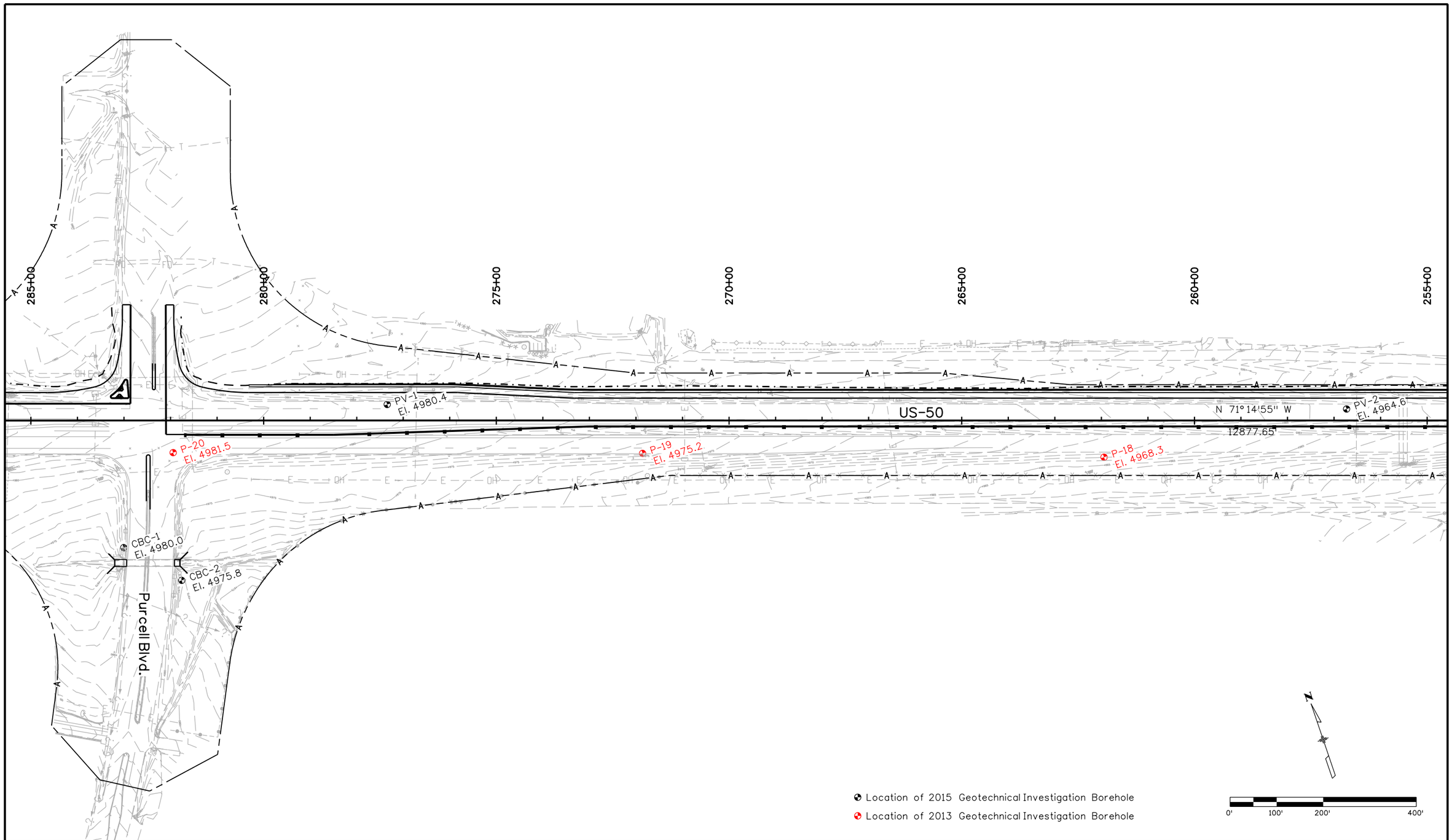

Print Date: 7/28/2015
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Horiz. Scale: As Noted Vert. Scale: As Noted

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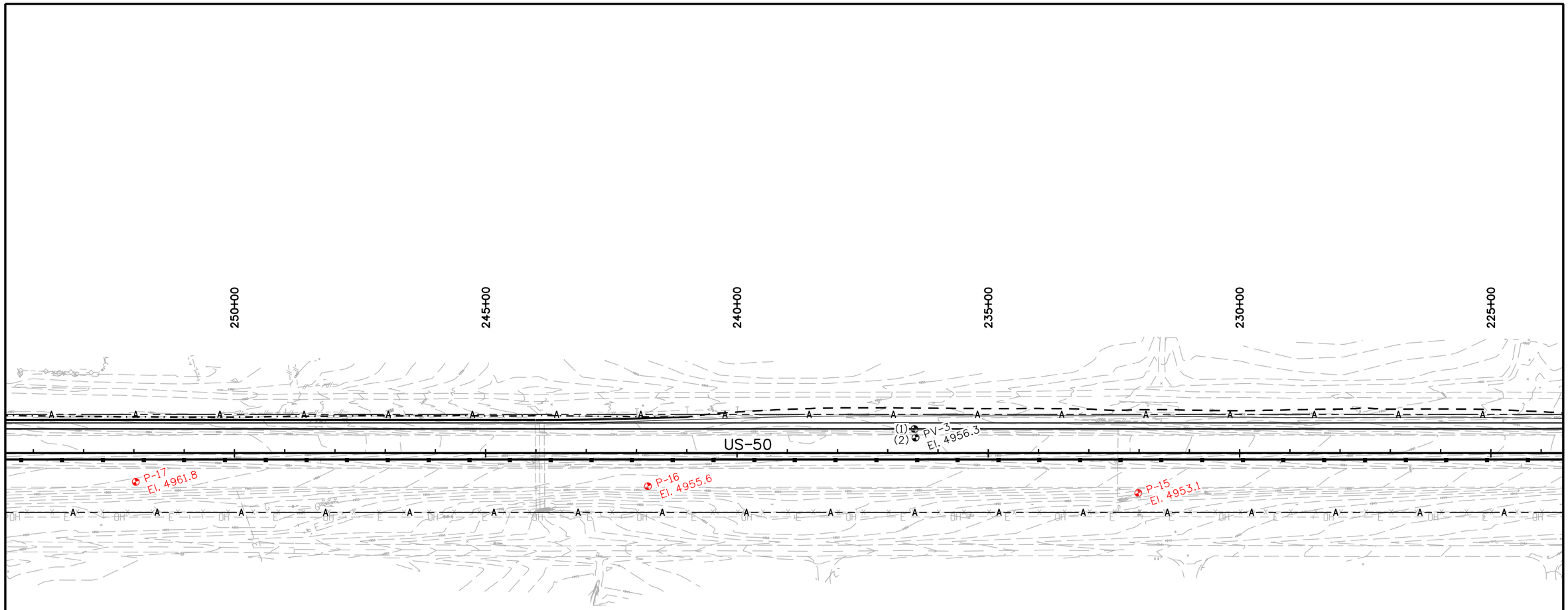
Revised:
Void:

US 50 WEST
PURCELL BLVD. TO WILLS BLVD
BOREHOLE LOCATION PLAN (1 OF 7)

Designer:	R. Lepro	Structure Numbers	
Detailer:	D. Knight		
Subset:	Geotech	Subset Sheets: 2 of 11	

Project No./Code
STA 0503-088
20448
Figure 3A

DKnight 1:57:10 PM M:\PROJECTS\302.02 US-50 West\Sheet Files\20448GEO_F3A BorePlan.dgn



PV-3 Note:
(1) - Shoulder Corehole
(2) - Existing Lane Borehole

Location of 2015 Geotechnical Investigation Borehole

Location of 2013 Geotechnical Investigation Borehole

Print Date: 7/28/2015	
File Name: 20448GEO_F3B BorePlan.dgn	
Horiz. Scale: As Noted	Vert. Scale: As Noted

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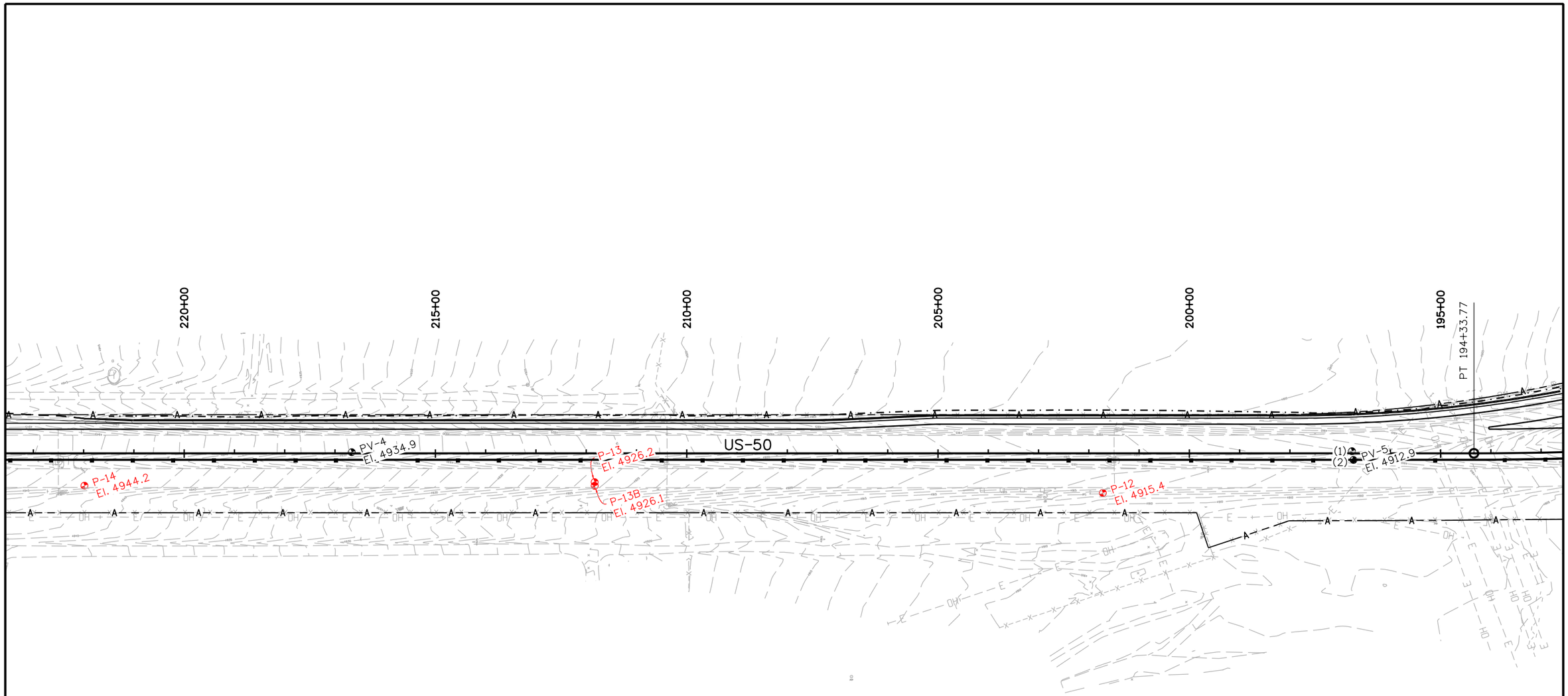
No Revisions:	
Revised:	
Void:	

US 50 WEST
PURCELL BLVD. TO WILLS BLVD
BOREHOLE LOCATION PLAN (2 OF 7)

Designer:	R. Lepro	Structure Numbers	
Detailer:	D. Knight		
Subset:	Geotech	Subset Sheets: 3 of 11	

Project No./Code	
STA 0503-088	
20448	
Figure	3B

DKnight 1:59:10 PM M:\PROJECTS\302.02 US-50 West\Sheet Files\20448GEO_F3B BorePlan.dgn



PV-5 Note:
(1) - Existing Lane Corehole
(2) - Median Borehole

Location of 2015 Geotechnical Investigation Borehole

Location of 2013 Geotechnical Investigation Borehole

DKnight 1:59:39 PM M:\PROJECTS\302.02 US-50 West\Sheet Files\20448GEO_F3C BorePlan.dgn

Print Date: 7/28/2015	Sheet Revisions			Colorado Department of Transportation	As Constructed
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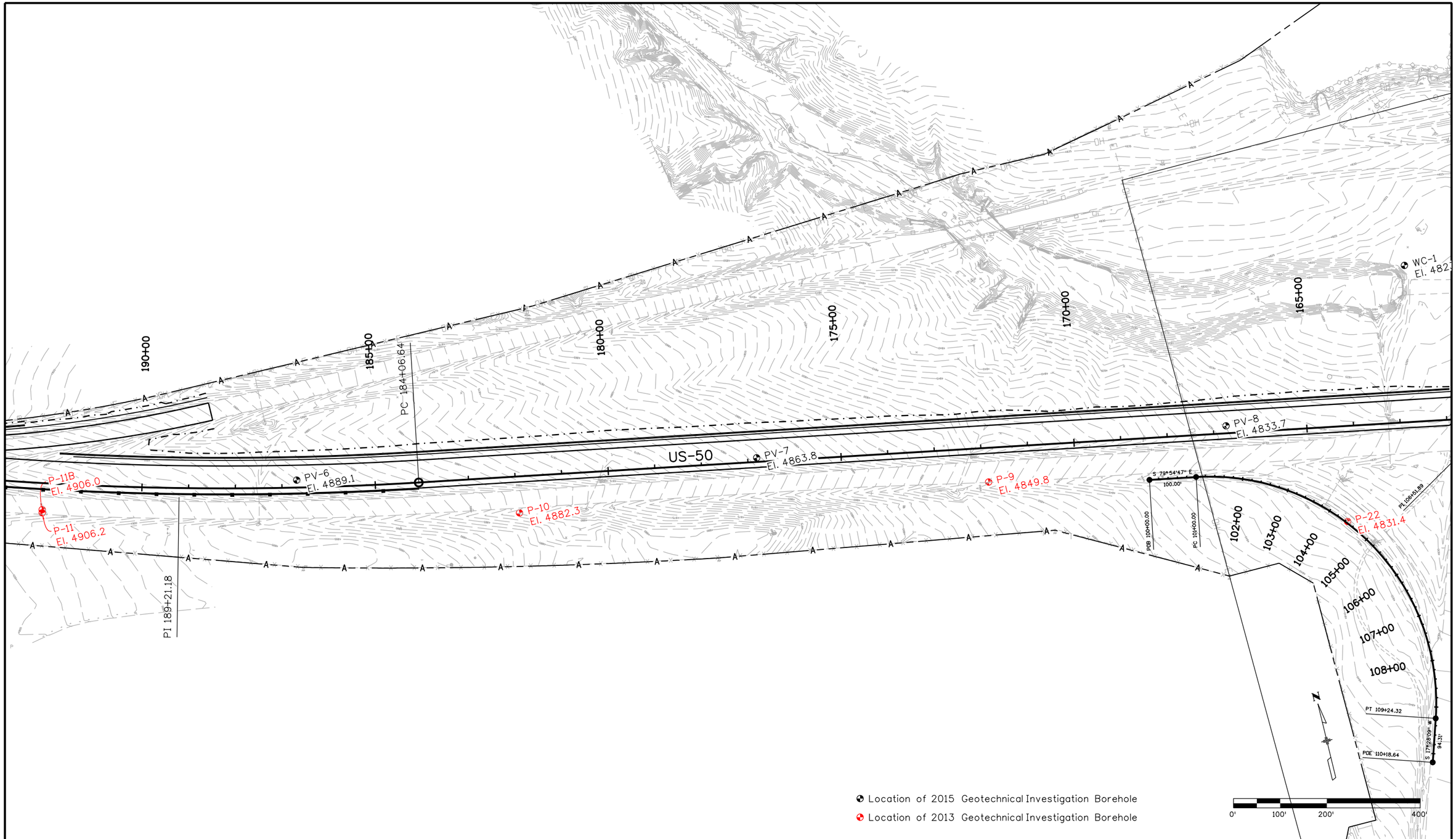
Horiz. Scale: As Noted Vert. Scale: As Noted				Region 2 DTD	Revised:
JFS&A RockSol Consulting Group, Inc.					Void:

US 50 WEST PURCELL BLVD. TO WILLS BLVD BOREHOLE LOCATION PLAN (3 OF 7)		Project No./Code	
Designer: R. Lepro	Structure Numbers	STA 0503-088	
Detailer: D. Knight		20448	
Subset: Geotech	Subset Sheets: 4 of 11	Figure	3C



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Horiz. Scale: As Noted Vert. Scale: As Noted		Region 2 DTD	Revised:
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US 50 WEST PURCELL BLVD. TO WILLS BLVD BOREHOLE LOCATION PLAN (4 OF 7)			Project No./Code
Designer: R. Lepro	Structure Numbers		STA 0503-088
Detailer: D. Knight			20448
Subset: Geotech	Subset Sheets: 5 of 11		Figure 3D

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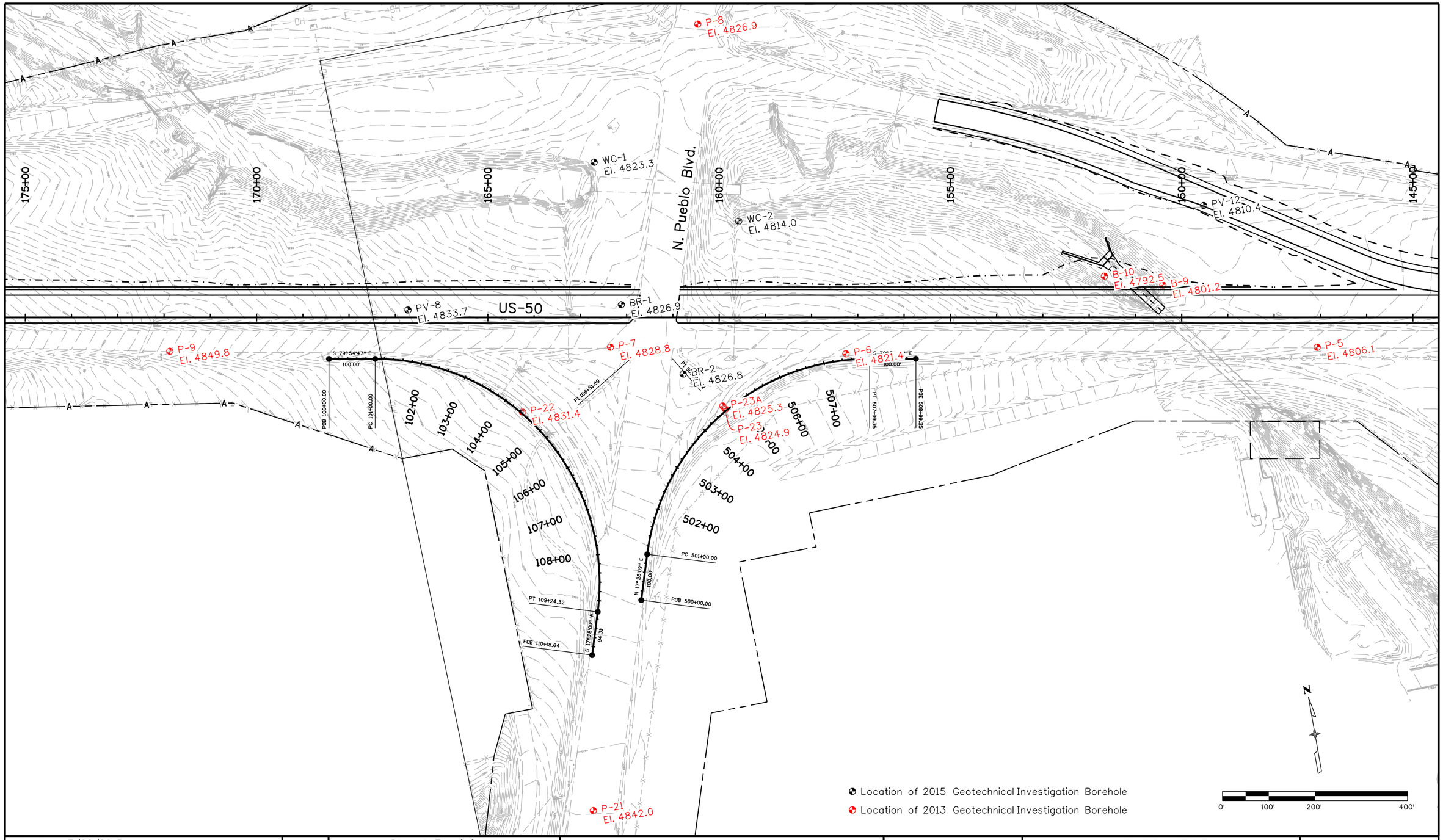

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Print Date: 7/28/2015
File Name: 20448GEO_F3E BorePlan.dgn
Horiz. Scale: As Noted Vert. Scale: As Noted

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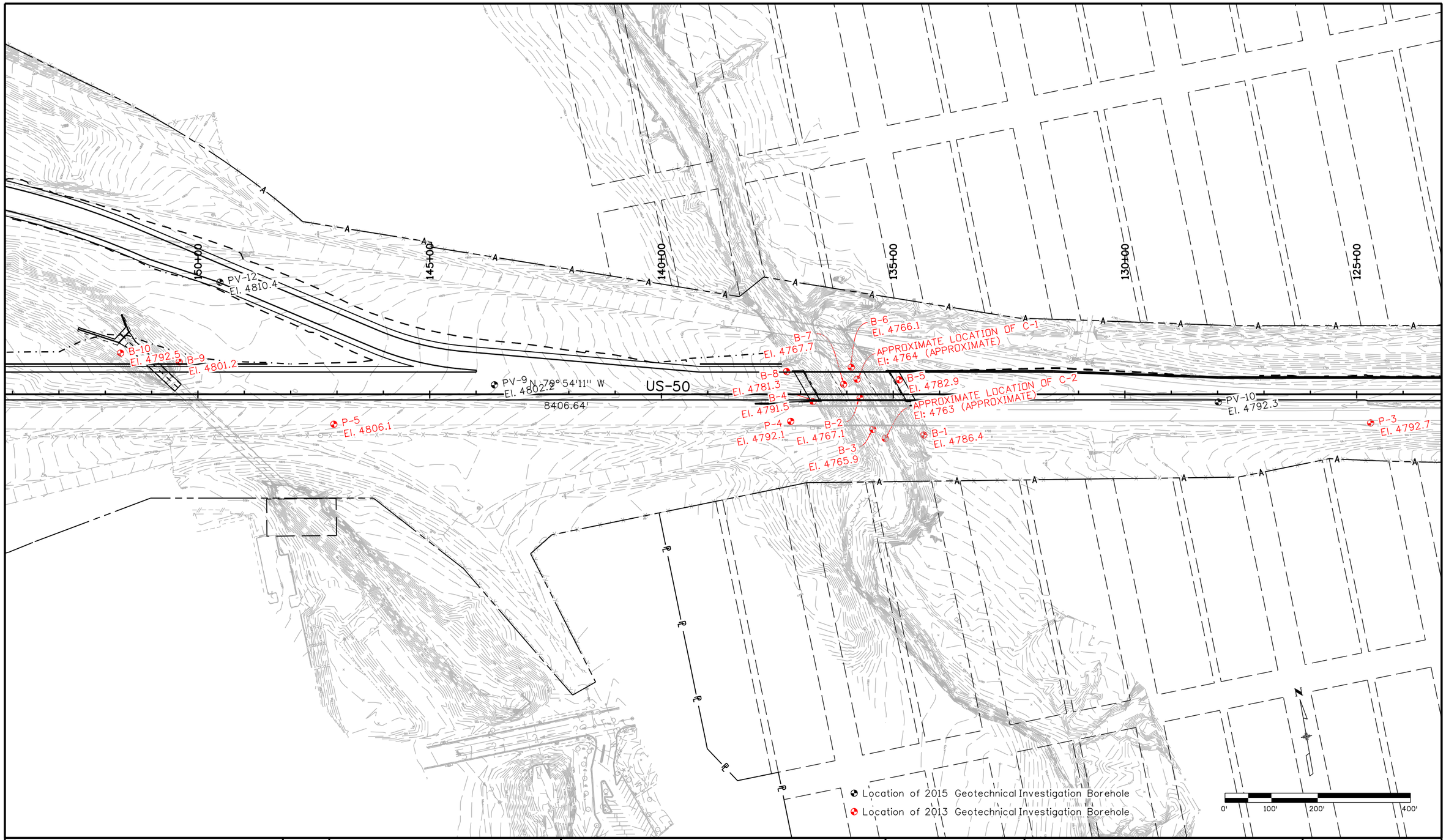
No Revisions:
Revised:
Void:

US 50 WEST
PURCELL BLVD. TO WILLS BLVD
BOREHOLE LOCATION PLAN (5 OF 7)

Designer: R. Lepro
Detailer: D. Knight
Subset: Geotech
Structure Numbers
Subset Sheets: 6 of 11

Project No./Code
STA 0503-088
20448
Figure 3E



Print Date: 7/28/2015
File Name: 20448GEO_F3F BorePlan.dgn
Horiz. Scale: As Noted Vert. Scale: As Noted

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Region 2 DTD

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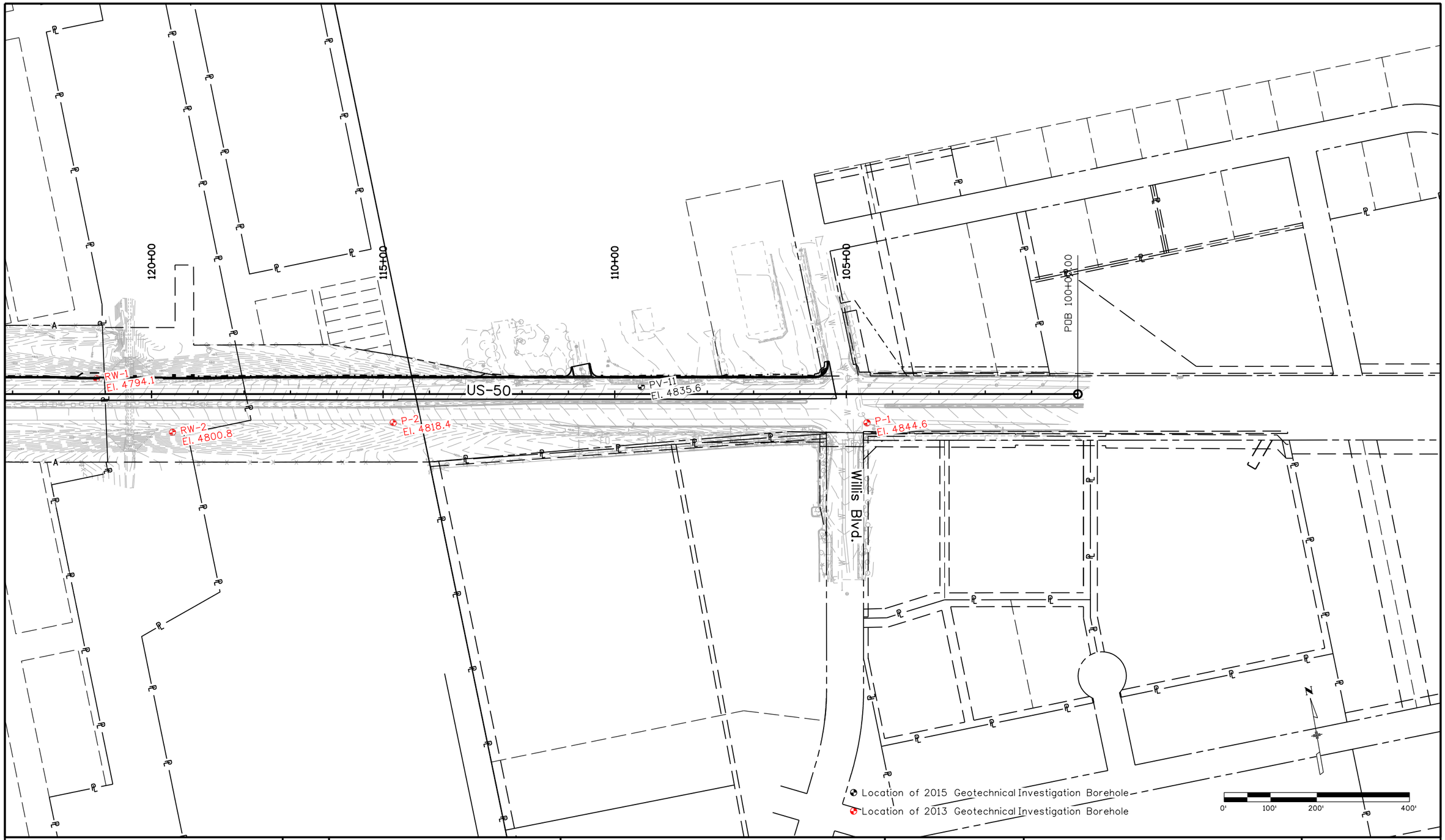
Revised:
Void:

US 50 WEST
PURCELL BLVD. TO WILLS BLVD
BOREHOLE LOCATION PLAN (6 OF 7)

Designer:	R. Lepro	Structure Numbers	
Detailer:	D. Knight		
Subset:	Geotech	Subset Sheets: 7 of 11	

Project No./Code
STA 0503-088
20448
Figure 3F



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File Name: 20448GEO_F3G BorePlan.dgn
Horiz. Scale: As Noted Vert. Scale: As Noted

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As Constructed
No Revisions:
Revised:
Void:

US 50 WEST
PURCELL BLVD. TO WILLS BLVD
BOREHOLE LOCATION PLAN (7 OF 7)

Designer:	R. Lepro	Structure Numbers	
Detailer:	D. Knight		
Subset:	Geotech	Subset Sheets: 8 of 11	

Project No./Code
STA 0503-088
20448
Figure 3G

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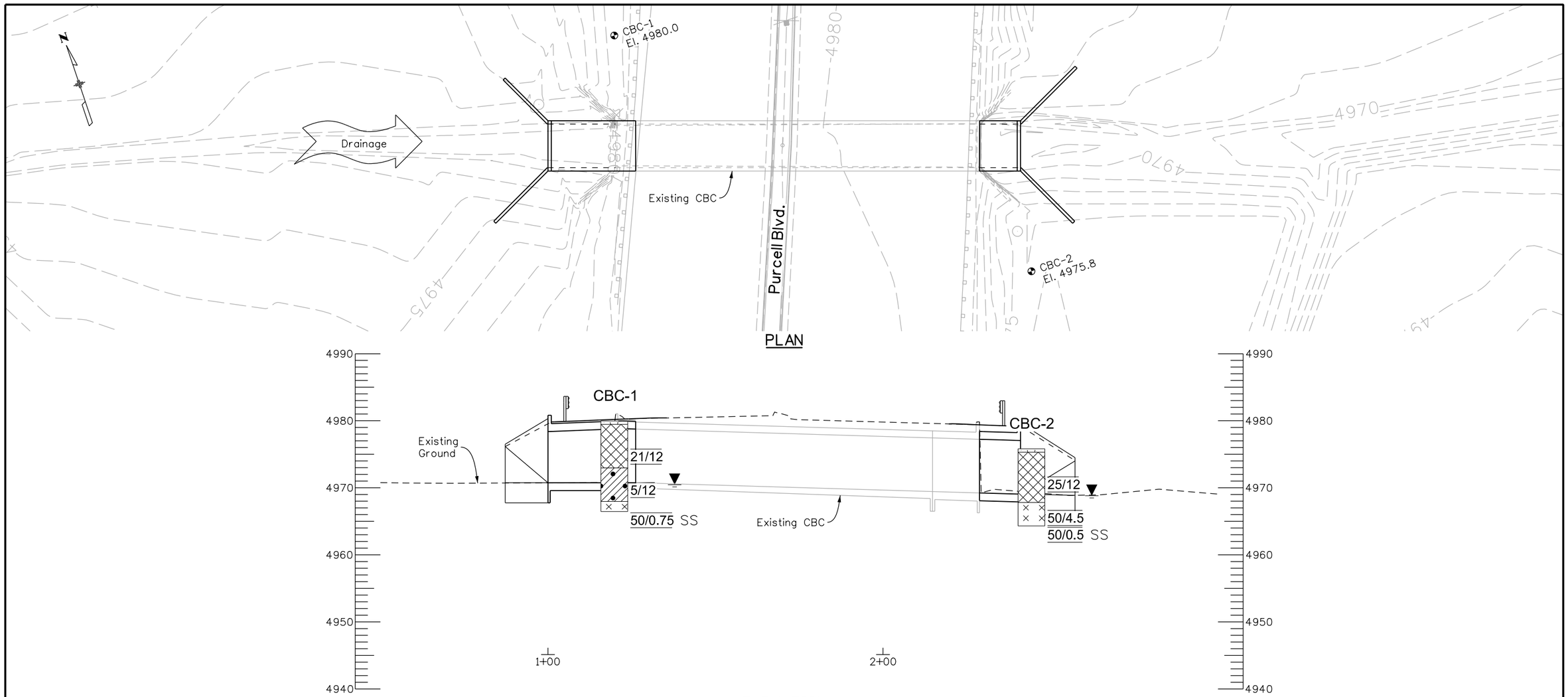


SUMMARY OF TEST RESULTS

Sample ID	Depth (ft)	Liquid Limit	Plasticity Index	%< #200 Sieve	Classification		Water Content (%)	Dry Density (%)	Sulfate (%)
					USCS	AASHTO			

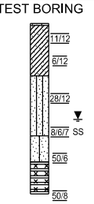
TYPE OF MATERIAL

- Asphalt Pavement
- Fill - CLAY
- Fill - SAND
- TOPSOIL
- Native - SAND, gravelly
- Native - CLAY
- Native - GRAVEL, silty
- Bedrock - SANDSTONE
- Bedrock - SHALE
- Fill - Aggregate Base Course
- Fill - SAND
- Fill - CLAY
- Native - SAND, silty
- Native - SAND, clayey
- Native - CLAY, gravelly
- Native - CLAY, sandy
- Bedrock - CLAYSTONE

SEE INDIVIDUAL LOG SHEETS FOR ADDITIONAL DESCRIPTION OF MATERIAL ENCOUNTERED

LEGEND

TEST BORING



- B — Bridge Borehole
- Ground Water Level At Time of Drilling
- 9/12 — 9 Blows for 12 Inches
- 50/3 — 50 Blows for 3 Inches
- 8/6/7 SS — Split Spoon Sampler Required 8 Blows for 6 Inches Required 6 Blows for 6 Inches Required 7 Blows for 6 Inches

BORING ID NOTED AT THE TOP OF LOG
BLOW COUNTS OBTAINED WITH SPLIT SPOON SAMPLERS ARE NOTED WITH "SS", ALL OTHER BLOW COUNTS OBTAINED WITH A MODIFIED CALIFORNIA BARREL SAMPLER
SEE INDIVIDUAL LOG SHEETS FOR MORE DETAIL

Print Date: 7/28/2015
File Name: 20448GEO_F4 EngGeo-PB CBC.dgn
Horiz. Scale: 1:30 Vert. Scale: 1:10

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Region 2 DTD

As Constructed
No Revisions:
Revised:
Void:

US 50 WEST WESTBOUND
PURCELL CBC
ENGINEERING GEOLOGY

Designer: R. Lepro
Detailer: D. Knight
Subset: Geotech
Structure Numbers:
Subset Sheets: 9 of 11

Project No./Code
STA 0503-088
20448
Figure 4

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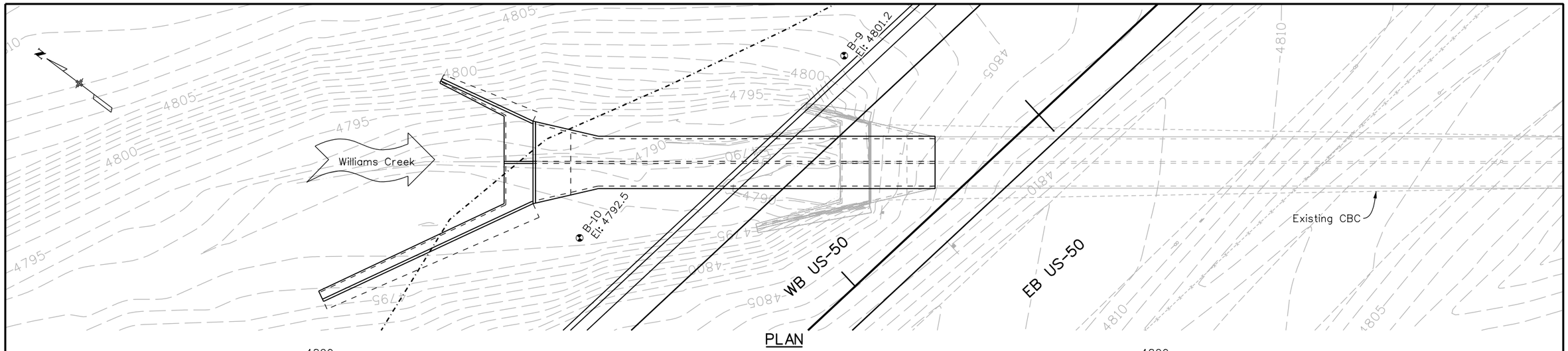


PLAN

ELEVATION

SUMMARY OF TEST RESULTS

Sample ID	Depth (ft)	Liquid Limit	Plasticity Index	%< #200 Sieve	Classification USCS	Classification AASHTO	Water Content (%)	Dry Density (%)	Sulfate (%)
B-9	4	25	9	37	SC	A-4 (0)	8.0		0.92
B-9	9						8.3		
B-9	14						7.9		
B-9	19						4.3		
B-10	0-4	29	15	46	SC	A-6 (3)			0.40
B-10	4	26	11	58	CL	A-6 (3)	20.3	113.3	

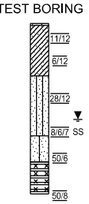
TYPE OF MATERIAL

- Asphalt Pavement
- Fill - CLAY
- Fill - SAND
- TOPSOIL
- Native - SAND, gravelly
- Native - CLAY
- Native - GRAVEL, silty
- Bedrock - SANDSTONE
- Bedrock - SHALE
- Fill - Aggregate Base Course
- Fill - SAND
- Fill - CLAY
- Native - SAND, silty
- Native - SAND, clayey
- Native - CLAY, gravelly
- Native - CLAY, sandy
- Bedrock - CLAYSTONE

SEE INDIVIDUAL LOG SHEETS FOR ADDITIONAL DESCRIPTION OF MATERIAL ENCOUNTERED

LEGEND

TEST BORING



B Bridge Borehole

Ground Water Level At Time of Drilling

9/12 9 Blows for 12 Inches

50/3 50 Blows for 3 Inches

8/6/7 SS Split Spoon Sampler
Required 8 Blows for 6 Inches
Required 6 Blows for 6 Inches
Required 7 Blows for 6 Inches

BORING ID NOTED AT THE TOP OF LOG
BLOW COUNTS OBTAINED WITH SPLIT SPOON SAMPLERS ARE NOTED WITH "SS". ALL OTHER BLOW COUNTS OBTAINED WITH A MODIFIED CALIFORNIA BARREL SAMPLER
SEE INDIVIDUAL LOG SHEETS FOR MORE DETAIL

Print Date: 7/28/2015
File Name: 20448GEO_F5 EngGeo-WC CBC.dgn
Horiz. Scale: 1:40 Vert. Scale: 1:20

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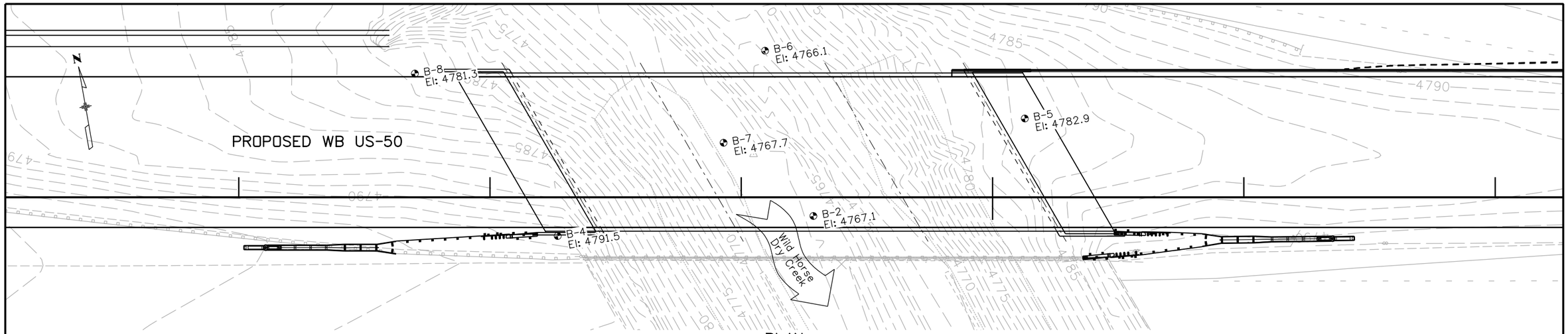
Region 2 DTD

As Constructed
No Revisions:
Revised:
Void:

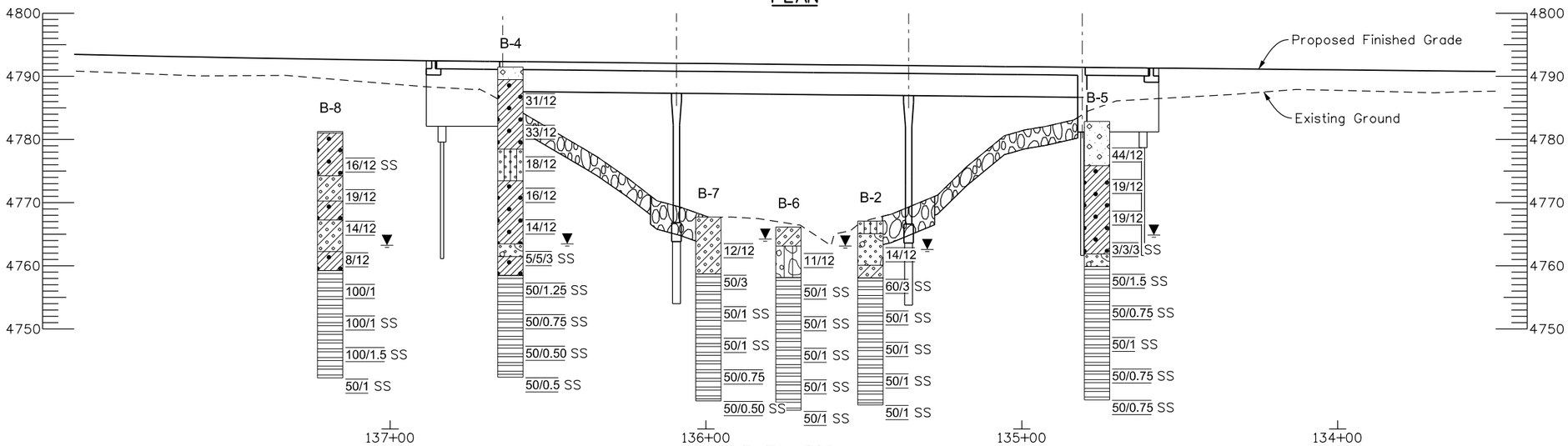
US 50 WEST WESTBOUND
WILLIAMS CREEK CBC
ENGINEERING GEOLOGY

Designer: R. Lepro
Detailer: D. Knight
Subset: Geotech
Structure Numbers:
Subset Sheets: 10 of 11

Project No./Code
STA 0503-088
20448
Figure 5



PLAN



ELEVATION

SUMMARY OF TEST RESULTS

Sample ID	Depth (ft)	Liquid Limit	Plasticity Index	%< #200 Sieve	Classification USCS	Classification AASHTO	Water Content (%)	Dry Density (%)	Sulfate (%)
B-2	0-4	26	9	51	CL	A-4 (2)			
B-2	4						11.2	125.9	
B-2	9						12.1		
B-2	9.5	24	8	22	SC	A-2-4 (0)			
B-2	14						12.6		
B-2	19						9.4		
B-2	24						10.6		
B-4	0-15								
B-4	4						10.7	124.0	
B-4	9	30	16	54	CL	A-6 (5)	11.2	128.5	
B-4	14			47			11.3	125.9	
B-4	19	35	20	94	CL	A-6 (18)	18.2	110.8	1.74
B-4	24						20.6	107.4	
B-4	29			25			13.9		
B-4	34						10.3		
B-4	39						15.8		
B-4	44						10.9		
B-4	49						5.0		
B-5	4						9.3	131.0	
B-5	9	30	17	72	CL	A-6 (10)	13.4	120.1	2.07
B-5	14	32	17	80	CL	A-6 (12)	17.7	112.5	
B-5	19						21.8		
B-5	24						8.7		
B-5	29						6.4		
B-5	34						10.2		
B-5	44						1.9		
B-6	0-4	29	15	60	CL	A-6 (6)			
B-6	4						12.5	125.9	
B-6	5-8	NP	NP	5	SW	A-1-a (0)	7.2		
B-6	14								
B-6	19						9.3		
B-6	24						13.8		
B-6	29						5.7		
B-7	0-4								
B-7	4						9.3	128.9	
B-7	9						8.4	128.9	
B-7	14						6.5		
B-7	19						15.2		
B-7	24	24	10	43	SC	A-4 (1)			0.44
B-7	29						14.2		
B-8	4						13.4	115.8	
B-8	9	23	8	91	CL	A-4 (5)	11.7	114.6	1.26
B-8	14	27	12	56	CL	A-6 (4)			
B-8	29						15.2		0.39
B-8	34	25	9	41	SC	A-4 (0)	14.6		

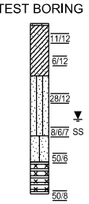
TYPE OF MATERIAL

- Asphalt Pavement
- Fill - Aggregate Base Course
- Fill - CLAY
- Fill - SAND
- Fill - SAND
- Fill - CLAY
- TOPSOIL
- Native - SAND, silty
- Native - SAND, gravelly
- Native - SAND, clayey
- Native - CLAY
- Native - CLAY, gravelly
- Native - GRAVEL, silty
- Native - CLAY, sandy
- Bedrock - SANDSTONE
- Bedrock - CLAYSTONE
- Bedrock - SHALE

SEE INDIVIDUAL LOG SHEETS FOR ADDITIONAL DESCRIPTION OF MATERIAL ENCOUNTERED

LEGEND

TEST BORING



- B — Bridge Borehole
- Ground Water Level At Time of Drilling
- 9/12 — 9 Blows for 12 Inches
- 50/3 — 50 Blows for 3 Inches
- 8/6/7 SS — Split Spoon Sampler Required 8 Blows for 6 Inches Required 6 Blows for 6 Inches Required 7 Blows for 6 Inches

BORING ID NOTED AT THE TOP OF LOG
BLOW COUNTS OBTAINED WITH SPLIT SPOON SAMPLERS ARE NOTED WITH "SS". ALL OTHER BLOW COUNTS OBTAINED WITH A MODIFIED CALIFORNIA BARREL SAMPLER
SEE INDIVIDUAL LOG SHEETS FOR MORE DETAIL

Print Date: 7/28/2015
File Name: 20448GEO_F6 EngGeo-WHDC Bridge.dgn
Horiz. Scale: 1:40 Vert. Scale: 1:20

JFS&A RockSol Consulting Group, Inc.

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Region 2 DTD

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No Revisions:
Revised:
Void:

US 50 WEST WESTBOUND
WILD HORSE DRY CREEK BRIDGE
ENGINEERING GEOLOGY

Designer: R. Lepro
Detailer: D. Knight
Subset: Geotech
Structure Numbers:
Subset Sheets: 11 of 11

Project No./Code
STA 0503-088
20448
Figure 6

DKnight 2:28:31 PM M:\PROJECTS\302.02 US-50 West\Sheet Files\20448GEO_F6 EngGeo-WHDC Bridge.dgn

APPENDIX A

LEGEND
AND
INDIVIDUAL BOREHOLE LOGS

BR-1, BR-2, CBC-1, CBC-2, PV-1 through PV-12, WC-1, and WC-2

LEGEND

RockSol Consulting Group, Inc.

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado

LITHOLOGY

- Asphalt Pavement
- Fill - Aggregate Base Course
- Fill - CLAY
- Fill - SAND
- Fill - SAND
- Fill - CLAY
- TOPSOIL
- Native - SAND, silty
- Native - SAND, gravelly
- Native - SAND, clayey
- Native - CLAY
- Native - CLAY, gravelly
- Native - CLAY, sandy
- Native - GRAVEL, silty
- Bedrock - CLAYSTONE
- Bedrock - SANDSTONE
- Bedrock - SHALE

SAMPLE TYPE

Auger Cuttings

MODIFIED CALIFORNIA SAMPLER
2.5" O.D. AND 2" I.D.
WITH BRASS LINERS INCLUDED

SPLIT SPOON SAMPLER
2" O.D. AND 1 3/8" I.D.
NO LINERS

15/12 Indicates 15 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 12 inches.

50/11 Indicates 50 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 11 inches.

5,5,5 Indicates 5 blows, 5 blows, 5 blows of a 140 pound hammer falling 30 inches was required to drive the sampler 18 inches.

GROUND WATER LEVEL NOTED AT THE TIME OF DRILLING

RockSol Consulting Group, Inc.

BORING : BR-1

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4826.9 ft **STATION NO.** 162+00
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601426.1 **EAST** 241437.8
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: NW corner, EB US50 & Pueblo Blvd.
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES
WATER DEPTH 23.0 ft on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4827	0		(Fill) SAND, gravel, moist, light brown, hard, approximately 2" in depth (Native) SAND, silty to clayey, slightly moist to moist, light brown, medium dense to dense										
4822	5		(Bedrock) SANDSTONE, clayey (interbedded claystone), slightly moist, light brown, hard	MC	50/11		0.73	112.9	9.9	30	18	12	43.5
4817	10		(Bedrock) SANDSTONE, clayey, slightly moist, light brown, very hard	MC	50/6	0.1		123.1	10.2				
4812	15			MC	50/3			123.4	9.7				
4807	20		(Bedrock) CLAYSTONE, sandy, slightly moist, light brown, very hard	SS	50/6		0.77		10.7	33	17	16	85.5
4802	25		(Bedrock) SHALE, silty to clayey, moist to wet, dark gray, very hard	MC	50/1								
			Bottom of hole at 29.1 feet.	SS	100/1								

LOG - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

RockSol Consulting Group, Inc.

BORING : BR-2

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4826.8 ft **STATION NO.** 160+80
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601255.1 **EAST** 241543.1
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: SE corner, EB US50 & Pueblo Blvd.
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES
WATER DEPTH None Encountered on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4827	0		(Fill) SAND, gravel, very moist, light brown, loose, approximately 6" in thickness										
			(Fill) CLAY, sandy, moist, light brown, medium stiff										
			(Bedrock) CLAYSTONE, sandy, moist, light brown, hard to very hard										
4822	5			MC	50/12	1.6	0.70	126.4	12.7				
4817	10			MC	50/4			127.6	10.0	27	18	9	60.1
4812	15			MC	50/6		0.26	114.9	11.6	31	14	17	74.0
4807	20			SS	50/4								
			(Bedrock) SHALE, silty to clayey, slightly moist to moist, gray, very hard										
4802	25			SS	50/1								
			Bottom of hole at 28.0 feet.										

RockSol Consulting Group, Inc.

BORING : CBC-1

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/15/15 **COMPLETED** 5/15/15
GROUND ELEVATION 4980.0 ft **STATION NO.** 283+00
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 604631.0 **EAST** 229793.8
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: West of Purcell Blvd north of culvert
LOGGED BY H. Ochoa **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES S of US50
WATER DEPTH 9.5 ft on 5/15/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4980	0		TOPSOIL, clay, sandy, approximately 6 inches in thickness	B BULK			0.03			27	15	12	63.9
			(Fill) CLAY, sandy, slightly moist to moist, brown, very stiff										
4975	5			MC	21/12			117.8	14.8				
			(Fill) CLAY, (reworked shale), very moist to wet, light brown, medium stiffness										
4970	10			MC	5/12			131.1	7.9				17.4
			(Bedrock) SHALE, slightly moist, light brown, very hard										
			Bottom of hole at 13.5 feet.	SS	50/0.75								

Approximate Bulk Depth 0-5
Liquid Limit= 27
Plastic Limit= 15
Plasticity Index= 12
Fines Content= ERROR
Sulfate= 0.03

RockSol Consulting Group, Inc.

BORING : CBC-2

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/15/15 **COMPLETED** 5/15/15
GROUND ELEVATION 4975.8 ft **STATION NO.** 281+70
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 604524.5 **EAST** 229889.2
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: East side of Purcell Blvd, South side of culvert
LOGGED BY H. Ochoa **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES S of US50
WATER DEPTH 7.0 ft on 5/15/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4976	0		TOPSOIL, clay, sandy, approximately 6 inches in thickness, moist, brown, stiff to very stiff	B BULK			0.77			27	14	13	49.4
			(Fill) SAND, clayey, sandy clay in parts (reworked shale), slightly moist to wet, light brown to brown, medium dense										
4971	5			MC	25/12			127.8	8.9				
			(Bedrock) SHALE, slightly silty, slightly moist to moist, brownish gray, very hard, iron oxide staining										
4966	10			MC	50/4.5		0.10	134.4	7.9				
			Bottom of hole at 11.5 feet.	SS	50/0.5								

Approximate Bulk Depth 0-5
Liquid Limit= 27
Plastic Limit= 14
Plasticity Index= 13
Fines Content= ERROR
Sulfate= 0.77

RockSol Consulting Group, Inc.

BORING : PV-1

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4980.4 ft **STATION NO.** 277+40
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 604740.3 **EAST** 230428.8
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: WB US50, E of Purcell St.
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Right turn lane
WATER DEPTH None Encountered on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4980	0		Asphalt Pavement, approximately 11" in thickness										
			Aggregate Base Course, approximately 6" in thickness	B BULK			0.03						34.1
			(Native) SAND, clayey, very moist, light brown, loose to medium dense	MC	6/12	-0.1		108.7	15.7				
4975	5			MC	9/12			111.1	17.0				
4970	10			MC	12/12			113.4	16.8				
			Bottom of hole at 10.0 feet.										

Approximate Bulk Depth 0.91-5
Liquid Limit=
Plastic Limit=
Plasticity Index=
Fines Content= ERROR
Sulfate= 0.03

RockSol Consulting Group, Inc.

BORING : PV-2

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4964.6 ft **STATION NO.** 256+80
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 604068.4 **EAST** 232377.6
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: WB US50
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Lane 2
WATER DEPTH None Encountered on 5/12/12

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4965	0		Asphalt Pavement, approximately 10" in thickness										
			(Fill) SAND, clayey moist, light brown, loose	BULK			0.06			37	13	24	33.6
				MC	9/12	0.0		108.3	18.0				
4960	5		(Native) SAND, clayey, moist, light brown, loose	MC	6/12			106.2	17.9				
			(Bedrock) SHALE, silty to clayey, slightly moist to moist, dark gray, very hard	MC	SR								
			Bottom of hole at 9.0 feet.										

Approximate Bulk Depth 0.83-5
Liquid Limit= 37
Plastic Limit= 13
Plasticity Index= 24
Fines Content= ERROR
Sulfate= 0.06

RockSol Consulting Group, Inc.

BORING : PV-3

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4956.3 ft **STATION NO.** 236+50
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 603422.2 **EAST** 234300.1
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: WB US50
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Lane 2, core in shoulder
WATER DEPTH None Encountered on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4956	0		Asphalt Pavement, approximately 10" in thickness										
			(Native) CLAY, sandy, moist, light brown, medium stiff	B BULK			0.20			30	14	16	51.7
				MC	7/12	0.1		104.9	18.4				
4951	5			MC	6/12			106.7	17.0				
			(Native) CLAY, sandy, moist, light brown, very stiff										
4946	10			MC	20/12			118.3	12.1				
			Bottom of hole at 10.0 feet.										

Approximate Bulk Depth 0.83-5
Liquid Limit= 30
Plastic Limit= 14
Plasticity Index= 16
Fines Content= ERROR
Sulfate= 0.20

RockSol Consulting Group, Inc.

BORING : PV-4

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4934.9 ft **STATION NO.** 216+80
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 602759.4 **EAST** 236164.2
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: WB US50
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Lane 1
WATER DEPTH None Encountered on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4935	0		Asphalt Pavement, approximately 11" in thickness										
			(Fill) SAND, clayey to silty, moist, light brown to brown, loose	BULK			0.67			27	14	13	49.5
				MC	7/12	0.0		102.6	20.5				
4930	5			MC	6/12			105.8	18.0				
			(Native) CLAY, sandy, moist, light brown, very stiff										
4925	10			MC	17/12			105.3	21.1				
			Bottom of hole at 10.0 feet.										

Approximate Bulk Depth 0.91-5
Liquid Limit= 27
Plastic Limit= 14
Plasticity Index= 13
Fines Content= ERROR
Sulfate= 0.67

RockSol Consulting Group, Inc.

BORING : PV-5

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4912.9 ft **STATION NO.** 196+80
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 602121.5 **EAST** 238049.4
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: WB US50
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Inside shoulder, core in Lane 1
WATER DEPTH None Encountered on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4913	0		Asphalt Pavement, approximately 10.5" in thickness										
			Aggregate Base Course, approximately 6" in thickness	B BULK			0.62			22	14	8	36.1
			(Fill) SAND, clayey with gravel, moist, light brown, medium dense	MC	27/12	0.9		122.7	12.5				
4908	5		(Native) CLAY, sandy with gravel in parts, moist, light brown, stiff	MC	13/12			110.3	14.5				
4903	10			MC	10/12			123.2	10.5				
			Bottom of hole at 10.0 feet.										

Approximate Bulk Depth 0.875-5
Liquid Limit= 22
Plastic Limit= 14
Plasticity Index= 8
Fines Content= ERROR
Sulfate= 0.62

RockSol Consulting Group, Inc.

BORING : PV-6

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/15/15 **COMPLETED** 5/15/15
GROUND ELEVATION 4889.1 ft **STATION NO.** 186+80
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601850.4 **EAST** 239018.7
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 6.0"
BORING LOCATION: Median EB/WB Hwy 50
LOGGED BY H. Ochoa **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES N side of EB US50, ~2500' W of Pueblo Blvd
WATER DEPTH None Encountered on 5/15/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4889	0		(Topsoil) SAND, clayey, moist, brown, medium dense, approximately 6" in thickness	B BULK			0.18			20	15	5	24.6
			(Fill) SAND silty to clayey with gravel, slightly moist to moist, light brown, dense	MC	33/12	-1.0		123.1	4.8				
4884	5		(Native) SAND, silty, slightly moist to moist, brown, medium dense	MC	29/12			128.7	5.2				
4879	10			MC	22/12			115.8	12.1				
			Bottom of hole at 10.0 feet.										

Approximate Bulk Depth 0-5
Liquid Limit= 20
Plastic Limit= 15
Plasticity Index= 5
Fines Content= ERROR
Sulfate= 0.18

RockSol Consulting Group, Inc.

BORING : PV-7

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/15/15 **COMPLETED** 5/15/15
GROUND ELEVATION 4863.8 ft **STATION NO.** 176+90
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601665.3 **EAST** 239987.9
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 6.0"
BORING LOCATION: Median, Hwy 50
LOGGED BY H. Ochoa **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES N side of EB US50, approx 1500' E of Pueblo Blvd
WATER DEPTH None Encountered on 5/15/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4864	0		(Topsoil) CLAY, sandy, moist, brown, stiff to very stiff, approximately 6" in thickness	B BULK			0.14			32	14	18	79.0
			(Native) CLAY, sandy, slightly moist, light brown, very stiff	MC	41/12	7.5		124.0	9.9				
			(Bedrock) CLAYSTONE, slightly moist to moist, light brown, very hard										
4859	5			MC	50/10			129.8	9.6				
				MC	50/7			130.1	9.1				
			Bottom of hole at 9.6 feet.										

Approximate Bulk Depth 0-5
Liquid Limit= 32
Plastic Limit= 14
Plasticity Index= 18
Fines Content= ERROR
Sulfate= 0.14

LOG - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

RockSol Consulting Group, Inc.

BORING : PV-8

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/15/15 **COMPLETED** 5/15/15
GROUND ELEVATION 4833.7 ft **STATION NO.** 166+80
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601495.6 **EAST** 240981.6
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 6.0"
BORING LOCATION: Median EB & WB US50
LOGGED BY H. Ochoa **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES N side of EB US50, approx 500' W of Pueblo Blvd
WATER DEPTH None Encountered on 5/15/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4834	0		(Topsoil) CLAY, sandy, moist, brown, stiff to very stiff, approximately 6" in thickness	B BULK			0.08			28	16	12	60.1
			(Native) CLAY, sandy, slightly moist to moist, light brown, stiff to very stiff	MC	13/12	0.8		99.7	5.9				
4829	5			MC	21/12			112.9	6.6				
			(Bedrock) SHALE, slightly silty to sandy, slightly moist to moist, light brown, very hard	MC	50/6			128.9	8.4				
			Bottom of hole at 9.5 feet.										

Approximate Bulk Depth 0-5
Liquid Limit= 28
Plastic Limit= 16
Plasticity Index= 12
Fines Content= ERROR
Sulfate= 0.08

LOG - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

RockSol Consulting Group, Inc.

BORING : PV-9

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/15/15 **COMPLETED** 5/15/15
GROUND ELEVATION 4802.2 ft **STATION NO.** 143+80
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601094.8 **EAST** 243259.0
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 6.0"
BORING LOCATION: Median WB/EB Hwy 50
LOGGED BY H. Ochoa **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES N side of EB US50, approx 1700' E of Pueblo Blvd
WATER DEPTH None Encountered on 5/15/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4802	0		(Topsoil) SAND, silty to clayey, moist, brown, medium dense, approximately 6" in thickness	B BULK			0.02			23	17	6	43.3
			(Native) SAND, silty to clayey with gravel in parts, slightly moist to moist, light brown, medium dense	MC	15/12	1.2		99.6	3.9				
4797	5			MC	10/12			103.7	3.9				
			(Native) CLAY, silty to sandy, slightly moist, light brown, stiff										
4792	10			MC	16/12			107.4	6.2				
			Bottom of hole at 10.0 feet.										

Approximate Bulk Depth 0-5
Liquid Limit= 23
Plastic Limit= 17
Plasticity Index= 6
Fines Content= ERROR
Sulfate= 0.02

RockSol Consulting Group, Inc.

BORING : PV-10

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4792.3 ft **STATION NO.** 128+00
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 600784.3 **EAST** 244789.9
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: WB US50
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Center median
WATER DEPTH None Encountered on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4792	0		Asphalt Pavement, approximately 6" in thickness										
			Aggregate Base Course, approximately 6" in thickness	B BULK			1.72			33	15	18	51.1
			(Native) CLAY, sandy, slightly moist to moist, light brown, very stiff to hard	MC	17/12	0.0		114.1	16.3				
4787	5			MC	41/12			105.0	19.2				
			(Bedrock) CLAYSTONE, sandy, slightly moist, light brown, very hard	MC	50/11			113.6	17.1				
			Bottom of hole at 10.0 feet.										

Approximate Bulk Depth 0.5-5
Liquid Limit= 33
Plastic Limit= 15
Plasticity Index= 18
Fines Content= ERROR
Sulfate= 1.72

RockSol Consulting Group, Inc.

BORING : PV-11

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4835.6 ft **STATION NO.** 109+50
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 600491.1 **EAST** 246623.1
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: US50 W of Wills Blvd.
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES Right turn lane
WATER DEPTH None Encountered on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4836	0		Asphalt Pavement, approximately 8.5" in thickness										
			(Fill) SAND, slightly silty to gravelly, moist, brown, medium dense	B BULK			0.56			26	13	13	34.7
			(Native) CLAY, sandy to silty, moist, brown, stiff	MC	15/12	0.8		112.9	16.1				
4831	5			MC	12/12	0.1		104.6	20.5				
			Bottom of hole at 5.0 feet.										

Approximate Bulk Depth 0.7-5
Liquid Limit= 26
Plastic Limit= 13
Plasticity Index= 13
Fines Content= ERROR
Sulfate= 0.56

RockSol Consulting Group, Inc.

BORING : PV-12

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/15/15 **COMPLETED** 5/15/15
GROUND ELEVATION 4810.4 ft **STATION NO.** 149+50
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601416.6 **EAST** 242714.6
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 6.0"
BORING LOCATION: Median EB/WB Hwy 50
LOGGED BY H. Ochoa **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES S side of WB US 50, approx 1000' E of Pueblo Blvd
WATER DEPTH None Encountered on 5/15/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4810	0		(Topsoil) SAND, silty, slightly moist, light brown, loose to medium dense, approximately 6 inches in thickness	B BULK			0.38			23	14	9	31.0
			(Native) SAND, slightly clayey to silty with gravel, slightly moist, light brown to brown, medium dense	MC	17/12			113.8	2.5				
4805	5			MC	18/12			113.8	2.9				
4800	10			MC	23/12			115.5	3.0				
			Bottom of hole at 10.0 feet.										

Approximate Bulk Depth 0-5
Liquid Limit= 23
Plastic Limit= 14
Plasticity Index= 9
Fines Content= ERROR
Sulfate= 0.38

RockSol Consulting Group, Inc.

BORING : WC-1

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/12/15 **COMPLETED** 5/12/15
GROUND ELEVATION 4823.3 ft **STATION NO.** 163+00
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601739.7 **EAST** 241433.8
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: W side of Pueblo Blvd. at Williams Creek
LOGGED BY J. Biller **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES North side of culvert
WATER DEPTH 17.0 ft on 5/12/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4823	0		(Topsoil) SAND, silty to gravelly, wet, brown, loose, approximately 6" in thickness										
			(Fill) SAND, clayey, moist, light brown, dense										
4818	5			MC	48/12			127.9	10.1				
4813	10			MC	49/12			121.2	11.9	29	16	13	43.4
4808	15		(Native) CLAY, sandy with gravel and silty sand, very moist to wet, brown, medium stiff	MC	7/12	-0.5	0.00	111.5	15.9				
			(Bedrock) CLAYSTONE, sandy, moist, brown, very hard										
4803	20			MC	50/7			119.6	14.6				
			(Bedrock) SHALE, very moist to wet, dark gray, very hard										
4798	25			SS	100/1				16.0				31.2
			Bottom of hole at 29.1 feet.	SS	50/1				13.2				

RockSol Consulting Group, Inc.

BORING : WC-2

CLIENT J.F. Sato
PROJECT NAME US 50 West, WB Preliminary Design
PROJECT NUMBER 302.02
PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado
DATE STARTED 5/15/15 **COMPLETED** 5/15/15
GROUND ELEVATION 4814.0 ft **STATION NO.** 159+80
DRILLING CONTRACTOR Old Dirt Drilling
NORTH 601559.5 **EAST** 241719.2
DRILLING METHOD Solid Stem Auger **HOLE SIZE** 4.25"
BORING LOCATION: Median between WB & EB US50
LOGGED BY H. Ochoa **HAMMER TYPE** Automatic
GROUND WATER LEVELS:
NOTES E side of Pueblo Blvd @ Williams Creek, South side of culvert
WATER DEPTH None Encountered on 5/15/15

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS	SWELL POTENTIAL (%)	SULFATE (%)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
4814	0		(Topsoil) CLAY, sandy with gravel, slightly moist, light brown, approximately 6" in thickness	B BULK									
			(Fill) CLAY, sandy with gravel, slightly moist to moist, brown, stiff to very stiff										
			(Native) CLAY with sand to sandy, gravel in parts, slightly moist to moist, light brown, stiff to very stiff										
4809	5			MC	15/12			112.1	6.5				
4804	10			MC	13/12	0.7	0.14	115.9	13.8				
			(Native) GRAVEL, sandy, wet, light brown, medium dense to dense										
4799	15		(Bedrock) SHALE, moist, light brown, very hard	MC	50/4	0.8		132.6	11.4				
			(Bedrock) SHALE, slightly moist, dark gray, very hard										
4794	20			MC	50/1				7.3				
			Bottom of hole at 20.1 feet.										

Approximate Bulk Depth 0-5
Liquid Limit=
Plastic Limit=
Plasticity Index=
Fines Content= ERROR

LOG - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

APPENDIX B

LABORATORY TEST RESULTS

RockSol Consulting Group, Inc.

SUMMARY OF PHYSICAL & CHEMICAL TEST RESULTS

CLIENT J.F. Sato

PROJECT NAME US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02

PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado

Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Swell Potential (%)	%<#200 Sieve	Classification		Water Content (%)	Dry Density (pcf)	Unconfined Compressive Strength (psi)	Sulfate (%)	Resistivity (ohm-cm)	pH	Chlorides (%)	Proctor S=Standard M=Modified		
							USCS	AASHTO								MDD	OMC	S/M
BR-1	4	30	18	12		44	SC	A-6 (2)	9.9	112.9		0.73						
BR-1	9				0.1				10.2	123.1								
BR-1	14								9.7	123.4								
BR-1	19	33	17	16		85	CL	A-6 (12)	10.7			0.77						
BR-2	4				1.6				12.7	126.4		0.70						
BR-2	9	27	18	9		60	CL	A-4 (3)	10.0	127.6								
BR-2	14	31	14	17		74	CL	A-6 (10)	11.6	114.9		0.26						
CBC-1	0-5	27	15	12		64	CL	A-6 (5)				0.03						
CBC-1	4								14.8	117.8								
CBC-1	9					17			7.9	131.1								
CBC-2	0-5	27	14	13		49	SC	A-6 (3)				0.77						
CBC-2	4								8.9	127.8								
CBC-2	9								7.9	134.4		0.10						
PV-1	0.91-5					34						0.03	1150 ohms-cm @ 19.5@	6.9	0.0111			
PV-1	0.92																	
PV-1	2				-0.1				15.7	108.7								
PV-1	4								17.0	111.1								
PV-1	9								16.8	113.4								
PV-2	0.83-5	37	13	24		34	SC	A-2-6 (3)				0.06	385 ohms-cm @ 19.5%	7.3	0.1455			
PV-2	2				0.0				18.0	108.3								
PV-2	4								17.9	106.2								
PV-3	0.83-5	30	14	16		52	CL	A-6 (5)				0.20	900 ohms-cm @ 19.3%	8.0	0.0081			
PV-3	2				0.1				18.4	104.9								
PV-3	4								17.0	106.7								
PV-3	9								12.1	118.3								
PV-4	0.91-5	27	14	13		49	SC	A-6 (3)				0.67	860 ohms-cm @ 20.5%	7.1	0.0179			
PV-4	2				0.0				20.5	102.6								
PV-4	4								18.0	105.8								
PV-4	9								21.1	105.3								
PV-5	0.875-5	22	14	8		36	SC	A-4 (0)				0.62	920 ohms-cm @ 17.9%	7.5	0.0132			

RockSol Consulting Group, Inc.

SUMMARY OF PHYSICAL & CHEMICAL TEST RESULTS

CLIENT J.F. Sato

PROJECT NAME US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02

PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado

Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Swell Potential (%)	%<#200 Sieve	Classification		Water Content (%)	Dry Density (pcf)	Unconfined Compressive Strength (psi)	Sulfate (%)	Resistivity (ohm-cm)	pH	Chlorides (%)	Proctor S=Standard M=Modified		
							USCS	AASHTO								MDD	OMC	S/M
PV-5	2				0.9				12.5	122.7								
PV-5	4								14.5	110.3								
PV-5	9								10.5	123.2								
PV-6	0-5	20	15	5		25	SC-SM	A-2-4 (0)				0.18	1800 ohms-cm @ 16.8%	7.6	0.0012			
PV-6	2				-1.0				4.8	123.1								
PV-6	4								5.2	128.7								
PV-6	9								12.1	115.8								
PV-7	0-5	32	14	18		79	CL	A-6 (12)				0.14	880 ohms-cm@25.7%	7.8	0.0029			
PV-7	2				7.5				9.9	124.0								
PV-7	4								9.6	129.8								
PV-7	9								9.1	130.1								
PV-8	0-5	28	16	12		60	CL	A-6 (4)				0.08	610 ohms-cm @ 21.6%	7.3	0.0462			
PV-8	2				0.8				5.9	99.7								
PV-8	4								6.6	112.9								
PV-8	9								8.4	128.9								
PV-9	0-5	23	17	6		43	SC-SM	A-4 (0)				0.02	1300 ohms-cm @ 18.6%	8.0	0.0044			
PV-9	2				1.2				3.9	99.6								
PV-9	4								3.9	103.7								
PV-9	9								6.2	107.4								
PV-10	0.5-5	33	15	18		51	CL	A-6 (6)				1.72	770 ohms-cm @ 22.5%	8.0	0.0130			
PV-10	2				0.0				16.3	114.1								
PV-10	4								19.2	105.0								
PV-10	9								17.1	113.6								
PV-11	0.7-5	26	13	13		35	SC	A-2-6 (1)				0.56	890 ohms-cm @ 19.8%	7.3	0.0226			
PV-11	2				0.8				16.1	112.9								
PV-11	4				0.1				20.5	104.6								
PV-12	0-5	23	14	9		31	SC	A-2-4 (0)				0.38	1200 ohms-cm @ 16.0%	6.7	0.0023			
PV-12	2								2.5	113.8								
PV-12	4								2.9	113.8								
PV-12	9								3.0	115.5								

RockSol Consulting Group, Inc.

SUMMARY OF PHYSICAL & CHEMICAL TEST RESULTS

CLIENT J.F. Sato

PROJECT NAME US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02

PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado

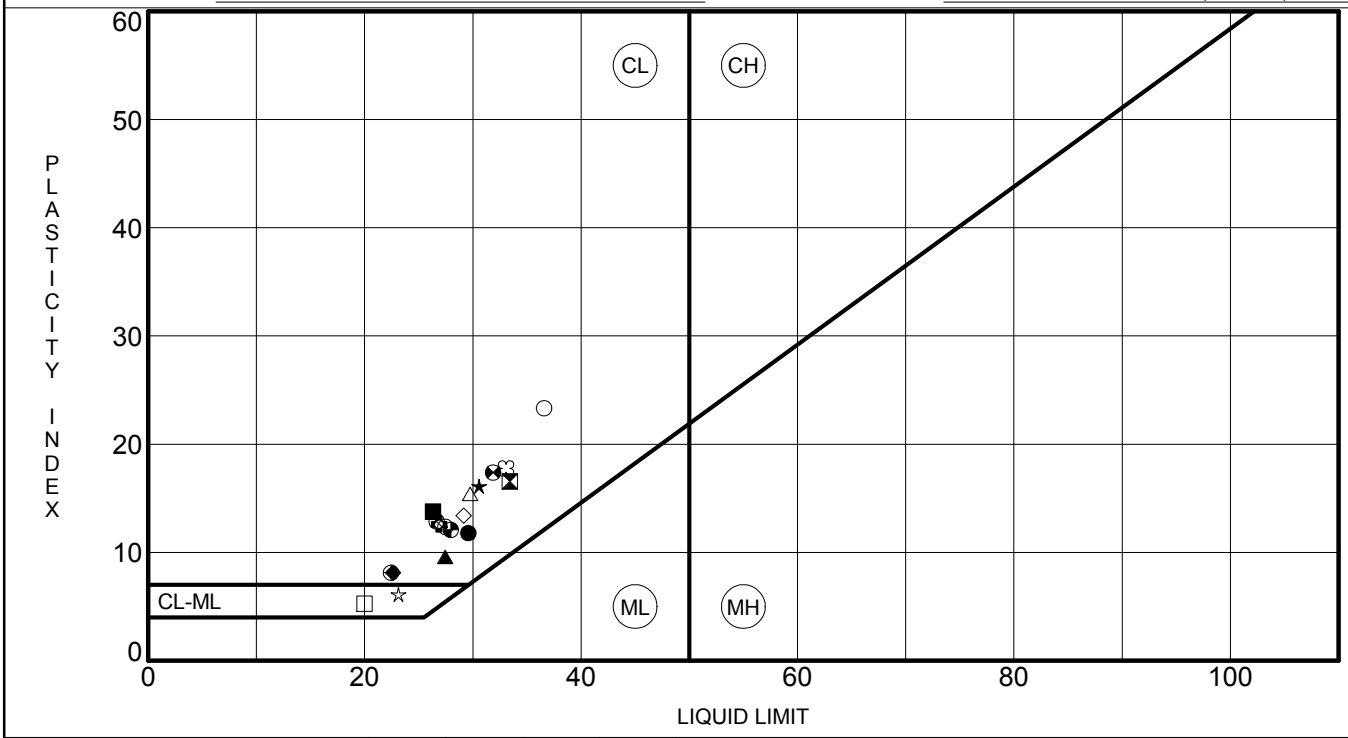
Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Swell Potential (%)	%<#200 Sieve	Classification		Water Content (%)	Dry Density (pcf)	Unconfined Compressive Strength (psi)	Sulfate (%)	Resistivity (ohm-cm)	pH	Chlorides (%)	Proctor S=Standard M=Modified		
							USCS	AASHTO								MDD	OMC	S/M
WC-1	4								10.1	127.9								
WC-1	9	29	16	13		43	SC	A-6 (2)	11.9	121.2								
WC-1	14				-0.5				15.9	111.5		0.00						
WC-1	19								14.6	119.6								
WC-1	24					31			16.0									
WC-1	29								13.2									
WC-2	-5																	
WC-2	4								6.5	112.1								
WC-2	9				0.7				13.8	115.9		0.14						
WC-2	14				0.8				11.4	132.6								
WC-2	19								7.3									

RockSol Consulting Group, Inc.

ATTERBERG LIMITS RESULTS
ASTM D4318 Method A

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



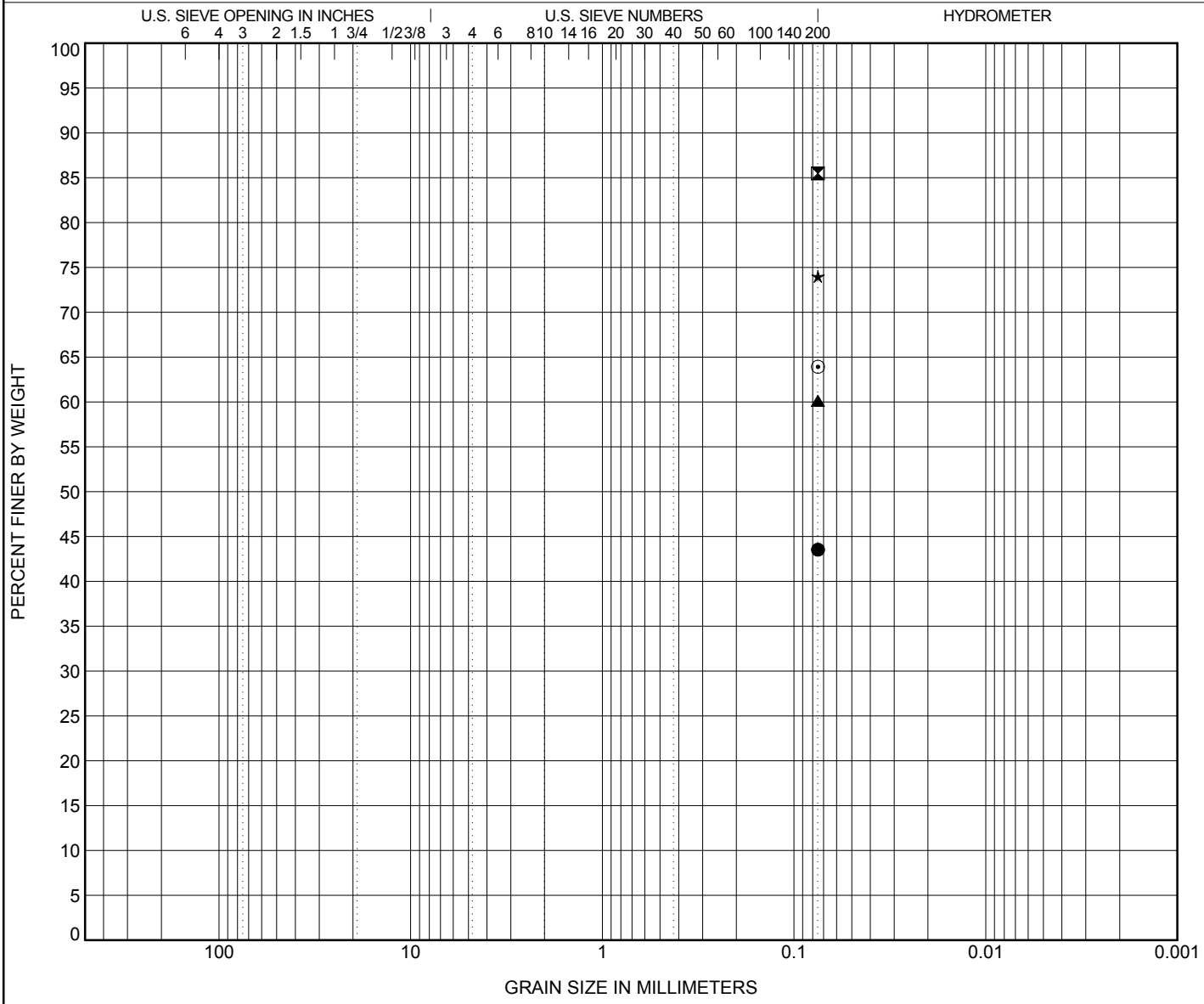
	Specimen Identification		LL	PL	PI	Fines	Classification
●	BR-1	4.0	30	18	12	43.5	(Bedrock) SANDSTONE, clayey (SC) (A-6)
⊠	BR-1	19.0	33	17	16	85.5	(Bedrock) CLAYSTONE, sandy (CL) (A-6)
▲	BR-2	9.0	27	18	9	60.1	(Bedrock) SANDY CLAYSTONE (CL) (A-4)
★	BR-2	14.0	31	14	17	74.0	(Bedrock) CLAYSTONE with SAND (CL) (A-6)
⊙	CBC-1	0.0-5.0	27	15	12	63.9	SANDY LEAN CLAY (CL) (A-6)
✿	CBC-2	0.0-5.0	27	14	13	49.4	CLAYEY SAND (SC) (A-6)
○	PV-2	0.8-5.0	37	13	24	33.6	CLAYEY SAND with GRAVEL (SC) (A-2-6)
△	PV-3	0.8-5.0	30	14	16	51.7	SANDY LEAN CLAY (CL) (A-6)
⊗	PV-4	0.9-5.0	27	14	13	49.5	CLAYEY SAND (SC) (A-6)
⊕	PV-5	0.9-5.0	22	14	8	36.1	CLAYEY SAND with GRAVEL (SC) (A-4)
□	PV-6	0.0-5.0	20	15	5	24.6	SILTY, CLAYEY SAND (SC-SM) (A-2-4)
⊛	PV-7	0.0-5.0	32	14	18	79.0	LEAN CLAY with SAND (CL) (A-6)
◒	PV-8	0.0-5.0	28	16	12	60.1	SANDY LEAN CLAY (CL) (A-6)
☆	PV-9	0.0-5.0	23	17	6	43.3	SILTY, CLAYEY SAND (SC-SM) (A-4)
⊠	PV-10	0.5-5.0	33	15	18	51.1	SANDY LEAN CLAY (CL) (A-6)
■	PV-11	0.7-5.0	26	13	13	34.7	CLAYEY SAND with GRAVEL (SC) (A-2-6)
◆	PV-12	0.0-5.0	23	14	9	31.0	CLAYEY SAND with GRAVEL (SC) (A-2-4)
◇	WC-1	9.0	29	16	13	43.4	CLAYEY SAND (SC) (A-6)

GRAIN SIZE DISTRIBUTION

RockSol Consulting

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BR-1	4.0	(Bedrock) SANDSTONE, clayey (SC) (A-6)	30	18	12		
⊠	BR-1	19.0	(Bedrock) CLAYSTONE, sandy (CL) (A-6)	33	17	16		
▲	BR-2	9.0	(Bedrock) SANDY CLAYSTONE (CL) (A-4)	27	18	9		
★	BR-2	14.0	(Bedrock) CLAYSTONE with SAND (CL) (A-6)	31	14	17		
⊙	CBC-1	0.0-5.0	SANDY LEAN CLAY (CL) (A-6)	27	15	12		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BR-1	4.0	0.075						43.5	
⊠	BR-1	19.0	0.075						85.5	
▲	BR-2	9.0	0.075						60.1	
★	BR-2	14.0	0.075						74.0	
⊙	CBC-1	0.0-5.0	0.075						63.9	

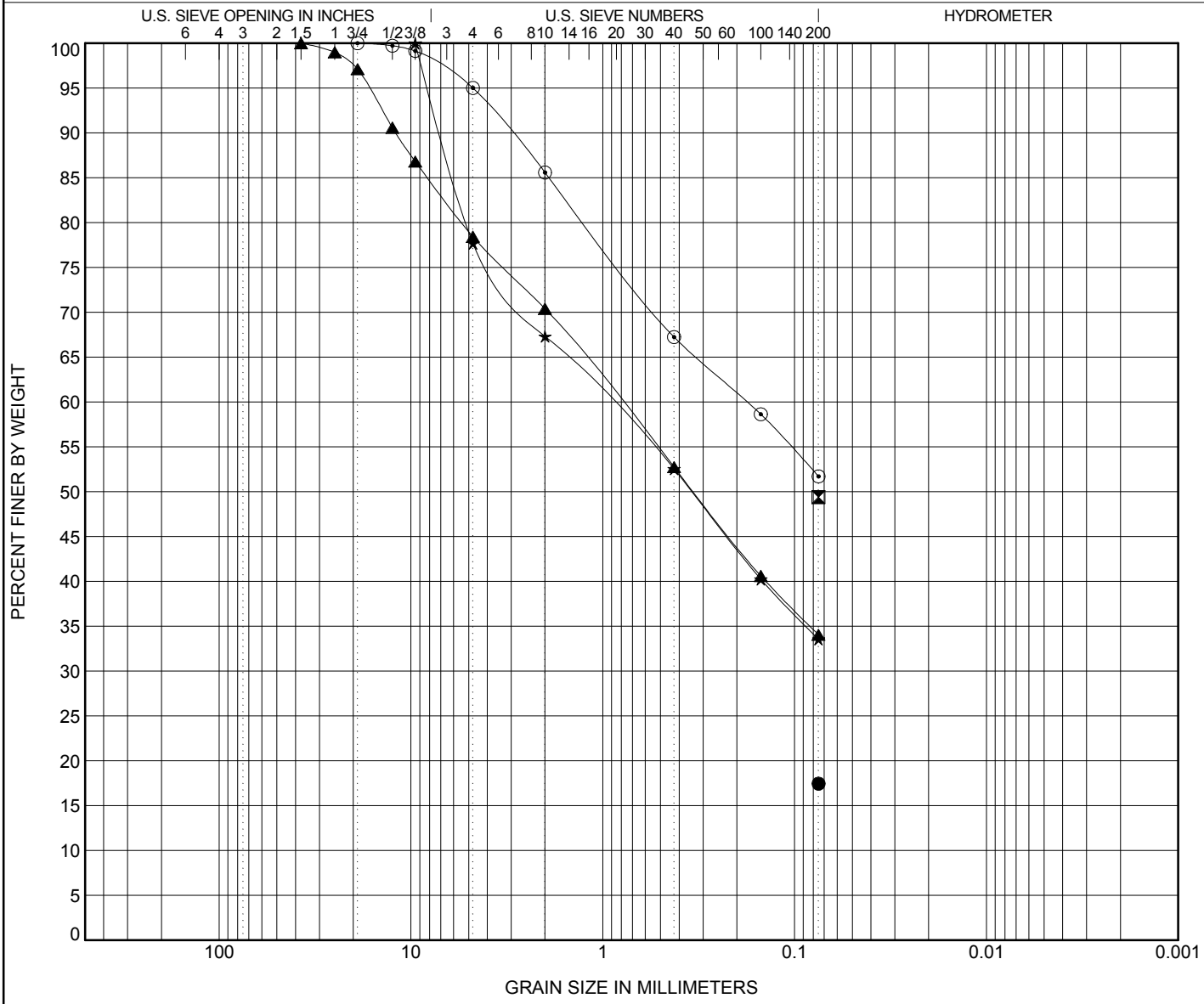
GRADATION - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

GRAIN SIZE DISTRIBUTION

RockSol Consulting

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	CBC-1	9.0	(Fill) CLAY-Reworked Shale					
⊠	CBC-2	0.0-5.0	CLAYEY SAND (SC) (A-6)	27	14	13		
▲	PV-1	0.9-5.0	SAND, clayey					
★	PV-2	0.8-5.0	CLAYEY SAND with GRAVEL (SC) (A-2-6)	37	13	24		
⊙	PV-3	0.8-5.0	SANDY LEAN CLAY (CL) (A-6)	30	14	16		

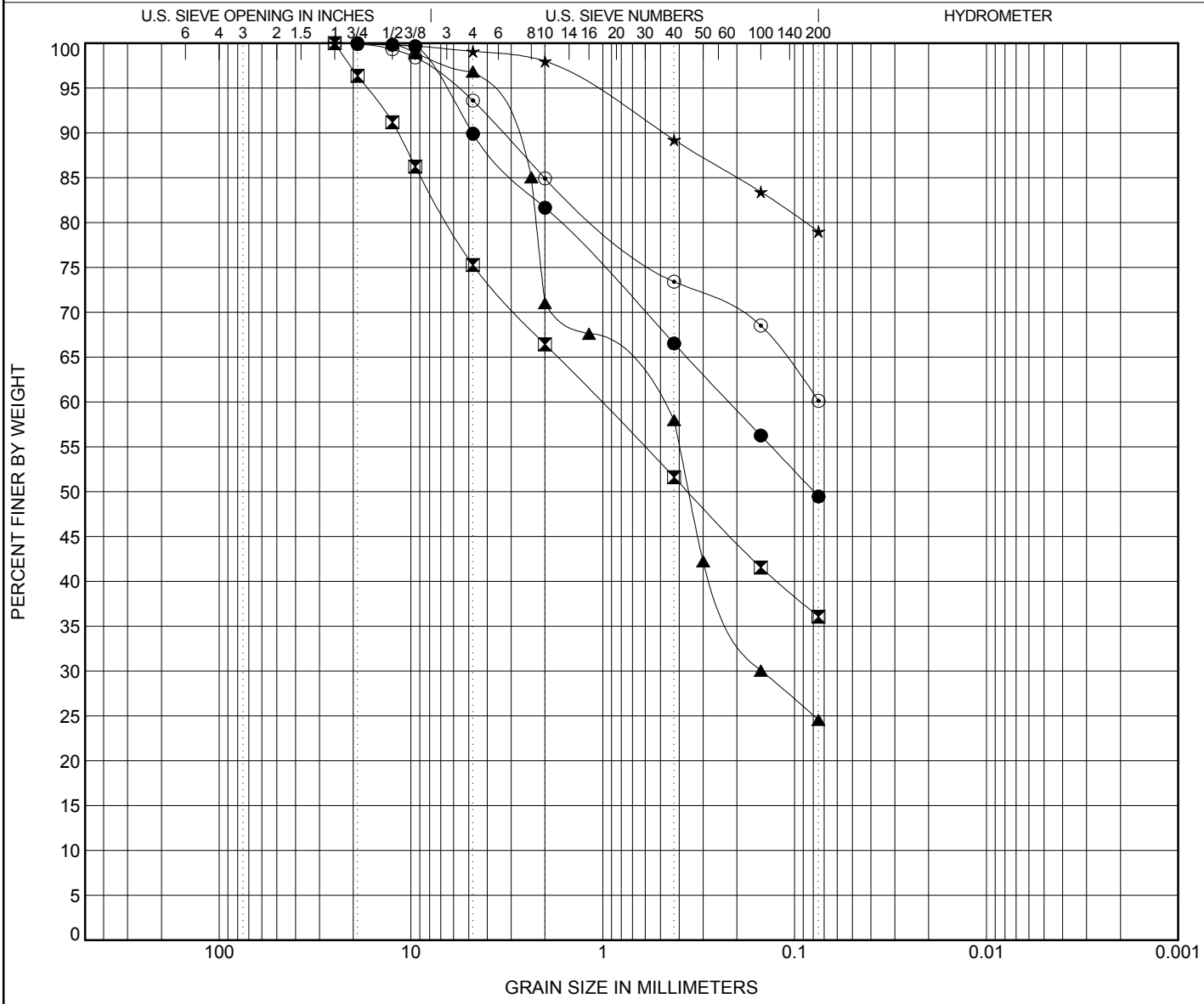
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CBC-1	9.0	0.075						17.4	
⊠	CBC-2	0.0-5.0	0.075						49.4	
▲	PV-1	0.9-5.0	37.5	0.803			21.6	44.4	34.1	
★	PV-2	0.8-5.0	9.5	0.929			22.3	44.1	33.6	
⊙	PV-3	0.8-5.0	19	0.177			5.0	43.3	51.7	

GRAIN SIZE DISTRIBUTION

RockSol Consulting

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	PV-4	0.9-5.0	CLAYEY SAND (SC) (A-6)	27	14	13		
⊠	PV-5	0.9-5.0	CLAYEY SAND with GRAVEL (SC) (A-4)	22	14	8		
▲	PV-6	0.0-5.0	SILTY, CLAYEY SAND (SC-SM) (A-2-4)	20	15	5		
★	PV-7	0.0-5.0	LEAN CLAY with SAND (CL) (A-6)	32	14	18		
⊙	PV-8	0.0-5.0	SANDY LEAN CLAY (CL) (A-6)	28	16	12		

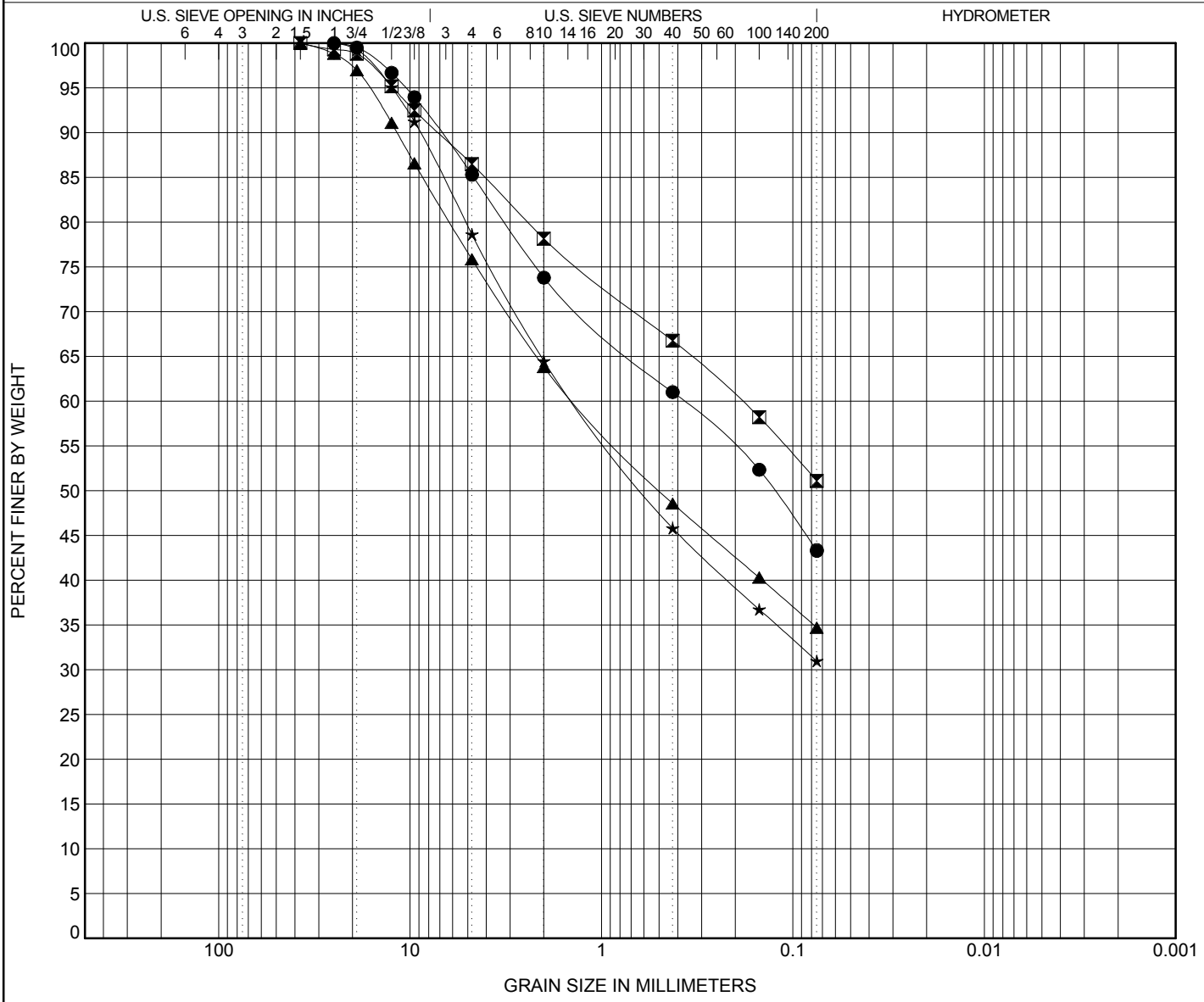
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	PV-4	0.9-5.0	19	0.219			10.1	40.4	49.5	
⊠	PV-5	0.9-5.0	25	1.022			24.7	39.2	36.1	
▲	PV-6	0.0-5.0	12.5	0.526	0.149		3.2	72.3	24.6	
★	PV-7	0.0-5.0	25				0.9	20.1	79.0	
⊙	PV-8	0.0-5.0	25				6.4	33.5	60.1	

GRAIN SIZE DISTRIBUTION

RockSol Consulting

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	PV-9	0.0-5.0	SILTY, CLAYEY SAND (SC-SM) (A-4)	23	17	6		
⊠	PV-10	0.5-5.0	SANDY LEAN CLAY (CL) (A-6)	33	15	18		
▲	PV-11	0.7-5.0	CLAYEY SAND with GRAVEL (SC) (A-2-6)	26	13	13		
★	PV-12	0.0-5.0	CLAYEY SAND with GRAVEL (SC) (A-2-4)	23	14	9		
⊙	WC-1	9.0	CLAYEY SAND (SC) (A-6)	29	16	13		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	PV-9	0.0-5.0	25	0.377			14.7	42.0	43.3	
⊠	PV-10	0.5-5.0	37.5	0.186			13.5	35.4	51.1	
▲	PV-11	0.7-5.0	37.5	1.358			24.2	41.1	34.7	
★	PV-12	0.0-5.0	25	1.379			21.4	47.7	31.0	
⊙	WC-1	9.0	0.075						43.4	

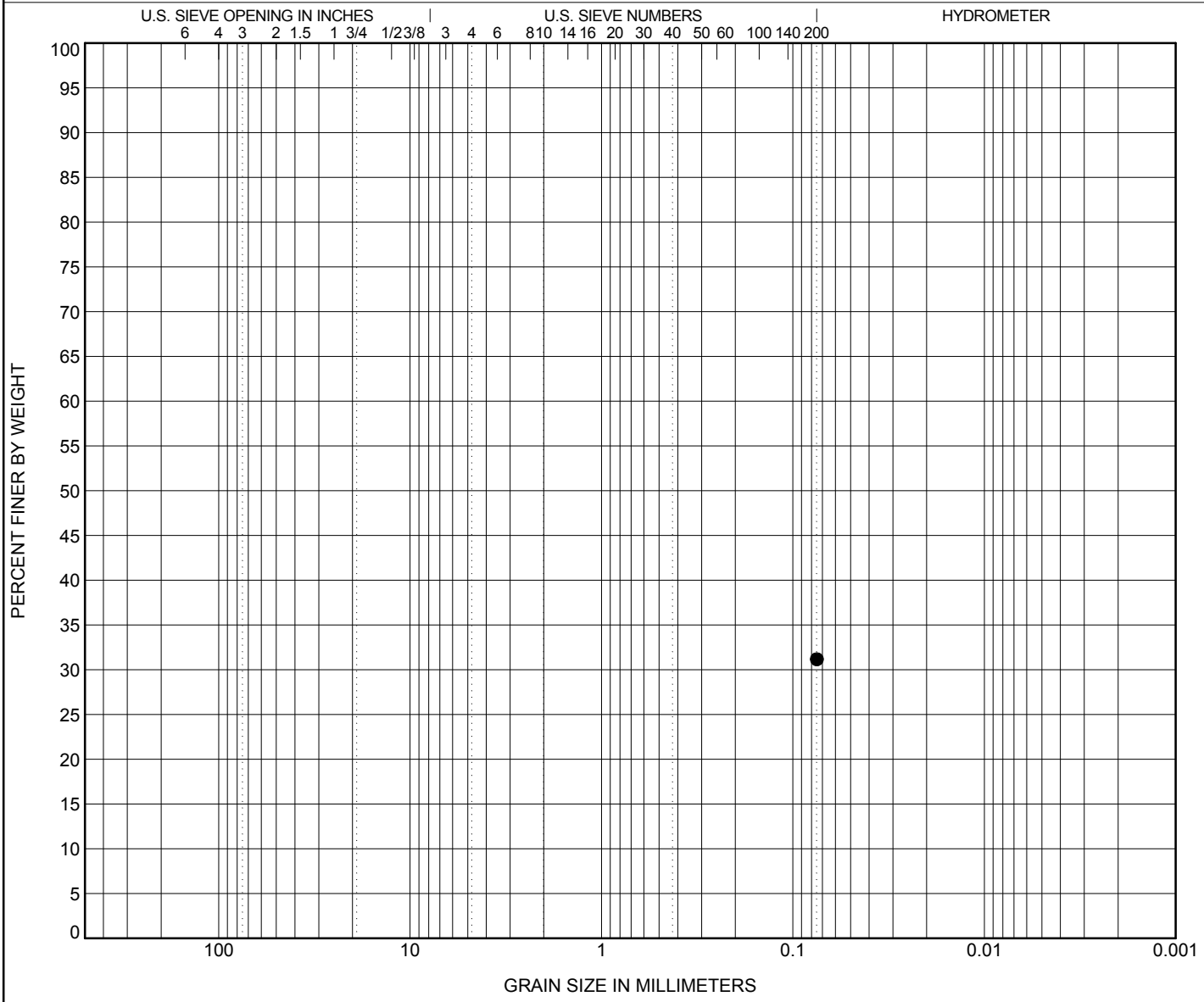
GRADATION - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

GRAIN SIZE DISTRIBUTION

RockSol Consulting

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**WC-1**	**24.0**	**(Bedrock) SHALE**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**WC-1**	**24.0**	**0.075**						**31.2**	

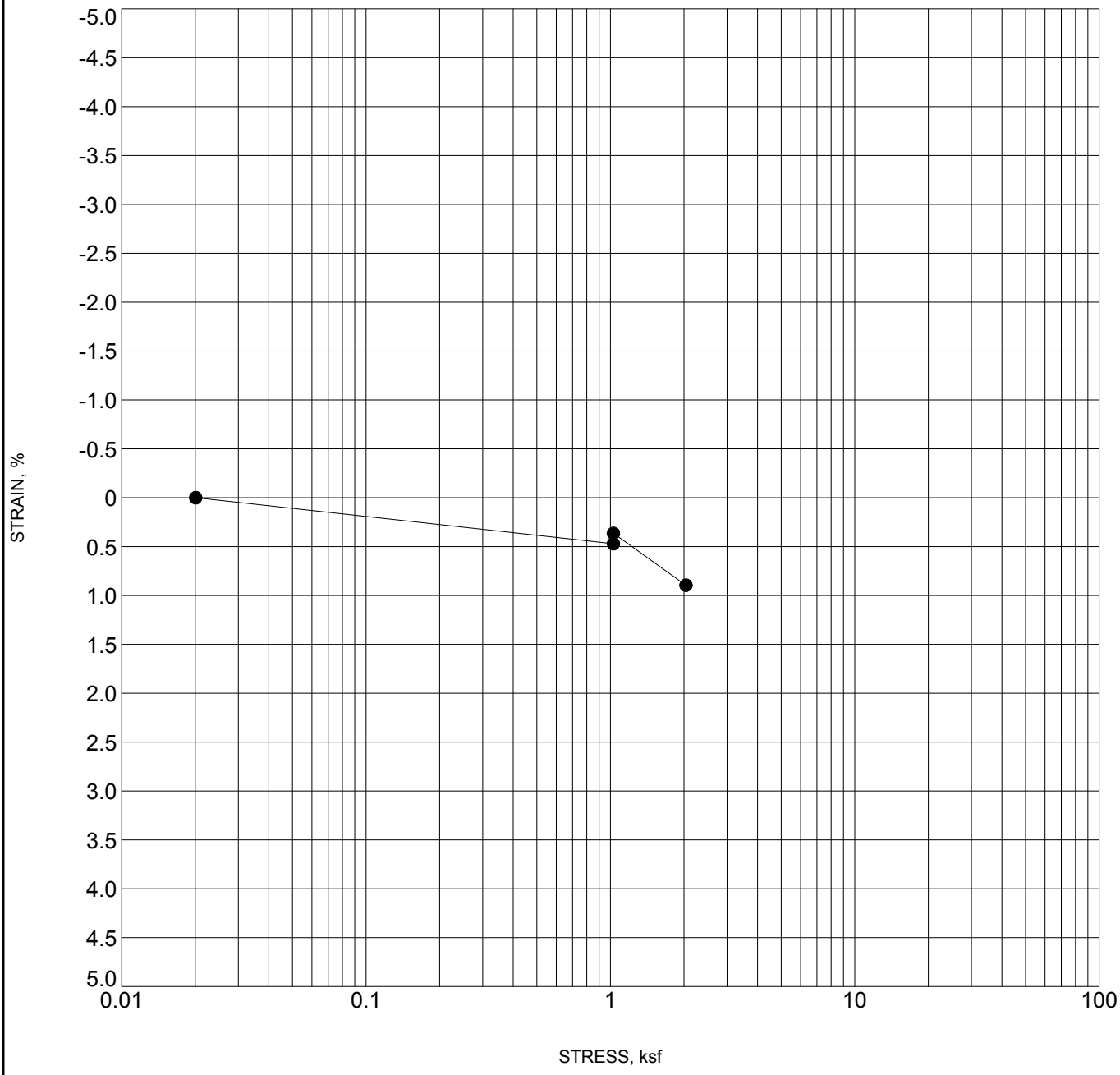
GRADATION - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **BR-1 9**	**(Bedrock) SANDSTONE, clayey**	**0.1**	**123.1**	**10.2**

SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

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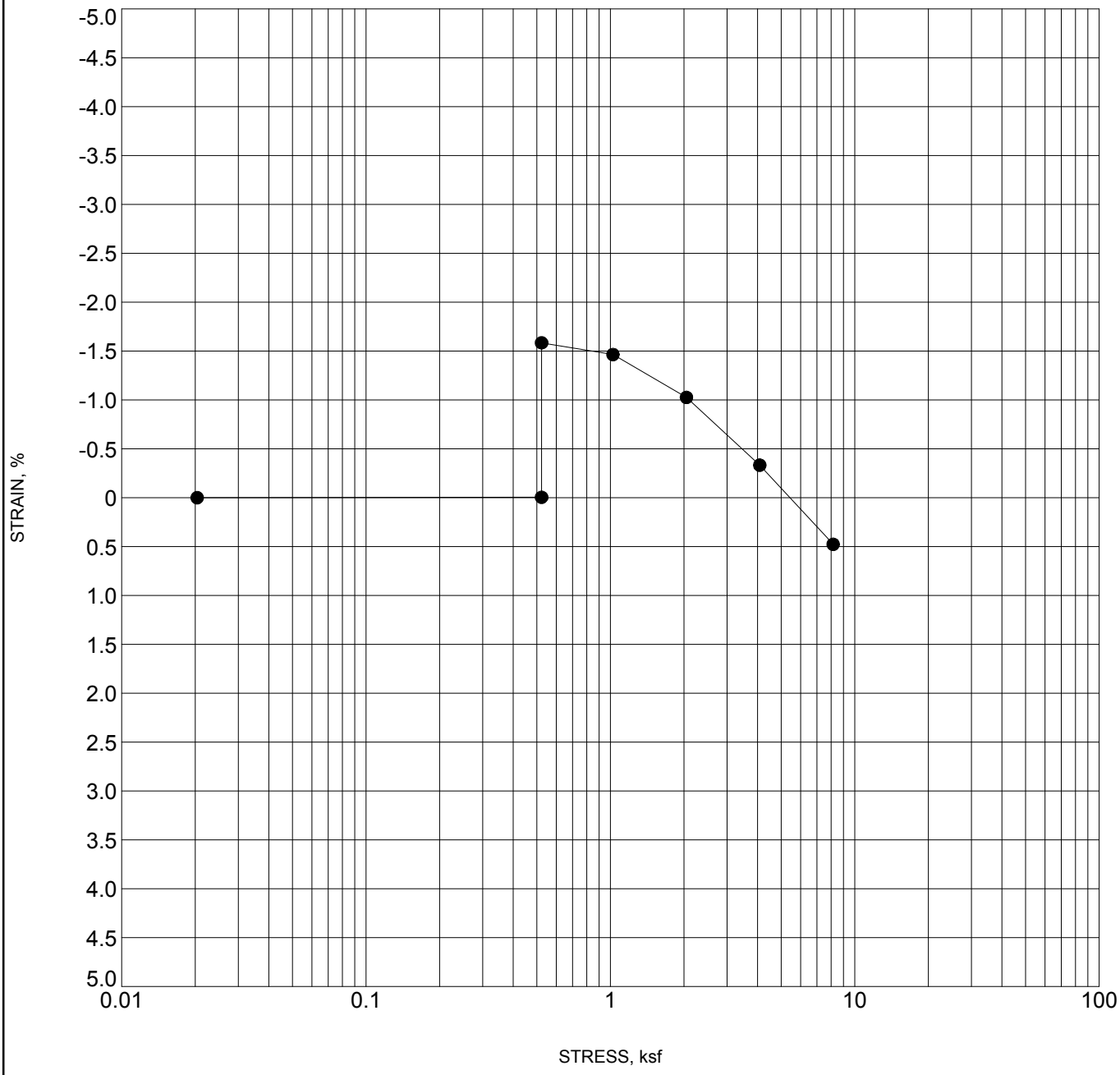

Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **BR-2 4**	**(Bedrock) CLAYSTONE, sandy**	**1.6**	**126.4**	**12.7**

SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

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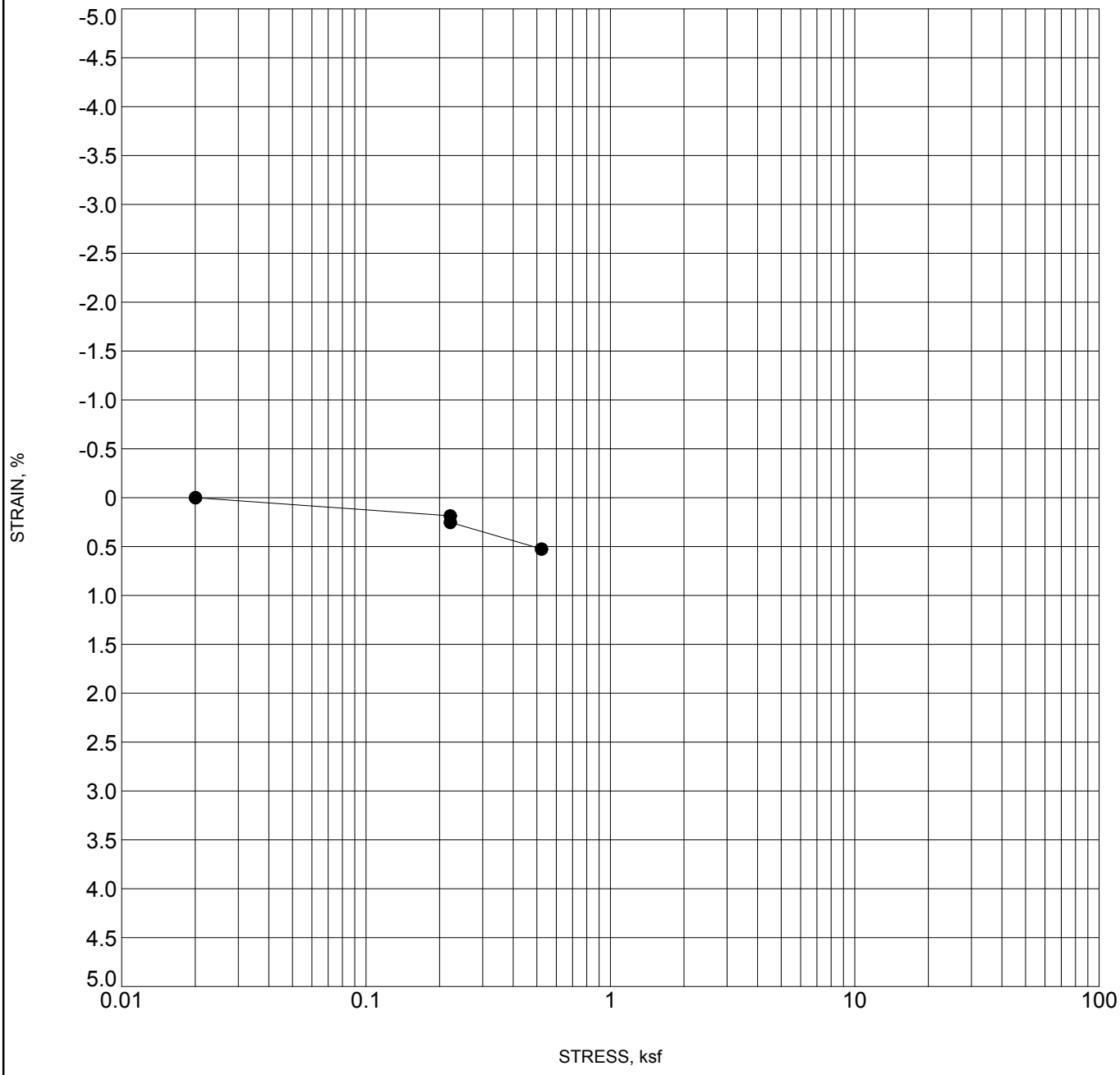


Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-1 2**	**SAND, clayey**	**-0.1**	**108.7**	**15.7**

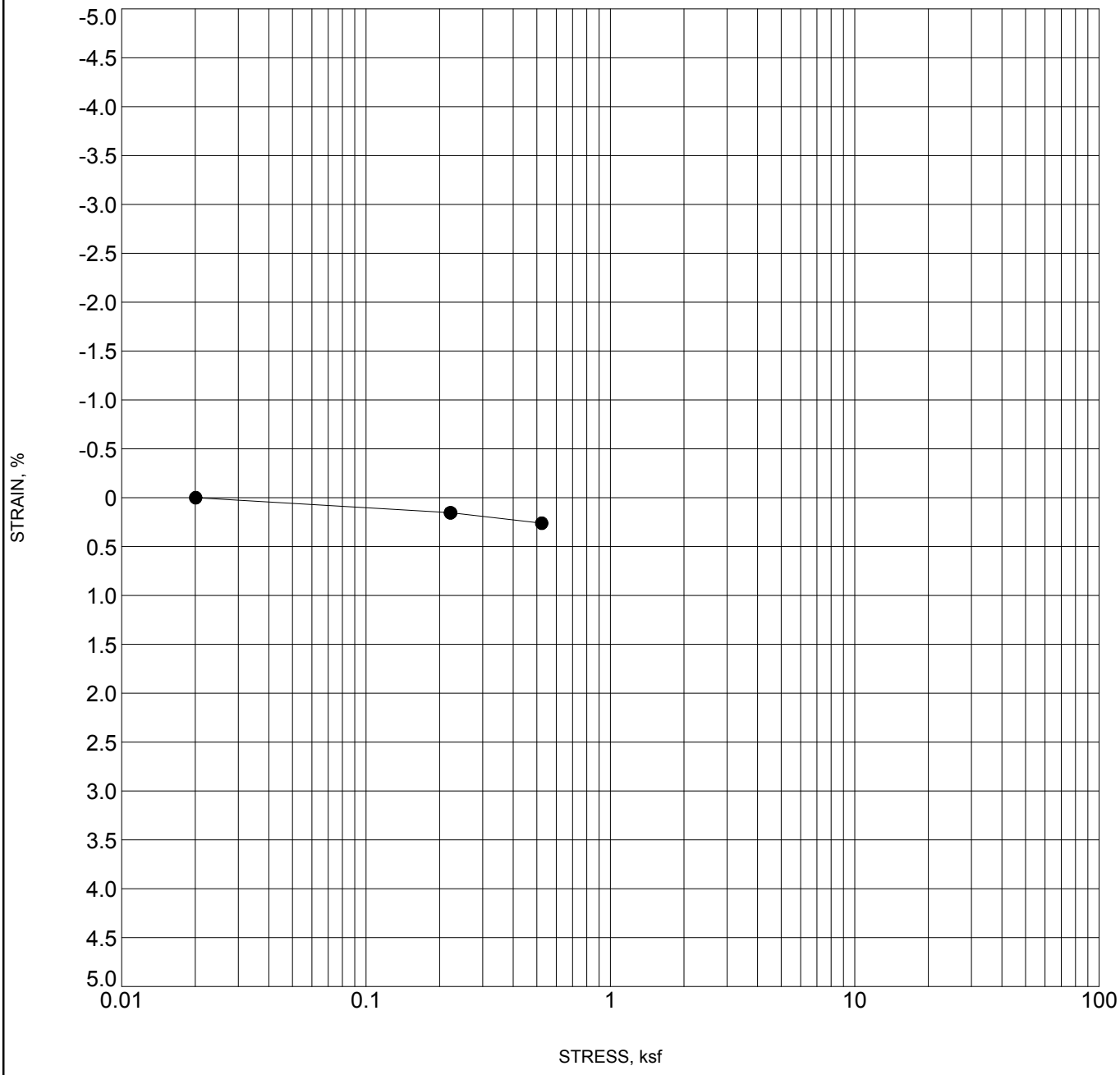
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-2 2**	**(Fill) SAND, clayey**	**0.0**	**108.3**	**18.0**

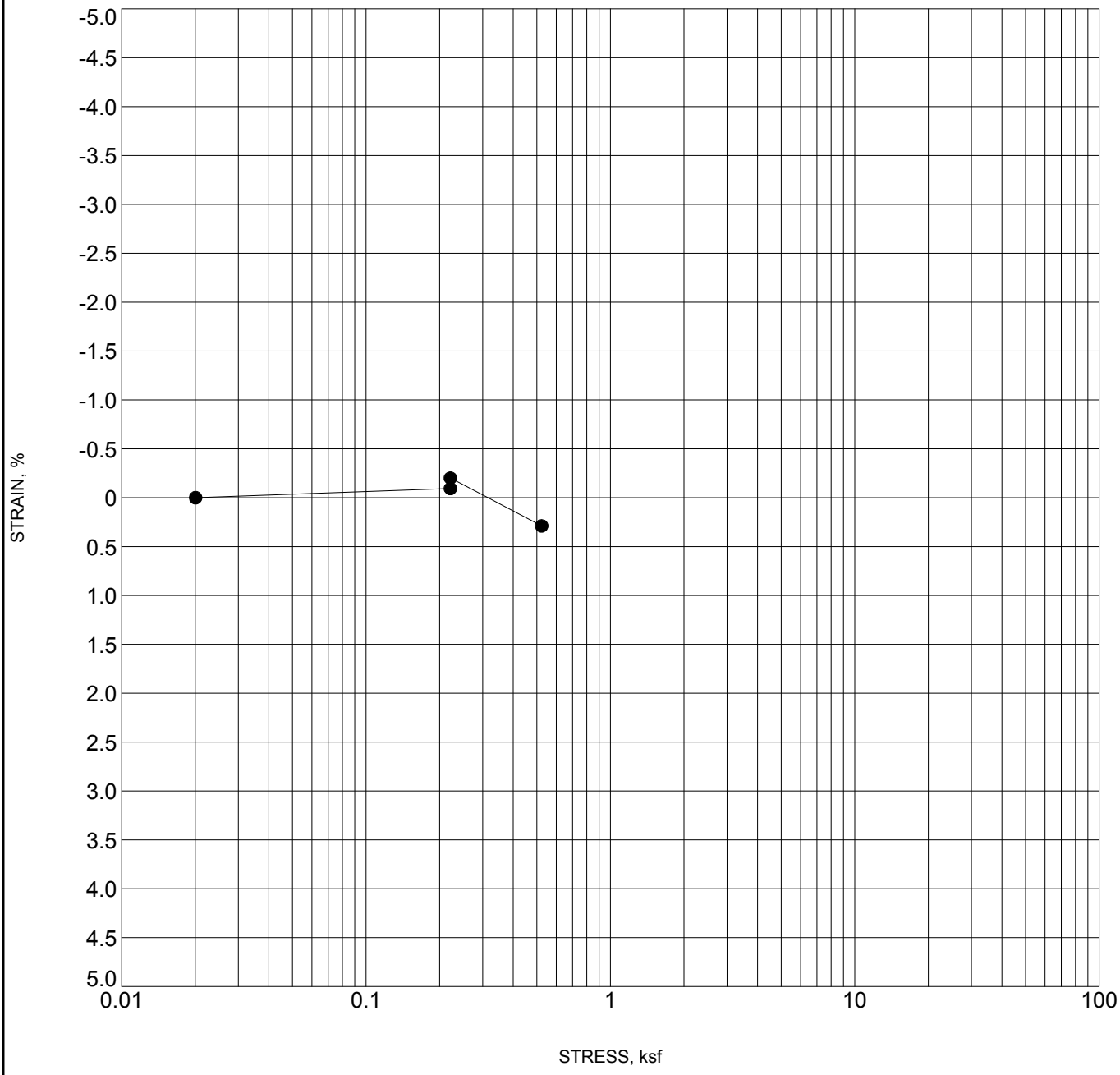
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-3 2**	**(Native) CLAY, sandy**	**0.1**	**104.9**	**18.4**

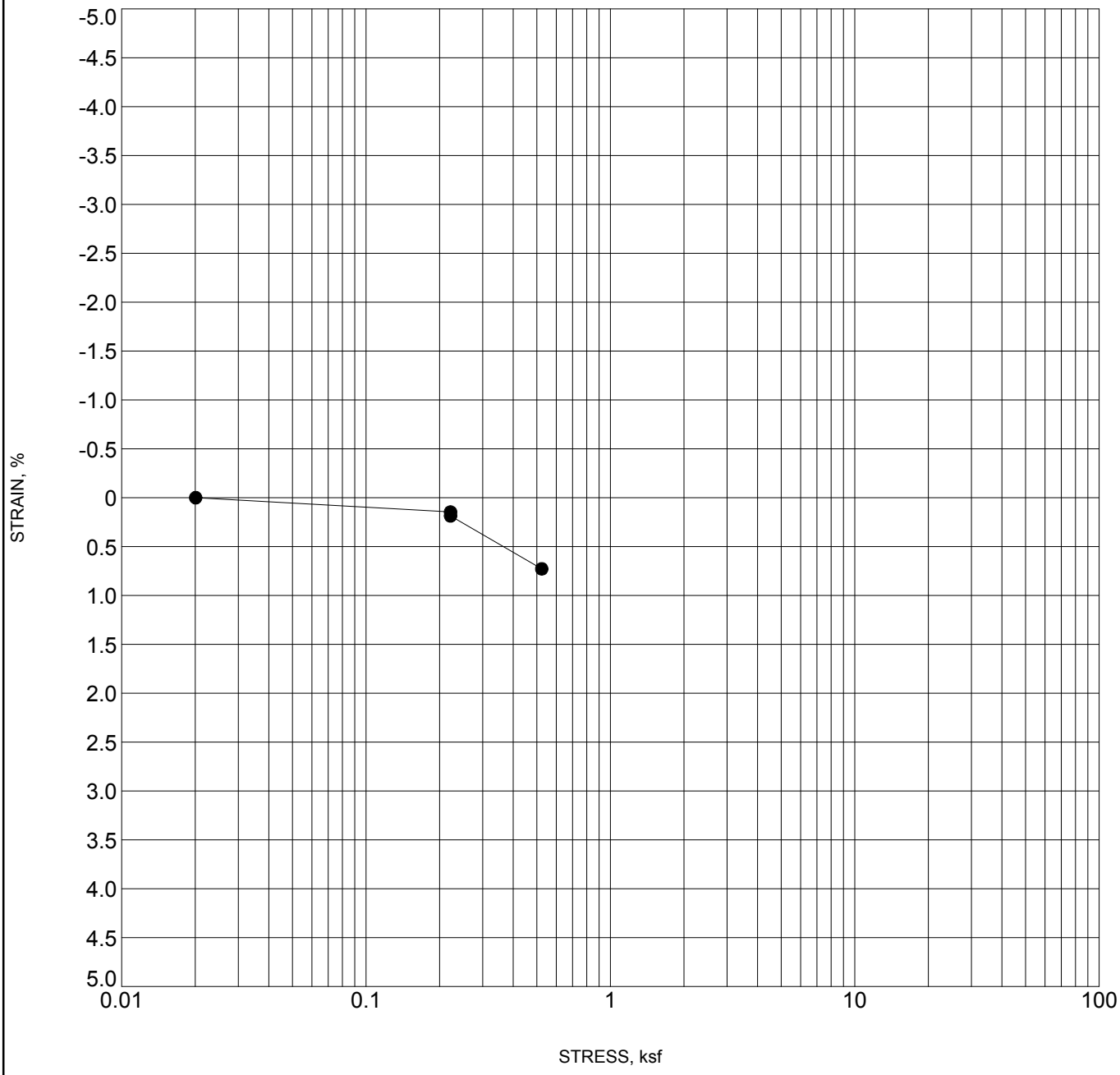
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-4 2**	**(Fill) SAND, clayey**	**0.0**	**102.6**	**20.5**

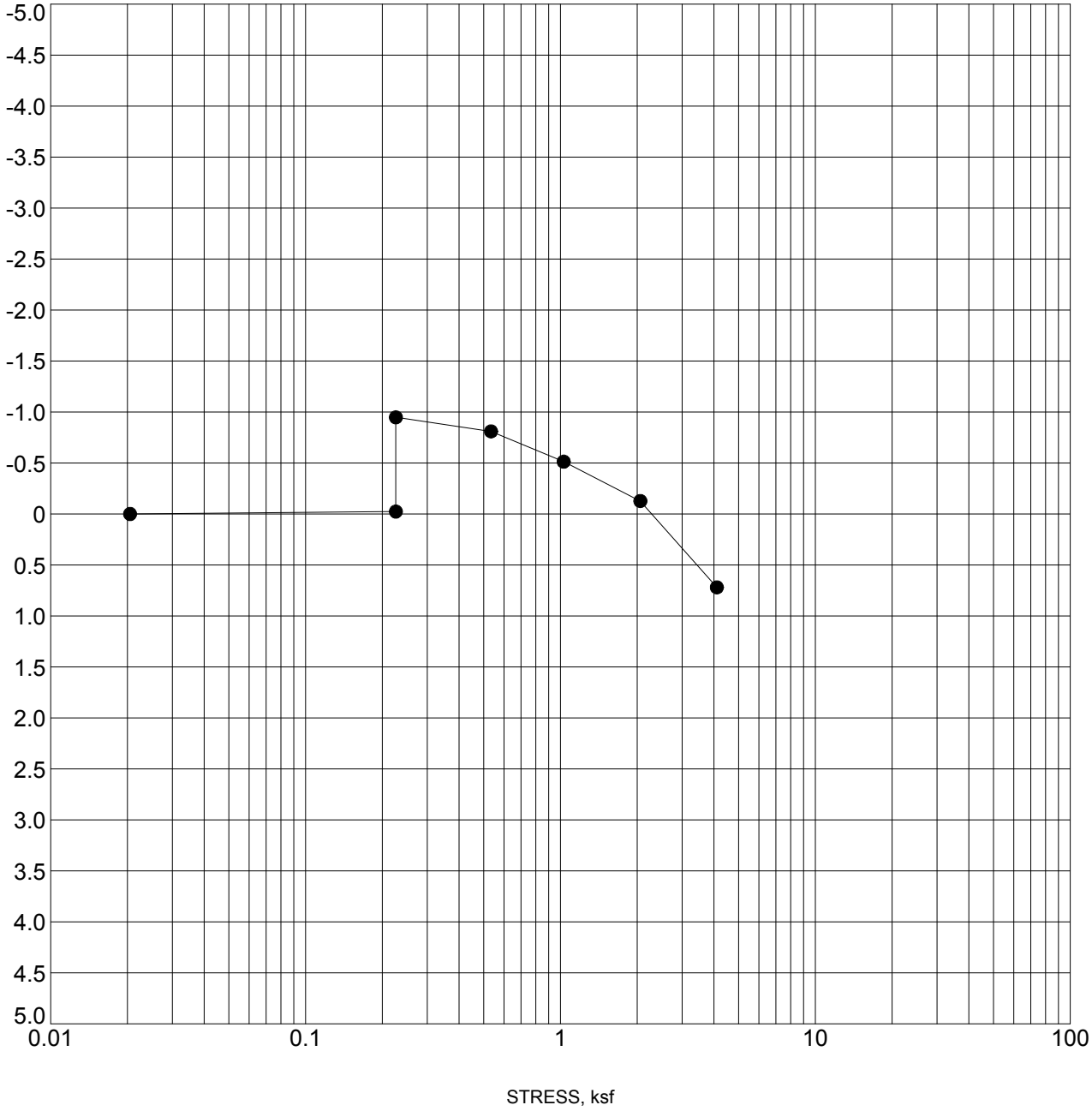
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-5 2**	**(Fill) SAND, clayey with gravel**	**0.9**	**122.7**	**12.5**

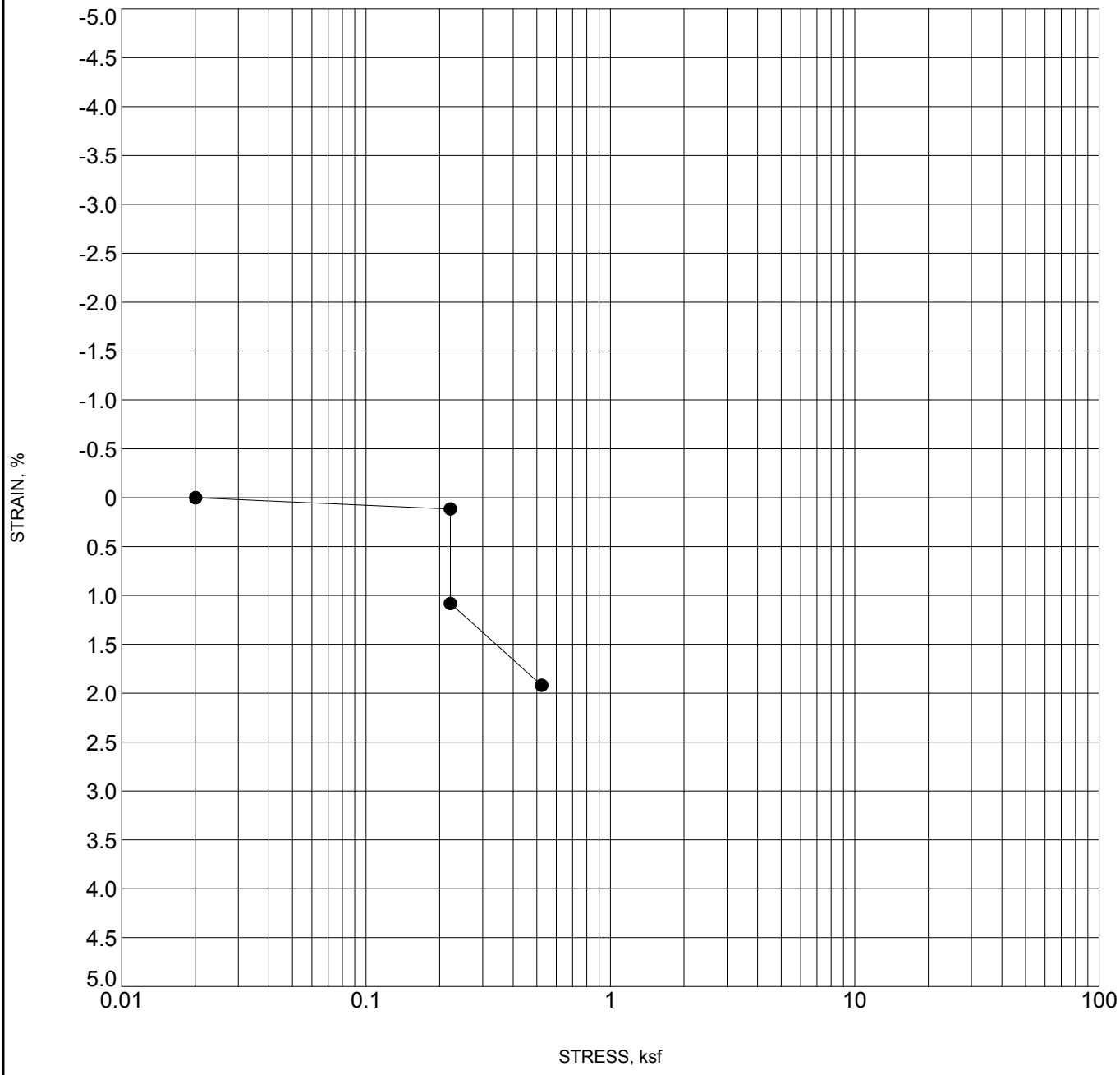
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-6 2**	**(Fill) SAND, silty to clayey with gravel**	**-1.0**	**123.1**	**4.8**

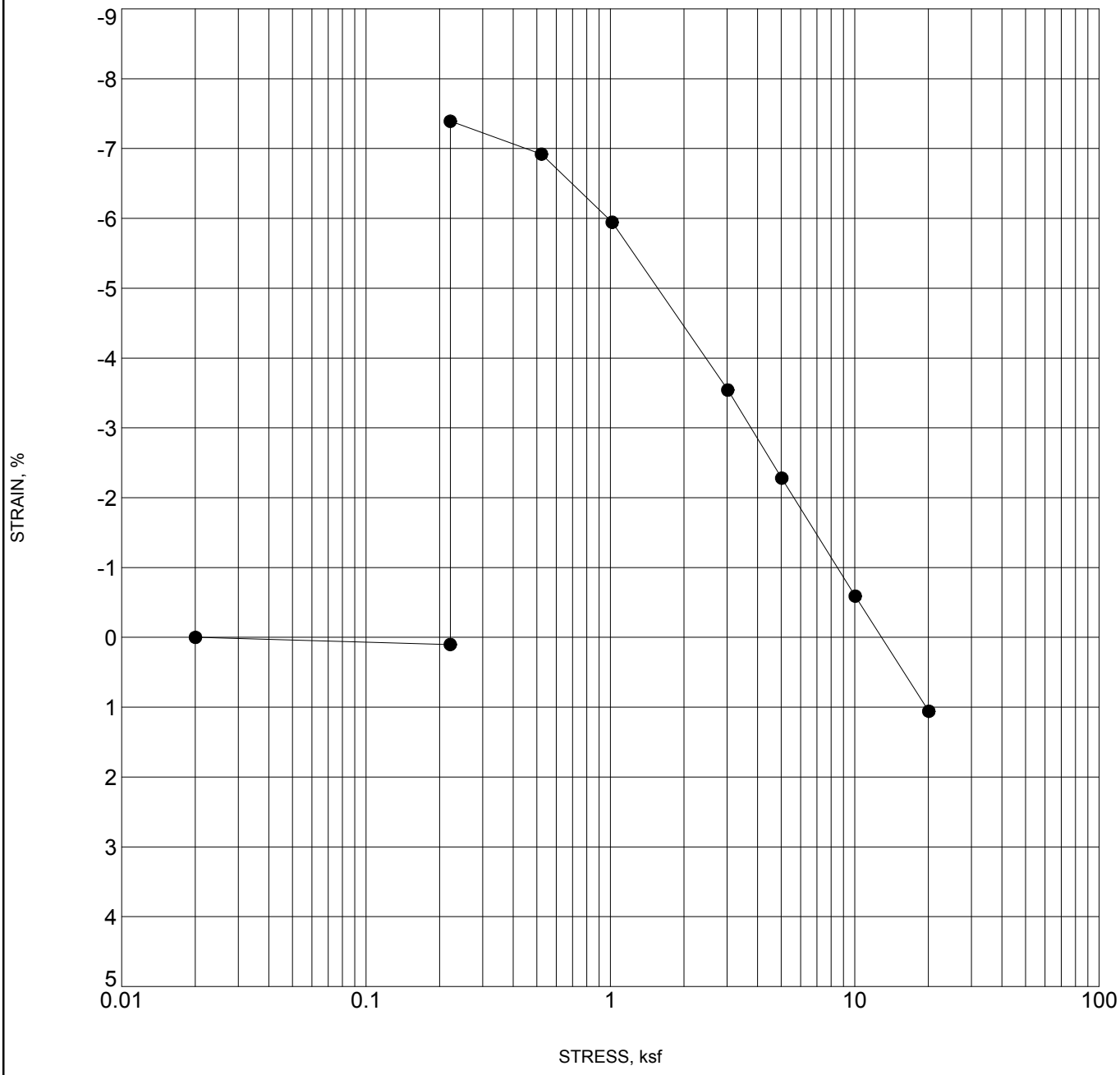
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-7 2**	**CLAY**	**7.5**	**124.0**	**9.9**

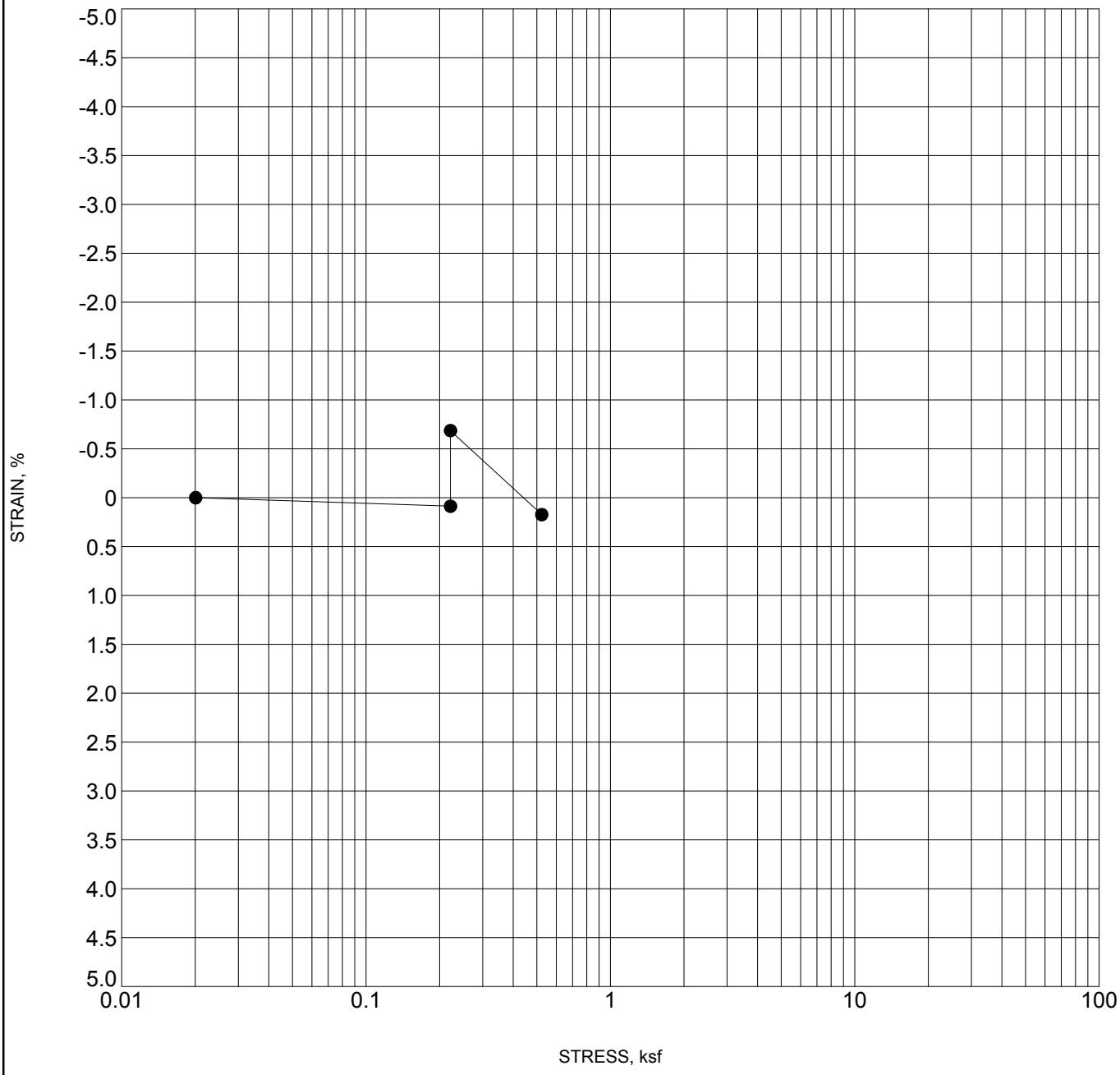
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/22/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-8 2**	**CLAY, sandy**	**0.8**	**99.7**	**5.9**

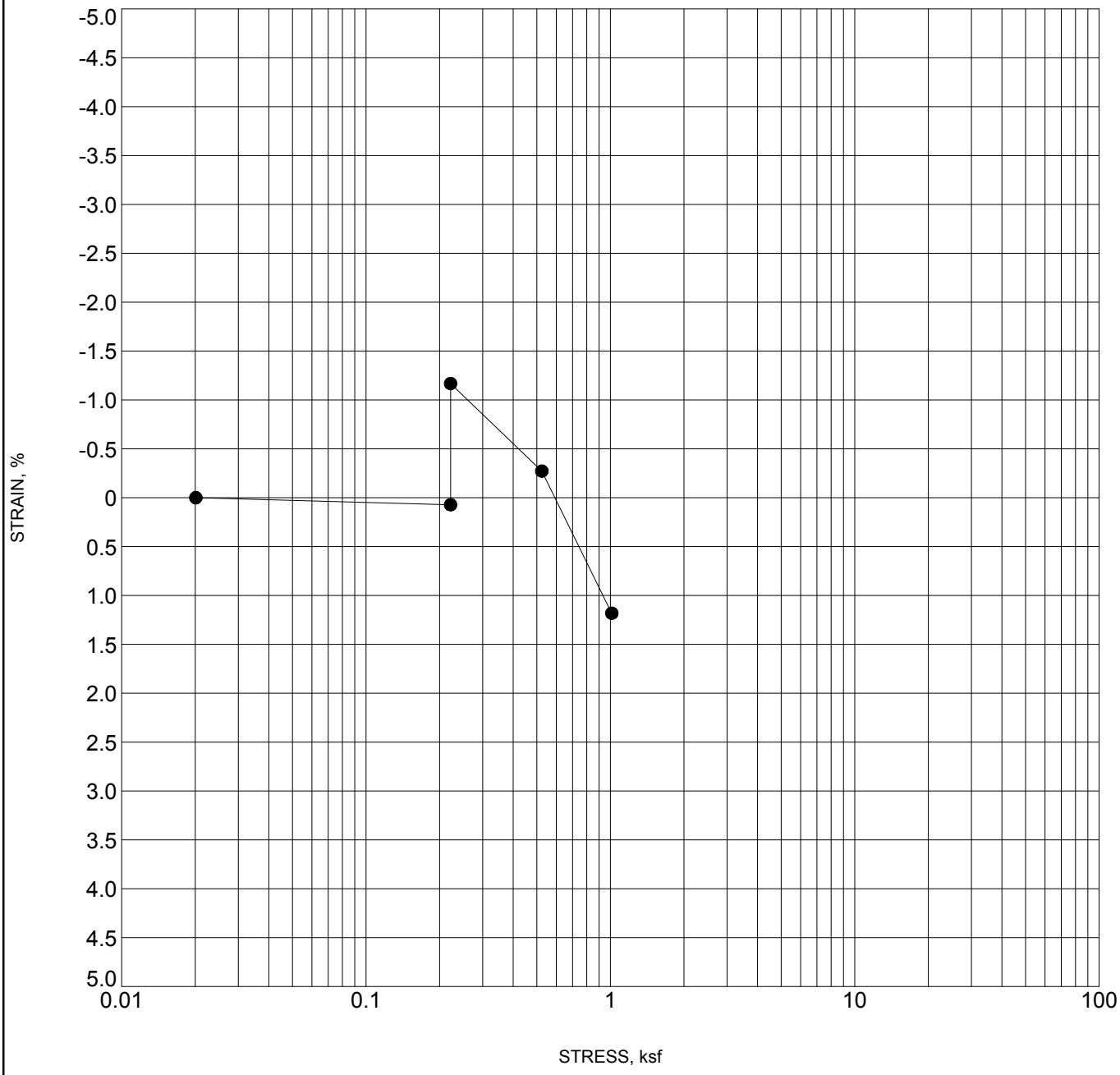
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-9 2**	**SAND, silty to clayey**	**1.2**	**99.6**	**3.9**

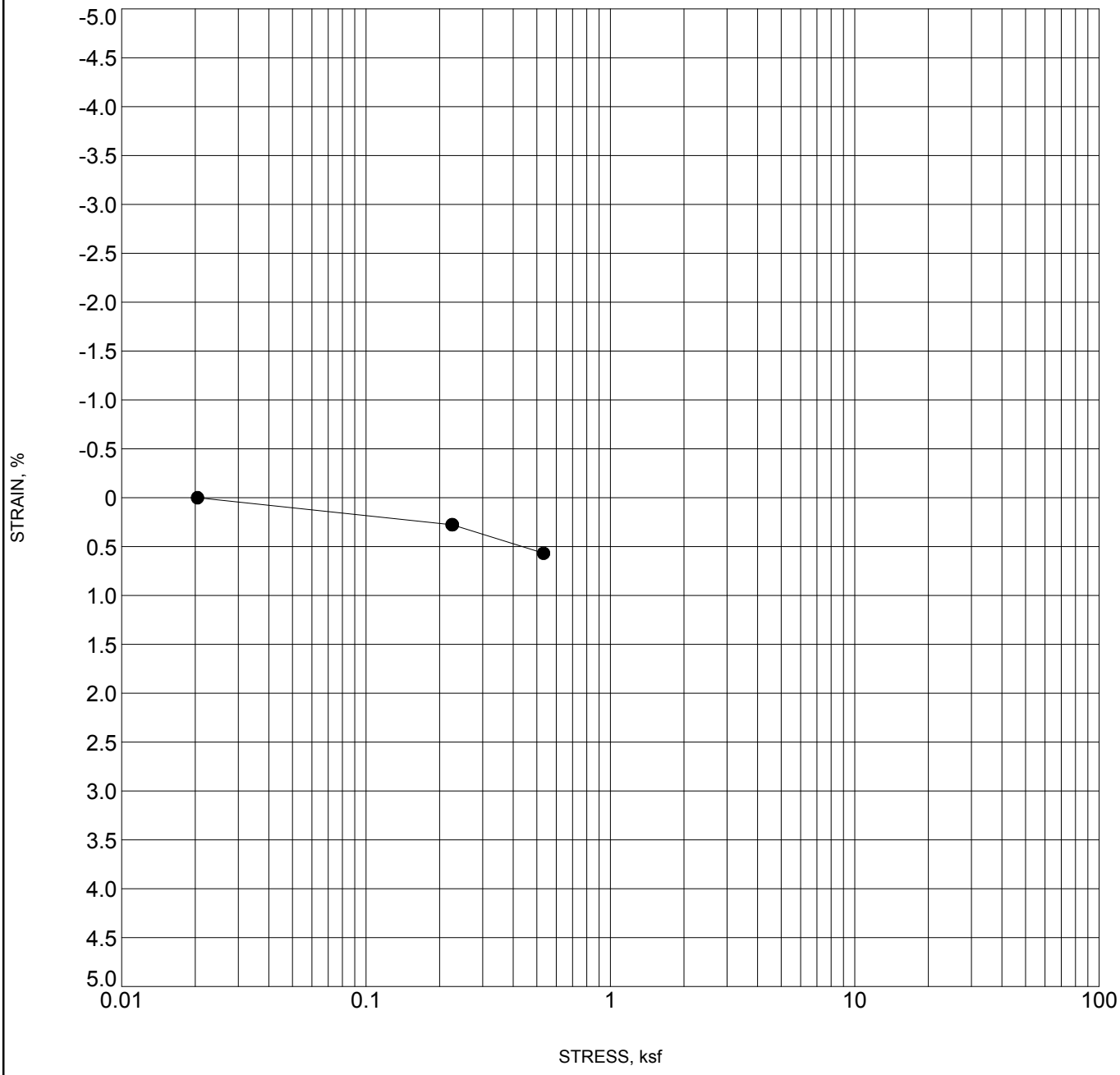
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-10 2**	**(Native) CLAY, sandy**	**0.0**	**114.1**	**16.3**

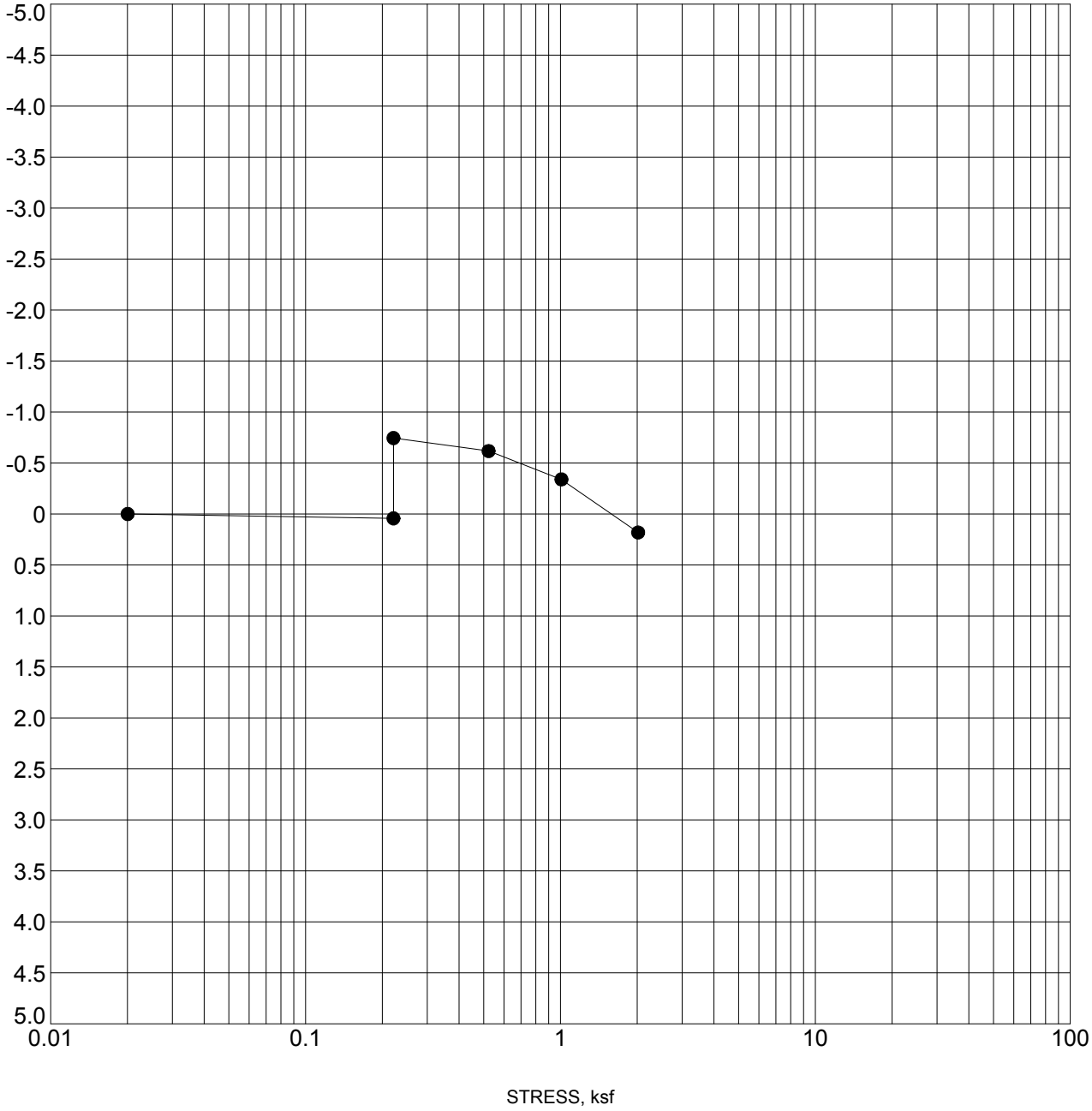
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-11 2**	**SANDY CLAY**	**0.8**	**112.9**	**16.1**

SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

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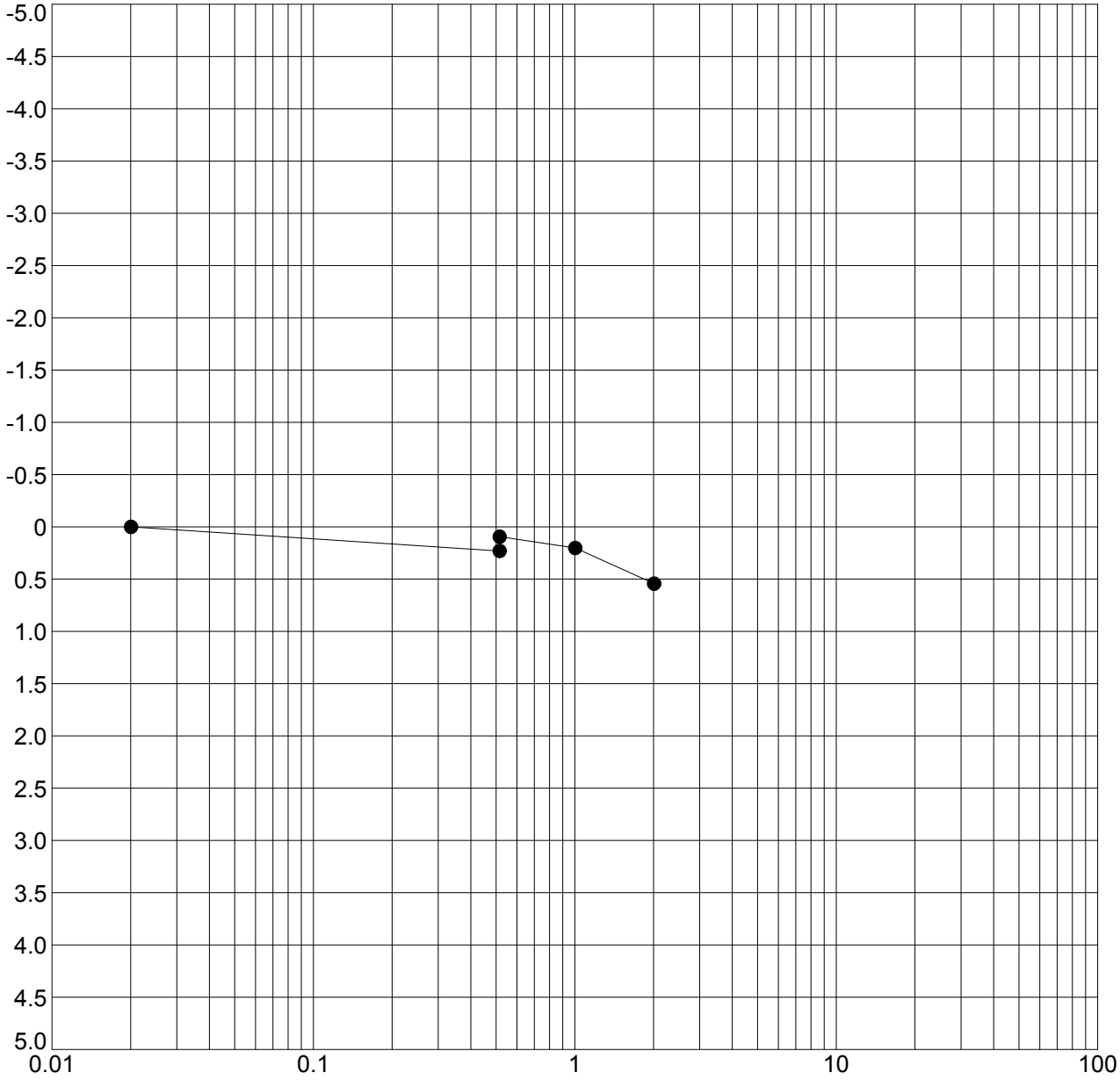
CLIENT J.F. Sato **PROJECT NAME** US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **PV-11 4**	**SANDY CLAY**	**0.1**	**104.6**	**20.5**

SWELL - CONSOLIDATION TEST

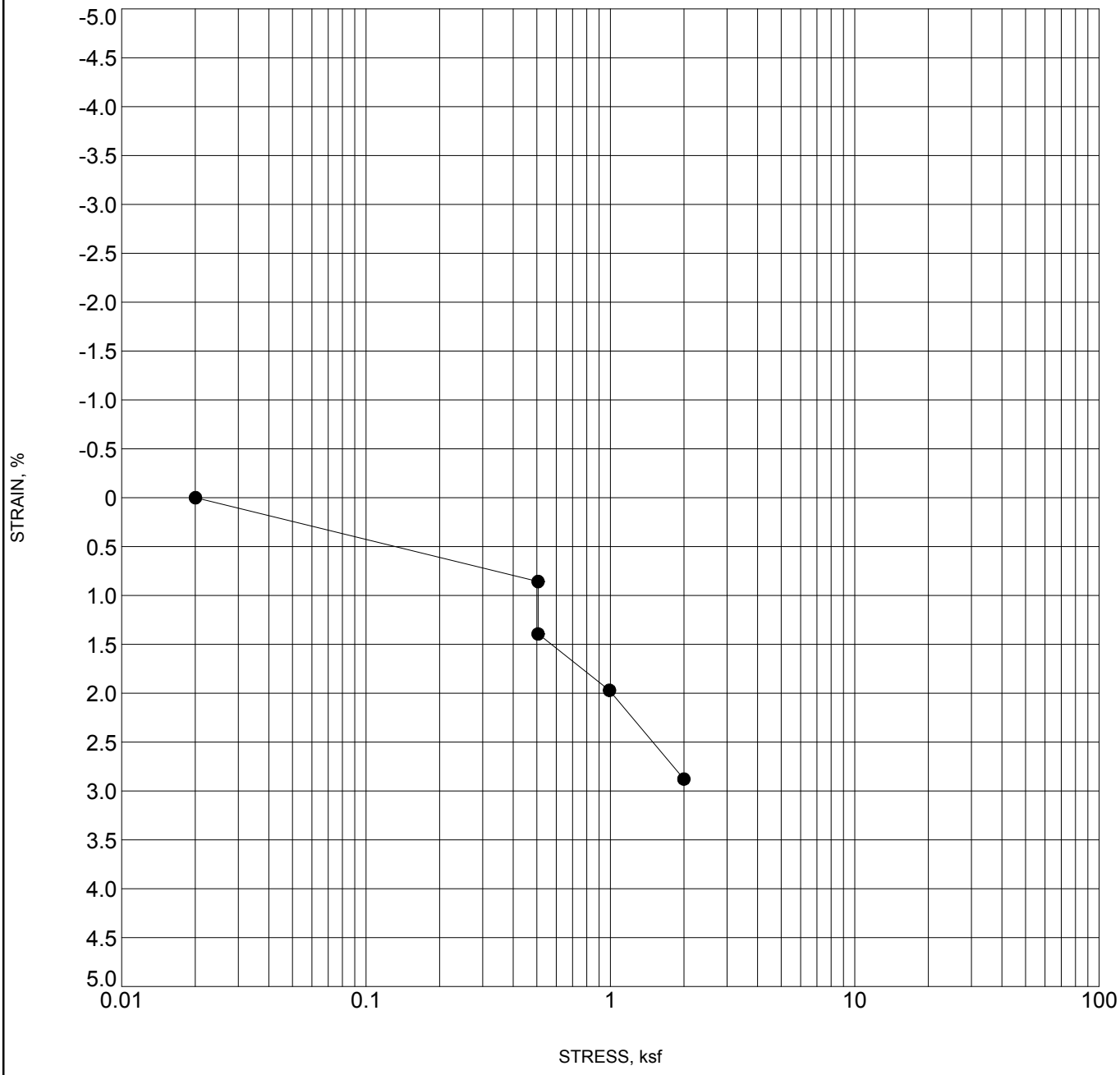
RockSol Consulting Group, Inc.

CLIENT J.F. Sato

PROJECT NAME US 50 West, WB Preliminary Design

PROJECT NUMBER 302.02

PROJECT LOCATION Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification		Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **WC-1**	**14**	**(Native) CLAY, sandy with gravel**	**-0.5**	**111.5**	**15.9**

SWELL - CONSOLIDATION TEST

RockSol Consulting Group, Inc.

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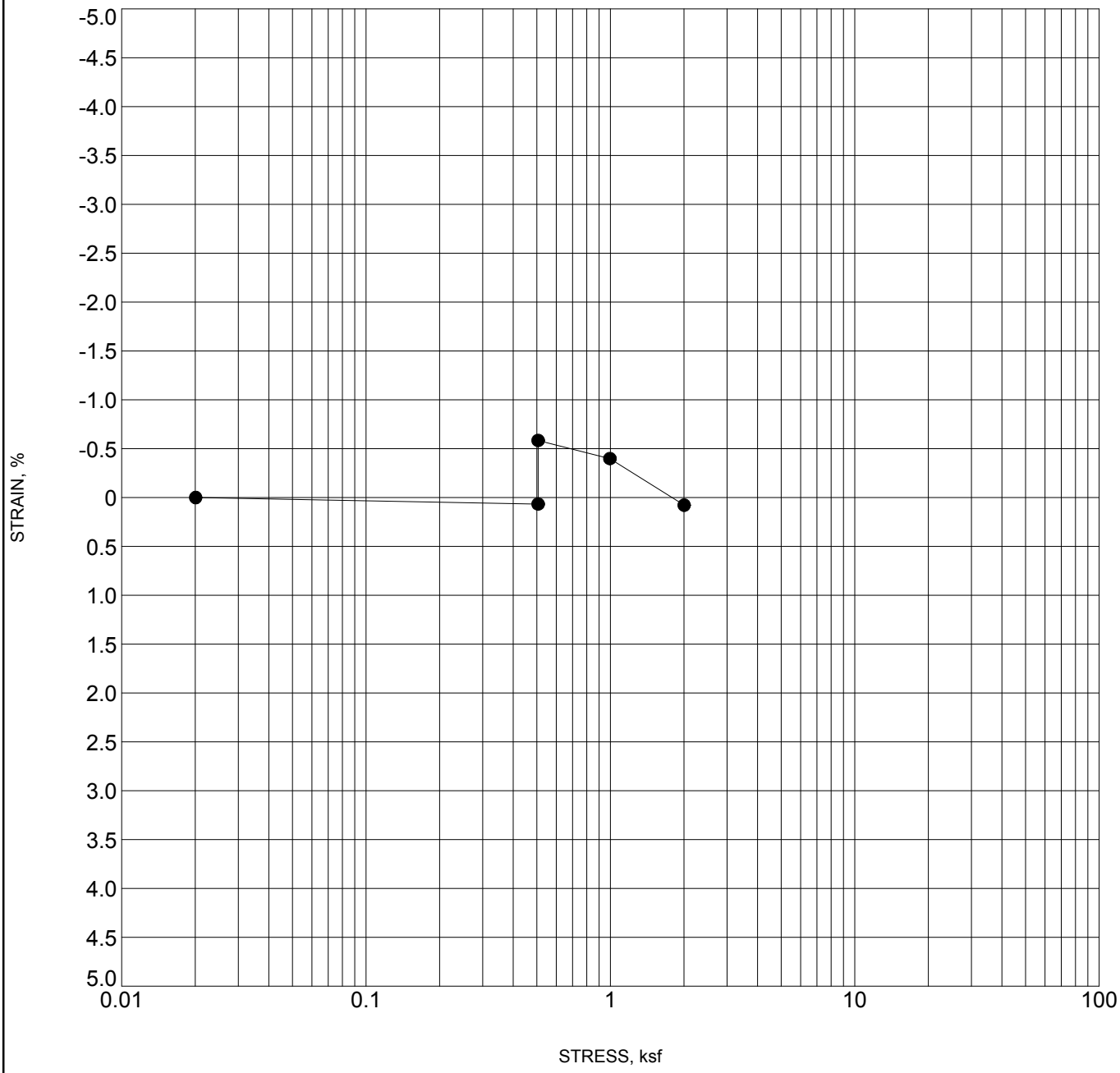
PROJECT NUMBER 302.02 **PROJECT LOCATION** Wills Blvd. to Purcell Blvd., Pueblo, Colorado



Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **WC-2 9**	**CLAY, sandy**	**0.7**	**115.9**	**13.8**

SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

SWELL - CONSOLIDATION TEST

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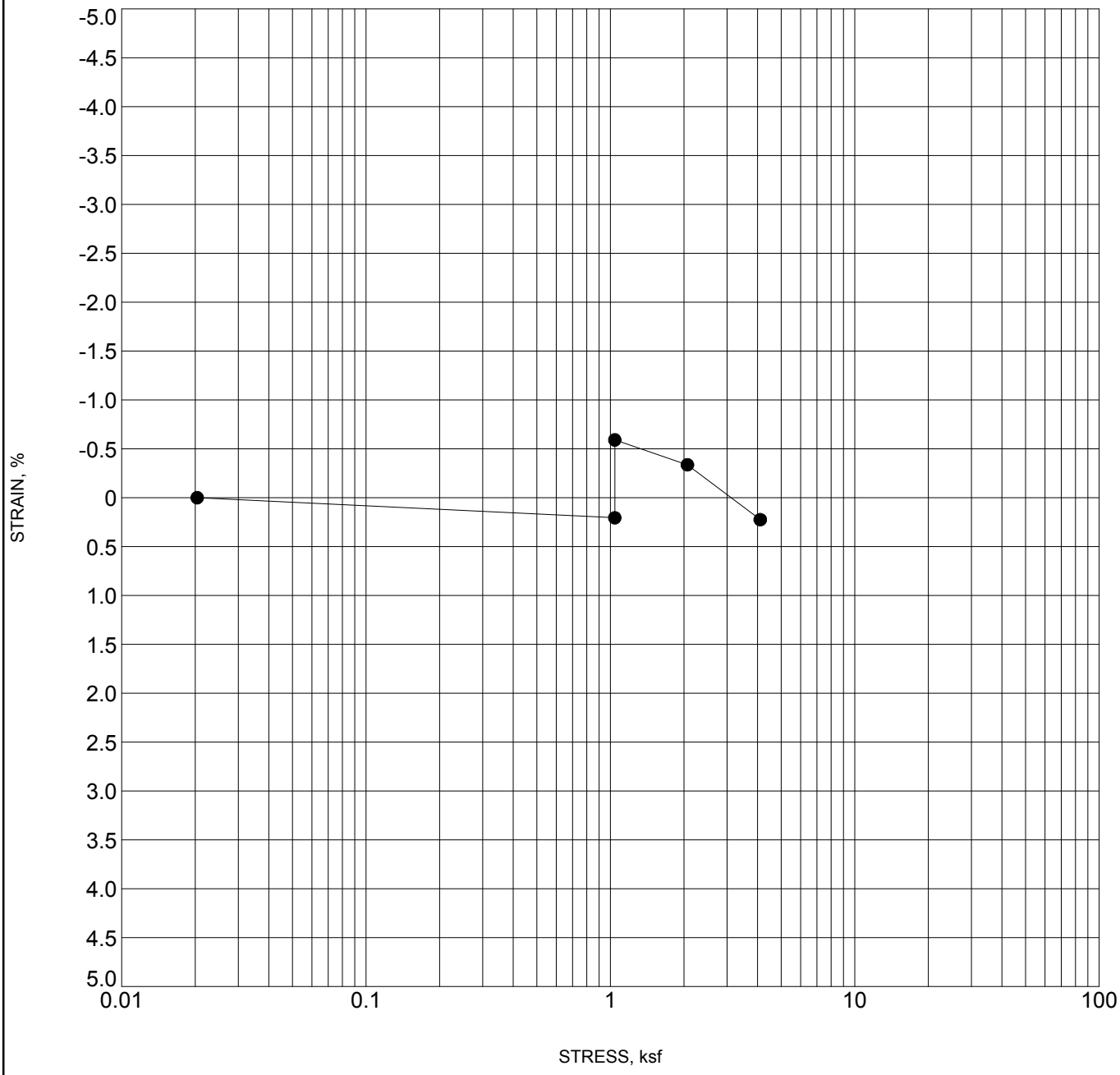


Specimen Identification	Classification	Swell/Consol. (%)	γ_d (pcf)	MC%
● **WC-2 14**	**(Bedrock) SHALE**	**0.8**	**132.6**	**11.4**

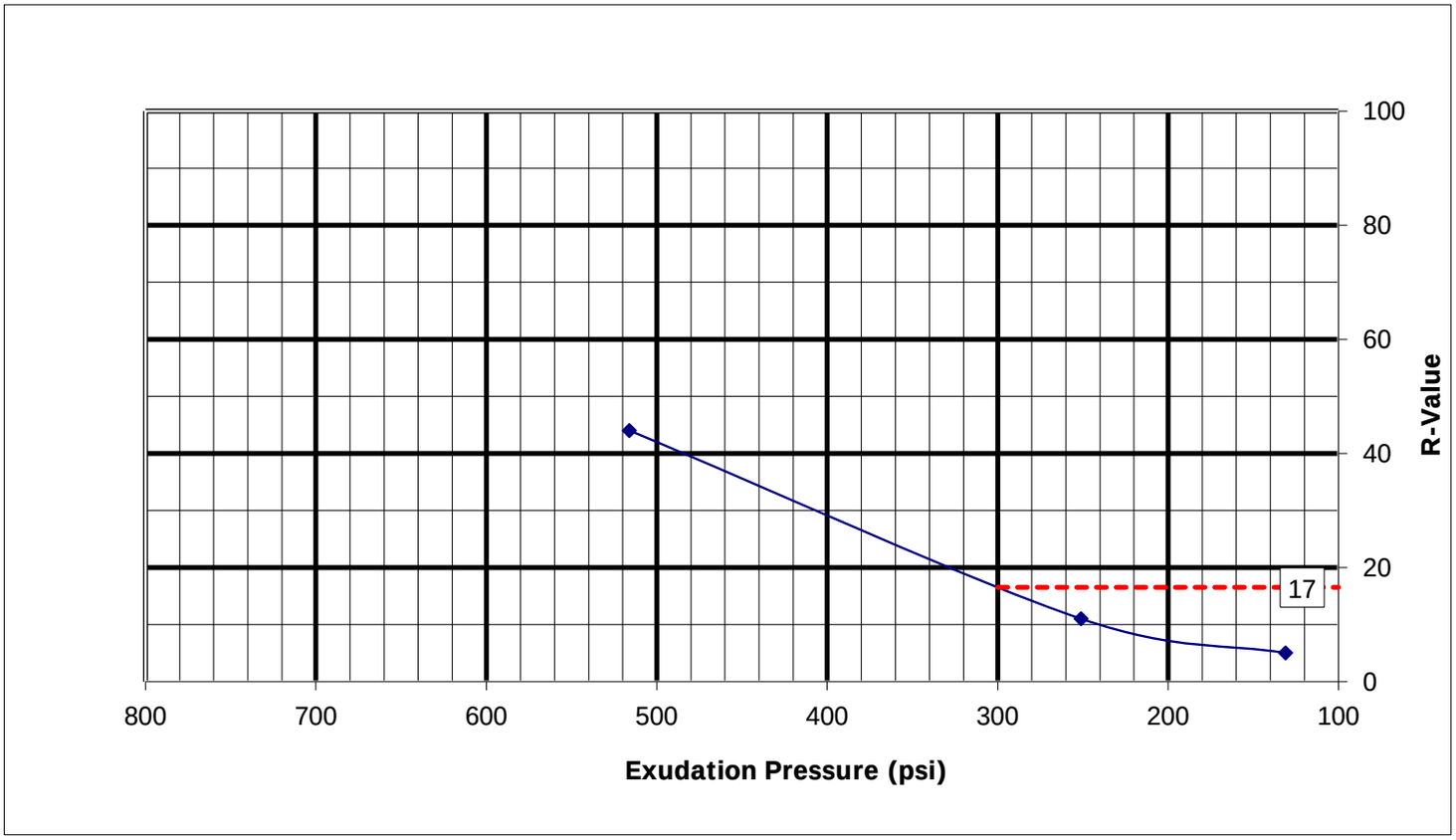
SWELL - STANDARD 302.02 US 50 WEST.GPJ ROCKSOL TEMPLATE.GDT 7/28/15

CESARE, INC.
Geotechnical Engineers & Construction Materials Consultants

AAR AASHTO R18

R-Value Test Graph (AASHTO T-190 / Colorado Procedure CP-L 3101)

Project Number:	15.024, Rocksol Consulting Group, LLC	Date:	29-Jun-15
Project Name:	US 50 W, Task order #5 (RockSol Project No. 302.02)	Technician:	DGB
Lab ID Number:	1521297	Reviewer:	RAZ
Sample Location:	WB US 50 - Composite sample PV-3, 4, 8, 10 at 1' to 5'		
Visual Description:	SAND, clayey, brown		



R-Value @ Exudation Pressure 300 psi: 17

Specification:

CDOT Pavement Design Manual, 2011.
Eq. 2.1 & 2.2, page 2-3.

$S_1 = [(R-5)/11.29]+3$ **S_1= 4.02**

$M_R = 10^{[(S_1+18.72)/6.24]}$ **M_R= 4,406**

M_R = Resilient Modulus, psi

S_1 = the Soil Support Value

R = the R-Value obtained

Test Specimen:	1	2	3
Moisture Content, %:	10.7	12.6	15.8
Expansion Pressure, psi:	1.06	0.33	-0.30
Dry Density, pcf:	119.8	115.5	108.7
R-Value:	44	11	5
Exudation Pressure, psi:	516	251	131

Note: The R-Value is measured; the M_R is an approximation from correlation formulas.

APPENDIX C

2013 FALLING WEIGHT DEFLECTOMETER TEST RESULTS (KUMAR & ASSOCIATES, INC.)

Kumar & Associates, Inc.
Geotechnical and Materials Engineers
and Environmental Scientists

ACEC MEMBER

2390 South Lipan Street
Denver, CO 80223
phone: (303) 742-9700
fax: (303) 742-9666
email: kadenver@kumarusa.com
www.kumarusa.com

Office Locations: Denver (HQ), Colorado Springs, Fort Collins, and Frisco, Colorado

July 29, 2013

Mr. Ryan Lepro
RockSol Consulting Group
6510 West 91st Avenue, Suite 130
Westminster, Colorado 80031

Subject: Nondestructive Deflection Testing Results and Pavement Structural Evaluation, U.S. Highway 50 from Purcell Boulevard to Wills Boulevard, Pueblo, Colorado.

Project No. 13-1-286

Dear Mr. Lepro:

This letter presents the results of a nondestructive, falling weight deflectometer (FWD) deflection testing program and pavement structural evaluation program performed for approximately 11 lane miles of U.S. Highway 50 between Purcell Boulevard and Wills Boulevard in Pueblo, Colorado. The study was conducted in general accordance with the scope of work in our Proposal No. P-13-330 to RockSol Consulting dated April 23, 2013.

Scope of Work: Based on stationing provided by RockSol Consulting, FWD testing was performed in the eastbound travel lanes from the approximate Station 98+12 to Station 272+50, and in the westbound travel lanes from the approximate Station 98+49 to Station 274+00. Based on conversations with the client, we understand that an approximate1.1 mile segment of the westbound lanes between Station 185+00 and Station 248+00 was not under consideration for rehabilitation at the time, and therefore did not require FWD testing.

The FWD testing was performed using a JILS 20 Falling Weight Deflectometer (FWD). The JILS 20 FWD has the capability of imposing an impact load of up to 20,000 pounds on the pavement surface. The FWD applies a predetermined load to the pavement surface and measures the resultant pavement deflection with seven velocity transducers at offsets from the load source of 0, 8, 12, 18, 24, 36 and 60 inches. Testing was performed at spaced intervals of approximately 300 feet per lane with an approximate offset of 150 feet between adjacent lanes. At the completion of the FWD testing, the results were analyzed to determine the structural characteristics of the pavement section and underlying subgrade materials using the AASHTO DARWin™ computer software program. The existing pavement section type and thicknesses for the roadway were provided by RockSol Consulting, and were used in the data analysis.

Project Understanding: At the onset of this study, we were requested by the client to perform testing on Highway 50 between the limits of Purcell Boulevard on the west and Wills Boulevard on the east. At this time, we understand that the Colorado Department of Transportation (CDOT) is primarily focused on widening the eastbound portion of the highway between Purcell Boulevard and Wildhorse Creek (approximate Station 245+00). The roadway widening may consist of either an asphalt overlay, or a complete reconstruction of the existing shoulder. Potential mill and overlay operations of the eastbound travel lanes within that segment are being evaluated at this time.

Existing Site: At the time of testing, the majority U.S. 50 consisted of a 4-lane arterial highway with small inside shoulders, and wider outside shoulders. The roadway configuration also consisted of various turn and merge lane configurations. Signalized intersections were located at Purcell Boulevard, Pueblo Boulevard, and Wills Boulevard.

The pavement type and thicknesses provided for U.S. Highway 50 consisted of hot mix asphalt (HMA) overlying base course material. Thicknesses of the HMA encountered in the exploratory borings drilled by RockSol varied from approximately 8.5 to 10.0 inches, while the base course encountered ranged in thickness from approximately 6 to 14.5 inches.

Results: The structural characteristics of the pavement section and underlying subgrade determined for the project from the DARWin™ computer software included the effective pavement modulus and subgrade resilient modulus. Results from FWD testing were also used to evaluate the existing structural capacity as it relates to remaining 18-kip equivalent single axle loadings (ESAL) and performance with respect to the intended 20-year design life of the pavement.

In analyzing flexible pavements, the FWD tests can be evaluated where the combined stiffness influence of the various pavement layer moduli (asphalt and aggregate base layer) represents the overall structural capacity of the pavement. The structural capacity obtained from this procedure is generally a function of the maximum deflection determined at the load center as well as the subgrade resilient modulus. The maximum measured deflection obtained at the load center is used to predict the effective pavement modulus of the combined pavement layers. The effective pavement modulus of the combined pavement layers and the known pavement thickness were correlated to an overall existing structural number of the pavement section at each test location. The existing structural number for the tested locations ranged from 2.83 to 6.04 with an average structural number of 4.56. The existing structural numbers are a function of the pavement modulus, and existing pavement thickness assumed at each test location.

In general, the deflection sensors located at a greater distance from the load source are used to determine the subgrade resilient modulus. When the deflection basin is measured using the FWD, the outer readings of the deflection basin under the imposed load represent the in-situ resilient modulus of the subgrade soil. The subgrade resilient modulus is the value that represents the pavement support condition. The subgrade resilient modulus determined from the FWD testing was also variable, ranging from approximately 2,345 psi to 19,797 psi with an average value of 7,442 psi.

The remaining service life of the roadway was determined by backcalculating the remaining ESALs with respect to the intended 20-year design life of the pavement. The existing structural numbers and resilient modulus values obtained from the FWD testing were used to backcalculate the remaining ESALs.

The subgrade resilient modulus, effective pavement modulus, correlated existing structural number, and remaining ESALs of the roadway segments determined at each of the FWD test locations are provided in Tables 1 through 4.

Limitations: This study has been conducted in accordance with generally accepted pavement engineering practices in this area. The results and conclusions provided in this report are based upon the data obtained from the FWD tests taken at the approximate locations summarized in Tables 1 through 4, and the asphalt pavement section thicknesses provided. Kumar & Associates, Inc. is not responsible for liability associated with interpretation of the data by others.

Sincerely,
KUMAR & ASSOCIATES, INC.

By: _____
Ryan R. Kumar, Staff Engineer

RRK/jw
Attachments
cc: File, book

Reviewed By:
James A. Noll, P.E.

TABLE 1
PAVEMENT ANALYSIS RESULTS
U.S. HIGHWAY 50
EASTBOUND OUTSIDE LANE

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
98+12	9,319	128,296	3.97	1,804,482
101+00	6,981	91,222	3.55	360,875
104+12	7,854	137,966	4.07	1,569,785
107+01	9,904	129,082	3.98	2,108,062
110+00	9,695	129,272	3.98	2,006,290
113+01	11,960	115,614	3.84	2,106,926
116+02	8,027	201,737	4.62	4,073,541
119+00	8,365	150,537	4.19	2,417,703
122+01	7,260	211,760	4.69	3,559,047
125+12	7,236	189,352	4.52	2,780,727
128+03	6,714	167,393	4.34	1,806,459
131+02	8,625	180,262	4.45	3,782,848
134+19	6,587	186,637	4.50	2,173,438
137+02	8,312	178,439	4.43	3,374,088
140+22	7,956	196,777	5.76	>10M
143+02	9,285	228,720	4.82	>10M
146+09	9,159	230,813	4.83	>10M
149+03	8,743	174,853	4.40	3,634,259
152+00	9,529	218,224	4.74	7,170,918
155+01	10,209	217,102	4.73	>10M
158+20	7,236	120,606	3.89	796,570
161+10	8,870	168,527	4.35	3,496,927
164+04	7,123	221,748	4.77	3,805,666
167+00	8,381	198,918	4.60	4,377,691
170+23	7,549	238,032	4.88	6,982,804
173+06	10,282	221,073	4.76	>10M
176+01	10,442	208,837	4.67	>10M
179+01	11,169	192,486	4.55	>10M
182+02	8,622	70,411	3.25	231,632
185+01	7,088	202,714	4.63	3,095,421
188+03	7,052	189,943	4.53	2,656,819
191+01	9,530	217,923	4.74	9,099,722
194+11	7,044	220,720	4.76	4,644,820
197+01	9,919	153,084	4.21	3,696,960
200+03	11,141	210,560	4.68	>10M
203+00	11,415	321,530	4.62	>10M
206+02	11,343	302,469	4.53	8,993,829
206+11	8,437	212,363	5.91	>10M
209+03	9,369	313,089	4.58	6,203,545

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
212+00	6,841	387,652	4.92	5,451,064
215+00	8,303	236,648	4.87	7,959,491
217+00	18,688	218,021	5.96	>10M
221+01	13,922	205,116	5.84	>10M
224+01	8,736	151,423	4.20	2,713,375
227+00	5,304	60,824	3.10	440,471
230+00	4,612	79,476	3.39	62,987
233+01	2,982	68,782	3.23	14,530
236+02	4,756	56,279	3.02	24,984
239+01	6,203	173,879	4.40	1,639,078
242+02	3,393	78,605	3.37	30,266
245+17	3,022	65,184	3.17	12,694
248+08	3,018	46,572	2.83	7,410
251+01	3,782	60,141	3.09	15,444
254+08	6,834	76,536	3.34	148,853
257+02	19,797	155,080	4.23	>10M
260+08	4,029	61,244	3.10	23,272
263+01	6,250	122,292	3.91	655,476
266+08	3,653	72,573	3.28	27,089
269+00	4,076	90,889	3.54	102,175
271+33	2,345	23,704	2.26	1,296

TABLE 2
PAVEMENT ANALYSIS RESULTS
U.S .HIGHWAY 50
EASTBOUND INSIDE LANE

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
98+49	9,403	173,015	4.39	4,745,498
98+50	8,328	178,216	4.43	3,796,970
101+53	8,604	194,171	4.56	4,946,553
104+51	12,363	212,637	4.70	>10M
107+51	12,444	156,792	4.25	8,172,216
110+51	8,790	185,460	4.49	4,697,184
113+51	7,940	216,244	4.73	5,872,972
116+51	5,769	81,805	3.42	172,304
119+50	9,268	361,433	4.81	9,430,890
122+64	8,202	196,030	5.75	>10M
125+50	8,365	210,003	5.88	>10M
128+51	8,035	175,425	4.41	3,393,323
131+51	6,791	227,488	6.04	>10M

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
134+52	8,786	217,315	5.95	>10M
137+52	9,037	180,763	4.45	4,725,575
140+52	8,258	216,371	5.94	>10M
143+51	9,494	210,736	5.89	>10M
146+55	9,435	211,345	5.90	>10M
149+50	10,096	221,111	4.76	>10M
152+60	8,504	200,986	5.80	>10M
155+51	7,319	365,944	4.83	5,611,410
158+71	8,272	207,075	5.86	>10M
161+52	9,546	362,124	4.81	>10M
164+50	12,619	219,985	5.98	>10M
167+72	10,172	164,144	3.70	1,196,586
170+50	10,908	341,070	4.72	>10M
173+58	9,850	197,000	5.76	>10M
179+51	5,438	125,249	3.94	440,035
182+84	9,209	131,687	4.01	1,644,492
185+94	7,347	209,866	4.68	4,563,026
188+53	8,743	203,995	4.64	6,445,906
191+54	9,642	217,592	4.74	934,957
194+50	9,864	295,918	4.50	5,906,901
197+52	12,446	383,348	4.90	>10M
200+50	8,314	194,552	3.91	1,130,325
203+52	11,815	388,943	4.93	>10M
206+50	10,011	350,062	4.76	>10M
209+53	5,744	203,248	5.82	>10M
212+53	13,254	256,320	4.29	8,139,721
215+58	6,552	209,437	5.88	>10M
218+51	17,430	320,135	4.62	>10M
221+50	8,650	196,654	5.76	>10M
224+51	7,416	164,874	4.32	2,210,343
227+50	2,692	67,524	3.21	18,484
230+60	4,606	96,576	3.61	149,041
233+50	5,343	90,470	3.54	191,453
236+52	4,308	60,171	3.09	26,939
239+51	6,872	46,502	2.83	71,481
241+90	8,756	96,311	3.61	661,520
245+57	4,892	104,855	3.71	221,989
248+50	3,062	56,128	3.02	18,224
251+50	6,234	116,370	3.84	464,699
254+51	12,385	124,267	3.93	2,584,716
257+51	9,557	127,427	3.96	1,673,368
260+51	4,686	136,519	4.05	410,158
263+50	4,061	90,427	3.53	99,942
266+51	4,224	102,923	3.69	153,627
269+50	4,069	72,019	3.28	5,626

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
272+50	3,195	46,436	2.83	12,093
274+00	4,059	145,330	4.14	419,548

TABLE 3
PAVEMENT ANALYSIS RESULTS
U.S. HIGHWAY 50
WESTBOUND OUTSIDE LANE

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
273+50	3,642	63,366	3.14	19,073
270+50	5,488	153,105	4.21	936,440
267+50	5,897	123,246	3.92	516,564
264+47	10,236	116,347	3.84	1,661,102
261+27	9,283	136,153	4.05	2,247,170
258+50	10,285	108,333	3.75	1,396,332
255+49	5,171	117,032	3.85	345,512
252+50	5,712	190,383	4.53	1,629,394
249+50	4,183	87,280	3.49	89,559
246+48	5,711	241,677	4.20	1,012,131
243+80	6,594	149,015	4.18	1,371,883
240+27	3,884	197,284	5.76	3,989,232
182+49	7,763	181,130	5.60	>10M
179+49	5,014	300,814	4.52	3,846,098
176+49	5,873	170,583	5.49	7,355,858
173+40	4,302	215,122	5.93	7,184,476
170+36	3,869	213,812	5.92	3,546,210
167+50	4,663	333,232	4.68	1,589,210
164+50	6,286	152,960	5.29	5,755,058
161+50	5,039	222,373	5.49	4,477,796
158+50	5,718	130,936	5.03	2,840,457
155+50	3,773	150,923	5.75	3,194,633
152+48	4,780	155,205	5.32	3,171,722
149+46	5,123	177,249	5.56	5,856,090
146+50	4,114	85,156	3.46	93,589
143+49	7,420	144,695	5.67	>10M
140+50	7,865	201,075	5.80	>10M
137+50	6,306	368,397	4.84	4,028,676
134+48	4,774	193,514	4.55	1,243,191
131+49	5,749	216,335	5.94	>10M
125+49	5,468	220,522	5.98	>10M
122+50	6,507	263,851	4.33	1,655,753
119+48	4,404	151,513	4.20	553,848

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
116+49	4,025	193,465	4.55	836,734
113+49	5,464	236,752	4.87	3,014,983
110+48	5,377	197,156	5.76	9,696,619
107+50	5,236	221,478	4.76	2,334,034
104+50	4,860	226,812	4.80	2,079,369
101+48	4,945	205,059	4.64	1,718,294

TABLE 4
PAVEMENT ANALYSIS RESULTS
U.S. HIGHWAY 50
WESTBOUND INSIDE LANE

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
270+77	6,025	133,348	4.02	583,682
267+99	4,766	156,469	4.24	705,399
265+00	12,811	87,545	3.50	1,217,474
261+89	8,877	190,570	4.53	5,092,763
258+76	12,481	178,057	4.43	9,706,916
256+00	2,701	101,726	3.68	53,696
252+98	4,681	80,982	3.41	104,710
249+65	5,476	190,868	5.70	8,195,124
182+78	6,991	342,739	4.72	3,841,498
180+00	6,266	355,095	4.78	3,643,458
177+00	5,742	353,336	4.77	2,932,863
173+99	4,298	206,715	5.85	6,474,310
171+98	8,651	332,972	4.68	6,666,895
167+99	6,484	203,058	5.82	>10M
165+00	11,502	139,943	4.09	3,915,811
161+91	6,043	193,324	5.72	>10M
158+83	8,607	194,517	5.74	>10M
156+00	5,846	175,208	5.54	7,749,539
153+00	5,968	397,879	4.96	4,201,478
150+00	7,828	212,391	5.91	>10M
147+00	3,832	168,592	5.47	2,653,484
144+00	5,497	321,454	4.62	1,907,000
141+00	4,907	179,964	4.45	1,145,966
137+99	10,711	167,544	3.72	1,557,455
135+00	5,685	196,596	5.76	9,654,643
131+98	9,606	320,215	4.62	6,962,382
129+00	6,280	315,901	4.60	2,523,859
125+99	7,328	156,816	5.34	8,774,664
122+97	6,686	289,590	4.47	2,155,938

Station	M_R (psi)	Effective Pavement Modulus (psi)	Existing SN	Approx. Remaining Life (ESAL)
120+00	9,351	313,588	4.59	6,265,406
117+00	10,806	324,179	4.64	9,414,468
113+95	5,532	211,869	4.69	2,396,544
110+99	5,276	170,995	5.49	5,720,616
107+99	5,206	242,953	4.91	2,852,056
104+99	10,275	196,254	4.58	8,587,720
101+94	6,493	216,642	5.95	>10M
98+96	6,511	220,928	5.98	>10M

M_R – Subgrade Resilient Modulus
SN – Existing Structural Number