COMMONWEALTH OF KENTUCKY
TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.transportation.ky.gov/

Matthew G. Bevin
Governor

Greg Thomas
Secretary

July 12, 2019

CONTRACT ID NO. 19-9002
ADDENDUM #2

Subject: Boone County

(1) Instructions to Proposers - Replace pages 4,26,28-30,36,49,51,52,54,55,59,61,63-67, 71,80 and 81
(2) Replace - Appendix C3, Appendix H, Special Note Summary in I-1, Note for Bridge Repairs in Appendix I-3
(3) Delete - Notes for Traffic Stations in Appendix I-3
(4) Add - 4 Special Notes to Appendix I-4

Proposal revisions are available at

http://transportation.ky.gov/Construction-Procurement/Pages/Design-Build-Projects.aspx.

If you have any questions, please contact us at 502-564-3500.

Sincerely,

Rachel Mills

Rachel Mills, P.E.
Director
Division of Construction Procurement

RM:mr
Enclosures

All questions prior to the award shall be directed to:

Name:	Rachel Mills, P.E., Director, Division of Construction Procurement
Phone:	502-564-3500
Email:	Rachel.Mills@ky.gov
Subject:	CID #: 19-9002 INFRA Design Build - QUESTION

Answers to questions will be posted at: http://transportation.ky.gov/Construction-Procurement/Pages/Design-Build-Projects.aspx

4. DESIGN-BUILD TEAM

4.1 PREQUALIFICATION

It is required that the Design Build Team (DBT) consist of a KYTC pre-qualified Contractor who has engaged the services of KYTC pre-qualified Design Consultant(s) to perform all **work required in the forthcoming ITP. If the Design Consultant(s) submitted does not meet** all the required qualifications, KYTC may reject the DBT's SOQ. All sub-consultants and subcontractors utilized by the DBT on this project shall be pre-qualified to perform work for KYTC or their services shall not be allowed.

To respond to the projects listed in this ITP, the project team shall be prequalified in the specified areas by the Statements of Qualifications due date listed in section 1.1. If there are questions concerning contractor prequalification, contact Mrs. Rachel Mills, PE (502) 564-3500. If there are questions concerning consultant prequalification, contact Mr. Eric Pelfrey, PE (502) 564-4555. Responses that do not have all areas of prequalification fulfilled may be considered non-responsive and will be returned.

4.1.1 *CONTRACTOR PREQUALIFICATION*

Consistent with Section 102.01 of Kentucky's 2019 Standard Specifications for Road and Bridge Construction ("Standard Specifications") all organizations and individuals bidding on Department projects and accepting subcontracts on Department of Highways ("Department") projects shall apply for and receive Department prequalification and possess a Certificate of Eligibility as provided in regulations published by the Department according to KRS 176.140.

The bidding company of the DBT must be prequalified in work type A or C2 to be registered as an eligible bidder for the project. In addition, as part of the Statement of Qualifications (SOQ) to be provided by the DBT, the DBT shall identify the members of the team that are to perform the following **major** items of work:

Work Type	Qualifications for Bidder
Grade and Drain	A
Asphalt Pavement	C2
Concrete Pavement	B
Bridges	E3

In order to be registered as an eligible bidder for the project, all construction team members for the DBT that are to be used for major items of work shall be prequalified prior to submission of the Statements of Qualifications (SOQ). Organizations and

The outside cover of the package shall be marked:

Alternate Technical Concept for
Boone County
KY 338 Interchange, KY 536 Interchange, and I-75
Item No. 6-18, 6-14, & 6-20002
CID No. 19-9002
Design-Build: FY 2019 Design Build #2

KYTC will accept ATC's electronically. The ATC or link should be e-mailed to Rachel.Mills@ky.gov. Be aware that KYTC cannot accept e-mail attachments that are 10 MB or larger. For any DBT wishing to submit a hardcopy, it can be delivered to the KYTC Central Office or the KYTC District 6 office (c/o Robert Franxman).

6.1.3 *EVALUATION OF ATCs*

ATCs are approved by the KYTC at its discretion and the KYTC reserves the right to reject any ATC submitted. KYTC shall attempt to evaluate all ATCs and ATC reconsiderations within 14 calendar days of receipt. However, this timeframe cannot be guaranteed, particularly for complex or unusual concepts. KYTC will either accept or deny all ATCs no later than 30 days before proposals are due. KYTC shall not consider any change that would require excessive time or cost for review, evaluation, or investigation.

6.1.4 *CONTENTS*

ATCs shall contain the following information detailed below. Incomplete ATC submittal packages shall be returned by KYTC without review or comment. They may be resubmitted before the deadline for ATC submittals.

6.1.4.1 Description

A detailed description of the ATC including specifications and conceptual drawings.

6.1.4.2 Usage

A description of where and how the ATC would be used on the project.

6.1.4.3 Deviations

References to all requirements in the Project Scope that are inconsistent with the proposed ATC, an explanation of the nature of these deviations, and a request for approval of such deviations.

6.1.4.4 Analysis

An analysis justifying the ATC and demonstrating why modifications or revisions to requirements of the Project Scope should be allowed. Include information on how the ATC meets or exceeds the project goals. Analysis shall present costs/cost savings associated with concept.

6.1.4.5 Traffic and Safety Impacts

A discussion of the impacts the ATC will have on vehicular traffic, pedestrian traffic, railroad traffic and safety, including an operational analysis, if relevant.

6.1.4.6 Maintenance of Traffic Impacts

A discussion of the impacts the ATC will have on maintenance of traffic during construction including any impacts on other roadways due to diversion of traffic on proposed or potential detour.

been met. Failure to clearly demonstrate that all conditions have been met may render the DBT's Technical Proposal non-responsive.

C. The ATC is not approved in its present form but may be resubmitted for reconsideration. The reconsideration request must address all KYTC comments, questions, and concerns. Reconsideration requests must meet all ATC submission and content requirements.

D. The ATC is not approved. Inclusion of the ATC in the Technical Proposal will render the Technical Proposal non-responsive.

E. The proposal is not an ATC.

The KYTC may, at its discretion, request additional information or clarification regarding a proposed ATC and/or conduct one-on-one meetings with DBTs to discuss their ATC. Verbal communications regarding ATC proposals shall be considered non-binding.

KYTC will notify the DBT of the decision in writing. Irrespective of an ATC's promise or innovative nature, submissions that do not include all necessary information will be rejected. KYTC will describe the reason(s) for rejection in a written notification. DBT's have the option of addressing KYTC's concerns and resubmitting an updated ATC before the deadline. All discussions pertaining to an ATC must be written or conducted in-person. KYTC is the sole judge of an ATC's merits and acceptability. KYTC reserves the right to reject an ATC request for any reason.

For approved ATC's, the DBT is responsible for completing all engineering plans. The DBT will also be advised by this notification if the ATC requires them to become the Engineer of Record for the entire project or a portion of the project that the ATC replaces.

An approved ATC may be submitted as a bid by the DBT. A schedule of values will be required for this alternative bid submission to support the lump sum price and shall be included in the overall schedule of values. An approved ATC that consists of multiple elements must be bid as a whole. Selective implementation of less than all the elements could result in the bid's rejection.

Compared to the advanced and/or stamped construction plans, the ATC may introduce extra costs, work, or risk. The ATC lump sum bid must incorporate the additional costs required to complete supplemental work. For example, if the ATC requires additional utility relocation, the DBT is obligated to pay for it. The DBT also takes on any additional risk associated with the ATC; submitted bids must price in the cost of this risk. If KYTC will incur additional costs due to ATC, the Contractor must include them in their bid to ensure a fair comparison and award process. The DBT is responsible for paying excess actual costs over and above the estimate of KYTC's additional costs.

Any ATC, conceptual or approved, that is not submitted with the bid will not be considered a pre-approved value engineering change proposal (VECP).

6.1.7 *INCORPORATION INTO TECHNICAL PROPOSAL*

The DBT may incorporate zero, one or more approved ATCs (or conditionally approved ATCs, if all conditions are met) into their Technical Proposal. The Technical Proposal must clearly state which ATCs have been incorporated and indicate what, if any, conditions are met. Approved ATCs should be clearly shown within the Technical Proposal. The Price Proposal shall reflect all incorporated ATCs. If the DBT abandons a pre-approved ATC or fails to construct it for any reason, they are obligated to complete the project using the original design, at the awarded cost.

6.1.8 *DISCLOSURE*

If, during evaluation of an ATC proposal, the KYTC becomes aware of a deficiency in the Project Scope that would have an impact on the ability of DBTs to make a best value offer, KYTC may, at its discretion, issue an addenda to correct this deficiency.

Other than as listed in the above paragraph, all conversations related to ATC proposals between the KYTC and DBTs shall be kept confidential during the bidding process. ATC proposals may be made public after the payment of the stipend has been tendered and/or upon Contract Execution or as required by Kentucky's Open Records Act. All documents received by the KYTC are subject to KRS 61.870 to 61.884, also known as the Open Records Act, and are subject to release unless a statutory exception exists that exempts the documents from public release. If any information in an ATC or Technical Proposal is to be treated as "confidential or proprietary," the DBT must identify each and every occurrence of the information within the Proposal by:

A. Listing the page numbers of every occurrence of the "confidential or proprietary" information on the cover sheet submitted with the ATC or Technical Proposal; and

B. Placing an asterisk before and after each line of the ATC or Technical Proposal that contains "confidential or proprietary" information. "Confidential or proprietary" may include trade secrets.

Prior to Award, KYTC shall not share with, or convey to, any person the information provided by the DBT, unless disclosure is required by law or the DBT gives prior written approval for such disclosure. In the event the KYTC is required to disclose any information the DBT considers confidential or proprietary, pursuant to applicable law, KYTC shall notify the DBT in writing prior to disclosing such information. KYTC shall use reasonable efforts to give notice of disclosure at least three days in advance of release. However, upon Award, all information provided to KYTC that was used in the evaluation of the Bids will be considered a public record unless the DBT refuses to accept a stipend (non-selected DBTs) or contract Award (selected DBT). KYTC shall not be obligated to maintain in confidence any information that is not confidential or proprietary including information that: (1) is already known by the state, (2) is or comes into the public domain through no fault of the state, (3) is independently developed by the state, or (4) comes to the state from a third party in a manner not in violation of any obligation of confidentiality by such third party to the DBT. Kentucky law generally requires that documents that contain both confidential and non-confidential information be disclosed with confidential information redacted.

7. GENERAL PROVISIONS FOR THE SCOPE OF THE WORK

The DBT shall provide for the engineering services, design, and preparation of detailed construction plans for the construction of the proposed project. The DBT may choose to present all or portions of the provided stamped engineering plans, as the final detailed construction plans. Any new or updated plans generated by the DBT shall be stamped by the Engineer of Record. The DBT shall provide for the relocation of utilities impacted by the proposed project as described in Section 11. Further, DBT shall provide for the furnishing of materials, construction and completion in every detail of all the work described in this ITP in order to fulfill the intent of the contract.

7.1 GOVERNING REGULATIONS

All services, including but not limited to survey, design and construction work, performed by the DBT and all subcontractors, shall be in compliance with the most current editions of all applicable AASHTO Design Standards, KYTC Department of Highway's Standard Specifications for Road and Bridge Construction, Standard Drawings, MUTCD, Manuals and Guidelines. The railroad work shall be in compliance with the most current editions of all applicable AREMA and Norfolk-Southern Railway guidance and specifications. As a part of the DBT's technical proposal submittal, a detailed general schedule to clearly demonstrate the DBT approach for completing the project shall be submitted. A comprehensive schedule detailing all project milestone dates shall be prepared for KYTC review and approval within 30 days of the award of the contract. This schedule shall show all major design, right-of-way, utility and construction activities and the critical path to completion. The comprehensive Progress Schedule required for this Project is the CPM schedule. The CPM schedule format shall be as described in the CPM Special Note in Appendix I. The DBT shall designate a Schedule Representative who shall be responsible for coordinating with the Engineer during the preparation and maintenance of the schedule and throughout execution of the entire contract.

The fact that the bid items for this Design-Build project are general rather than specific shall not relieve the DBT of the requirement that all work performed and all materials furnished shall be in reasonable conformity with the specifications. The DBT's Consultant shall reference in the plans the appropriate Construction and Material Specifications Item Number for all work to be performed and all materials to be furnished.

It shall be the responsibility of the DBT to acquire and utilize the necessary KYTC and Norfolk-Southern Railway manuals that apply to the design, right-of-way, utility, and construction work required to complete this project.

7.2 LUMP SUM BID ITEMS

For this project, an "all-inclusive" Lump Sum bid item combining the individual projects Lump Sum bid is to be utilized. Each project (KY 338, KY 536, & I-75 Pavement Rehabilitation) will have individual Lump Sum bids that will be combined for the "all-inclusive" Lump Sum bid. The components that are to be incorporated into each project bid item are described throughout the ITP and shall include but are not limited to:

A. Project Development Services
B. Grade & Drain
C. Asphalt and Concrete Paving

as they pertain to the identified impacts within this document. If the DBT chooses to impact areas outside of the areas identified, it is their responsibility to coordinate changes the USACE and KDOW and pay any additional in-lieu fees.

9.5 ASBESTOS COMPLIANCE

For structures that the DBT will be demolishing, the DBT will be responsible for meeting the requirements of the 10 Day Notice (including asbestos inspection and laboratory results) with the Kentucky Division for Air Quality (DAQ). DEP Form 7036 will be completed and filed with the Florence Regional DAQ Office located at 8020 Veteran's Memorial Drive Suite 110, Florence KY 41042 at least 10 days prior to removal of any impacted structure. The list of the demolitions to be completed by the DBT will be shown in Appendix E1 when available.

9.6 CONSTRUCTION STORM WATER PERMIT (KYR10)

Projects that are not required to have a Section 402 Individual KPDES permit, must request coverage under the program's General Construction Storm Water Permit (KYR10). The DBT must submit to KYTC's project manager a BMP plan for the project and receive approval prior to beginning work. All temporary erosion control is the responsibility of the DBT as outlined in the Special Note for Erosion Control found in Appendix I. The DBT will be responsible for filing the Notice of Intent (NOI) with the Kentucky Division of Water requesting coverage under the KYR10 permit. KYTC is the MS4 for the project, therefore, the DBT will not be required to submit any land disturbance forms to SD1.

10. RIGHT-OF-WAY (ROW)

10.1 GENERAL REQUIREMENTS

KYTC shall be responsible for the procurement of the Right-of-Way for the project. The limits of the Right-of-Way to be procured are defined in the advanced and/or stamped construction plans provided. See Appendix E for additional information regarding the status of each parcel.

KYTC also purchased permanent easements for utility companies which are shown on advanced and/or stamped construction plans.

The DBT shall stake and flag all existing and proposed right of way and easements needed in the field prior to the start of construction. The DBT shall maintain these markings throughout the duration of the project.

10.2 DBT'S PROPOSED RIGHT-OF-WAY PLAN AMENDMENTS

It shall be the responsibility of the DBT to perform all roadway, rail and bridge construction work within the Right-of-Way and easement limits as depicted in the advanced and/or stamped construction plans provided, except for staging and borrow/waste sites that may be needed for the project. Please see Section 13.2.8 for additional restrictions regarding excess material sites.

If after award, the DBT determines that additional Right-of-Way or easements are required, then the acquisition of the Right-of-Way or easement shall be the responsibility of the DBT. The DBT shall be required to follow the process detailed in Appendix E Right-of-Way Requirements for an approved ATC.

The DBT shall provide As-Built Record Drawings to KYTC for the DBT-managed utilities. These drawings shall show the location of, and label as such, all abandoned utilities and shall show and label all other utilities, whether remaining in place or relocated, located within the project right-of-way, or otherwise impacted by the project. The DBT shall provide the record drawings for each adjustment to KYTC not later than 90 days after the utility owner accepts the adjustment.

11.4.9 MAINTENANCE OF UTILITY SERVICE

All utilities shall remain fully operational during all phases of construction, except as specifically allowed and approved in writing by the utility owner. The DBT shall schedule utility adjustment work in order to minimize any interruption of service, while at the same time meeting the project schedule and taking into consideration seasonal demands. Again, the DBT should be aware there may be seasonal restrictions on utility outages. No time extensions will be granted for any utility company restrictions.

Any intentional or accidental disruption of service due to damage to gas, sewer, or water mains caused by any of the DBT's operations without three days advance notice to the utility facility owner shall be cause for liquidated damages in the amount of five thousand dollars per day ($5,000/day) per occurrence against the DBT until such a time as the utility facility is restored.

Any intentional or accidental disruption of any individual gas, sewer, or water service caused by any of the DBT's operations without three days advance notice to the utility facility owner shall be cause for liquidated damages in the amount of five hundred dollars per day ($500/day) per occurrence against the contractor until such a time as service is restored.

In the case of a main disruption, liquidated damages shall be charged at the main disruption rate only. Liquidated damages shall not be charged in addition to service disruptions when a main disruption is involved.

Any cost associated with damage during construction shall be the responsibility of the DBT.

11.4.10 TRAFFIC CONTROL

The DBT shall be responsible for the coordination of all traffic control made necessary by the utility adjustment work, whether performed by the DBT or by the utility owner. Traffic control for utility adjustments shall be coordinated with, and subject to approval by, the local agency(ies) with jurisdiction. Traffic control shall comply with the guidelines of the MUTCD and of Section 13.1 (Maintenance of Traffic) of this ITP document. Delegation of responsibilities regarding who performs the traffic control operations during the utility adjustment work shall be included in the utility agreement or amendment.

If utility construction requires closure of multiple legs of a major intersection or closure of an interstate ramp, 3 days' notice must be provided to KYTC to coordinate with our communications professionals for travel advisory notice.

which are included in the provided plans. KYTC will obtain from Norfolk-Southern Railroad: 1) approval for the plans and a 2) railroad construction agreement between KYTC and the railroad. The railroad construction agreement will be provided to the DBT once approved. A draft agreement is included in Appendix G. No work can occur on Norfolk-Southern right-of-way until KYTC receives approval for the railroad plans, the railroad construction agreement and right of entry upon NS property. The railroad construction agreement and right of entry is anticipated to be available by March 1, 2020.

This section defines the criteria required for the Project to accommodate and/or relocate facilities and structures for Norfolk-Southern Railroad. The DBT is responsible for coordination with all owning and operating railroads that may be impacted by the work. Details regarding the DBT's plan for railroad coordination shall be addressed in the Railroad Coordination Plan prepared by the DBT for the Project.

Any changes to the provided railroad plans or railroad construction agreement will be the responsibility of the DBT and the DBT will be required to obtain approvals from NS before changes can be executed. These changes will need to be approved by KYTC who must sign the updated construction agreement.

The DBT shall set forth an approach, procedures, and methods for the rail line construction meeting the requirements set forth in the Railroad Agreement provided in Appendix G.

12.2 RAILROAD DESIGN STANDARDS IF DBT PROPOSES an ATC OR CHANGES

If the DBT proposes an ATC or change to the approved railroad plans and/or construction agreement, the DBT shall prepare the geometric design of the railroad facilities and/or roadway elements impacting railroad facilities following the FHWA Railroad-Highway Grade Crossing Handbook, American Railway Engineering and Maintenance-of-Way Association (AREMA), and FHWA Manual on Uniform Traffic Control Devices (MUTCD) and incorporating the usual and customary design standards and operating requirements of the owning and operating railroad(s) that has or is expected to have an agreement with KYTC. Norfolk Southern requires a 60 mph design speed for the shoofly and two additional future tracks on the proposed railroad bridge.

Construction details and specifications shall conform to KYTC standard specifications and the rules, regulations, and requirements of the owning and operating railroads including those related to safety, fall protection, utility crossings (if required), and protective equipment.

Coordinating Design

The DBT shall coordinate the design with the owning and operating railroad. This coordination shall include meetings and plan submissions and shall address pertinent commentary provided by the railroad. The DBT's design shall minimize service interruptions to existing rail lines and be approved by the railroad. The DBT is expected to fully consult the railroad(s) in such a manner as to ensure compliance with all standards and provide a viable final design.

Design Costs

The DBT will be responsible for all design costs including associated costs from NS due to the proposed ATC and/or changes.

Records
The DBT shall maintain a record of all negotiation, coordination, and construction efforts in relation to the railroad involvement. These records shall be provided in copy to KYTC as completed. Specific documents required are as follows: estimates, design comments, agreements, inspection records, invoices, and change orders

12.3 PROJECT WORK AFFECTING RAILROAD OPERATIONS

Where the Project crosses or impacts a railroad Right-of-Way, operations, or facilities, the DBT shall coordinate the work with the owning and operating railroads. As documented in the approved railroad construction agreement, all costs, fees, work, insurance requirements, and other incidentals associated with these matters shall be the responsibility of the DBT and included in the all-inclusive lump sum bid item. KYTC will retain responsibility for costs of flagging but the DBT shall acquire approval from KYTC regarding the need for flagging services.

Schedule
The KYTC shall be responsible for obtaining the required approvals, permits, and agreements as required for the work and documented in the approved railroad construction agreement, including any railroad related work. If an approved ATC requires changes to the railroad construction agreement and/or railroad plans, then the DBT is responsible for all costs and schedule impacts associated with the change, including obtaining railroad approval.

The DBT shall be responsible for including and incorporating all railroad related items including the work performed by the railroad into the Project schedule. The DBT shall be responsible for scheduling the work to be completed by Norfolk-Southern railroad as well as the work to be completed by its own forces. It is currently anticipated that Norfolk-Southern forces will be mobilized a minimum of three times. No time delays shall be granted to the DBT for the railroad related work whether the work is part of the stamped construction plans or an approved ATC.

The DBT shall provide 35 calendar days' notice to KYTC for KYTC to advise industry and emergency responders of closures to the at-grade rail crossings of Richwood Road, Shorland Drive or Old Lexington Pike. KYTC will notify affected industries and emergency responders. At no time will it be permitted to close both Richwood Road (KY 338) and Shorland Drive at-grade crossings at the same time until the grade separation is open to vehicular traffic; at all times there will be a minimum of a single point of ingress/egress to the industrial park situated on the east side of the existing railroad.

Operation Safety
The DBT shall arrange with NS for railroad flagging as required with approval from KYTC. These flagging costs will be paid by KYTC as per the railroad construction agreement. The DBT shall comply with the owning and operating railroad's requirements for contractor safety training prior to performing work or other activities on the owning and operating railroad's property.

Railroad Right of Entry Agreement
In order to enter the railroad's right-of-way to perform the work, KYTC will obtain a Right of Entry Agreement from the railroad and shall coordinate the arrangements of the necessary agreements directly with the owning and operating railroad. The Right of Entry

Cost of Reimbursements if DBT proposed an ATC or Changes

The DBT shall be responsible for all reimbursement costs due to an approved ATC or change to any railroad company that may be affected by the work, for reimbursing all costs that any involved railroad companies incur in adjusting its facilities or operations to accommodate the work in compliance with all applicable laws and regulations.

Design Criteria in Railroad Right-of-Way

A. The design of any facilities shall conform to the requirements of the owning and operating railroad specifications and the provisions set forth by the Railroad Agreement.

B. All railroad tracks and other railroad property must be protected from damage during the work.

C. All horizontal clearances shall conform to the operating railroad specifications.

D. All roadway substructure elements within 50 feet 0 inches of the center line of tracks shall be designed per American Association of State Highway and Transportation Officials (AASHTO) LRFD collision load requirements.

Monitoring Construction

The DBT shall provide monthly status reports to KYTC.

12.5 CONTACT INFORMATION

Norfolk-Southern Railroad contact: TBD

13. DESIGN AND CONSTRUCTION REQUIREMENTS

13.1 MAINTENANCE OF TRAFFIC (MOT)

In addition to the Governing Regulations listed in Section 7.1 of this document, the DBT shall submit an approach for MOT for the project that incorporates the work required within this ITP as well as propose any innovative ideas that may expedite the work. A Traffic Management Plan shall need to be submitted and approved (form can be found on the KYTC Highway Design Web Page). The advanced and/or stamped construction plans have maintenance of traffic plans for each component of the project that the DBT may choose to utilize. It shall be the responsibility of the DBT to coordinate the MOT between each component. KYTC will entertain significant changes to the MOT plans through the ATC process as described in Section 6.1. The DBT shall be responsible to undertake minor revisions and adjustments to the provided MOT plans with approval of the KYTC engineer.

13.1.1 GENERAL

All MOT procedures shall be in accordance with Manual on Traffic Control Devices (MUTCD) except when the KYTC standard drawings or standard specifications are more restrictive then KYTC documents shall govern. The speed limit on any road within the project be reduced by 10 MPH with approval from the engineer. The DBT will be allowed less restrictive procedures if the advanced and/or stamped construction plans have so indicated. The DBT must maintain access to businesses and provides passage for emergency responders.

13.1.2 MOT RESTRICTIONS

No lane closures shall be allowed on I-75, KY 338, KY 536 and US 25 during observance of any National Holidays identified in Section 101 of the Standard Specifications and between the dates of November 1st and January 15th. Under special circumstances, KYTC reserves the right to restrict the use of lane closures due to unforeseen special events. In principle, the DBT shall maintain the current lane configuration (or better), for the life of the project except as noted in the provided MOT plans. Suggestions for additional working hours may be proposed by the DBT to KYTC as a part of the DBT project proposal.

Temporary Raised Pavement Markers, Type IVA as identified is Section 112 of the Standard specifications shall be required when I-75 traffic lanes are situated outside their normal position.

Delineators for barriers shall be required on temporary concrete barrier wall according to Section 509 of the Standard Specifications.

All temporary striping shall be temporary paint, and all striping removal shall be performed by water-blasting. Temporary tape may only be used for short segments and durations with the approval of the engineer.

The DBT shall submit any updated MOT plans to KYTC for approval. The KYTC will approve or provide comments within 14 calendar days.

Ramp closures shall only be allowed as detailed in the stamped construction plans and final proposal plans for the pavement rehab. Multiple ramp closures at a single time must be approved by the engineer unless prescribed in the stamped construction plans. Detours for ramp closures must be as prescribed in the stamped construction plans. Any time a ramp is closed beyond the allotted times specified above disincentive fees will be charged at $3,500 per hour for each hour or portion of an hour.

13.1.2.1 I-75

I-75 (Ramp Tie-Ins)

Traffic control schemes for the ramp tie-ins are included in the stamped construction plans. All work on I-75 to be completed for the ramp tie-ins, except traffic control operations and final pavement markings shall be conducted behind temporary concrete barrier wall as identified in the Standard Drawings. A lane closure for separation must be in place during barrier wall placement. Access to and from the work zone adjacent to the interstate shall be at the beginning or end of the string of barrier wall.

The contractor will be allowed to reduce the number of mainline I-75 lanes open to traffic in each direction during non-peak hours in any phase or direction. From 8:00 PM to 6:00 AM, the contractor will be allowed to reduce traffic to two lanes. From 12:00 AM (Midnight) to 6:00 AM (5:00 AM for Northbound), the contractor will be allowed to reduce traffic to a single lane. Construction operations on I-75 using shoulder closures without barrier wall are prohibited unless they are less than one work shift and positive separation of at least 11 feet is provided. Any time the number of mainline lanes in either the northbound or southbound direction are closed beyond the allotted times specified above and in the plans, disincentive fees will be charged at $3,500 per

13.2.5 PAVEMENT

Approved Pavement Designs, as exhibited on the Typical Sections, are detailed within the advanced and/or stamped construction plans.

Material Transfer Vehicle Required: Yes__X__ No_____
See Special Note for Materials Transfer Vehicle in the Standard Specifications.

Pavement Ride Quality Required: Yes__X__ No_____

See Section 410 of the Standard Specifications for Asphalt Pavement. Category A shall apply for all Asphalt Pavements on mainline interstate. Category B shall apply for all other Asphalt Pavements.

See Section 501 of the Standard Specifications for Concrete Pavement. Category B shall apply for Concrete Pavement.

In addition to the requirements included in the Standard Specifications, JPC pavements shall be constructed according to the SPECIAL NOTE FOR DOWEL BAR AND TIE BAR PLACEMENT IN JPC PAVEMENT that is included in Appendix I.

13.2.6 TYPICAL SECTION

See advanced and/or stamped construction plans for each project. No variations of typical section dimensions permitted.

13.2.7 DRAINAGE

See the respective Drainage folders provided in supplemental folder with the advanced and/or stamped construction plans. The drainage design for the projects are challenging and complicated. The DBT will be responsible for managing the drainage during construction and any changes in the design of the drainage structures.

13.2.8 EXCESS MATERIAL SITES

The construction activities of this project may result in a considerable amount of excess material. It is the DBT's responsibility to dispose of material in compliance with the United States Army Corps of Engineers (USACE) and the Kentucky Division of Water (DOW) rules and regulations pertaining to discharges into U.S. Waters. The DBT will be responsible for obtaining the excess material site(s) and the associated required permits (i.e. Section 404 & 401 permits) and certifications. When applying for permits, obtain approval from KYTC and obtain the permit in the DBT's name from USACE. The DBT will include the time to acquire the permit in their project schedule. Mitigation requirements resulting from the use of an excess material site will likely be in the form of in-lieu fees and will be the responsibility of the DBT and should be included in the Lump Sum bid. Any work associated with the excess material site will be incidental to the excavation cost including but not limited to the following items: Erosion Control Devices, Clearing and Grubbing, Seeding and Protection, Temporary and Permanent Drainage Ditches and Structures.

Questions concerning any potential impacts to "Waters of the United States" should be brought to the attention of the appropriate District Office for the Army

13.2.12 ADDITIONAL DESCRIPTION OF REQUIRED WORK AND SPECIAL PROVISIONS

All areas disturbed along residential properties shall be restored using sod as the seeding and protection. Vertical concrete surfaces in excess of 30 inches in height and 48 inches in width shall receive an architectural treatment as detailed in the advanced and/or stamped construction plans. Approach roads and commercial entrances may require reconstruction, as a part of this reconstruction, existing design widths and profile grades shall be maintained or improved upon. This may require work off the existing Right of Way and in accordance with Section 10 of this document. Intelligent compaction of soils, aggregates and asphalt mixtures shall be used along with paver mounted temperature profiles and E-ticketing as described in Appendix I. These special provisions shall apply to all portions of the design build contract.

13.3 STRUCTURES

13.3.1 STRUCTURE DESIGN

KYTC has provided final structure plans including geotechnical reports for all structures except as noted below. The DBT can construct all structures as proposed in the stamped construction plans. However, if the DBT proposes any ATC's or other changes that deviate from the proposed plan and receives KYTC approval, then the DBT becomes the Engineer of Record for the proposed structure and assumes any liability/responsibility associated with the proposed design (See Section 6.1.6).

13.3.1.1 Railroad Bridge over KY 338 (6-18)

Any proposed changes to the railroad bridge over realigned KY 338 through the ATC process shall also be approved by Norfolk-Southern Railroad. No time delays shall be granted to the DBT for the railroad related work (See Section 12).

13.3.1.2 I-75 Soil Nail Wall #14 (6-18)

See Special Note for Soil Nail Wall in Appendix I.

13.3.1.3 Retaining Wall # 3 (6-18)

Retaining Wall # 3 has a conceptual layout and a geotechnical report, however the DBT will be responsible for final design. The DBT will submit the final retaining wall design which will be reviewed by KYTC within 14 calendar days.

13.3.1.4 Noise Walls along I-75 (Both 6-14 & 6-18)

See Special Note for Noise Walls in Appendix I.

13.3.2 STRUCTURE DESIGN / ADVANCE SITUATION FOLDER FOR AN APPROVED ATC

The DBT shall have a consultant DBT member pre-qualified in Structure Design Bridges under 500 feet for submittal and final design of any structures with an approved ATC. The DBT shall be responsible for preparing any structure plans required. The structure plans shall be developed in accordance with Division of Structure Design Guidance Manual (http://transportation.ky.gov/bridges/GuidanceManual.htm). Review times shown requirements. Meetings and submittals shall be in accordance with the Geotechnical Manual.

If the DBT performs any changes through an approved ATC that requires additional geotechnical design or explorations, the DBT shall produce and submit a Foundation Analysis and Design Report for each structure and a Geotechnical Engineering Roadway Report for slopes and subgrade design. These reports shall include all engineering analyses and design recommendations.

D. If the DBT determines that additional subsurface explorations are necessary to properly design and construct the work in accordance with KYTC requirements, the DBT shall perform the subsurface explorations and analysis at its own expense. The DBT shall selectively locate subsurface explorations on the basis of field observations, and design considerations. Location of explorations shall be as topography, site conditions, soil conditions, and design factors dictate.

The DBT shall provide all subsurface exploration plans and explorations to KYTC in accordance with the KYTC Geotechnical Manual. DBT will be responsible for Maintenance of Traffic according to the MUTCD for any explorations affecting traffic. If any explorations are needed on the Railroad Right of Way, the DBT must obtain approval from the Railroad.

E. Foundations for structures shall be designed in accordance with the KYTC Geotechnical Guidance Manual, KYTC Structural Guidance Manual, AASHTO LRFD Bridge Design Specifications, and with applicable Special Notes located in the Appendix I to this Project Scope document. In addition, AREMA standards will be used for the railroad bridge design.

F. The DBT shall design retaining walls in accordance with the KYTC Geotechnical Guidance Manual, KYTC Structural Design Guidance Manual, AASHTO LRFD Bridge Design Specifications, and with applicable Special Notes located in Appendix I.

1. The DBT shall design foundations for gravity retaining walls in accordance with the KYTC Geotechnical Manual. The gravity walls shall be constructed in accordance with KYTC Standard Drawing RGX-002. The geometry of the gravity walls may vary from the Standard Drawing only if approved by the KYTC.
2. Gabion basket retaining walls shall not be permitted for permanent construction.
3. Metal "Bin" type retaining walls shall not be permitted for permanent construction.
4. Only pre-approved Mechanically Stabilized Earth (MSE) wall systems shall be used on this Project. See the Special Note for MSE retaining walls located in Appendix I for pre-approved systems. Only inextensible reinforcement shall be allowed. Norfolk-Southern has indicated that they will not permit MSE structures or lagging near the influence area of their tracks.

5. A consistent formliner as detailed in the advanced and/or stamped construction plans will be used throughout the project for all wall types.

G. Reinforced soil slopes shall not be designed at a slope ratio steeper than one (1) Horizontal to one (1) Vertical. Reinforced soil slopes shall be designed in accordance with design procedures presented in the latest version of Publication No. FHWA NHI-00-043, "Mechanically Stabilized Earth Walls and Reinforced Soil Slopes."

H. If an ATC is pursued, the DBT shall be responsible for analysis and design of soil slopes. Slopes steeper than three to one (3H:1V) shall be reinforced. Slopes three to one (3H:1V) or flatter may require reinforcement or other remediation measures depending on soil conditions:

1. Where embankment settlement is anticipated to exceed 3 inches in total settlement, the DBT shall submit an instrumentation plan for review to monitor settlement and determine when the pavement section can be placed.
2. All geotechnical instrumentation shall be left in place for future readings after the project has been completed. Instrumentation destroyed by the DBT shall be replaced at the DBT's expense.
3. Shale cannot be used in the upper two feet of the subgrade.
4. If shale that has a possibility of being acidic producing is used on the project, testing shall be required to determine the acidic producing potential. Acidic producing shale cannot be left exposed. The acidic producing shale shall be encased with a minimum 2.5-foot layer of compacted clay soil. A minimum of 4 feet of clay shall be required on top of the embankment to control the corrosion of guardrail and/or sign post, etc. from the acidic shale. Sulfate resistant cement (ASTM C-150 Type II) shall be used for subsurface structures such as pipes, culverts, bridges, etc.
5. The subgrade should be constructed in accordance with the pavement design specifications. For a chemically stabilized subgrade a minimum preliminary CBR design value of 3.0 (CBR valued will be decided after soil testing is complete) is recommended for the soil beneath the chemically stabilized subgrade. Chemical treatment for the top 8 inches of subgrade is recommended (Stockpiling of soil may be required). The chemical identified for treating the soil types encountered on this project shall be lime. It is suggested that 6 percent, by dry mass, be utilized to determine plan quantities, using an average dry density to be determined after soil testing is complete. The chemical shall be applied in accordance with Section 208 of the current edition of Standard Specifications for Road and Bridge Construction; however, contrary to Section 208 of the Standard Specifications, the curing time and testing of the subgrade may be constructed with an expedited schedule according to Appendix I. Where chemical stabilization is not feasible (cross over's, tie-in's, etc...) a minimum of 1 foot of Kentucky Coarse #2's, 3's or 23's shall be used. The granular material shall be wrapped with Geotextile Type IV Fabric.
6. Any ponds located within project limits shall be drained and mucked out a minimum of 3 feet. This material shall just be limited to final dressing of

slopes. Refill shall consist of suitable earth material or Kentucky Coarse #2's, 3's or 23's. The granular material shall be wrapped with Geotextile Type IV Fabric.

7. Some areas of deep organic soils may be encountered. The organic material shall be removed. This material shall just be limited to final dressing of slopes. Refill shall consist of suitable earth material or Kentucky Coarse #2's, 3's or 23's shall be used. The granular material shall be wrapped with Geotextile Type IV Fabric.
8. If springs are encountered during construction, proper mitigation procedures shall be followed to allow for positive drainage.
9. Working platforms for Embankment or subgrade construction, consisting of limestone, may be needed in some areas. The granular material shall be wrapped with Geotextile Type IV Fabric.
10. Foundation embankment benches and longitudinal perforated pipe underdrains shall be constructed in accordance with Standard Drawings RGX-010 and RDP-006. If stability is a concern the benches shall be constructed one at a time beginning with the lowest bench. Each bench shall be backfilled prior to excavation of the next bench. This procedure shall be followed to help maintain stability of the existing slopes in these areas.

I. Excavation support methods may be required. A dewatering method may be needed in some areas. The DBT shall be responsible for the stability of any excavations or temporary cuts. Protection of adjacent structures and utilities is the responsibility of the DBT. The DBT shall be responsible for any damage to the existing infrastructure. Any damage shall be repaired immediately.

J. No blasting is expected and shall not be utilized for removal of materials.

13.4 PERMANENT TRAFFIC CONTROL

13.4.1 PAVEMENT MARKINGS AND DELINEATORS

The DBT shall utilize the pavement striping, intersection markings, lane markings, and delineator posts as detailed in the advanced and/or stamped construction plans and in accordance with the MUTCD and applicable KYTC standards. If the DBT chooses to make a change to the provided construction plans, the DBT shall provide striping plans for review and approval by KYTC. The DBT shall also provide inlaid pavement markers on I-75, KY 338, KY 536, and US 25 according to the specification in Appendix I. The DBT shall be aware that removal of existing pavement marker castings and permanent patching of the resultant hole with Fibercrete, or an approved equal, is required.

Other special provisions in addition to the Governing Regulations are listed in Section 7.1 of this document.

13.4.2 SIGNING SPECIAL PROVISIONS

All temporary signing shall be provided by the DBT for this project. Detour signage shall be submitted, approved and erected for any approved closures and any other closure deemed necessary by the Engineer. The DBT shall expect that up to 12 variable message boards may be required at a single time.

The DBT shall utilize the permanent sign plans as detailed in the advanced construction plans. If the DBT chooses to make a change to the advanced construction plans through a design change or an approved ATC and the permanent sign plans are affected, review of the re-designed permanent signing plans may take up to 21 days. The DBT shall fabricate and install all permanent signage for the project.

Other special provisions in addition to the Governing Regulations are listed in Section 7.1 of this document.

13.4.3 TRAFFIC SIGNALS SPECIAL PROVISIONS

Construction and implementation of new traffic or reconstructed signals for the project shall be addressed as part of the DBT bid proposal. Traffic signals shall be completed as shown on the respective construction plans at the following intersections:

KY 338 Intersections
Paddock Drive, Frogtown Road, DCD ramps at I-75, Best Pal Drive, and the SPUI interchange at US 25.

KY 536 Intersections
DCD ramps at I-75, Biltmore Boulevard, Sam Neace Drive, Berberich Drive, and US 25.

Temporary signals shall be completed for the KY 338 project at Chambers Lane and Shorland Drive as detailed in the advanced and/or stamped construction plans. The temporary signals will be connected to the railroad signals at each intersection for railroad pre-emption as established by the railroad. Coordination with Norfolk-Southern will be required for Norfolk Southern to perform the work.

Traffic data for use in the design of the signalized intersections has been provided in Appendix C. If the DBT chooses to make a change to the advanced and/or stamped construction plans through an approved ATC, the DBT shall provide plans for review and approval of the new traffic signals. Review of the traffic signal plans may take up to 21 days.

KYTC has ordered the mast arms for the signals on the KY 536 (6-14) project and will be available by award of the design build contract. KYTC will order the mast arms for the signals on the KY 338 (6-18) project after the ATC process to ensure no changes to the stamped plans are required. These mast arms will be made available to the DBT once delivered in the spring 2020.

Other special provisions in addition to the Governing Regulations are listed in Section 7.1 of this document.

13.4.4 ROADWAY LIGHTING SPECIAL PROVISIONS

Construction and implementation of new lighting for the project shall be addressed as part of the DBT bid proposal as detailed in the advanced and/or stamped construction plans. If the DBT chooses to make a change to the advanced and/or stamped construction plans through an approved ATC, the DBT shall provide plans for review and approval of the new lighting. Review of the lighting plans may take up to 21 days.

Temporary lighting may be required at the KY 338/Triple Crown intersection until permanent lighting is in place for the roundabout configuration. See Special Note for lighting requirements in Appendix I3.

Other special provisions in addition to the Governing Regulations are listed in Section 7.1 of this document.

14 PROPOSAL SUBMISSION AND SELECTION CRITERIA

For determination of the successful bidder, the DBT shall be required to provide the KYTC two separate bidding submittals for the project. The first submittal shall be a technical proposal and the second submittal shall be a price proposal. The Scoring Committee will evaluate the technical proposal and provide a score to the Awards Committee. The price proposal shall be submitted after the Scoring Committee has completed scoring the proposals and the Awards Committee will establish an overall score. The KYTC's Project Awards Committee will select the winning Design Build Team for this project and the award will be made accordingly. The price proposals will be opened on October 18, 2019 and the award will be made by October 31, 2019.

All properly submitted proposals from proposers allowed to submit a proposal shall be accepted by the KYTC. However, the KYTC reserves the right to request necessary amendments which may become part of the DBT's proposal; reject all proposals; reject any proposal that does not meet mandatory requirements; or cancel this solicitation, in the best interest of the KYTC. For comparison purposes, the Awards Committee shall prepare a cost estimate based upon information provided by the DBTs in the proposal submittals. For acceptance purposes, the KYTC may use this estimate to accept or reject any or all proposals.

The KYTC also reserves the right to waive minor irregularities in proposals providing such action is in the best interest of the KYTC.

If the KYTC waives minor irregularities, such waiver shall in no way modify the solicitation requirements or excuse the DBT from full compliance with the specifications and other contract requirements if the DBT is awarded the contract.

The Scoring Committee members shall evaluate and score the technical proposal. This evaluation shall be based on the information contained in the DBT's technical proposal concerning the information outlined below.

14.1 TECHNICAL PROPOSAL (15%)

A DBT shall submit one (1) unbound version of the Technical Proposal, and one (1) CD/DVD or one (1) USB "thumb" drive containing two (2) electronic files of the Technical Proposal as follows:

A. One electronic searchable single file PDF which does not restrict printing or copying text, images and other content.

B. One electronic password protected single file PDF which restricts copying of text, images and other content.

The Technical Proposal shall be received no later than 4:00 p.m., Eastern Time, on October 4, 2019. The KYTC shall reject any proposal received after aforementioned time and date *replaced, or added without written approval of KYTC. Requests for removal, replacements, and additions shall be submitted in writing. To qualify for approval, the written request shall document that the qualifications of the proposed replacement or addition will be equal to or better than those of the Key Personnel submitted in the SOQ.*

***Can be the same as the Environmental Compliance Manager assigned to manage design development.*

Describe the qualifications and experience of the individuals assigned to these tasks and describe the specific management tasks they will perform. Include information relative to each individual's familiarity with the proposed project and similar projects.

Provide a detailed report of all current projects being worked on by members of the DBT and identify all areas where individuals will have significant responsibilities outside of the proposed project.

Individuals must be currently employed by a member of the DBT.

KYTC shall use the following criteria to distribute Project Organization and Management points:

Component of Project Organization and Management		**Percentage of Proposed Project Organization and Management Points**
A.1	Project Schedule, Completion Date & Organization	60
A.2	Project Management Plan	20
A.3	DBT Experience on projects of similar complexity	20

14.1.2.2 <u>Part B – Roadway Design, Bridges, Structures, and Geotechnical Concepts</u>

The design approach indicated in the Technical Proposal shall reflect an understanding of roadway & drainage design, bridges, structures, and geotechnical concepts for the Project. Bridges, Structures, and geotechnical concepts are critical components of the Project. The KY 338 project includes a railroad bridge, the US 25 SPUI bridge, 14 retaining walls, a soil nail wall, and a noise wall. The KY 536 project has 7 retaining walls and noise walls. At a minimum, the Technical Proposal shall address the following issues:

A. An understanding of the Project criteria, basic configuration and mandatory elements for the project;

B. An understanding of roadway design for innovative intersection/interchange types including DCD, SPUI, and roundabouts.

Regulations listed in Section 7.1 of this document, the KYTC will advise the DBT of the short comings and direct the DBT to revise and resubmit the plan. No time extension shall be granted as a result of such action. The KYTC will schedule a review meeting or issue review comments as appropriate.

In the event the DBT believes that any review comment, or orders issued by the KYTC, require a change to the scope of the agreed work, the DBT shall first contact the KYTC for clarification and shall, within 10 days of receipt of the comments or orders, provide written notice to the District Project Manager and Project Engineer concerning the reasons why the DBT believes the scope has been changed.

15.2 MAJOR DESIGN DECISION

Separate submittals for concurrence with major design decisions are required. Major design decisions involve significant utility relocation, unforeseen acquisition of ROW, traffic operation or geometric decisions that involve two or more viable solutions, and any other decision that impacts the public, operation of the facility or future maintenance.

When the DBT becomes aware of additional decisions during the course of the design, they shall advise KYTC's Project Manager in writing.

15.3 CONSTRUCTION PLANS

After the review comments for the final plan review submission have been complied with, and following approval of the design documentation, the DBT shall prepare plan sets for use during construction. All review comments shall be resolved in writing by the DBT to satisfaction of the KYTC before DBT submits the construction plans. Each plan sheet shall have its last revised date noted on the sheet and clearly marked "Approved For Construction". Physical construction shall not begin until the plans marked "Approved For Construction" (by the Project Manager) are delivered to each party on the Plan Distribution Table below. KYTC will comment on these plans within 14 working days of their submission by the Project Manager. No time extensions will be approved by the Project Manager if the plan distribution is not completed and project delays occur as a result.

If the DBT chooses to utilize the provided final stamped plans for either 6-14, 6-18, or proposal plans for 6-20002, then the DBT shall provide a stamp indicating "Approved for Construction", signature by PE, and date on the front layout sheet for each respective plan set.

The DBT shall supply full size (22"x36") and/or half size (11"x17") paper prints and electronic pdf version of each plan submission simultaneously to the parties indicated below:

Plans Distribution Table	Number of half size sets
KYTC District Office	4
KYTC Central Office	2

16 BUILDABLE UNITS

Definition: Buildable Units are portions of the projects which may be designed, reviewed and built with only limited controls and assumptions coming from the design of other portions of the project. Often a Buildable Unit will be defined by a geographic area within the plan, but it may also be defined by types of work or construction stages which may require or permit similar, nearby work to be divided into separate Buildable Units. All Buildable Units shall summarize the materials required to construct that portion of the project. The summary shall include the Construction and Material Specifications Item Number, and a description of the materials to be used.

General: The DBT may break the project work into two or more separate BU which may be progressed through design and construction with minimal or known effect on each other and/or which may be dealt with sequentially such that sufficient data is available for design and review of each BU. In order that the design and construction of one BU may proceed without significant approved information from an associated BU, the DBT may develop and propose assumptions which will allow for the first BU to proceed through design and/or construction. These assumptions shall be submitted for review and comment but their accuracy and effort upon the final design are the sole responsibility of the DBT. Should error in these assumptions result in additional work, remedial work or other changes to assume an acceptable design or should they result in the need to remove work and substitute additional work, the DBT shall be responsible for all such costs including, removal of unacceptable materials from the site, modification, additional work, repairs, etc. as necessary to produce an acceptable result.

If the DBT elects to develop Buildable Units, The DBT shall prepare, for review by the KYTC, a table of Buildable Units for the project with each BU described in detail. This table of Buildable Units will be approved or comments given within 14 calendar days after the submission. If the table is approved, the DBT shall modify the Progress Schedule to show a separate group of activities for BU and these activities shall encompass all of the design and construction work in each BU. Work activities shall be further separated in the Progress Schedule to show a meaningful completion status (i.e. separate activities comprising the placement of a bridge deck on steel beams shall describe; shoring, form building, steel placement, placement of conduit & joints, pouring concrete, forming parapets, pouring or slip forming parapets, provision of membranes, provision of wearing surfaces, curing, repair, form removal, cleaning, etc.)

The Final Review Submission and construction plans shall specifically be identified by the Buildable Unit code. If the design of a BU requires input information from an adjacent or related BU, the source for that information in previously approved plans shall be cited or the DBT shall provide an estimated value of the data. The input data shall also be carefully identified. In the same way any assumption, calculations or results from the stage and BU which are used as input to another BU to verify previous assumptions. Should assumptions not match values calculated later, the DBT shall re-analyze all affected components and determine appropriate changes. Should those elements have already been constructed, the DBT shall recommend repairs, adjustments, modifications or replacement of the existing work as necessary to comply with the Scope of Work. All costs for re-design, re-submission, modifications, removals, disposal of materials and new work needed to remedy the project and bring it to compliance shall be borne by the DBT and no time extensions shall be approved for this.

Appendix C3 -- CAP

ClearView ▸

Item Number: 06-0014.00 **Contract ID:**Unavailable **County:** BOONE
Letting Date: **Project Manager:** kytc\Carol.Callan-Ramler
Description:
IMPROVE THE KY-536 (MT. ZION ROAD) INTERCHANGE. (14CCR)(16CCR)(18CCR) (DESIGN BUILD)

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Open CAP Report

#	Requestor	Location	Request Date	CAP Description	Modified By	Modified
1	Carol Callan-Ramler / Tim Flynn	D6	05/30/2018	State agrees to sod all disturbed areas.	ky\carol.callan-ramler	06/13/2019
2	Carol Callan-Ramler / Tim Flynn	D6	05/30/2018	Clarification to #1: Parcel 118: State agrees to sod all disturbed areas.	ky\carol.callan-ramler	06/13/2019
3	Carol Callan-Ramler / Tim Flynn	D6	02/07/2019	Parcel 123: State agrees to sod all disturbed areas.	ky\carol.callan-ramler	06/13/2019
4	Carol Callan-Ramler / Tim Flynn	D6	12/18/2018	Parcel 126: State agrees to repair any disturbed area of subject parking lot with “in kind” materials. State agrees to sod all disturbed areas. Property Owners have retained Business Sign for salvage value and said sign is to be removed by owners from the easement area. If the sign is not removed by 3-31-19 the State shall obtain possession of and raze said sign.	ky\carol.callan-ramler	06/13/2019
5	Carol Callan-Ramler / Tim Flynn	D6	02/23/2018	Parcel 127: State agrees to sod all disturbed areas.	ky\carol.callan-ramler	06/13/2019
6	Carol Callan-Ramler / Tim Flynn	D6	02/09/2018	Parcel 131: State agrees to remove the “pork chop” median located within the proposed entrance way located right of Station 212+00. State agrees to sod all disturbed areas.	ky\carol.callan-ramler	06/13/2019
7	Carol Callan-Ramler / Tim Flynn	D6	03/26/2018	Parcel 205: State agrees to sod all disturbed areas. Subject’s 6 ft. security fencing is not to be disturbed.	ky\carol.callan-ramler	06/13/2019
8	Carol Callan-Ramler / Tim Flynn	D6	12/19/2018	Parcel 310: State agrees to install a 24’ Right In-Right Out commercial grade entrance way compliant with all local and state requirements for commercial grade entrances, left of Station 213+10 to T/E identified as “building removal / entrance way” construction.	ky\carol.callan-ramler	06/13/2019
New						

ClearView ▸

Item Number: 06-0018.00 **Contract ID:**Unavailable **County:** BOONE
Letting Date: **Project Manager:** KYTC\CAROL.CALLAN-RAMLER
Description:
RECONSTRUCT THE KY-338 (RICHWOOD ROAD) INTERCHANGE. (FUNDING FOR IMR SHOWN UNDER 6-14.01) (10CCR)(12CCR)(14CCR)(16CCR) (DESIGN BUILD)

☐ **Info:** Welcome to the Clear View Production site. All changes here will affect Production SYP.

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Open CAP Report

#	Requestor	Location	Request Date	CAP Description	Modified By	Modified
1	Carol Callan-Ramler / Mary Beth Johnson	D6	05/29/2019	Parcel 102: The proposed driveway located at STA 101+20 RT (413 Richwood Road - KY 338) will be 12 feet in width. A Consent and Release is being signed for the removal of the existing drive and restoration of the area located outside the temporary easement area. The brick mailbox located at 461 Richwood Road (KY 338) is not to be disturbed during construction. The mailbox at 413 Richwood Road (KY 338) will be relocated to the newly constructed entrance.	ky\carol.callan-ramler	06/10/2019
2	Carol Callan-Ramler / Mary Beth Johnson	D6	03/14/2019	Parcel 329: KYTC commits to the following: • Construct a concrete entrance being approximately 15 feet in width and approximately 6 inches deep as per the attached plan sheet, R25 (rev. February 04, 2019) • Install 112.5 L.F. of guardrail at RT St 390+00 to RT St 391+15.6 along Richwood Road (aka Paper Blvd.) • Emergency response vehicles will have continuous access to Dixie Highway (US 25) from Shorland Drive during the entire duration of the project, until access is provided directly to Richwood Road.	ky\carol.callan-ramler	06/10/2019

New ☐ ☐

Appendix H - GEOTECHNICAL

Appendix H1 -- KY 536 (Item No. 6-14) Geotechnical Reports (Roadway)

For Reference Only

6-14 Geotechnical Reports for Roadway + Structures Summary

Last Update: 6-7-19, v.0

Structure Type	Number	Structure	Alignment	Begin	End	Length	Offset	Average Height Approx.	Wall Type	Structure Number	Report Date	Page #
Retaining Walls		Retaining Wall	KY 536	164+40	168+00	360	LT	6.5	Gravity	S-039-2016	08-11-17	R9
		Retaining Wall	KY 536	174+65	175+20	55	LT	12	Soldier Pile	S-040-2016	08-11-17	R11, R13
		Retaining Wall	KY 537	179+11	181+30	219	LT	5	Std. Gravity	S-042-2016	03-07-18	R13, R15
		Retaining Wall	KY 538	183+00	184+15	115	LT	4	Std. Gravity	S-043-2016	03-07-18	R15
		Retaining Wall	KY 539	185+95	191+20	525	LT	7	Std. Gravity	S-044-2016	03-07-18	R15, R18
		Retaining Wall	KY 536	192+44	194+23	179	LT	7.5	Gravity	S-045-2016	08-11-17	R18, R21
		Retaining Wall	KY 536	201+45	203+20	175	RT	7.8	Gravity	S-046-2016	08-11-17	R24
		Retaining Wall	KY 536	203+92	205+77	185	LT	7	Gravity	S-047-2016	08-11-17	R24, R27
		Retaining Wall	Biltmore Connector	26+15	27+00	85	RT	8	Gravity	S-048-2016	08-11-17	R43
		Retaining Wall	Biltmore Connector	26+40	27+00	60	LT	5.5	Gravity	S-049-2016	08-11-17	R43
Noise Wall		Sound Wall Along I-75/I-71	I-75 / I-71 SB	00+00	24+16	2,416	RT			S-087-2018	01-25-19	R75
Roadway Reports	**Number**	**Facility (ies) / Report Contents**	**Alignment**	**Begin**	**End**	**Length**	**Offset**	**Average Height**	**Wall Type**	**Report Number**	**Report Date**	**Page #**
Roadway Report	N/A	KY 536	KY 536 I-75 (mile points)	153+00 177.659	217+47 178.345	6,447 0.686	N/A	N/A	N/A	R-047-2015	07-18-17	Overall Plans

(R-047-2015) Consultant

M E M O R A N D U M

TO: **Randy Turner, PE**
Project Management Coordinator
Division of Highway Design

FROM: **Bart Asher, PE, PLS**
Director
Division of Structural Design

BY: **Erik Scott, PE**
Geotechnical Branch

DATE: **July 18, 2017**

Subject: **Geotechnical Engineering Roadway Report**
Boone County
I-75 / KY-536 (Mt. Zion Road) Interchange Reconstruction
FD52 008 0075 177-179 D
I-75 Milepost 177.659 to 178.345
KY 536 Station 153+00 to 217+46.55
Mars No. 8022203D
Item No. 6-14.00

The geotechnical engineering roadway report for the subject project has been completed by Terracon Consultants, Inc. The drilling and sampling was performed by Thelen Associates (now Geotechnology, Inc.) under their statewide contract for drilling services. The electronic data files in DGN format are being forwarded to the Design Consultant, Stantec Consulting Services, Inc., for incorporation into the roadway plans. The electronic files will also be made available on ProjectWise.

If you have any questions or need additional information, please contact the Geotechnical Branch at 502-564-2374.

cc: **Division of Design (Plan Processing Section)**
Division of Construction
TEBM for Pavement Design
TEBM for Project Delivery & Preservation (District)
TEBM for Project Development (District)
Project Manager (District)
Stantec Consulting Services, Inc.
Terracon Consultants, Inc.

Attachment

Report of Geotechnical Exploration

Reconstruct I-75 Interchange with KY 536
State No. 8022203D
Item No. 6-14.00
R-047-2015
Boone County, Kentucky

July 18, 2017
Terracon Project Number N1155079

Prepared for:
Kentucky Transportation Cabinet
Geotechnical Branch
Frankfort, Kentucky

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

July 18, 2017

Terracon

Kentucky Transportation Cabinet
Division of Structural Design-Geotechnical Branch
1236 Wilkinson Blvd.
Frankfort, Kentucky 40601-1200

Attn: Mr. Erik Scott, PE
P: [502] 782-3819
E: erik.scott@ky.gov

Re: Report of Geotechnical Exploration
Reconstruct I-75 Interchange with KY 536
State No. 8022203D
Item No. 6-14.00
R-047-2015
Boone County, Kentucky
Terracon Project Number: N1155079

Dear Mr. Scott:

Terracon Consultants, Inc. (Terracon) is submitting this Report of Geotechnical Exploration for the above referenced roadway project. This work was conducted under Terracon's 2014 Statewide Contract No. PON26251500000099. This report presents the results of the field borings, laboratory testing program, and geotechnical-related recommendations for design and construction of the roadways associated with this project.

We have enjoyed working with your staff and appreciate the opportunity to be of service to KYTC on this project.

Respectfully submitted,
Terracon Consultants, Inc.

for Aaron J. Muck

Jess A. Schroeder, P.E.
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Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

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1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/I-71 Interchange with KY 536 (Mt. Zion Road) in Boone County, Kentucky. Stantec is the lead design engineer on the project. Terracon Consultants, Inc. was selected to perform the geotechnical services through our Statewide Engineering Contract. Terracon's services included laboratory testing and engineering services. The field exploration phase was conducted by Thelen Associates, Inc. (now Geotechnology, Inc.) working under a separate statewide contract with KYTC.

A new "double crossover diamond" interchange is planned with the KY 536 pavement lanes continuing to run beneath the existing I-75 bridge. The project involves reconstruction along KY 536 (Mt. Zion Road), new ramps, a new multi-use path along the northern edge of KY 536, as well as improvements, extensions, and realignments to various side roads that include Biltmore Blvd., Biltmore Connector, Biltmore Drive, Investment Way, Sam Neace Drive, and about 1300 ft. of US 25. Reference is made to the Project Location Map attached in Appendix A.

This report addresses the geotechnical conditions and recommendations related to the roadway portions of the project. There are also proposed retaining walls that were included in the scope; those are addressed under separate cover.

2.0 TOPOGRAPHY AND DRAINAGE

The project area lies in a dissected upland of the Outer Bluegrass Region. Ground elevations generally range from about Elev. 870 ft. to about 950 ft. Grades typically rise to the east. Surface drainage in the area is generally dendritic with most flow towards the South Branch of Gunpowder Creek, which lies west of I-75. The Ohio River lies about 8 miles north of the site and has a normal pool elevation of 455 ft. in the project area.

3.0 GEOLOGY

Geologic mapping indicates the project area is underlain by limestone and shale of the Bull Fork Formation and Ordovician System. Published mapping shows the limestone component can be as high as about 95 percent of the rock mass. No karst features are mapped in the project area and the karst-related risk is considered to be low.

The USGS Soil Survey shows that the uppermost soils along the project site comprise mostly of Rossmoyne Silt Loam with lesser amounts of Jessup Silt Loam (a wind-blown loess) and Faywood Silty Clay (residuum).

4.0 DRILLING AND SAMPLING

4.1 General

An exploration plan was developed by Terracon after a review of the available plans, profiles, and cross-sections provided by Stantec. The draft exploration plan was subsequently reviewed and approved by KYTC Geotechnical Branch. Some borings were eliminated and some were relocated during the field program due to access, utility conflicts, etc. The deleted borings were approved by KYTC Geotechnical Branch. Appendix B includes plan sheets that show the test boring locations.

The KYTC Geotechnical Manual was used as a guide in developing the test boring program, as described below.

4.2 Rock Core Borings

Selected critical cut sections along the alignments contained rock core borings. Terracon utilized these borings to evaluate cut slope stability. At various times during the drilling operations performed by Thelen (now Geotechnology, Inc.), samples and field logs were delivered to Terracon's office and laboratory where a project geologist logged the rock core. The geologist determined the depth of the Rock Disintegration Zone (RDZ) and determined the percent recovery and Rock Quality Designation (RQD) for each core run.

4.3 Disturbed Sample Borings

Disturbed sample borings were drilled along the proposed roadway alignments to determine type and thickness of various soils. These borings were typically extended to the cut-off depths presented in the final exploration plan, unless auger refusal was encountered first.

Soil cuttings from the augers were visually logged by the driller and assigned a soil type designation based upon soil texture, color, moisture content, and consistency. Soil auger cuttings were collected at approximate five foot intervals for subsequent moisture content testing. Bulk bag samples were also collected to represent each of the major soil types for subsequent engineering classification tests, moisture-density testing (Standard Proctor), and California Bearing Ratio (CBR) testing, as applicable. The Proctor and CBR tests were only performed on bag samples from cut sections.

Graphical presentation of disturbed borings with associated laboratory test results are provided on the profile sheets attached in Appendix B.

4.4 Undisturbed Sample Borings

Various undisturbed sample borings were performed to collect subsurface data at proposed embankments. Undisturbed thin-walled (Shelby) tube samples were generally collected at five foot intervals of depth to provide samples for potential shear strength testing. In cases where granular materials were encountered or where gravel or other materials prevented adequate Shelby tube recovery, standard penetration test (SPT) samples were collected. Selected Shelby tube samples were extruded by Terracon and laboratory testing was performed. Various tests included engineering classification tests, unconfined compression tests, and consolidated-undrained (CU) triaxial compression tests. The CU test stages were conducted on individual sections trimmed from the Shelby tube specimens. No “multi-stage” testing was performed on a given specimen.

4.5 Rockline Soundings

Rockline soundings were performed at various locations within selected cut sections or where additional top-of-rock data was necessary to assist with slope stability analyses. The rockline sounding data is included on the profile sheets and on the appropriate stability sections attached in Appendix B.

4.6 Pavement Cores

Some areas of the project will include pavement replacement, overlaying, or rehabilitation. At selected locations, pavement cores were taken to identify the existing section and typically included one Shelby tube sample at subgrade elevation, as well.

4.7 Observation Wells

In undisturbed borings where the overburden depth exceeded 10 feet in cuts and 5 feet in proposed fill areas, an observation well was installed. The observation wells were installed upslope of the original boring. Groundwater observation levels are tabulated below at the four locations where observation wells were installed.

Table 4.7.1: Observation Well Measurements Performed on June 28. 2016

Boring	Location	Date Drilled	Approx. Ground Elev., ft.	Approx. Water Elev., ft.
5A	Ramp A1	4/12/16	926.1	913.1
8A	Ramp D2	4/6/16	931.4	929.1
72	Mainline	5/18/16	964.2	932.3
73	Mainline	5/18/16	939.4	933.7

The observed groundwater levels indicated here are based upon conditions encountered at the time of the exploration program. These levels or conditions may vary with location and time based on changes in climate, precipitation, runoff, etc.

5.0 LABORATORY TESTING AND RESULTS

5.1 General

All laboratory testing was performed by Terracon in accordance with applicable AASHTO or Kentucky Methods of soil and rock testing specifications. Appendix B includes profiles and sections that show the laboratory test results. Additionally, undisturbed sample and rock core slake durability / jar slake test results are tabulated in Appendix C. Appendix C also includes plots of the unconfined compression and CU triaxial compression tests.

5.2 Disturbed Soil Drilling and Testing Results

All disturbed bulk bag samples were subjected to moisture content, particle size distribution, Atterberg Limits, and specific gravity testing. Additionally, all disturbed bag samples collected from proposed cut sections included a Standard Proctor moisture-density relationship test and California Bearing Ratio (CBR) test. Results are provided on the profile sheets in Appendix B.

Test borings found the overburden thickness to vary from about 0.9 ft. to about 27 ft. The shallowest bedrock was generally encountered near proposed Ramps A, A-1, A-2, and C-1 (less than about 3 ft.). The greatest overburden thicknesses were generally encountered near proposed Ramp D-2 and along the Mainline, about STA 205+00, where embankment fill exists.

Of the specimens tested, the soils classified as CH (26%) and CL (74%) according to the Unified Soil Classification System (USCS). By the AASHTO classification system, the soils classified as A-4 (4%), A-6 (39%), and A-7-6 (57%).

Sixteen CBR tests were performed with test results ranging from 3.4 to 15.2. Nine of the tests showed CBR values less than 6. There was no obvious pattern to the location on the site versus CBR value.

Samples of the cohesive overburden soils were generally considered as moist with natural moisture contents above or near the soils' corresponding Plastic Limit.

5.3 Undisturbed Soil Testing

Undisturbed test borings were performed in selected cut and proposed embankment areas. These test borings included Shelby tube sampling and in some cases, Standard Penetration Test (SPT) sampling. Laboratory testing included moisture contents and in several cases, particle size distribution, Atterberg Limits, and specific gravity. Various shear strength tests were also conducted for slope stability analyses and those tests included consolidated, undrained (CU) triaxial and unconfined compression tests. Laboratory test results for undisturbed test specimens are presented in Appendix C on the appropriate stability sections, and are also attached in Appendix B.

Photographs of the extruded Shelby tube samples were also taken and are part of the project file.

5.4 Pavement Core and Undisturbed Soil Testing

Six of the test borings included coring through existing pavement and collecting one undisturbed Shelby tube sample of the soil subgrade. A summary of these findings is provided below. Soil subgrade at all of the locations consisted of stiff to very stiff silty clays classifying as "CL."

Table 5.4.1: Summary of Pavement Cores

Boring	Location	STA	Offset	Asphalt	Concrete	Granular Base
56	Biltmore Blvd.	303+00	15' RT	0.5'	-	None
57	Biltmore Connector	28+50	7' LT	0.9'	-	None
58	Sam Neace	15+60	25' RT	1.0'	-	None
59	US 25	500+60	25' RT	0.6'	-	0.2'
60	US 25	503+60	12' LT	1.0'	-	0.5'
61	US 25	507+80	8' LT	0.5'	1.5'	None

Pavement section thicknesses are approximate.

Laboratory test results on undisturbed soil specimens at pavement core locations are presented in Appendix C.

5.5 Slake Durability Index (SDI) and Jar Slake (JS) Testing

The SDI and Jar Slake tests provide indications of the effects of weathering on the bedrock's exposed faces. These tests are primarily performed on samples of shale. The Kentucky Transportation Cabinet assigns four categories pertaining to shales, as shown below:

Table 5.5.1: KYTC Shale Classification, per Item GT-505 of the Geotechnical Manual

Classification	SDI, %	Typical Jar Slake Category
Durable	95 to 100	6
Non-Durable, Class I	80 to 94	4 or 5
Non-Durable, Class II	50 to 79	3 or 4
Non-Durable, Class III	<49	1 or 2

For this project, nineteen Slake Durability (SDI) / Jar Slake (JS) tests were performed on specimens of recovered rock core. The SDI values ranged from about 4.8 to 82.4 and JS values ranged from about 1 to 6. Rock classification per KYTC GT-505 ranged from Non-Durable Shale Class III to Non-Durable Shale, Class I. Refer to Appendix C for SDI / JS test results.

6.0 SLOPE STABILITY ANALYSES

6.1 Cut Sections

6.1.1 Rock Cut Slopes

Bedrock at this project site comprises interbedded shale and limestone. The bedrock is horizontally-bedded. There is typically weathering along bedding planes and fractures.

Several rock core specimens indicated Non-Durable Class III shale from Slake Durability and Jar Slake laboratory testing. KYTC GT-608-2 states that the typical rock cut for Class III non-durable shale is 2H:1V or flatter from the ground line to the ditch line. Normally, these types of slopes are designed without a roadside ditch bench or overburden bench.

Cut slope recommendations for bedrock zones have been based upon review of rock cores and the SDI/JS laboratory testing, as described in Paragraph 5.5. The rock cut slopes are shown as 2H:1V (or flatter, based upon the civil design drawings). No formal rock core meeting was requested, nor conducted by KYTC.

Monitoring of the exposed shale cut slopes is recommended as they may require seasonal maintenance.

6.1.2 Soil Cut Stability

Test borings drilled at critical cut sections were utilized to evaluate proposed cut slopes. The selected cut slopes for evaluation were first submitted to KYTC for review and approval. Subsurface stratification and ground water level assumptions were based upon test boring conditions. Terracon evaluated the cut slope stability using *GeoStudio SLOPE/W® 2016* *version 8.16.0.12859.* The cut slopes were evaluated under "intermediate-term" and "long-term" conditions. Per KYTC requirements, the long-term analyses of cut slopes utilize an effective strength cohesion value that is reduced by 80 percent from the design value.

Target safety factors against slope failure are shown below and are based upon KYTC criteria.

Table 6.1.2.1: KYTC Target Safety Factors for Slope Stability

Classification	Intermediate-Term	Long-Term
Cut Slopes in Soil	1.2 – 1.4	1.4 – 1.6

Cut slope stability analyses were conducted at seven locations; details are provided below and shown on the Cut Stability Sheets attached in Appendix B.

Table 6.1.2.2: Cut Slope Stability Analyses

Location	Steepest Allowable Slope	Est. Cut Depth thru Soil, ft.	Safety Factor, Intermediate-Term	Safety Factor, Long-Term
ML, STA 173+00, LT Side	2H:1V	13 (+/-)	1.6	1.5
Ramp A-1, STA 11100+40, LT Side	3H:1V	15 (+/-)	3.0	1.5
Ramp C, STA 317+00, LT Side	2.5H:1V(1)	11 (+/-)	2.4	1.5
Ramp C-2, STA 20321+00, RT Side	2.5H:1V(1)	9 (+/-)	3.7	1.6
Ramp D-1, STA 10401+20, RT Side	3H:1V	16 (+/-)	2.7	1.5
Ramp D-2, STA 20400+80, LT Side	3H:1V(2)	4 to 14 (+/-)	1.9	1.4
Ramp D-2, STA 20402+20, LT Side	3H:1V	33 (+/-)	1.7	1.4

(1) After evaluating preliminary design of 2H:1V cut slope, a final uniform cut slope of 2.5H:1V was evaluated after discussion with KYTC.

(2) To meet required safety factor criteria, an undercut was found to be required in the lowermost 30 feet of the slope toe (measured from the cut slope toe, 30 feet horizontally in an upslope direction away from the toe. The undercut should extend to weathered or unweathered bedrock, whichever comes first, be benched as required, and replaced with granular embankment.

6.2 Embankment Sections

6.2.1 Embankment Stability Analyses

An embankment section was selected for slope stability analysis, as reviewed and approved by KYTC. The embankment slope was evaluated for short-term conditions using total stress shear strength parameters, as well as long-term, using effective stress shear strength parameters. Again, the slope stability analyses were conducted using *GeoStudio SLOPE/W® 2016 version 8.16.0.12859.* Details are provided below and shown on the Embankment Stability Sheet attached in Appendix C.

Table 6.2.1.1: Embankment Slope Stability Analyses

Location	Slope Geometry	Approx. Embankment Height, ft.	Safety Factor, Short-Term	Safety Factor, Long-Term
ML, STA 217+00, LT Side(1)	2.5H:1V +/-	26 (+/-)	1.7	2.0

(1) Existing slope analyzed.

A second area was evaluated for embankment stability. This area was associated with proposed Retaining Wall S-047-2016, located along the mainline between Stations 203+92 and 205+77, left side. Slope stability analyses showed that in order to satisfy global stability, the gravity retaining wall should be backfilled with Granular Embankment. This granular material should continue as required to comprise the entire proposed embankment zone, even if located outside the limits of normal retaining wall backfill. The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches.

Table 6.2.1.2: Embankment Slope Stability Analyses at Retaining Wall S-047-2016

Location	Slope Geometry	Approx. Embankment Height, including retaining wall, ft.	Safety Factor, Short-Term	Safety Factor, Long-Term
ML, STA 205+00, LT Side	2H:1V +/-	17 (+/-)	1.8	1.8

Working platform construction is anticipated in areas where soft subgrade conditions may occur beneath proposed embankments. The need for working platform stabilization beneath constructed embankments will depend on field conditions at the time of construction. For approximation purposes only, it is estimated that the 2-foot thick working platform quantity will be on the general order of 2500 lin. ft. of roadway at an average width of about 30 feet. This is a general estimate only and variations should be expected.

7.0 GEOTECHNICAL NOTES

7.1 Clearing and grubbing of roadway areas shall be completed in accordance with Section 202 of the current Standard Specifications for Road and Bridge Construction before placing embankment.

7.2 All soils, whether from on site excavation or borrow, may require manipulation to obtain proper moisture content prior to compaction. Direct payment shall not be permitted for rehandling, hauling, stockpiling, and/or manipulating soils.

7.3 Per Section 206 of the current Standard Specifications, the moisture content of embankment material shall not vary by more than +2 to -2 percent of its optimum moisture content at the time of compaction. The moisture content criteria shall have equal weight with the density requirement when determining acceptability of compacted embankment.

7.4 Excavation of surface ditches and channel changes adjacent to embankment areas shall be performed prior to placement of adjacent embankments. The material excavated for the channel changes and surface ditches is suitable for embankment construction if adjusted to proper moisture content in accordance with Section 206 of the current Standard Specifications.

7.5 The Contractor is responsible for excavating to specified sections. This shall be considered “unclassified excavation” and incidental to excavation or embankment operations with no additional compensation given.

7.6 Erosion control measures as stated in Sections 212 and 213 of the current Standard Specifications should be followed.

7.7 Embankment and cut slope faces should be vegetated as soon as practical. Routine observation should be performed and the slopes maintained as needed.

7.8 Borrow material, if required for creating roadway subgrades, shall meet the minimum CBR value of 3.

7.9 Embankment construction shall be in accordance with Section 206 of the current Standard Specifications, Embankment of Rock/Shale/Soil Combination or Embankments Principally of Non-Durable Shale, as applicable.

7.10 Shale material should not be allowed within the uppermost 2 ft. of any finished subgrade.

7.11 Due to constructability issues in this urban setting, chemical stabilization of the roadbed is deemed not feasible. Instead, the top one foot of subgrade shall be constructed with KY Coarse Aggregate No. 2, 3, or 23 in accordance with Section 805 of the Standard Specifications for Road and Bridge Construction, current edition. The aggregate shall be wrapped with Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications. Contrary to the Standard Specifications, Type IV Geotextile Fabric shall be used in lieu of Type III Fabric. The aggregate shall daylight horizontally to the edge of embankment fills and to the ditch line in cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction. Where soft subgrade is encountered, the thickness of rock may need to be increased to also serve as a working platform for subgrade stabilization.

7.12 Perforated underdrain pipes shall be placed in vertical sags in accordance with KYTC Standard Drawing RDP-005 at the following approximate locations and/or as directed by the Engineer:

Approximate Station Limits
Mainline
STA 185+68
STA 210+73

Sherwood Lakes Drive
STA 100+47

KY 536 Entr. Lt. 212+22
STA 100+35

Biltmore Blvd.
STA 298+85

Biltmore Drive
STA 50+50

Biltmore Connector
STA 28+00

Sam Neace Drive / Biltmore Drive West
STA 101+00

US 25
STA 504+00

Ramp C-2
STA 20319+90

Ramp D-1
STA 10401+14

Ramp D-2
STA 20402+01

7.13 Transverse benching and/or perforated pipe underdrains, in accordance with Standard Drawing RDP-006, shall be installed at the following approximate locations, and any additional locations as designated by the Engineer.

Approximate Station Limits

Mainline
STA 162+40

Taco Bell Access
STA 100+93

Biltmore Blvd.
STA 297+74

Biltmore Connector
STA 21+40
STA 22+55
STA 23+22

Ramp A-1
STA 11099+40
STA 11101+68
STA 11101+97

Ramp A-2
STA 21100+26

Ramp C
STA 317+10

Ramp D-2
STA 20399+40
STA 20402+60

Ramp F-1
STA 11621+23

Ramp F-2
STA 21621+34

7.14 Foundation embankment benches shall be constructed in accordance with Standard Drawing RGX-010 at the locations listed below and/or as directed by the Engineer. If water is encountered during benching, construct a minimum one (1) foot thick drainage blanket as directed by the Engineer, or contact the Geotechnical Branch for guidance. The benches shall be constructed one at a time beginning with the lowest bench. Each bench shall be backfilled prior to excavation of the next bench. This procedure should be followed to help maintain stability of the existing slopes in these areas. The drainage blanket shall consist of Kentucky Coarse Aggregate No. 2 in accordance with Section 805 of the current Standard Specifications, or other available material deemed suitable by the Engineer. The drainage blanket shall extend to the toe of slope to provide positive drainage. The drainage blanket shall be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

Approximate Station Limits
Mainline
STA 153+40 – 154+60, RT
STA 155+40 – 156+00, RT
STA 158+10 – 159+80, RT
STA 190+00 – 191+20, RT
STA 192+20 – 193+60, RT
STA 203+80 – 206+00, LT
STA 205+40 – 208+00, RT
STA 209+40 – 211+80, RT
STA 209+80 – 211+80, LT
STA 212+60 – 216+80, LT
STA 212+60 – 217+20, RT

KY 536 AAPR RD LT, STA 206+09
STA 100+40 – 100+60, RT

Biltmore Connector
STA 21+20 – 21+80, RT
STA 27+00 – 28+20, RT

Lakeside Drive
STA 100+80 – 101+20, LT

US 25
STA 497+20 – 497+40, LT
STA 497+20 – 497+80, RT
STA 498+00 – 498+80, LT

Ramp D-1
STA 10399+60 – 10399+90, RT

7.15 In order to provide a working platform for embankment construction, KY Coarse Aggregate No. 2, 3 or 23 shall be placed over all soft and/or saturated areas that may be detected during construction, as directed by the Engineer. The aggregate shall be in accordance with Section 805 of the current Standard Specifications for Road and Bridge Construction. The required thickness is estimated to be 2 feet, but the actual locations and thickness may depend on seasonal fluctuations in the water table and field conditions. The aggregate shall be wrapped with Geotextile Fabric in accordance with Sections 214 & 843 of the current Standard Specifications. Type IV Fabric shall be used for this application, contrary to the Standard Specifications. The Coarse Aggregate material and placement will be paid by the ton, and will not be paid as Embankment-in-Place or Roadway Excavation. The Geotextile Fabric will be paid by the square yard. The need for working platform stabilization will depend on field conditions at the time of construction.

7.16 Slope stability analyses indicated the need to flatten the originally designed 2H:1V cut slope to a uniform 2.5H:1V cut slope through both bedrock and soil overburden at the following locations:

Ramp C, Left Side:	STA 314+70 to STA 319+00
Ramp C, Right Side:	STA 317+20 to STA 319+80
Ramp C-2, Right Side:	STA 20319+80 to STA 20321+60

7.17 Slope stability analyses indicated the need to undercut a portion of the cut slope toe and replace it with granular material at the following location:

Ramp D-2, Left Side:	STA 20400+00 to STA 20402+40

(Refer to the cut stability sheet at STA 20400+80, Ramp D-2)

Specifically, the undercut should extend down to the top of weathered bedrock and over a horizontal distance no less than 30 feet, as measured from the ditch line away from the roadway centerline. The granular material shall consist of Kentucky Coarse Aggregate No. 2, 3, or 23 in accordance with Section 805 of the current Standard Specifications. The aggregate material shall be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

8.0 DESIGN RECOMMENDATIONS

8.1 The top 1 foot of the subgrade for the project should consist of Kentucky Coarse Aggregate No. 2, 3, or 23. The 1-foot rock layer should be incorporated into the pavement design as a structural layer. A CBR value of 2.0 is recommended for the material below the rock layer. The rock should be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the Standard Specifications, current edition.

8.2 An average soil shrinkage value of two (2) percent is estimated for this project. This value should be applied to the formula for calculating the Apparent Shrinkage as outlined in the Design Manual. The recommended rock swell is estimated to be ten (10) percent for material excavated below the rock disintegration zone (RDZ). The RDZ zone itself has zero (0) percent shrink and swell.

9.0 CLOSING

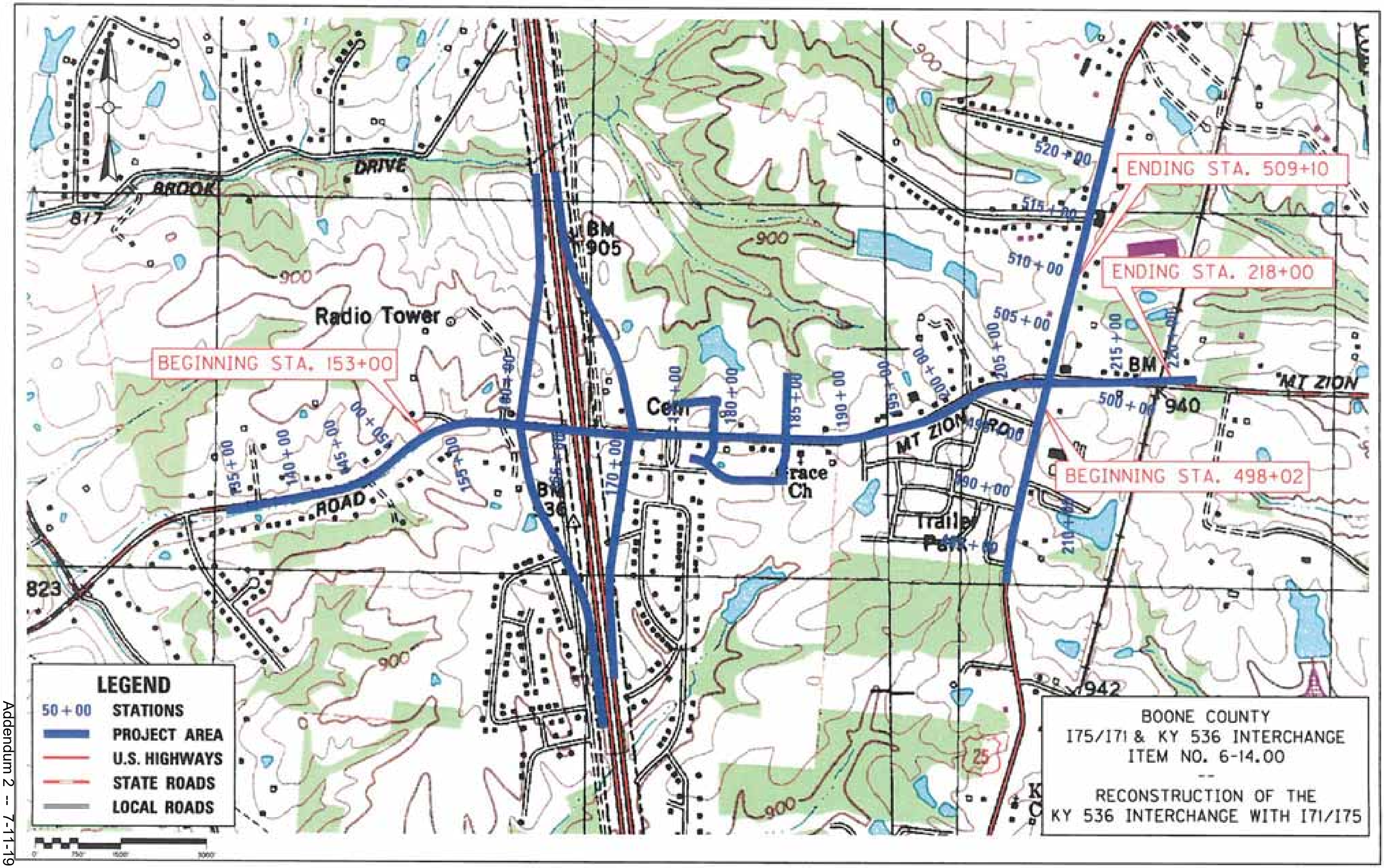
The analysis and conclusions presented in this report are based upon the data obtained from the test borings performed by others at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur away from the borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident over the short term. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If KYTC is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use by KYTC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

PROJECT LOCATION MAP



BOONE COUNTY
I75/I71 & KY 536 INTERCHANGE
ITEM NO. 6-14.00
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RECONSTRUCTION OF THE
KY 536 INTERCHANGE WITH I71/I75

APPENDIX B

PROJECT DRAWINGS

Geotechnical Symbols
Geotechnical Notes
Soil Profile Sheets
Cut Stability Sheets
Embankment Stability Sheet

GEOTECHNICAL SYMBOL SHEET

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

AASHTO Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35% or less passing 0.075 mm)							Silt-Clay Materials (More than 35% passing 0.075 mm)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, Percent Passing											
2.00 mm (No. 10)	50 max	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
0.425 mm (No. 40)	30 max	50 max	51 min	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of Fraction Passing 0.425 mm (No. 40)											
Liquid Limit	- - -		- - -	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min

Unified Soil Classifications

MAJOR DIVISIONS		SYMBOL		NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	⁙	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	⁙	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GM	⫶	Silty gravels, gravel-sand-silt mixtures.
		GC	▨	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	⁙	Well graded sands or gravelly sands, little or no fines.
		SP	⁙	Poorly graded sands or gravelly sands, little or no fines.
		SM	⫶	Silty sands, sand-silt mixtures.
		SC	▨	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS LL IS LESS THAN 50	ML	▥	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	▨	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays.
	SILTS AND CLAYS LL IS GREATER THAN 50	MH	▥	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	▨	Inorganic clays of high plasticity, fat clays.
UNCLASSIFIED MATERIAL		NONE		Non-classified material(i.e. overburden, pavement, slag, etc.) Include visual description.

AI	Activity Index
LI	Liquidity Index
S+C	Silt + Clay (% finer than No.200 Sieve)
○	Rockline Soundings
◑	Disturbed Sample Boring
◎	Undisturbed Sample Boring
⊙	Undisturbed Sample Boring & Rock Core
●	Rock Core
⌖	Slope Inclinometer Installation typical applications: ⌖ ◑ ◎ ⊙ ●
OW	Observation Well
➡	Approximate Footing Elevation
▼ (Date)	Water Elevation
VS (psf)	Field Vane Shear Strength
▮	Thin-walled Tube Sample
<	Standard Penetration Test Sample
N	Penetration Resistance
Qu (psf)	Unconfined Compressive Strength
UU (psf)	Unconsolidated Undrained Triaxial Strength
w%	Moisture Content
KY RQD	Rock Quality Designation (Kentucky Method)
STD RQD	Rock Quality Designation (Standard Method)
SDI(JS)	Slake Durability Index (Jar Slake Test)
REC	Core Recovery
Ø	Angle of Internal Friction (Total Stress)
$\bar{Ø}$	Angle of Internal Friction (Effective Stress)
c (psf)	Cohesion (Total Stress)
$\bar{c}$ (psf)	Cohesion (Effective Stress)
γ (pcf)	Total Unit Weight
RDZ	Rock Disintegration Zone
OB	Overburden Bench
IB	Intermediate Bench
R	Refusal
NR	Refusal Not Encountered

▦	LIMESTONE
⁙	SANDSTONE
⌒	DURABLE SHALE (SDI 95)
◡	NONDURABLE SHALE (SDI 95)
■	COAL
⁂	TALUS, MINE WASTE, FILL MATERIAL, BOULDERS, & ETC.
≈	GRANULAR EMBANKMENT
< >	STRUCTURE GRANULAR BACKFILL
○	SLOPE PROTECTION

GEOTECHNICAL SYMBOL SHEET
Addendum 2 -- 7-11-19

MicroStation v8.11.9.292
E-SHEET NAME:
USER:
DATE
FILE NAME:

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

GEOTECHNICAL NOTES

1. Clearing and grubbing of roadway areas shall be completed in accordance with Section 202 of the current Standard Specifications for Road and Bridge Construction before placing embankment.

2. All soils, whether from on site excavation or borrow, may require manipulation to obtain proper moisture content prior to compaction. Direct payment shall not be permitted for rehandling, hauling, stockpiling, and/or manipulating soils.

3. Per Section 206 of the current Standard Specifications, the moisture content of embankment material shall not vary by more than +2 to -2 percent of its optimum moisture content at the time of compaction. The moisture content criteria shall have equal weight with the density requirement when determining acceptability of compacted embankment.

4. Excavation of surface ditches and channel changes adjacent to embankment areas shall be performed prior to placement of adjacent embankments. The material excavated for the channel changes and surface ditches is suitable for embankment construction if adjusted to proper moisture content in accordance with Section 206 of the current Standard Specifications.

5. The Contractor is responsible for excavating to specified sections. This shall be considered 7/32 unclassified excavation9/32 and incidental to excavation or embankment operations with no additional compensation given.

6. Erosion control measures as stated in Sections 212 and 213 of the current Standard Specifications should be followed.

7. Embankment and cut slope faces should be vegetated as soon as practical. Routine observation should be performed and the slopes maintained as needed.

8. Borrow material, if required for creating roadway subgrades, shall meet the minimum CBR value of 3.

9. Embankment construction shall be in accordance with Section 206 of the current Standard Specifications, Embankment of Rock/Shale/Soil Combination or Embankments Principally of Non-Durable Shale, as applicable.

10. Shale material should not be allowed within the uppermost 2 ft. of any finished subgrade.

11. Due to constructability issues in this urban setting, chemical stabilization of the roadbed is deemed not feasible. Instead, the top one foot of subgrade shall be constructed with KY Coarse Aggregate No. 2, 3, or 23 in accordance with Section 805 of the Standard Specifications for Road and Bridge Construction, current edition. The aggregate shall be wrapped with Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications. Contrary to the Standard Specifications, Type IV Geotextile Fabric shall be used in lieu of Type III Fabric. The aggregate shall daylight horizontally to the edge of embankment fills and to the ditch line in cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction. Where soft subgrade is encountered, the thickness of rock may need to be increased to also serve as a working platform for subgrade stabilization.

12. Perforated underdrain pipes shall be placed in vertical sags in accordance with KYTC Standard Drawing RDP-005 at the following approximate locations and/or as directed by the Engineer:

Approximate Station Limits

Mainline
STA 185+68
STA 210+73

Sherwood Lakes Drive
STA 100+47

KY 536 Entr. Lt. 212+22
STA 100+35

Biltmore Blvd.
STA 298+85

Biltmore Drive
STA 50+50

Biltmore Connector
STA 28+00

Sam Neace Drive / Biltmore Drive West
STA 101+00

US 25
STA 504+00

US 25
STA 504+00

Ramp C-2
STA 20319+90

Ramp D-1
STA 10401+14

Ramp D-2
STA 20402+01

13. Transverse benching and/or perforated pipe underdrains, in accordance with Standard Drawing RDP-006, shall be installed at the following approximate locations, and any additional locations as designated by the Engineer.

Approximate Station Limits

Mainline
STA 162+40

Taco Bell Access
STA 100+93

Biltmore Blvd.
STA 297+74

Biltmore Connector
STA 21+40
STA 22+55
STA 23+22

Ramp A-1
STA 11099+40
STA 11101+68
STA 11101+97

Ramp A-2
STA 21100+26

Ramp C
STA 317+10

Ramp D-2
STA 20399+40
STA 20402+60

Ramp E-1
STA 11621+23

Ramp E-2
STA 21621+34

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS:

GEOTECHNICAL NOTES
Addendum 2 -- 7-11-19

GEOTECHNICAL NOTES

14. Foundation embankment benches shall be constructed in accordance with Standard Drawing RGX-010 at the locations listed below and/or as directed by the Engineer. If water is encountered during benching, construct a minimum one (1) foot thick drainage blanket as directed by the Engineer, or contact the Geotechnical Branch for guidance. The benches shall be constructed one at a time beginning with the lowest bench. Each bench shall be backfilled prior to excavation of the next bench. This procedure should be followed to help maintain stability of the existing slopes in these areas. The drainage blanket shall consist of Kentucky Coarse Aggregate No. 2 in accordance with Section 805 of the current Standard Specifications, or other available material deemed suitable by the Engineer. The drainage blanket shall extend to the toe of slope to provide positive drainage. The drainage blanket shall be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

Approximate Station Limits

Mainline

STA 153+40 154+60, RT
STA 155+40 156+00, RT
STA 158+10 159+80, RT
STA 190+00 191+20, RT
STA 192+20 193+60, RT
STA 203+80 206+00, LT
STA 205+40 208+00, RT
STA 209+40 211+80, RT
STA 209+80 211+80, LT
STA 212+60 216+80, LT
STA 212+60 217+20, RT

KY 536 APPR RD LT, STA 206+09

STA 100+40 100+60, RT

Biltmore Connector

STA 21+20 21+80, RT
STA 27+00 28+20, RT

Lakeside Drive

STA 100+80 101+20, LT

US 25

STA 497+20 497+40, LT
STA 497+20 497+80, RT
STA 498+00 498+80, LT

Ramp D-1

STA 10399+60 10399+90, RT

15. In order to provide a working platform for embankment construction, KY Coarse Aggregate No. 2, 3 or 23 shall be placed over all soft and/or saturated areas that may be detected during construction, as directed by the Engineer. The aggregate shall be in accordance with Section 805 of the current Standard Specifications for Road and Bridge Construction. The required thickness is estimated to be 2 feet, but the actual locations and thickness may depend on seasonal fluctuations in the water table and field conditions. The aggregate shall be wrapped with Geotextile Fabric in accordance with Sections 214 & 843 of the current Standard Specifications. Type IV Fabric shall be used for this application, contrary to the Standard Specifications. The Coarse Aggregate material and placement will be paid by the ton, and will not be paid as Embankment-in-Place or Roadway Excavation. The Geotextile Fabric will be paid by the square yard. The need for working platform stabilization will depend on field conditions at the time of construction.

16. Slope stability analyses indicated the need to flatten the originally designed 2H:1V cut slope to a uniform 2.5H:1V cut slope through both bedrock and soil overburden at the following locations:

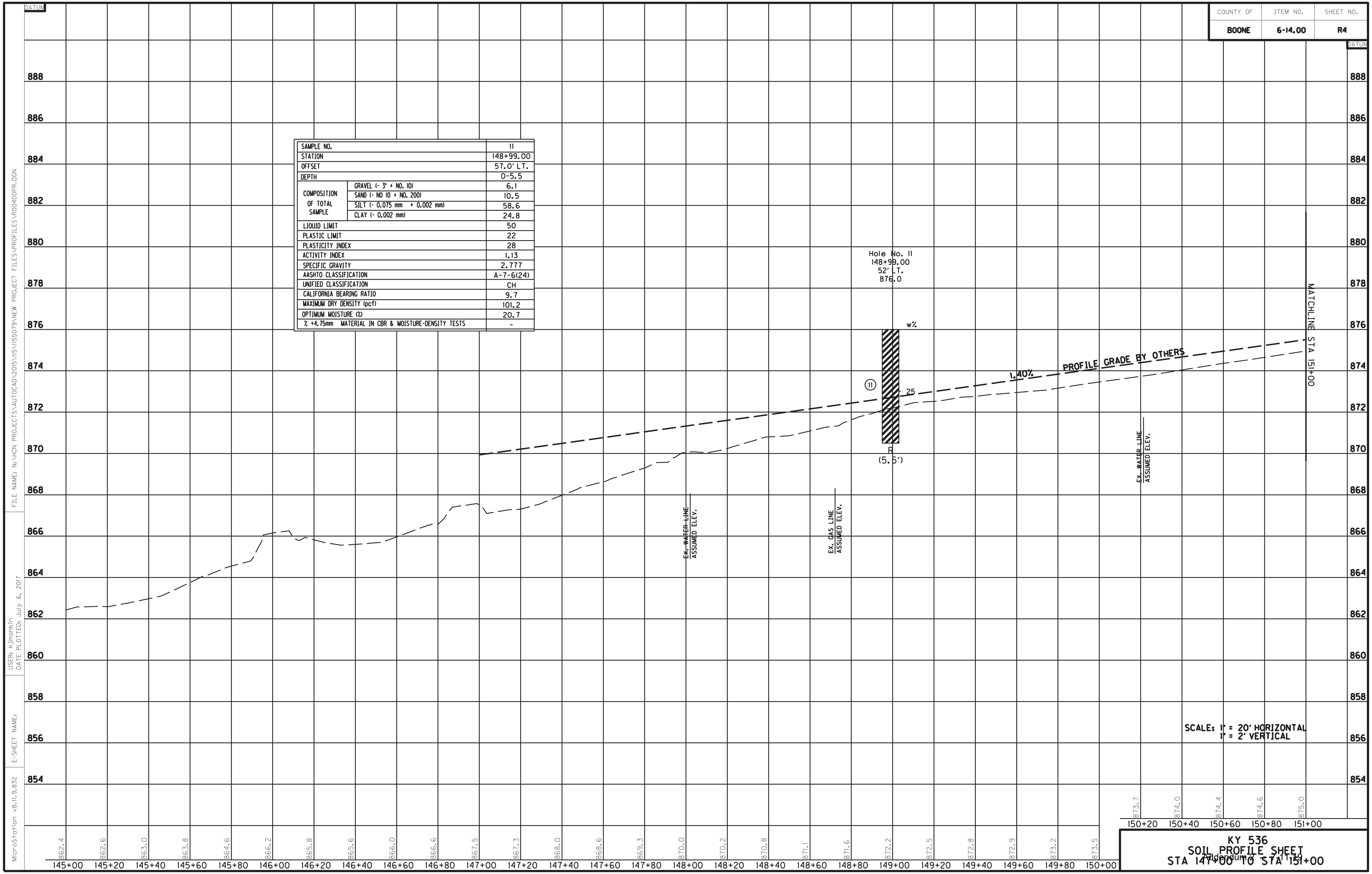
Ramp C, Left Side: STA 314+70 to STA 319+00
Ramp C, Right Side: STA 317+20 to STA 319+80
Ramp C-2, Right Side: STA 20319+80 to STA 20321+60

17. Slope stability analyses indicated the need to undercut a portion of the cut slope toe and replace it with granular material at the following location:

Ramp D-2, Left Side: STA 20400+00 to STA 20402+40
(Refer to the cut stability sheet at STA 20400+80, Ramp D-2)

Specifically, the undercut should extend down to the top of weathered bedrock and over a horizontal distance no less than 30 feet, as measured from the ditch line away from the roadway centerline. The granular material shall consist of Kentucky Coarse Aggregate No. 2, 3, or 23 in accordance with Section 805 of the current Standard Specifications. The aggregate material shall be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R4



SAMPLE NO.		11
STATION		148+99.00
OFFSET		57.0' LT.
DEPTH		0-5.5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6.1
	SAND (- NO 10 + NO. 200)	10.5
	SILT (- 0.075 mm + 0.002 mm)	58.6
	CLAY (- 0.002 mm)	24.8
LIQUID LIMIT		50
PLASTIC LIMIT		22
PLASTICITY INDEX		28
ACTIVITY INDEX		1.13
SPECIFIC GRAVITY		2.777
AASHTO CLASSIFICATION		A-7-6(24)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		9.7
MAXIMUM DRY DENSITY (pcf)		101.2
OPTIMUM MOISTURE (%)		20.7
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 536
SOIL PROFILE SHEET
STA 147+00 TO STA 151+00

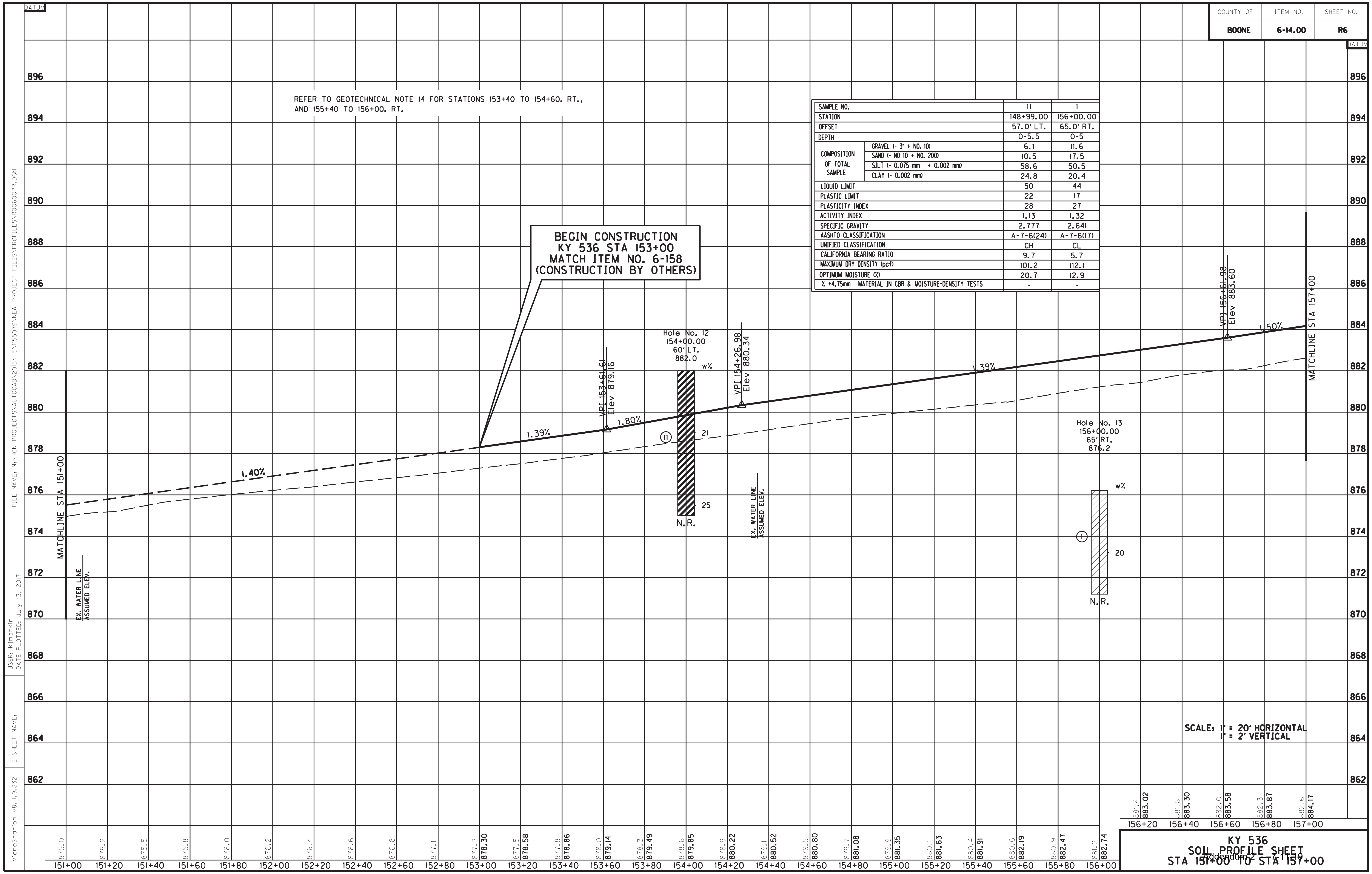
Addendum 2 – 7.11.19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R00400PR.DGN
USER: kjmankin
DATE PLOTTED: July 6, 2017
E-SHEET NAME:
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R6

REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 153+40 TO 154+60, RT., AND 155+40 TO 156+00, RT.

SAMPLE NO.		11	1
STATION		148+99.00	156+00.00
OFFSET		57.0′ LT.	65.0′ RT.
DEPTH		0-5.5	0-5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6.1	11.6
	SAND (- NO 10 + NO. 200)	10.5	17.5
	SILT (- 0.075 mm + 0.002 mm)	58.6	50.5
	CLAY (- 0.002 mm)	24.8	20.4
LIQUID LIMIT		50	44
PLASTIC LIMIT		22	17
PLASTICITY INDEX		28	27
ACTIVITY INDEX		1.13	1.32
SPECIFIC GRAVITY		2.777	2.641
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(17)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		9.7	5.7
MAXIMUM DRY DENSITY (pcf)		101.2	112.1
OPTIMUM MOISTURE (%)		20.7	12.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-



FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R0600PR.DGN

USER: kjmankin
DATE PLOTTED: July 13, 2017

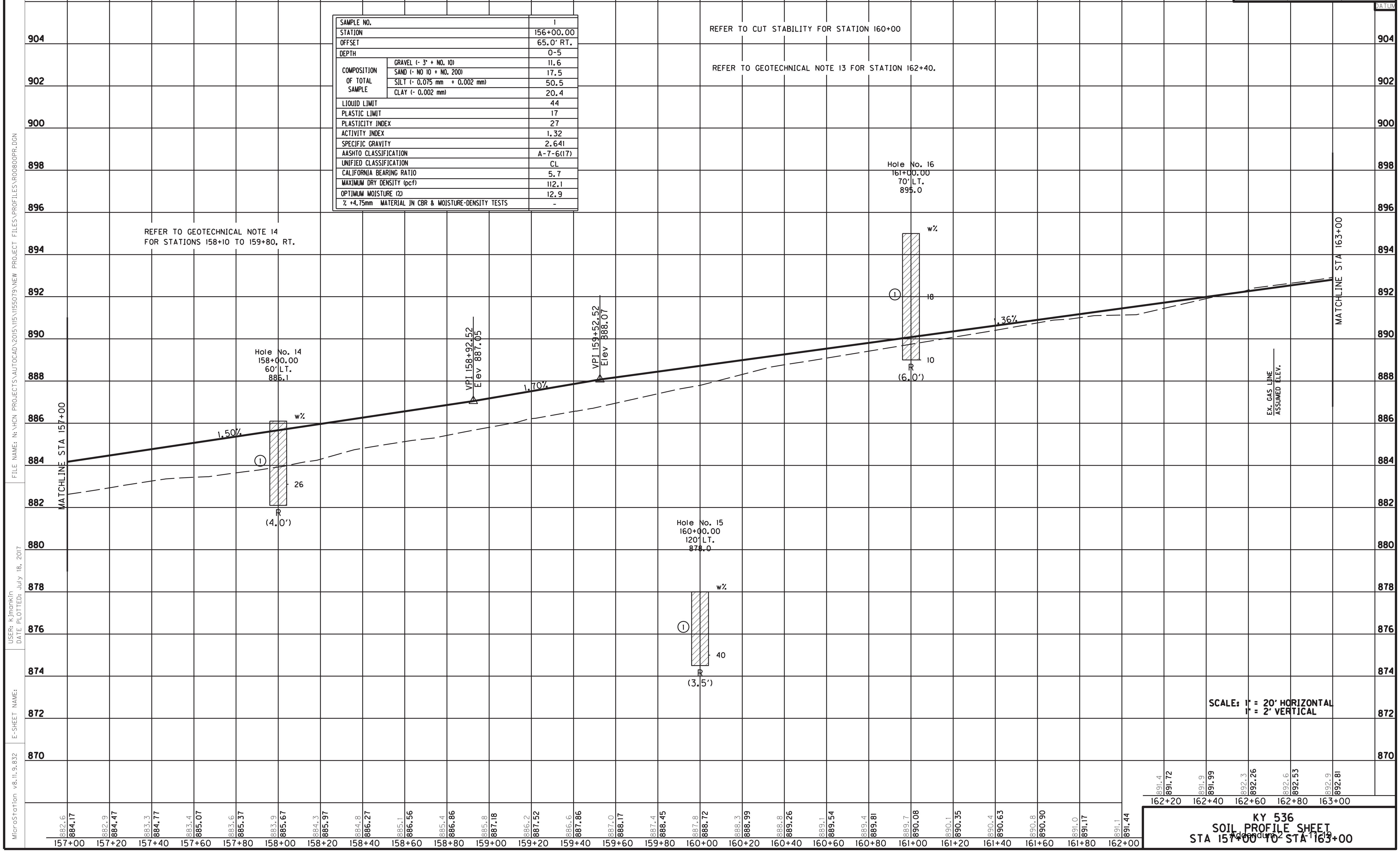
E-SHEET NAME:

MicroStation v8.11.9.832

KY 536
SOIL PROFILE SHEET
STA 151+00 TO STA 157+00

Addendum 2 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R8



SAMPLE NO.		1
STATION		156+00.00
OFFSET		65.0' RT.
DEPTH		0-5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	11.6
	SAND (- NO 10 + NO. 200)	17.5
	SILT (- 0.075 mm + 0.002 mm)	50.5
	CLAY (- 0.002 mm)	20.4
LIQUID LIMIT		44
PLASTIC LIMIT		17
PLASTICITY INDEX		27
ACTIVITY INDEX		1.32
SPECIFIC GRAVITY		2.641
AASHTO CLASSIFICATION		A-7-6(17)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		5.7
MAXIMUM DRY DENSITY (pcf)		112.1
OPTIMUM MOISTURE (%)		12.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

REFER TO CUT STABILITY FOR STATION 160+00

REFER TO GEOTECHNICAL NOTE 13 FOR STATION 162+40.

REFER TO GEOTECHNICAL NOTE 14
FOR STATIONS 158+10 TO 159+80, RT.

157+00	882.6	884.17
157+20	882.9	884.47
157+40	883.3	884.77
157+60	883.4	885.07
157+80	883.6	885.37
158+00	883.9	885.67
158+20	884.3	885.97
158+40	884.8	886.27
158+60	885.1	886.56
158+80	885.4	886.86
159+00	885.8	887.18
159+20	886.2	887.52
159+40	886.6	887.86
159+60	887.0	888.17
159+80	887.4	888.45
160+00	887.8	888.72
160+20	888.3	888.99
160+40	888.8	889.26
160+60	889.1	889.54
160+80	889.4	889.81
161+00	889.7	890.08
161+20	890.1	890.35
161+40	890.4	890.63
161+60	890.8	890.90
161+80	891.0	891.17
162+00	891.1	891.44
162+20	891.4	891.72
162+40	891.9	891.99
162+60	892.3	892.26
162+80	892.6	892.53
163+00	892.9	892.81

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 536
SOIL PROFILE SHEET
STA 157+00 TO STA 163+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R00800PR.DGN

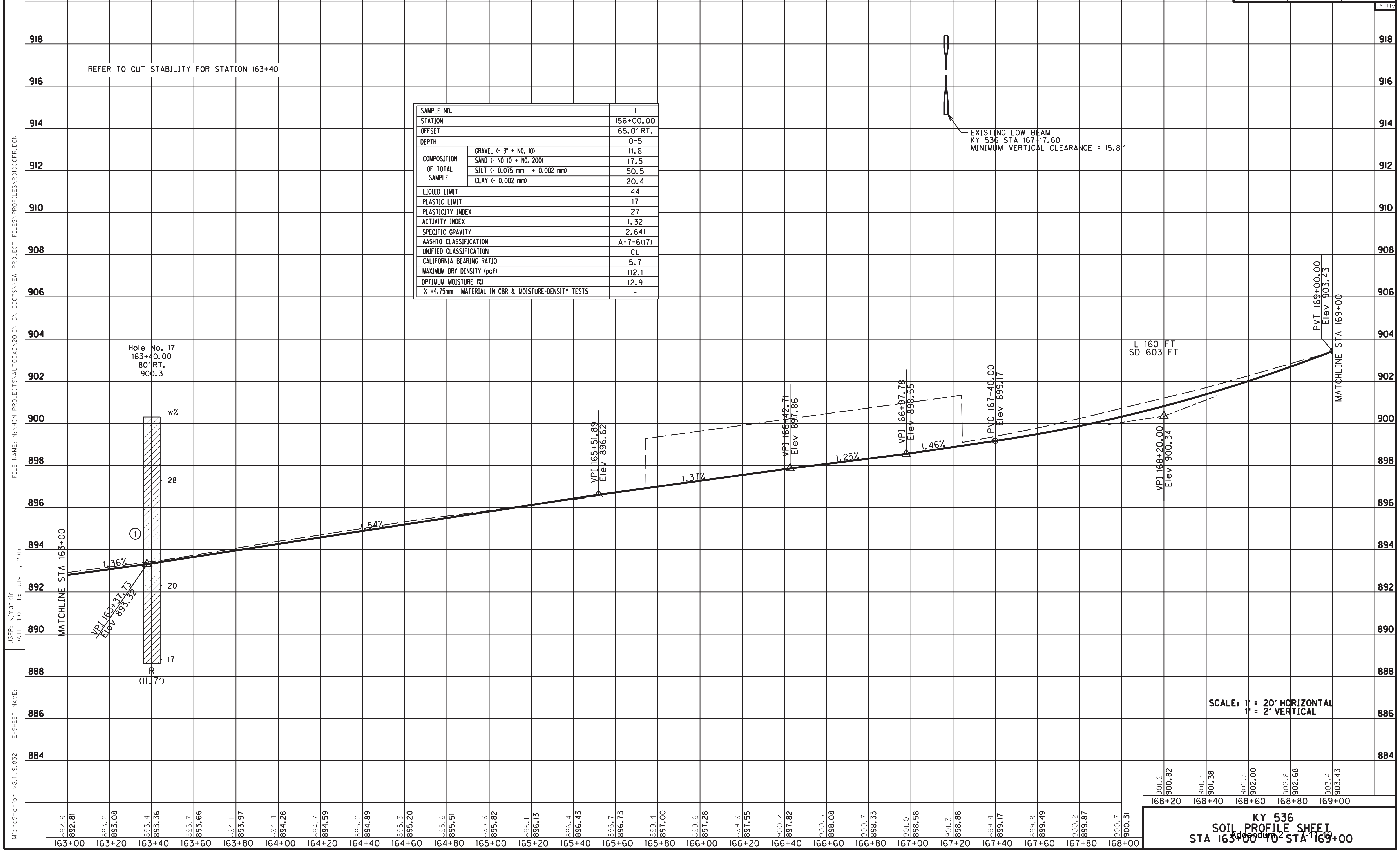
USER: kjmankin
DATE PLOTTED: July 18, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R10

REFER TO CUT STABILITY FOR STATION 163+40



SAMPLE NO.		1
STATION		156+00.00
OFFSET		65.0' RT.
DEPTH		0-5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	11.6
	SAND (- NO 10 + NO. 200)	17.5
	SILT (- 0.075 mm + 0.002 mm)	50.5
	CLAY (- 0.002 mm)	20.4
LIQUID LIMIT		44
PLASTIC LIMIT		17
PLASTICITY INDEX		27
ACTIVITY INDEX		1.32
SPECIFIC GRAVITY		2.641
AASHTO CLASSIFICATION		A-7-6(17)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		5.7
MAXIMUM DRY DENSITY (pcf)		112.1
OPTIMUM MOISTURE (%)		12.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

KY 536
SOIL PROFILE SHEET
STA 163+00 TO STA 169+00

Addendum 2 -- 7-11-19

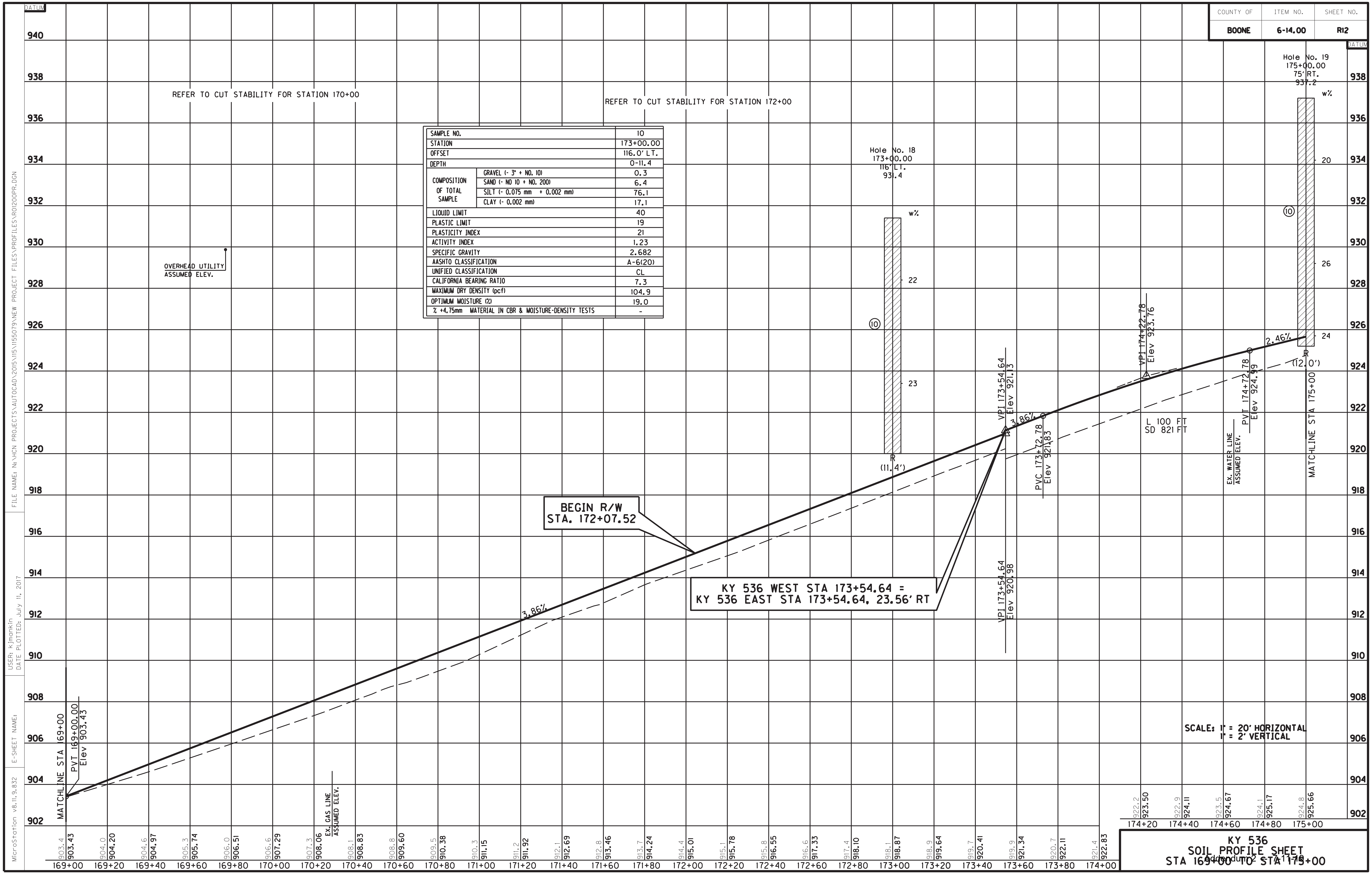
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R01000PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R12



SAMPLE NO.		10
STATION		173+00.00
OFFSET		116.0' LT.
DEPTH		0-11.4
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0.3
	SAND (- NO 10 + NO. 200)	6.4
	SILT (- 0.075 mm + 0.002 mm)	76.1
	CLAY (- 0.002 mm)	17.1
LIOUID LIMIT		40
PLASTIC LIMIT		19
PLASTICITY INDEX		21
ACTIVITY INDEX		1.23
SPECIFIC GRAVITY		2.682
AASHTO CLASSIFICATION		A-6(20)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		7.3
MAXIMUM DRY DENSITY (pcf)		104.9
OPTIMUM MOISTURE (%)		19.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

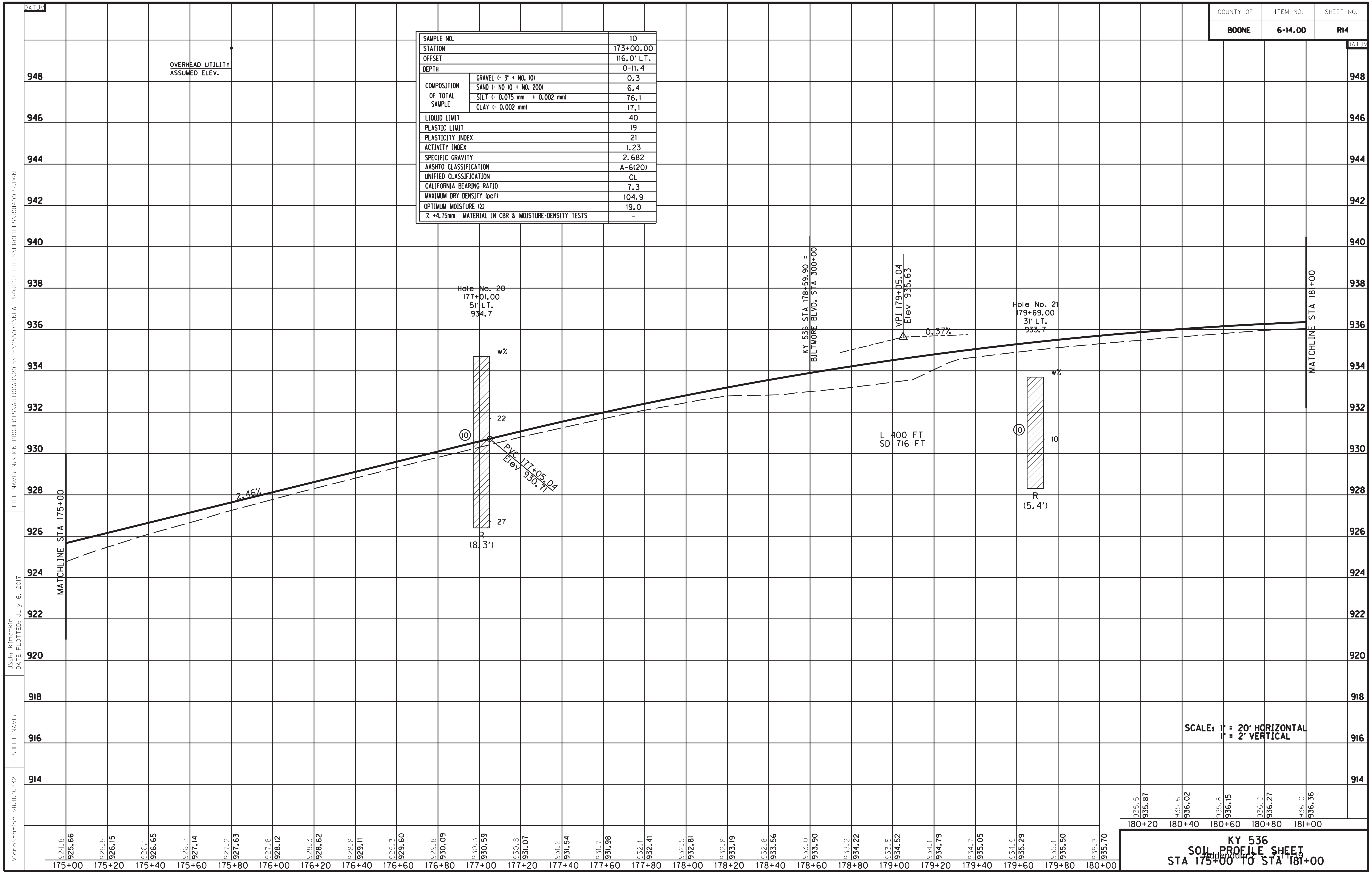
KY 536
SOIL PROFILE SHEET
STA 169+00 TO STA 175+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R01200PR.DGN
USER: kjmankin
DATE PLOTTED: July 11, 2017
E-SHEET NAME:
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	**R14**

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R01400PR.DGN
USER: kjmankin
DATE PLOTTED: July 6, 2017
E-SHEET NAME:
MicroStation v8.11.9.832



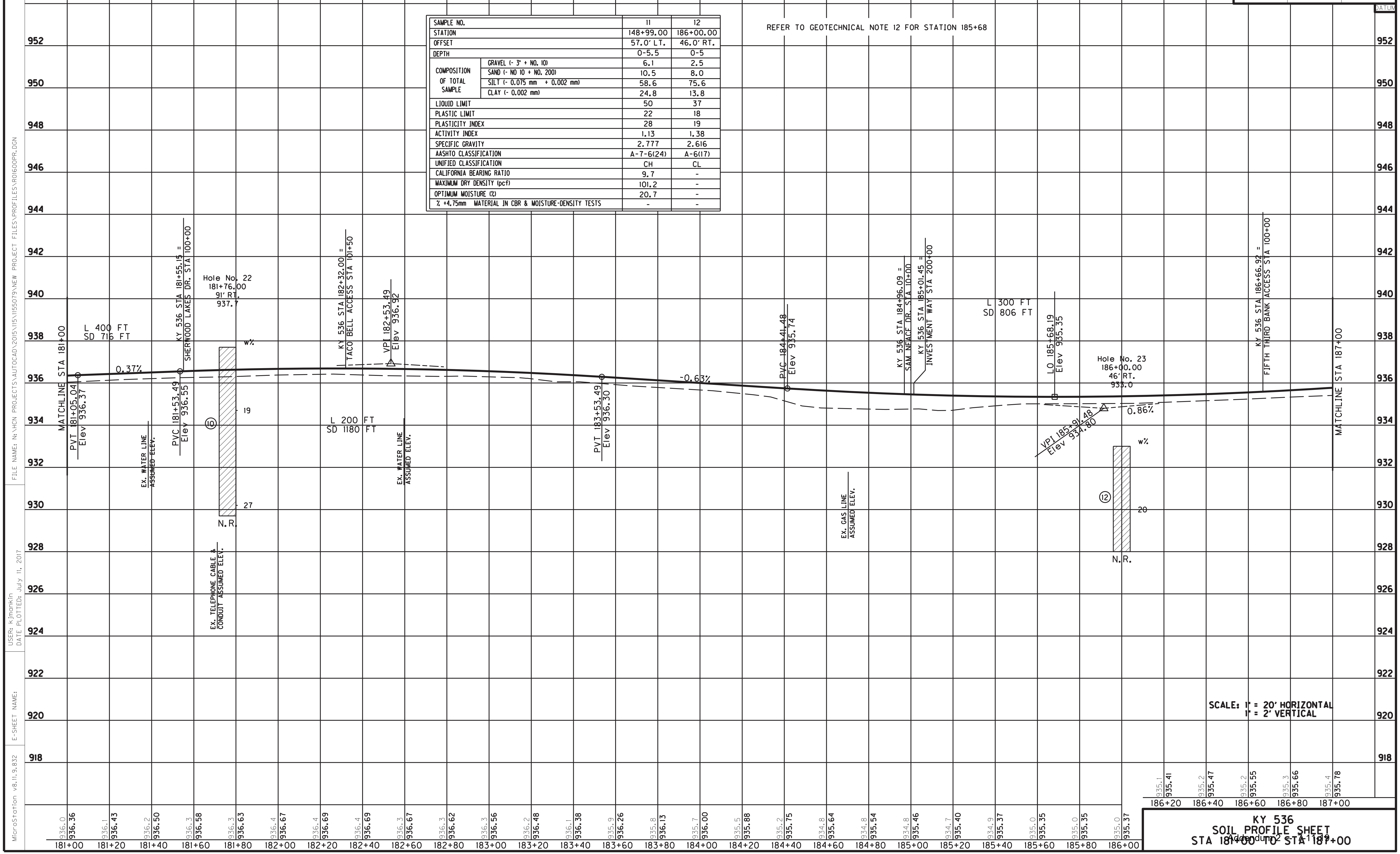
SAMPLE NO.		10
STATION		173+00.00
OFFSET		116.0' LT.
DEPTH		0-11.4
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0.3
	SAND (- NO 10 + NO. 200)	6.4
	SILT (- 0.075 mm + 0.002 mm)	76.1
	CLAY (- 0.002 mm)	17.1
LIQUID LIMIT		40
PLASTIC LIMIT		19
PLASTICITY INDEX		21
ACTIVITY INDEX		1.23
SPECIFIC GRAVITY		2.682
AASHTO CLASSIFICATION		A-6(20)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		7.3
MAXIMUM DRY DENSITY (pcf)		104.9
OPTIMUM MOISTURE (%)		19.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

KY 536
SOIL PROFILE SHEET
Addendum 2 - 7-11-19
STA 175+00 TO STA 181+00

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R16

REFER TO GEOTECHNICAL NOTE 12 FOR STATION 185+68

SAMPLE NO.		11	12
STATION		148+99.00	186+00.00
OFFSET		57.0′ LT.	46.0′ RT.
DEPTH		0-5.5	0-5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6.1	2.5
	SAND (- NO 10 + NO. 200)	10.5	8.0
	SILT (- 0.075 mm + 0.002 mm)	58.6	75.6
	CLAY (- 0.002 mm)	24.8	13.8
LIQUID LIMIT		50	37
PLASTIC LIMIT		22	18
PLASTICITY INDEX		28	19
ACTIVITY INDEX		1.13	1.38
SPECIFIC GRAVITY		2.777	2.616
AASHTO CLASSIFICATION		A-7-6(24)	A-6(17)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		9.7	-
MAXIMUM DRY DENSITY (pcf)		101.2	-
OPTIMUM MOISTURE (%)		20.7	-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-



SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 536
SOIL PROFILE SHEET
STA 181+00 TO STA 187+00

Addendum 2 - 7-11-19

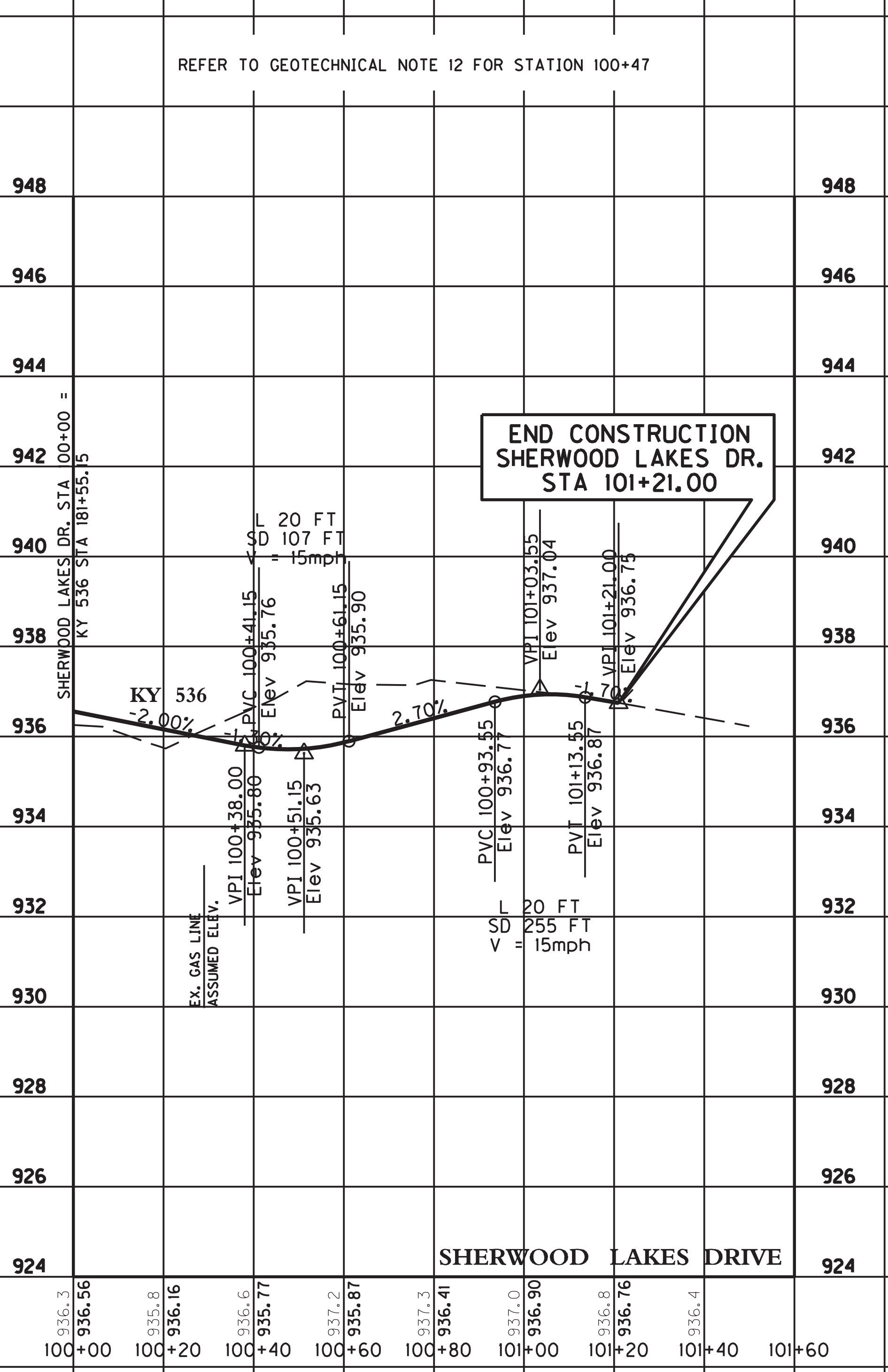
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R01600PR.DGN

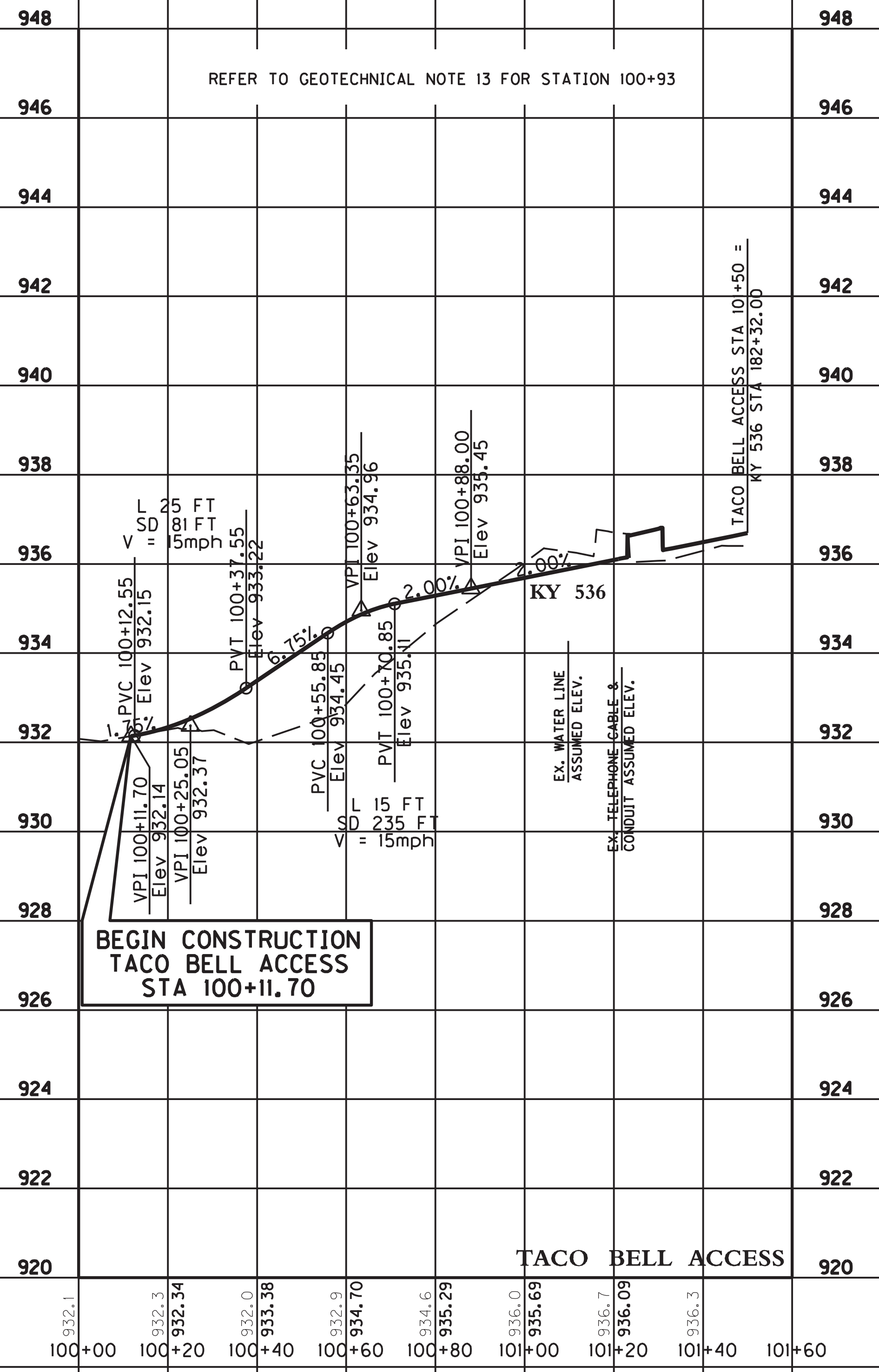
USER: kjmankin
DATE PLOTTED: July 11, 2017

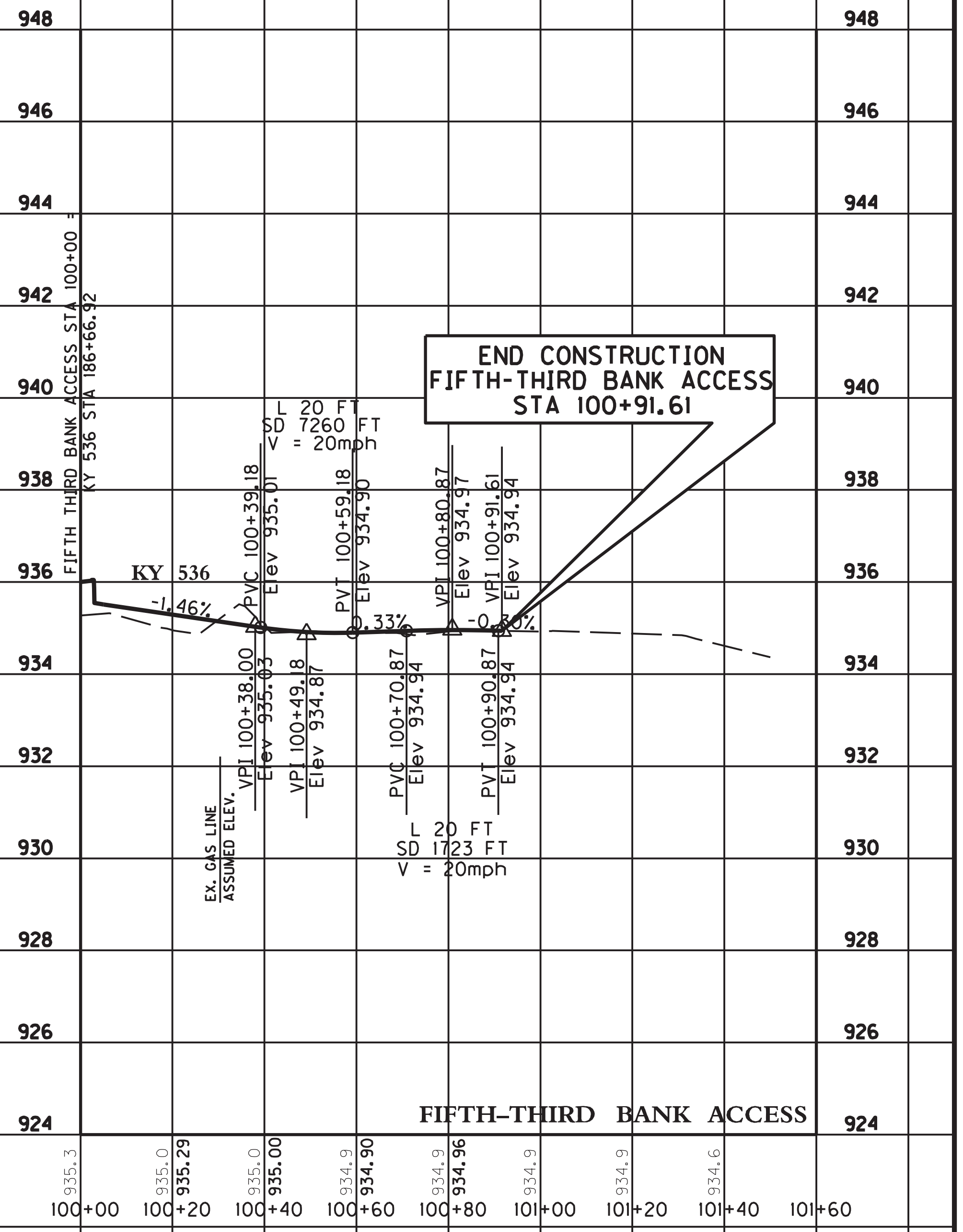
E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R17







FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115079\NEW PROJECT FILES\PROFILES\R0170OPR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

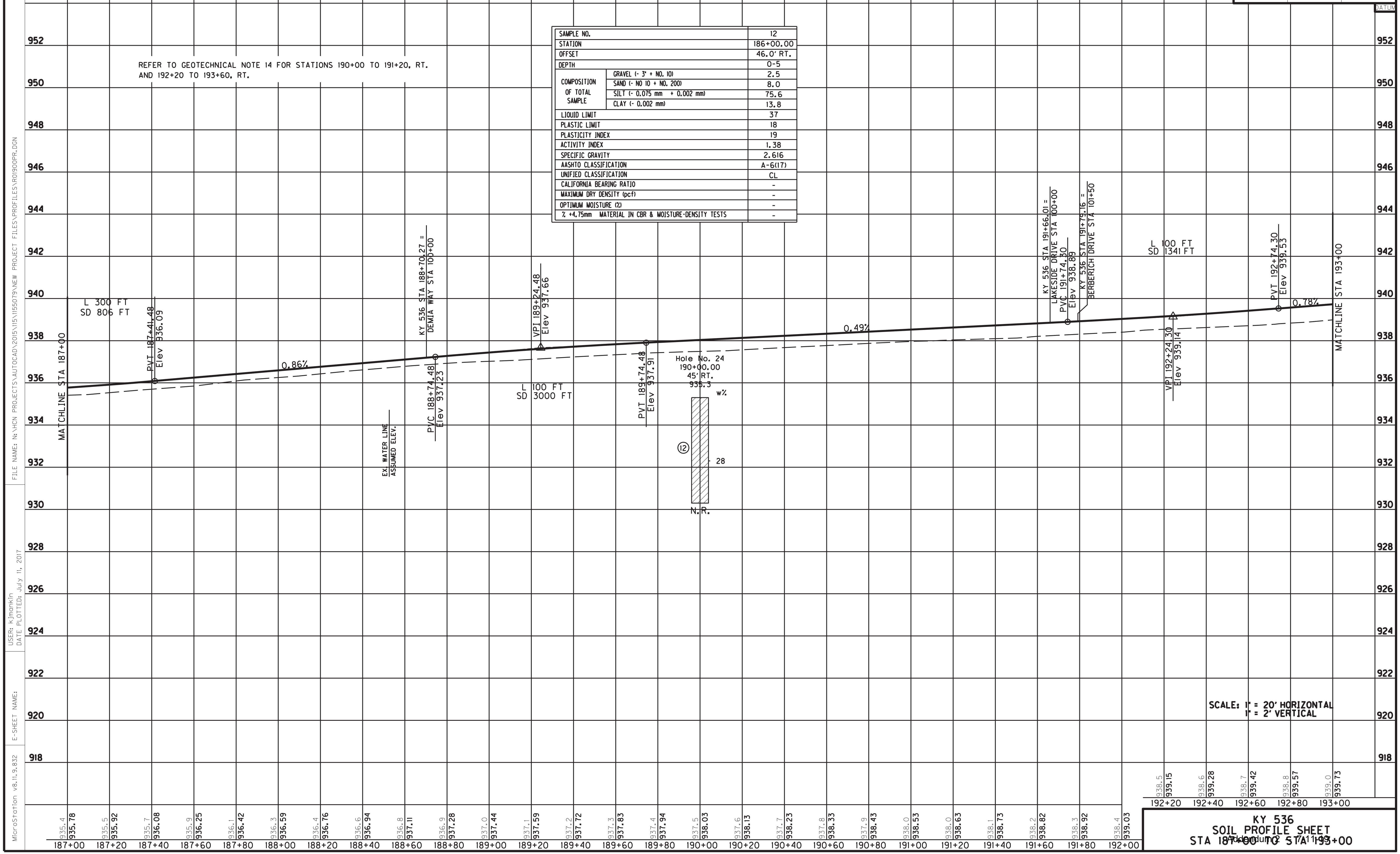
APPROACH ROADS & ENTRANCES
SOIL PROFILE SHEET
KY 536 STA 181+00 TO 187+00

Addendum 2 - 7-17-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R19

REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 190+00 TO 191+20, RT.
AND 192+20 TO 193+60, RT.

SAMPLE NO.		12
STATION		186+00.00
OFFSET		46.0' RT.
DEPTH		0-5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2.5
	SAND (- NO 10 + NO. 200)	8.0
	SILT (- 0.075 mm + 0.002 mm)	75.6
	CLAY (- 0.002 mm)	13.8
LIQUID LIMIT		37
PLASTIC LIMIT		18
PLASTICITY INDEX		19
ACTIVITY INDEX		1.38
SPECIFIC GRAVITY		2.616
AASHTO CLASSIFICATION		A-6(17)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		-
MAXIMUM DRY DENSITY (pcf)		-
OPTIMUM MOISTURE (%)		-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

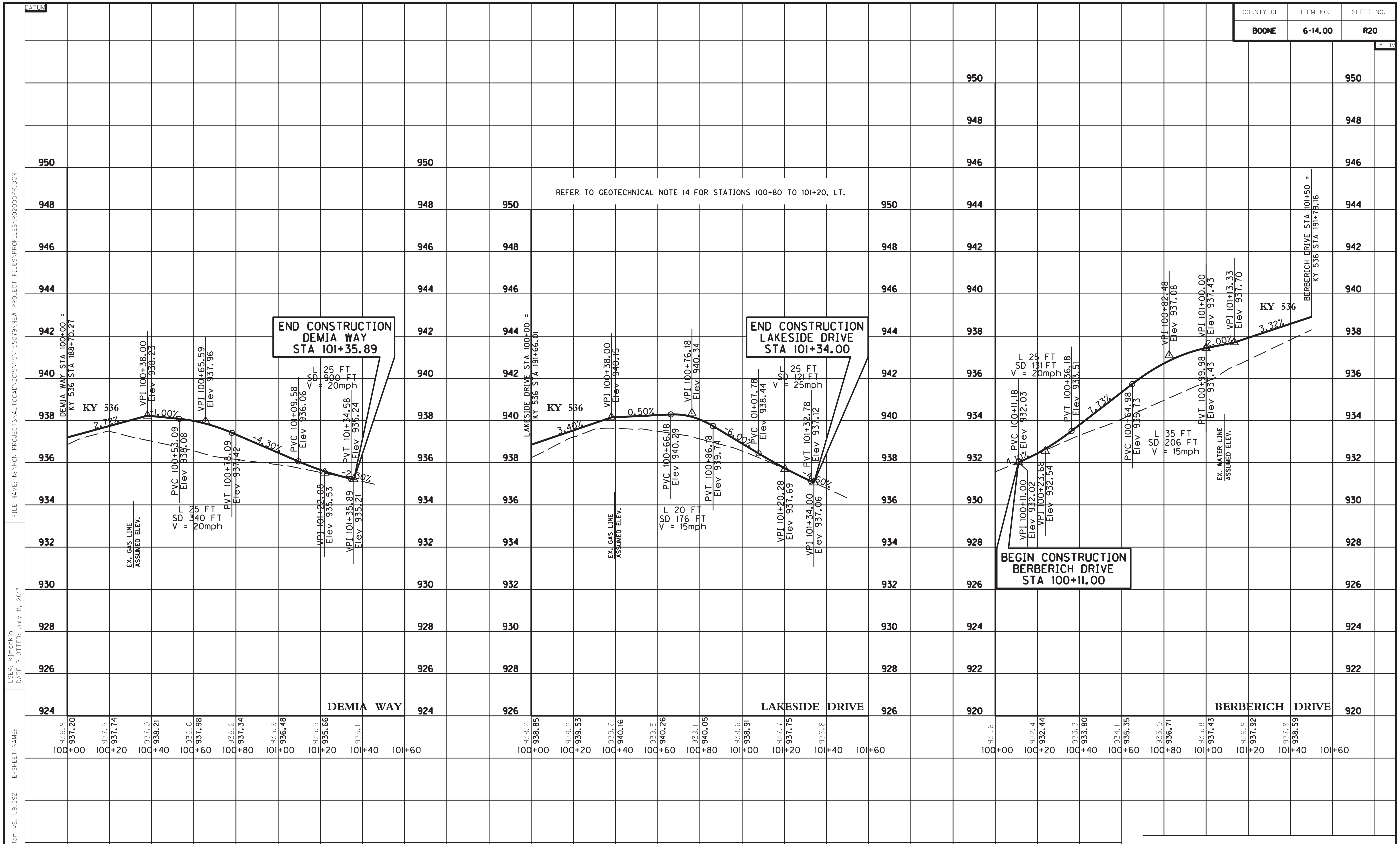


SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 536
SOIL PROFILE SHEET
STA 187+00 TO STA 193+00
Addendum 2 - 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R01900PR.DGN
USER: kjmankin
DATE PLOTTED: July 11, 2017
E-SHEET NAME:
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R20


REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 100+80 TO 101+20, LT.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

APPROACH ROADS & ENTRANCES
SOIL PROFILE SHEET
KY 536 STA 187+00 TO 193+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R02000PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

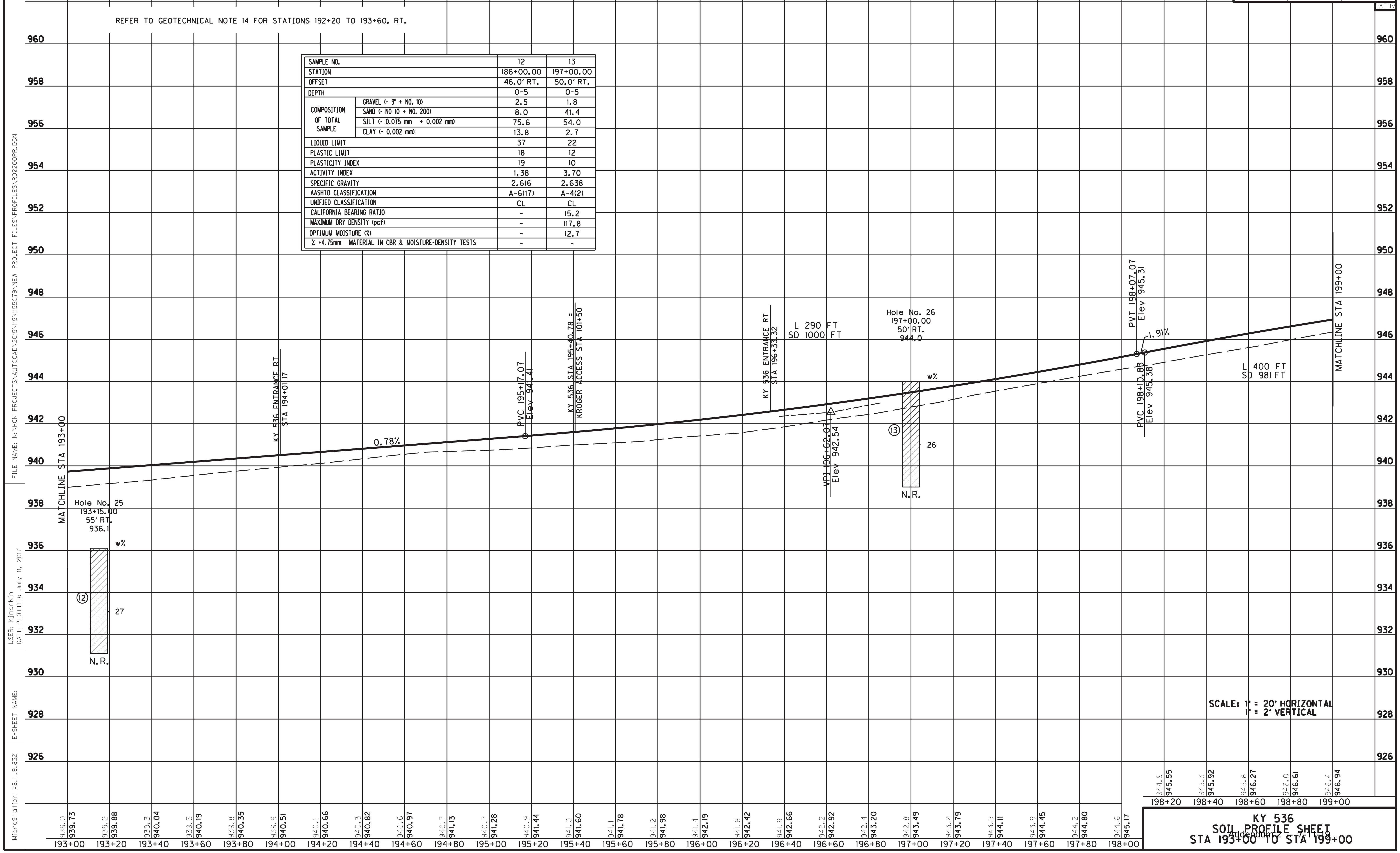
E-SHEET NAME:

MicroStation v8.11.9.292

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R22

REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 192+20 TO 193+60, RT.

SAMPLE NO.		12	13
STATION		186+00.00	197+00.00
OFFSET		46.0′ RT.	50.0′ RT.
DEPTH		0-5	0-5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2.5	1.8
	SAND (- NO 10 + NO. 200)	8.0	41.4
	SILT (- 0.075 mm + 0.002 mm)	75.6	54.0
	CLAY (- 0.002 mm)	13.8	2.7
LIQUID LIMIT		37	22
PLASTIC LIMIT		18	12
PLASTICITY INDEX		19	10
ACTIVITY INDEX		1.38	3.70
SPECIFIC GRAVITY		2.616	2.638
AASHTO CLASSIFICATION		A-6(17)	A-4(2)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		-	15.2
MAXIMUM DRY DENSITY (pcf)		-	117.8
OPTIMUM MOISTURE (%)		-	12.7
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-



SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 536
SOIL PROFILE SHEET
STA 193+00 TO STA 199+00

Addendum 2 - 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R02200PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

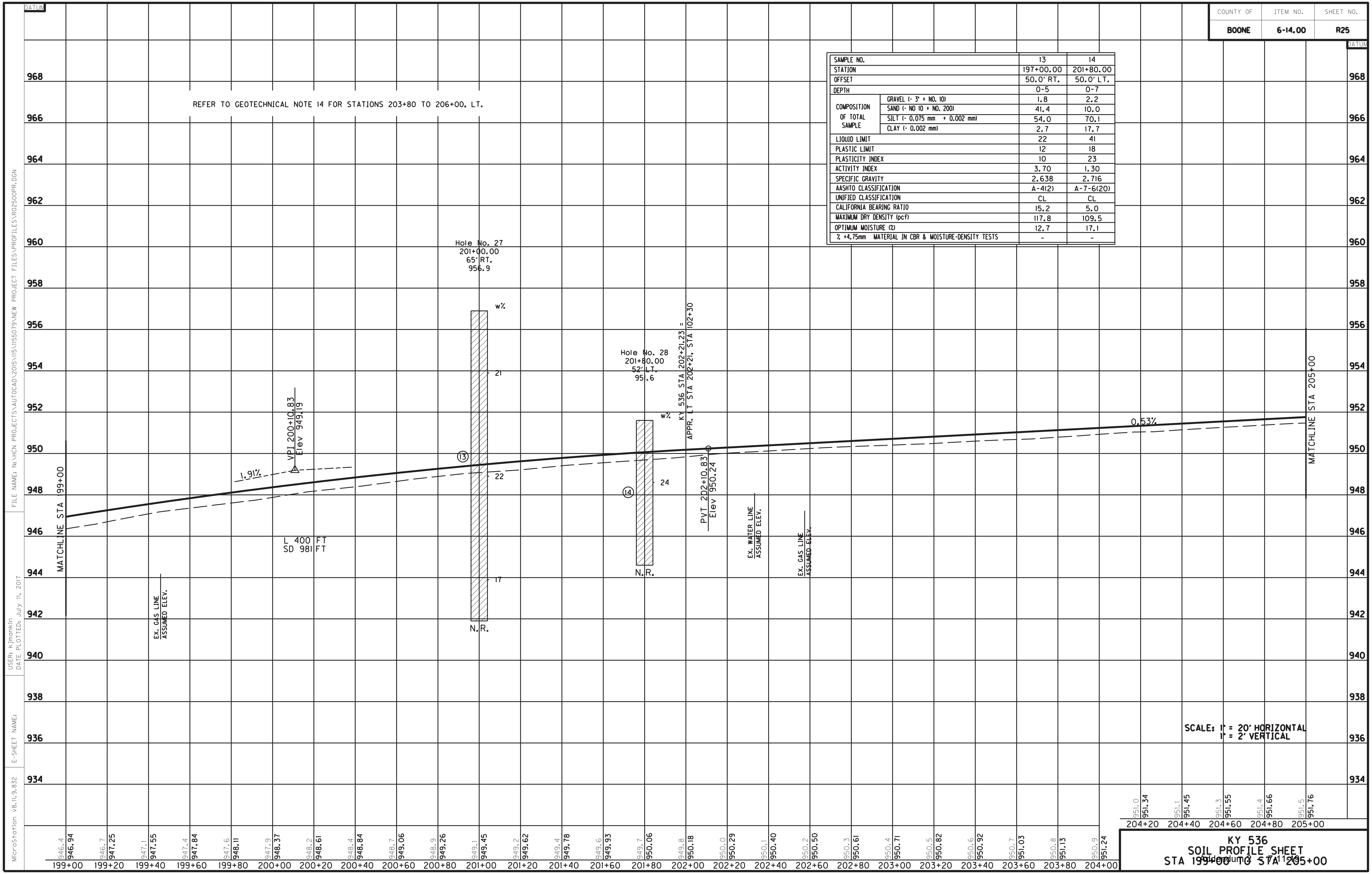
E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R25

REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 203+80 TO 206+00, LT.

SAMPLE NO.		13	14
STATION		197+00.00	201+80.00
OFFSET		50.0' RT.	50.0' LT.
DEPTH		0-5	0-7
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1.8	2.2
	SAND (- NO 10 + NO. 200)	41.4	10.0
	SILT (- 0.075 mm + 0.002 mm)	54.0	70.1
	CLAY (- 0.002 mm)	2.7	17.7
LIQUID LIMIT		22	41
PLASTIC LIMIT		12	18
PLASTICITY INDEX		10	23
ACTIVITY INDEX		3.70	1.30
SPECIFIC GRAVITY		2.638	2.716
AASHTO CLASSIFICATION		A-4(2)	A-7-6(20)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		15.2	5.0
MAXIMUM DRY DENSITY (pcf)		117.8	109.5
OPTIMUM MOISTURE (%)		12.7	17.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-



SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R02500PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

KY 536
SOIL PROFILE SHEET
STA 199+00 TO STA 205+00

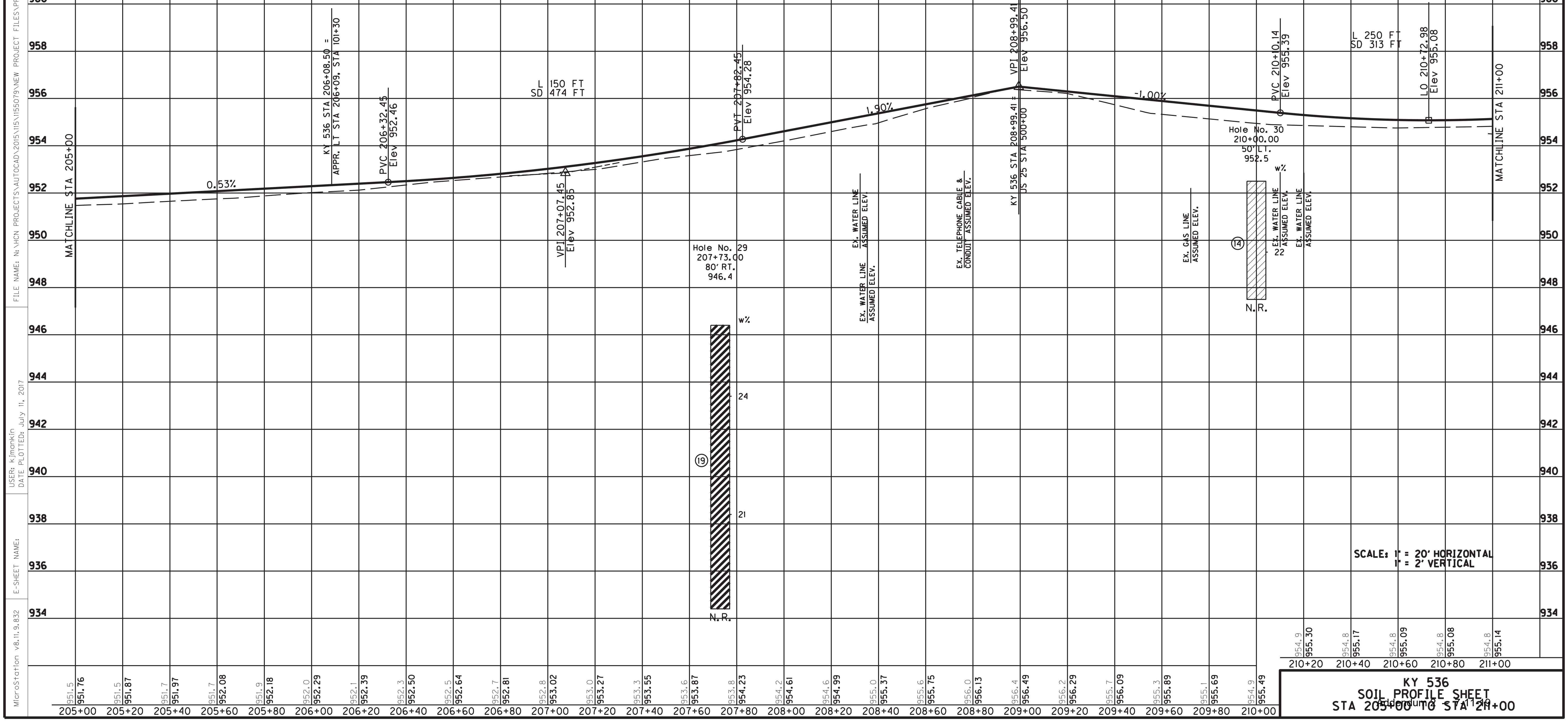
Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R28

REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 203+80 TO 206+00, LT., 205+40 TO 208+00, RT., 209+40 TO 211+80, RT., AND 209+80 TO 211+80, LT.

REFER TO GEOTECHNICAL NOTE 12 FOR STATION 210+73

SAMPLE NO.		14	19
STATION		201+80.00	504+01.00
OFFSET		50.0′ LT.	18.0′ RT.
DEPTH		0-7	0-11
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2.2	1.8
	SAND (- NO 10 + NO. 200)	10.0	15.8
	SILT (- 0.075 mm + 0.002 mm)	70.1	53.1
	CLAY (- 0.002 mm)	17.7	29.4
LIQUID LIMIT		41	64
PLASTIC LIMIT		18	22
PLASTICITY INDEX		23	42
ACTIVITY INDEX		1.30	1.43
SPECIFIC GRAVITY		2.716	2.673
AASHTO CLASSIFICATION		A-7-6(20)	A-7-6(37)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		5.0	5.7
MAXIMUM DRY DENSITY (pcf)		109.5	98.3
OPTIMUM MOISTURE (%)		17.1	21.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-



SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 536
SOIL PROFILE SHEET
STA 205+00 TO STA 211+00

Addendum 2 - 7-11-19

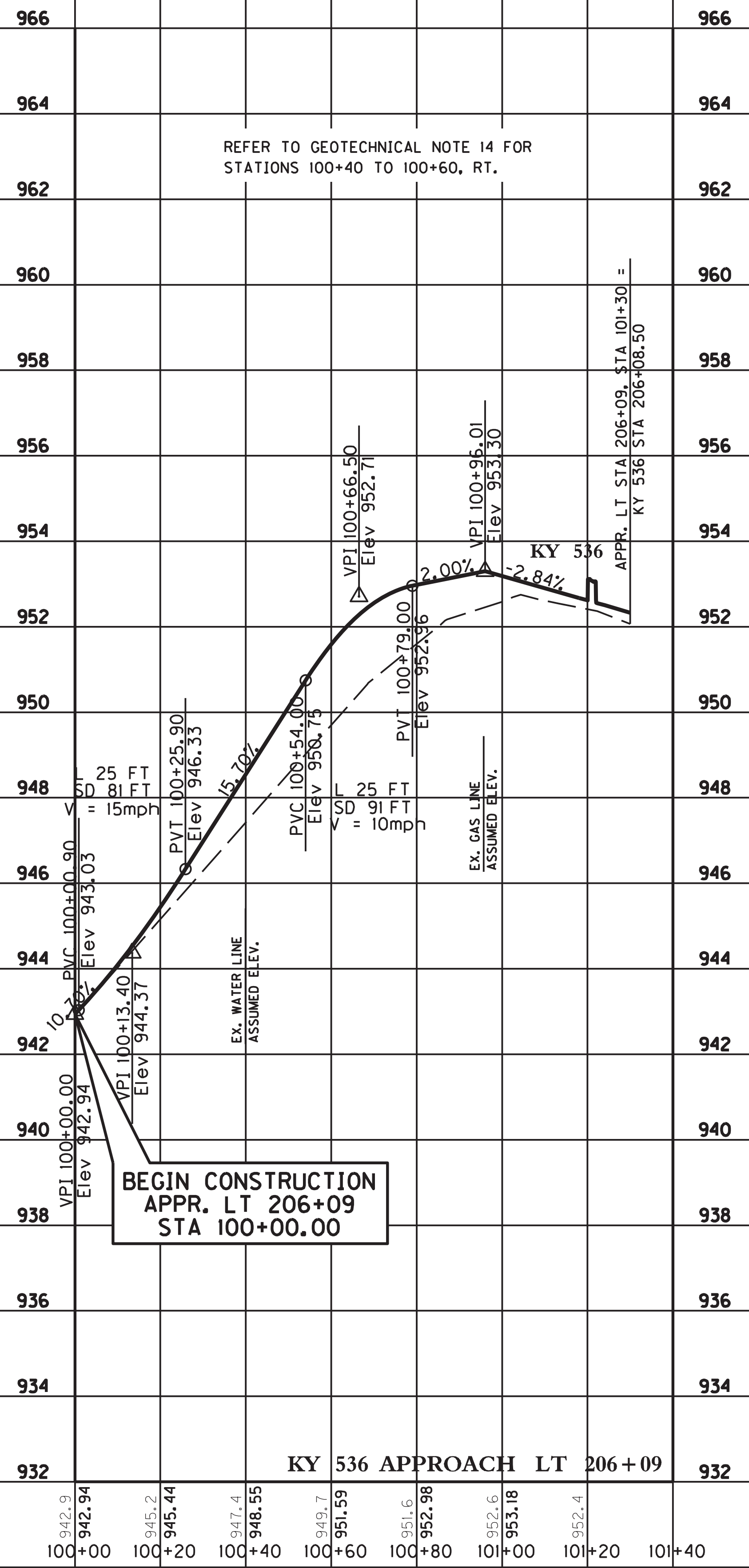
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R02800PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R29



REFER TO GEOTECHNICAL NOTE 14 FOR
STATIONS 100+40 TO 100+60, RT.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

APPROACH ROADS & ENTRANCES
SOIL PROFILE SHEET
KY 536 STA 205+00 TO 211+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R02900PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.292

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R31

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R03100PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

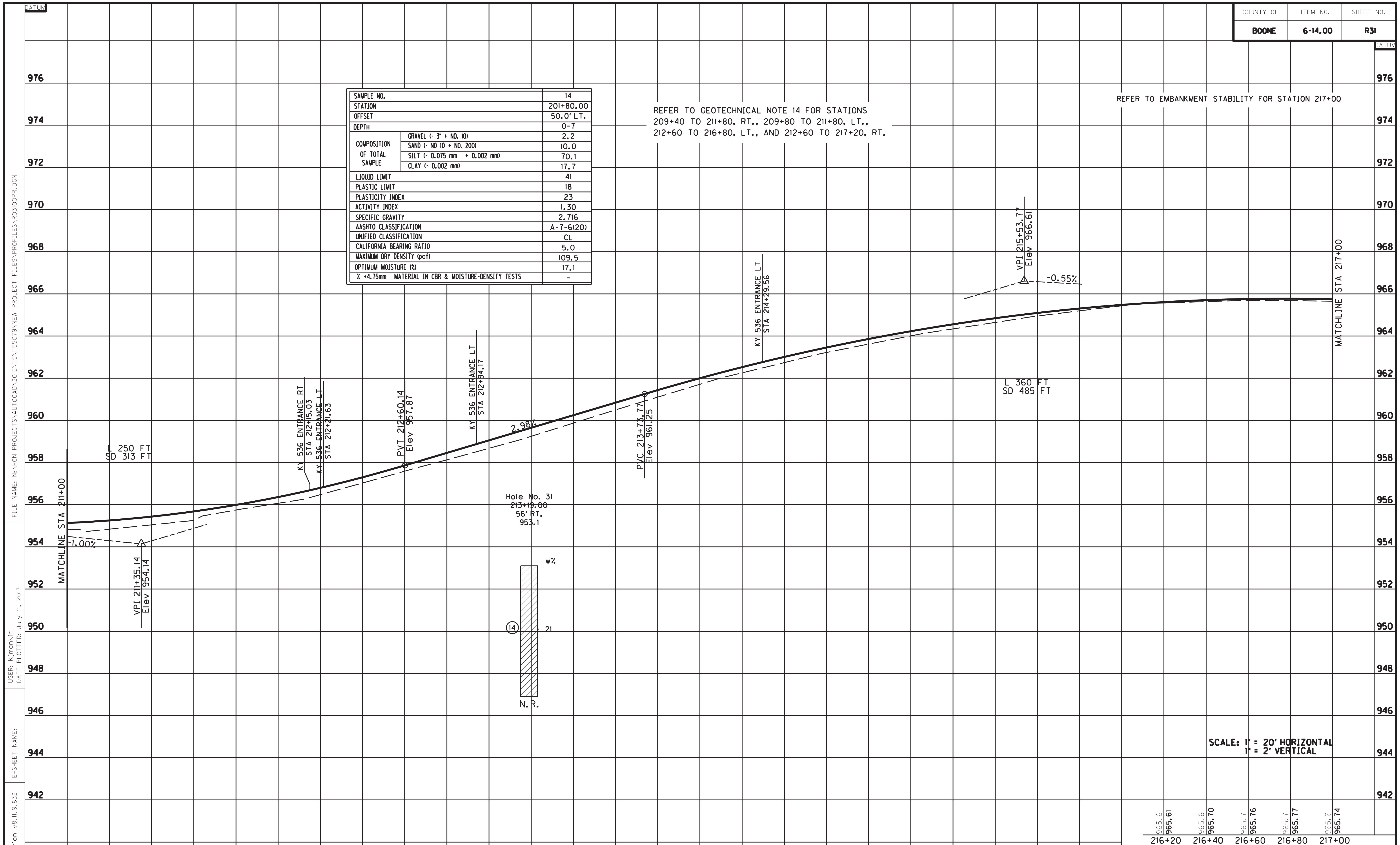
E-SHEET NAME:

MicroStation v8.11.9.832

REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 209+40 TO 211+80, RT., 209+80 TO 211+80, LT., 212+60 TO 216+80, LT., AND 212+60 TO 217+20, RT.

REFER TO EMBANKMENT STABILITY FOR STATION 217+00

SAMPLE NO.		14
STATION		201+80.00
OFFSET		50.0' LT.
DEPTH		0-7
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2.2
	SAND (- NO 10 + NO. 200)	10.0
	SILT (- 0.075 mm + 0.002 mm)	70.1
	CLAY (- 0.002 mm)	17.7
LIQUID LIMIT		41
PLASTIC LIMIT		18
PLASTICITY INDEX		23
ACTIVITY INDEX		1.30
SPECIFIC GRAVITY		2.716
AASHTO CLASSIFICATION		A-7-6(20)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		5.0
MAXIMUM DRY DENSITY (pcf)		109.5
OPTIMUM MOISTURE (%)		17.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-



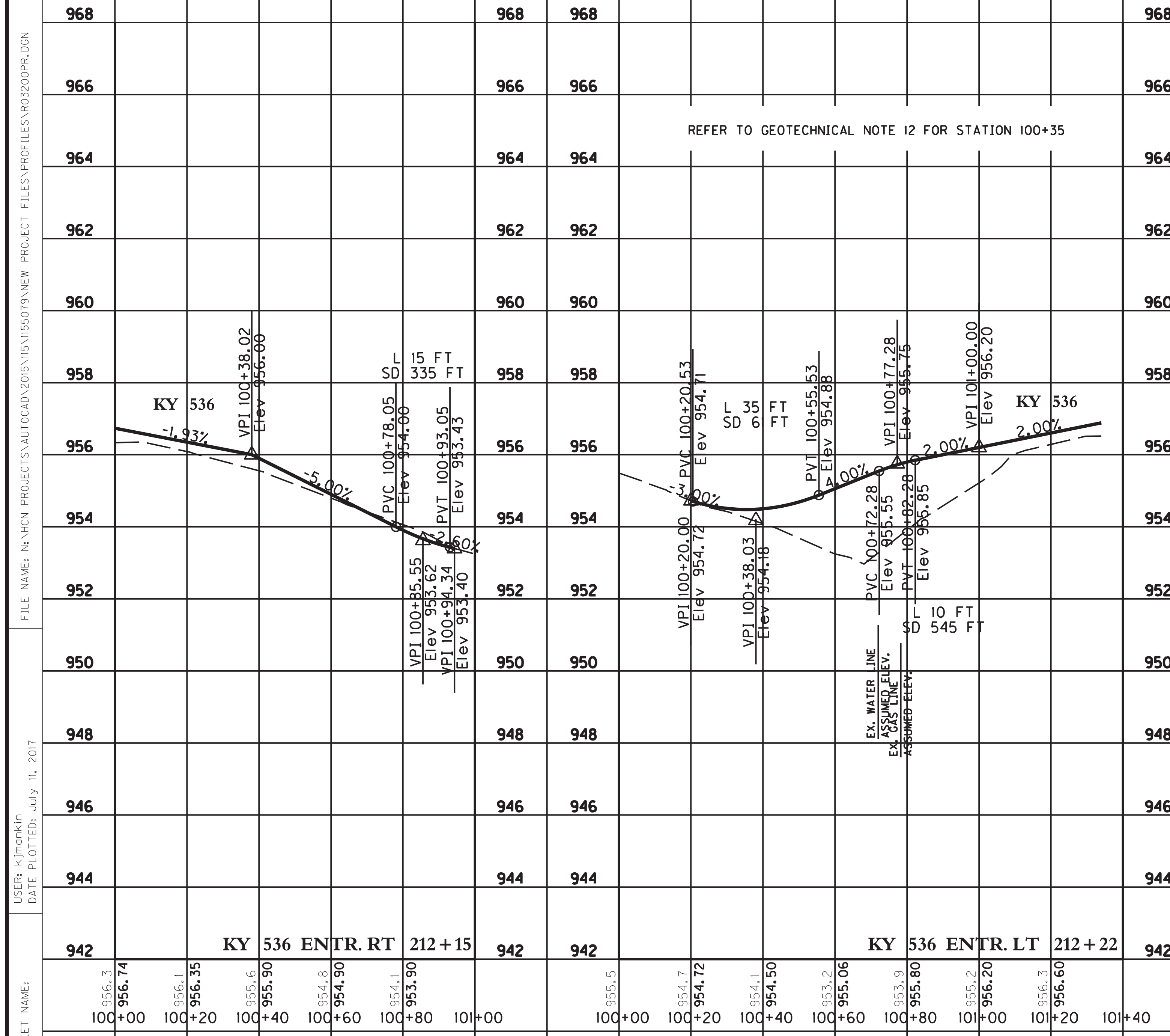
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

211+00	954.8	955.14
211+20	954.8	955.25
211+40	955.0	955.44
211+60	955.3	955.68
211+80	955.7	955.99
212+00	956.1	956.36
212+20	956.5	956.80
212+40	957.0	957.30
212+60	957.6	957.86
212+80	958.1	958.46
213+00	958.7	959.05
213+20	959.2	959.65
213+40	959.9	960.24
213+60	960.5	960.84
213+80	961.1	961.43
214+00	961.7	962.00
214+20	962.3	962.52
214+40	962.7	963.01
214+60	963.2	963.45
214+80	963.6	963.86
215+00	964.0	964.23
215+20	964.3	964.56
215+40	964.6	964.85
215+60	964.9	965.10
215+80	965.2	965.31
216+00	965.4	965.48
216+20	965.6	965.61
216+40	965.6	965.70
216+60	965.7	965.76
216+80	965.7	965.77
217+00	965.6	965.74

KY 536
SOIL PROFILE SHEET
STA 211+00 TO STA 217+00

Addendum 2 – 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R32



DATUM

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

APPROACH ROADS & ENTRANCES
SOIL PROFILE SHEET
KY 536 STA 211+00 TO 217+00

Addendum 2 - 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R03200PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

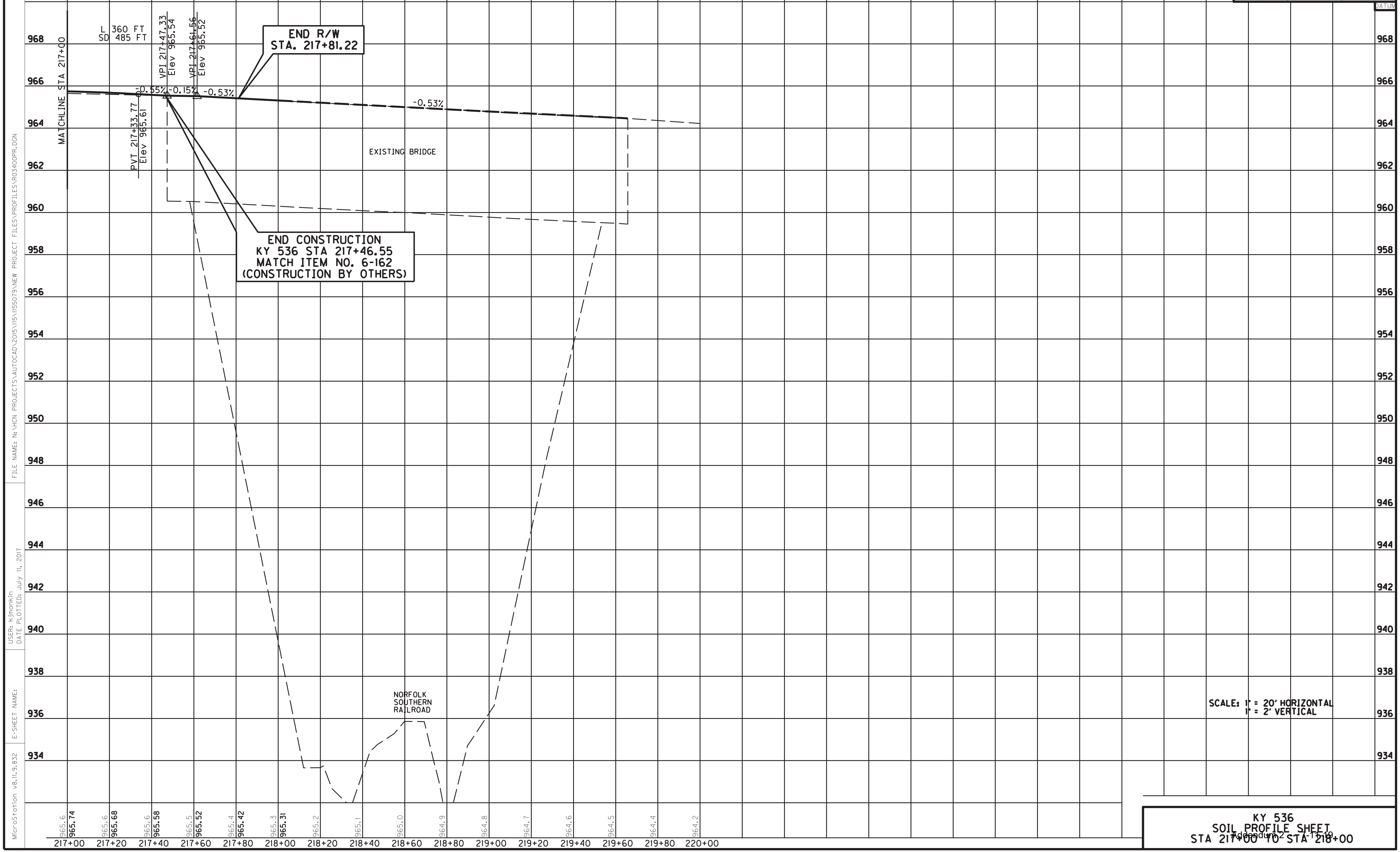
E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R34

REFER TO EMBANKMENT STABILITY FOR STATION 217+00

REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 212+60 TO 217+20, RT.



FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R03400PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

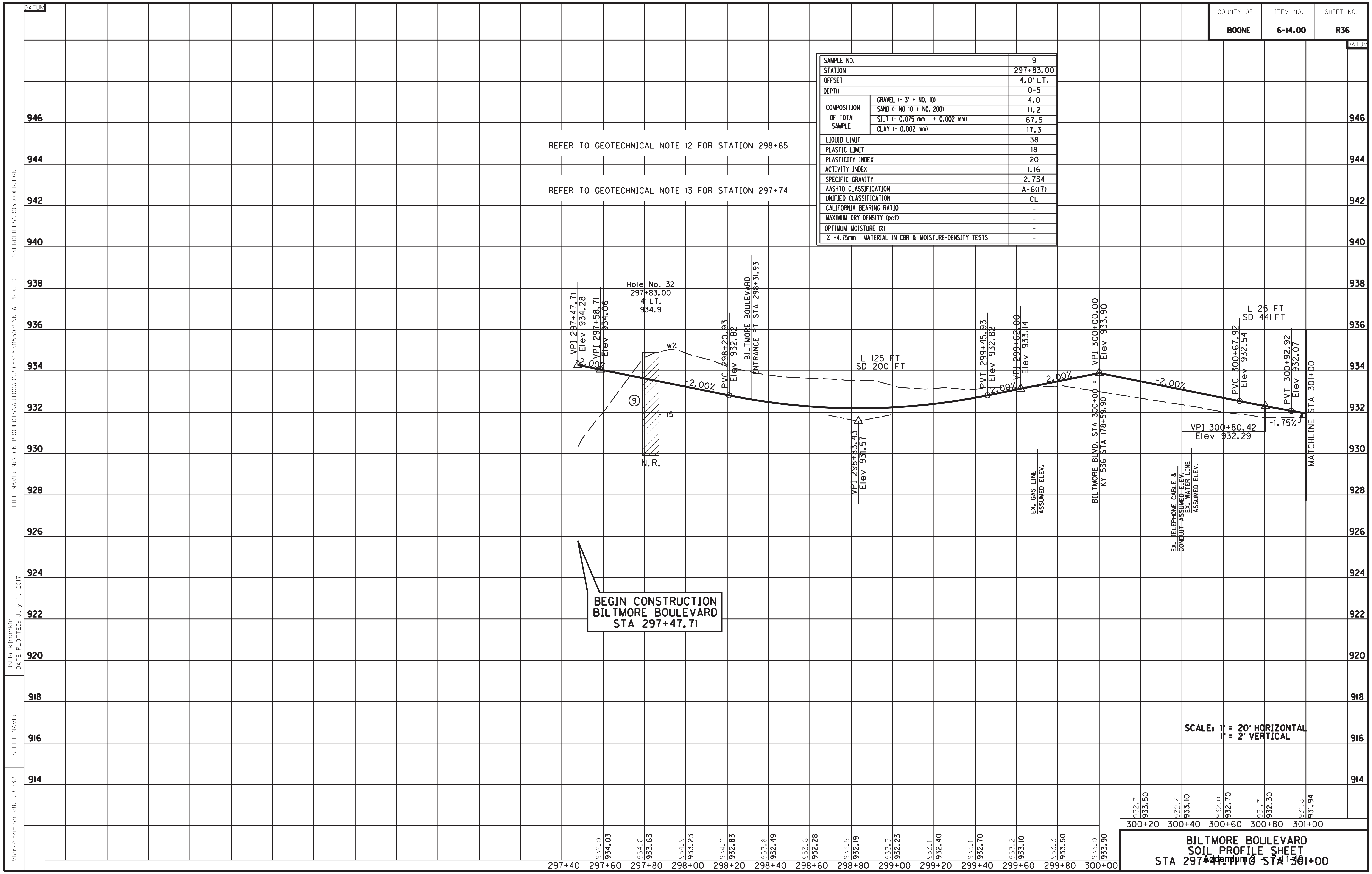
E-SHEET NAME:

MicroStation v8.11.9.832

KY 536
SOIL PROFILE SHEET
STA 217+00 TO STA 218+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R36



REFER TO GEOTECHNICAL NOTE 12 FOR STATION 298+85

REFER TO GEOTECHNICAL NOTE 13 FOR STATION 297+74

SAMPLE NO.		9
STATION		297+83.00
OFFSET		4.0' LT.
DEPTH		0-5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4.0
	SAND (- NO 10 + NO. 200)	11.2
	SILT (- 0.075 mm + 0.002 mm)	67.5
	CLAY (- 0.002 mm)	17.3
LIQUID LIMIT		38
PLASTIC LIMIT		18
PLASTICITY INDEX		20
ACTIVITY INDEX		1.16
SPECIFIC GRAVITY		2.734
AASHTO CLASSIFICATION		A-6(17)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		-
MAXIMUM DRY DENSITY (pcf)		-
OPTIMUM MOISTURE (%)		-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

BEGIN CONSTRUCTION
BILTMORE BOULEVARD
STA 297+47.71

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R03600PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

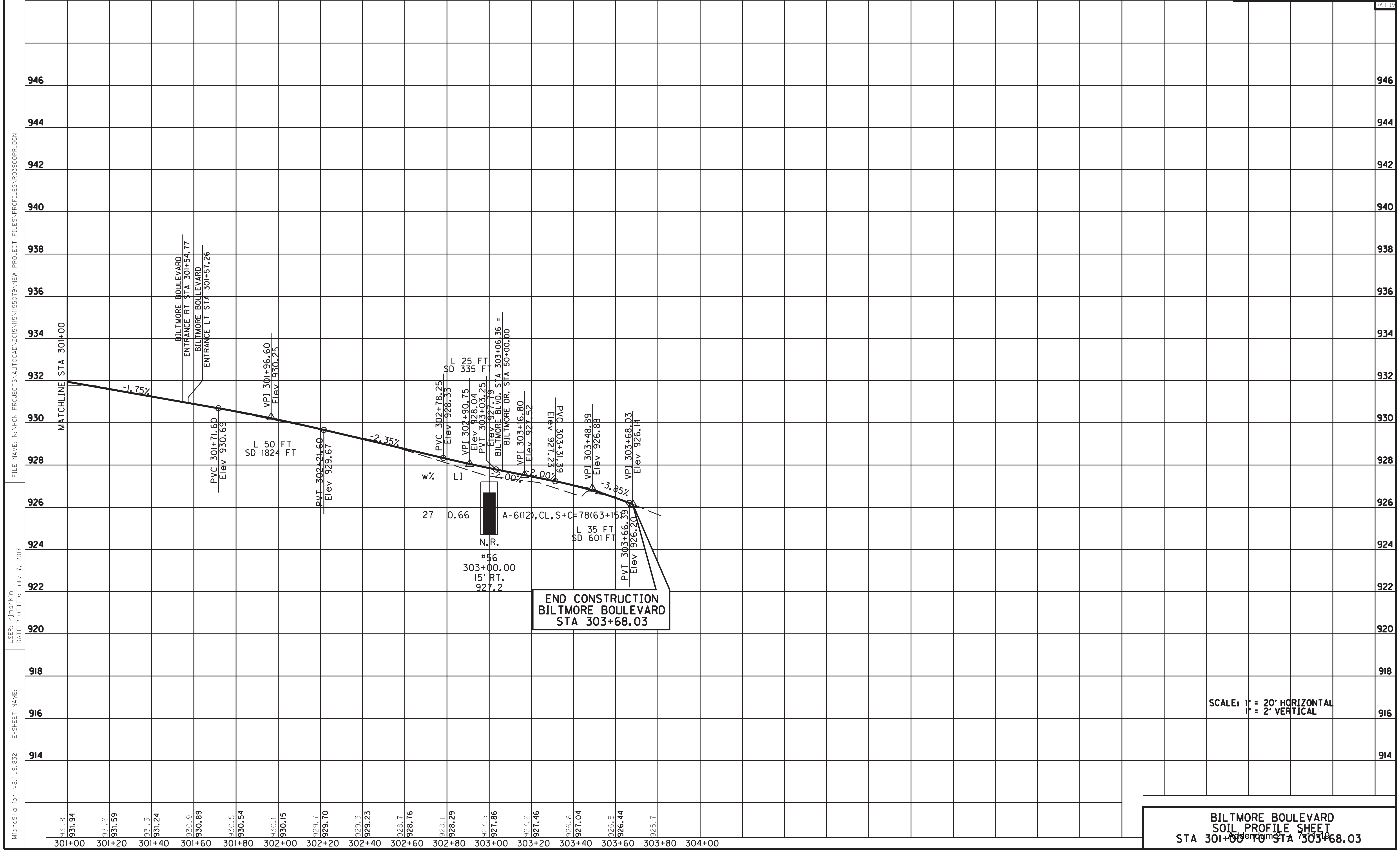
E-SHEET NAME:

MicroStation v8.11.9.832

BILTMORE BOULEVARD
SOIL PROFILE SHEET
STA 297+47.71 TO STA 301+00

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R39



SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

BILTMORE BOULEVARD
SOIL PROFILE SHEET
STA 301+00 TO STA 303+68.03

Addendum 2 - 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R03900PR.DGN

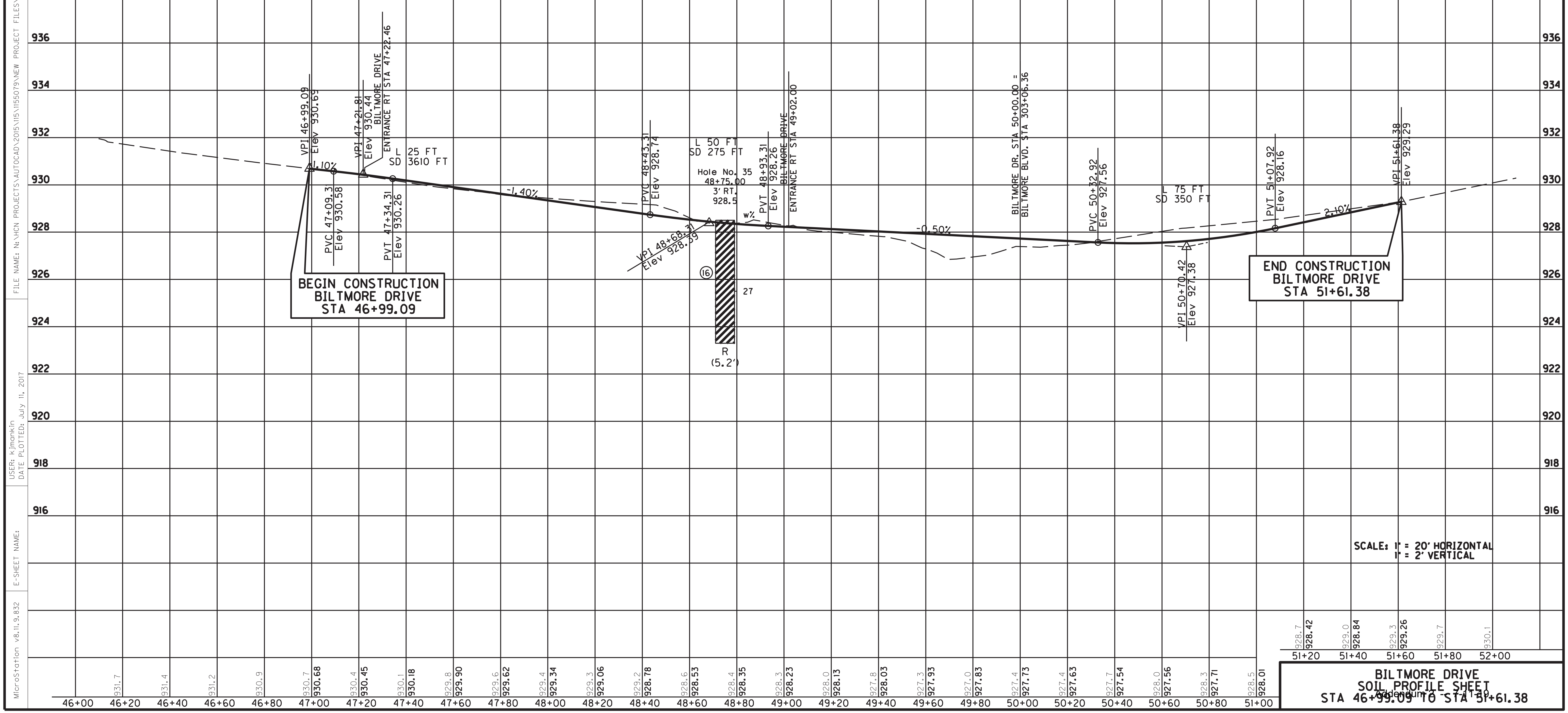
USER: kjmankin
DATE PLOTTED: July 7, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

SAMPLE NO.		16
STATION		48+75.00
OFFSET		3.0' RT.
DEPTH		0-5.2
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6.9
	SAND (- NO 10 + NO. 200)	16.2
	SILT (- 0.075 mm + 0.002 mm)	47.2
	CLAY (- 0.002 mm)	29.7
LIQUID LIMIT		54
PLASTIC LIMIT		19
PLASTICITY INDEX		35
ACTIVITY INDEX		1.18
SPECIFIC GRAVITY		2.751
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		-
MAXIMUM DRY DENSITY (pcf)		-
OPTIMUM MOISTURE (%)		-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

REFER TO GEOTECHNICAL NOTE 12 FOR STATION 50+50



SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R0380OPR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

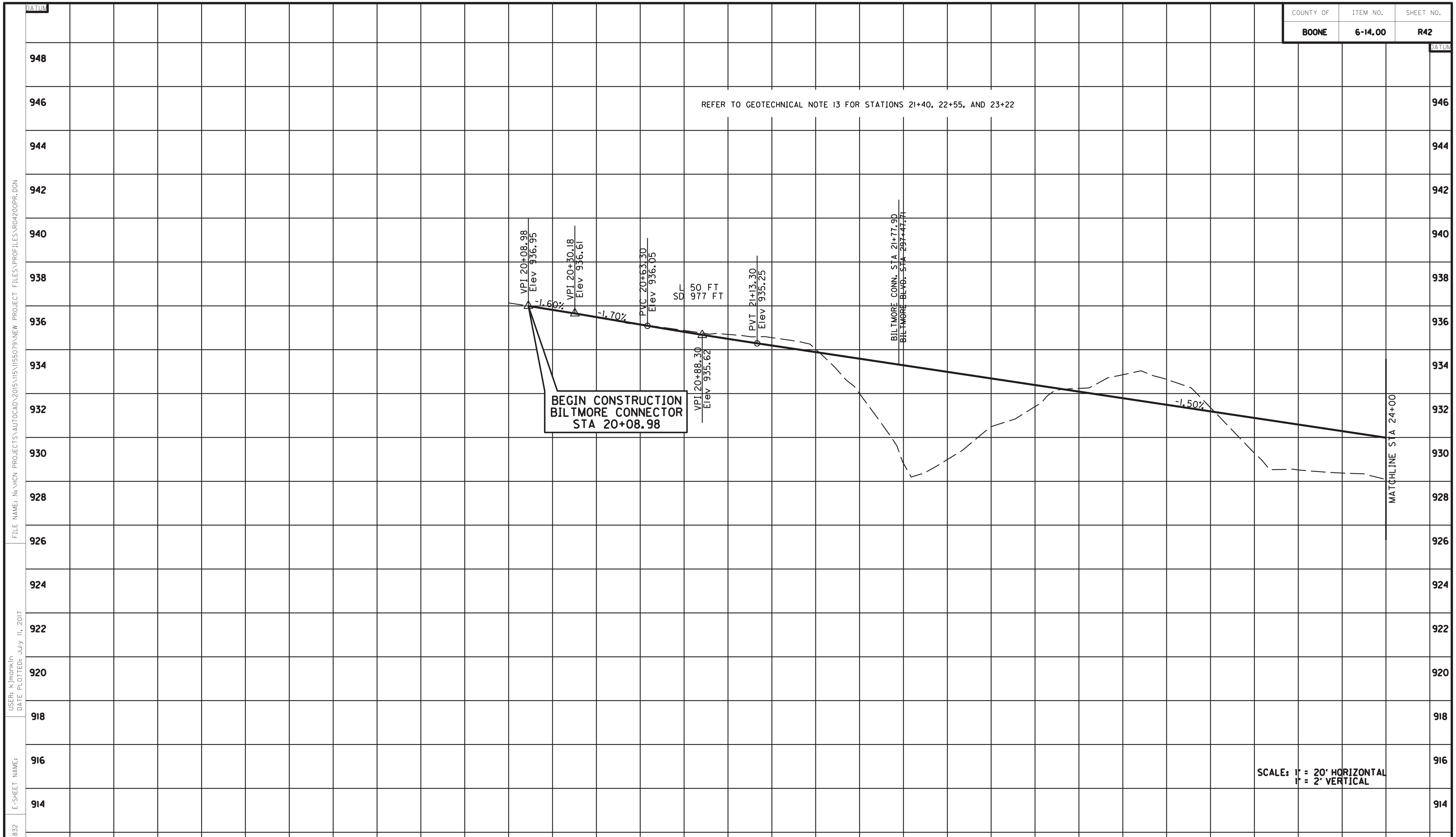
MicroStation v8.11.9.832

BILTMORE DRIVE
SOIL PROFILE SHEET
STA 46+99.09 TO STA 51+61.38

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R42

REFER TO GEOTECHNICAL NOTE 13 FOR STATIONS 21+40, 22+55, AND 23+22



SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

20+00	937.1	
20+20	936.8	
20+40	936.4	936.44
20+60	936.1	936.10
20+80	935.8	935.77
21+00	935.7	935.45
21+20	935.5	935.15
21+40	935.0	934.85
21+60	933.0	934.55
21+80	929.8	934.25
22+00	929.9	933.95
22+20	931.4	933.65
22+40	932.4	933.35
22+60	933.2	933.05
22+80	933.8	932.75
23+00	933.6	932.45
23+20	932.3	932.15
23+40	930.2	931.85
23+60	929.5	931.55
23+80	929.3	931.25
24+00	929.0	930.95

BILTMORE CONNECTOR
SOIL PROFILE SHEET
STA 20+08.98 TO STA 24+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R04200PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

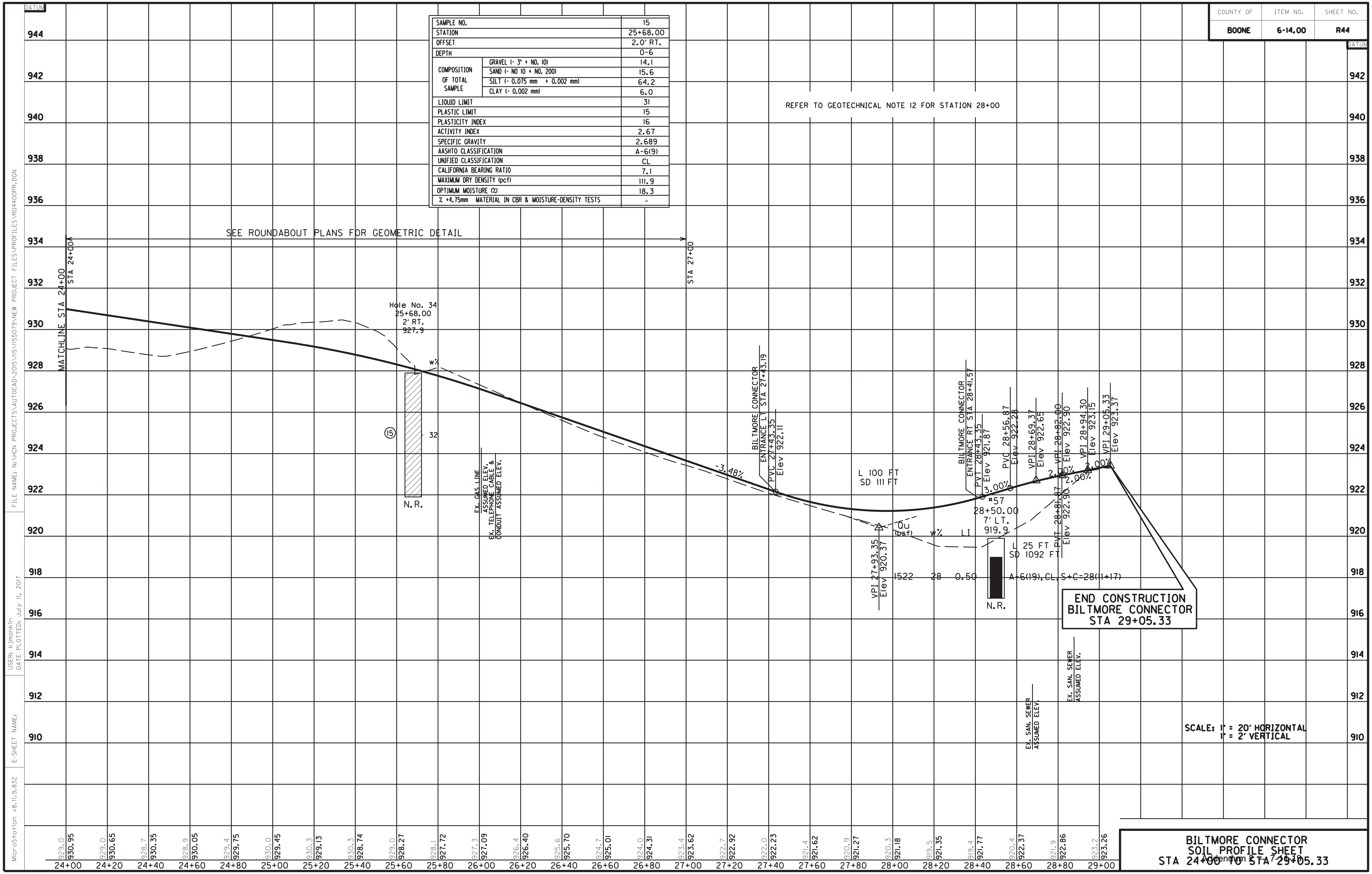
E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R44

SAMPLE NO.		15
STATION		25+68.00
OFFSET		2.0' RT.
DEPTH		0-6
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	14.1
	SAND (- NO 10 + NO. 200)	15.6
	SILT (- 0.075 mm + 0.002 mm)	64.2
	CLAY (- 0.002 mm)	6.0
LIQUID LIMIT		31
PLASTIC LIMIT		15
PLASTICITY INDEX		16
ACTIVITY INDEX		2.67
SPECIFIC GRAVITY		2.689
AASHTO CLASSIFICATION		A-6(9)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		7.1
MAXIMUM DRY DENSITY (pcf)		111.9
OPTIMUM MOISTURE (%)		18.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

REFER TO GEOTECHNICAL NOTE 12 FOR STATION 28+00



BILTMORE CONNECTOR
SOIL PROFILE SHEET
STA 24+00 TO STA 29+05.33

Addendum 2 - 7-16-19

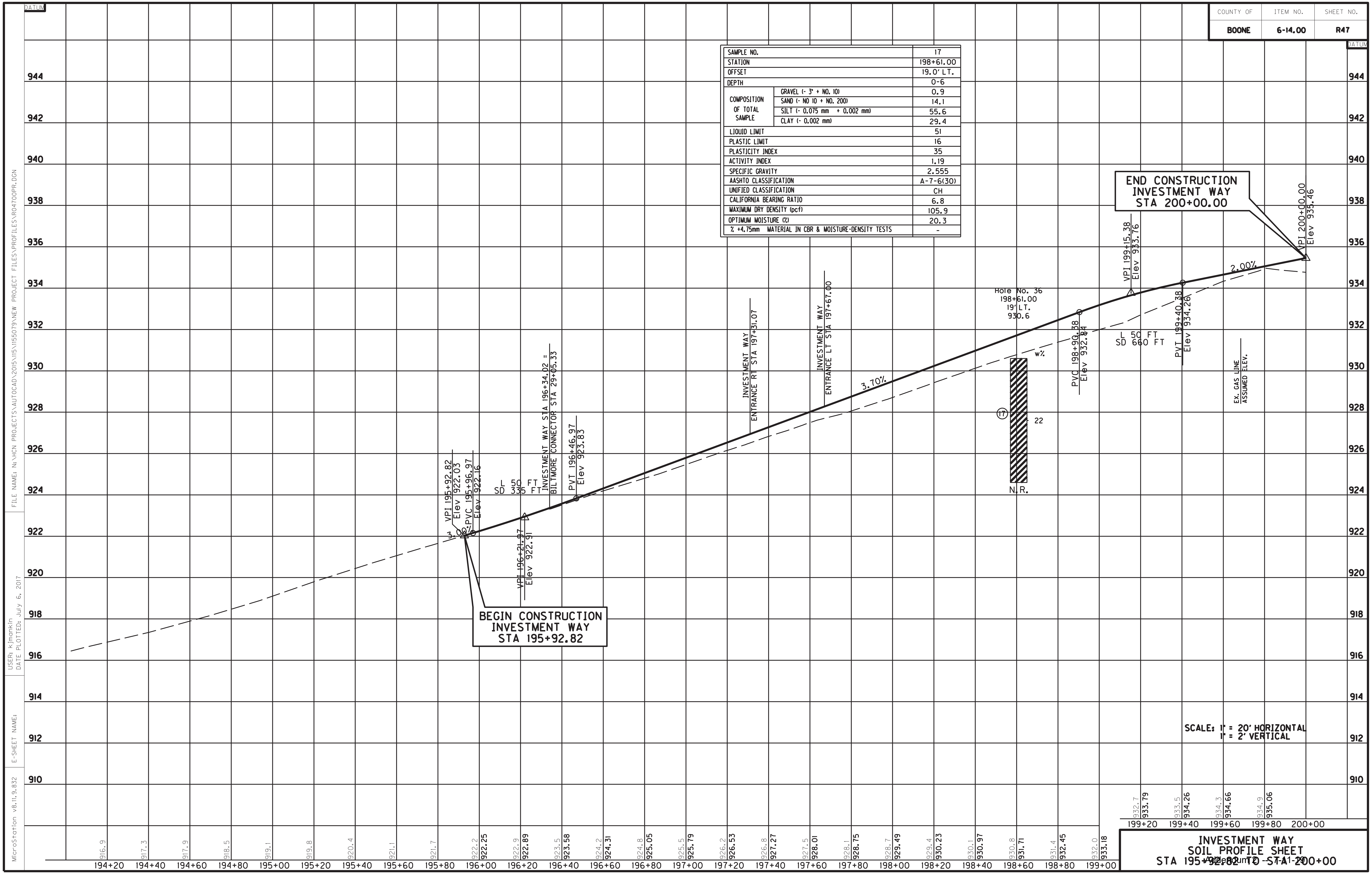
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R04400PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R47



SAMPLE NO.		17
STATION		198+61.00
OFFSET		19.0' LT.
DEPTH		0-6
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0.9
	SAND (- NO 10 + NO. 200)	14.1
	SILT (- 0.075 mm + 0.002 mm)	55.6
	CLAY (- 0.002 mm)	29.4
LIQUID LIMIT		51
PLASTIC LIMIT		16
PLASTICITY INDEX		35
ACTIVITY INDEX		1.19
SPECIFIC GRAVITY		2.555
AASHTO CLASSIFICATION		A-7-6(30)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		6.8
MAXIMUM DRY DENSITY (pcf)		105.9
OPTIMUM MOISTURE (%)		20.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

INVESTMENT WAY
SOIL PROFILE SHEET
STA 195+92.82 TO STA 200+00

Addendum 2 -- 7-11-19

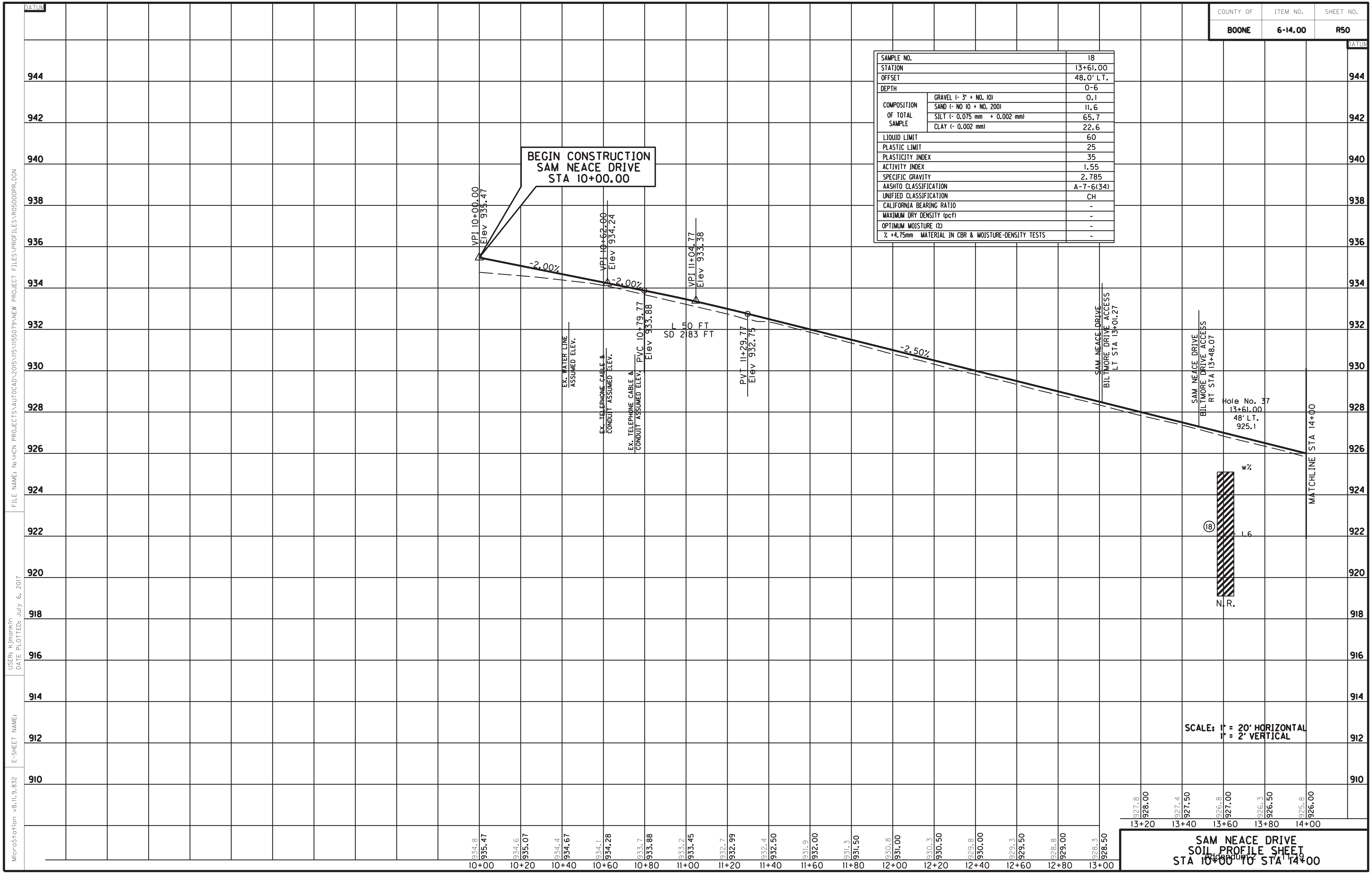
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R04700PR.DGN

USER: kjmankin
DATE PLOTTED: July 6, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R50



934.8	934.6	934.4	934.1	933.7	933.2	932.7	932.4	931.9	931.3	930.8	930.3	929.8	929.3	928.8	928.3	927.8	927.4	926.8	926.3	925.8
935.47	935.07	934.67	934.28	933.88	933.45	932.99	932.50	932.00	931.50	931.00	930.50	930.00	929.50	929.00	928.50	928.00	927.50	927.00	926.50	926.00
10+00	10+20	10+40	10+60	10+80	11+00	11+20	11+40	11+60	11+80	12+00	12+20	12+40	12+60	12+80	13+00	13+20	13+40	13+60	13+80	14+00

SAMPLE NO.		18
STATION		13+61.00
OFFSET		48.0' LT.
DEPTH		0-6
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0.1
	SAND (- NO 10 + NO. 200)	11.6
	SILT (- 0.075 mm + 0.002 mm)	65.7
	CLAY (- 0.002 mm)	22.6
LIQUID LIMIT		60
PLASTIC LIMIT		25
PLASTICITY INDEX		35
ACTIVITY INDEX		1.55
SPECIFIC GRAVITY		2.785
AASHTO CLASSIFICATION		A-7-6(34)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		-
MAXIMUM DRY DENSITY (pcf)		-
OPTIMUM MOISTURE (%)		-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R05000PR.DGN

USER: kjmankin
DATE PLOTTED: July 6, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

SAM NEACE DRIVE
SOIL PROFILE SHEET
STA 10+00 TO STA 14+00

Addendum 2 - 7-11-19

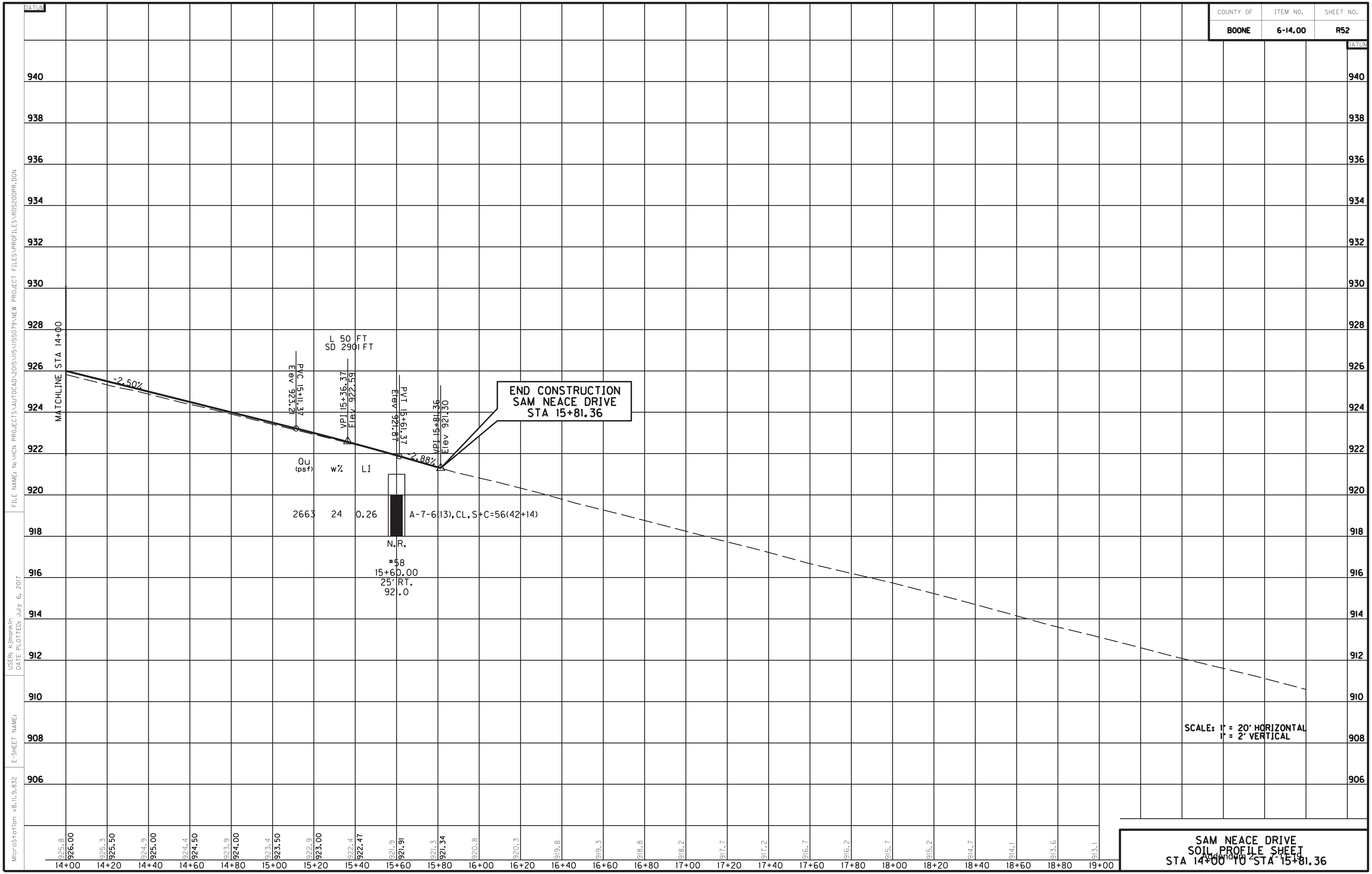
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R52

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R05200PR.DGN

USER: kjmankin
DATE PLOTTED: July 6, 2017

E-SHEET NAME:

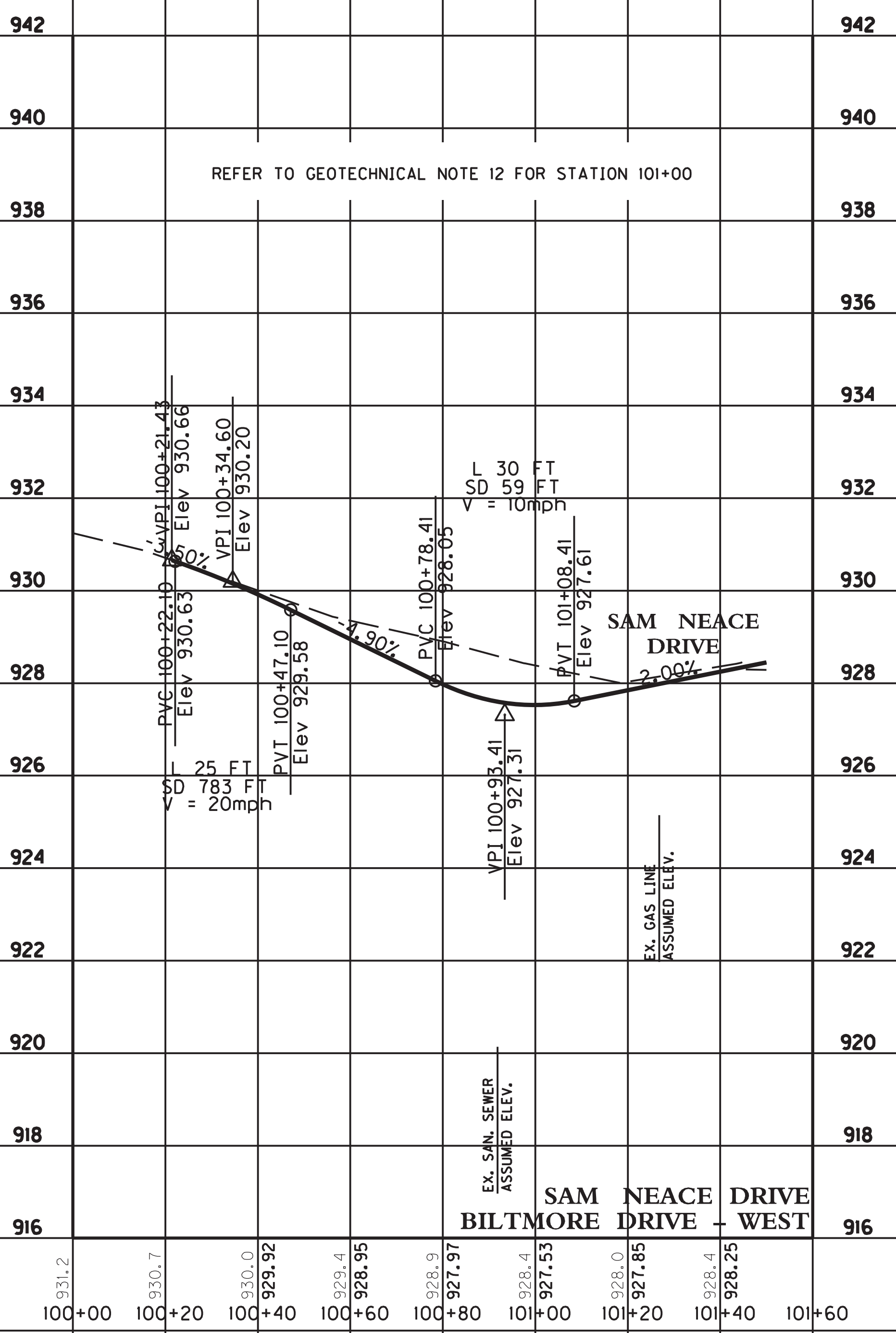
MicroStation v8.11.9.832

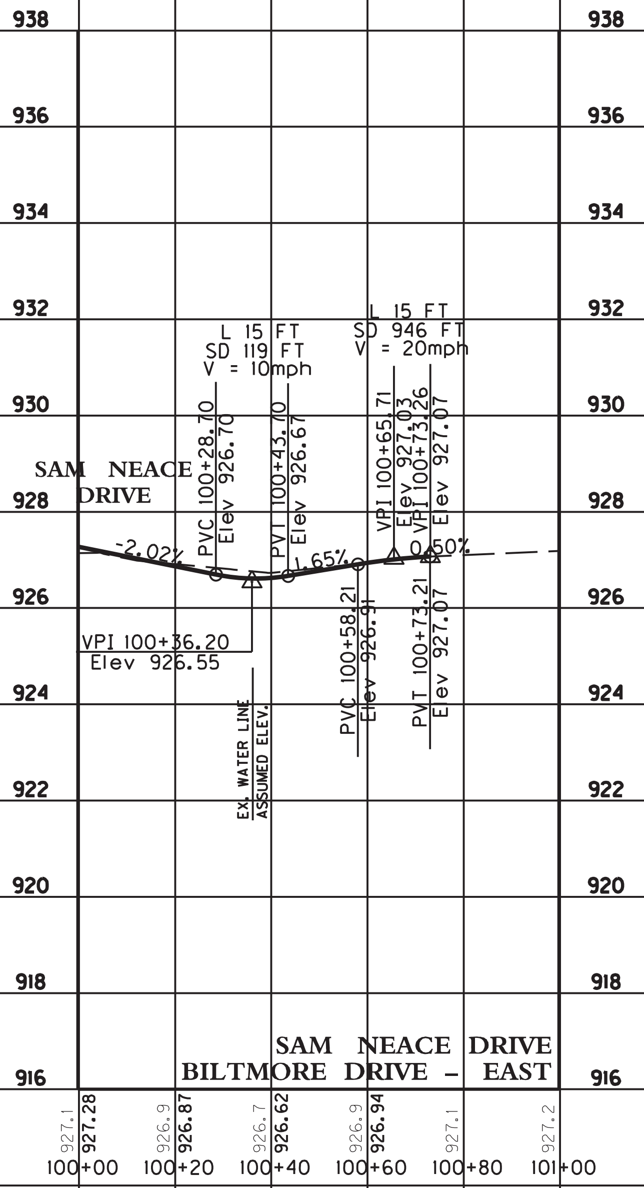


SAM NEACE DRIVE
SOIL PROFILE SHEET
STA 14+00 TO STA 15+81.36

Addendum 2 – 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R53


REFER TO GEOTECHNICAL NOTE 12 FOR STATION 101+00



SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

SAM NEACE DRIVE APPROACH ROADS
SOIL PROFILE SHEET

Addendum 2 -- 7-11-19

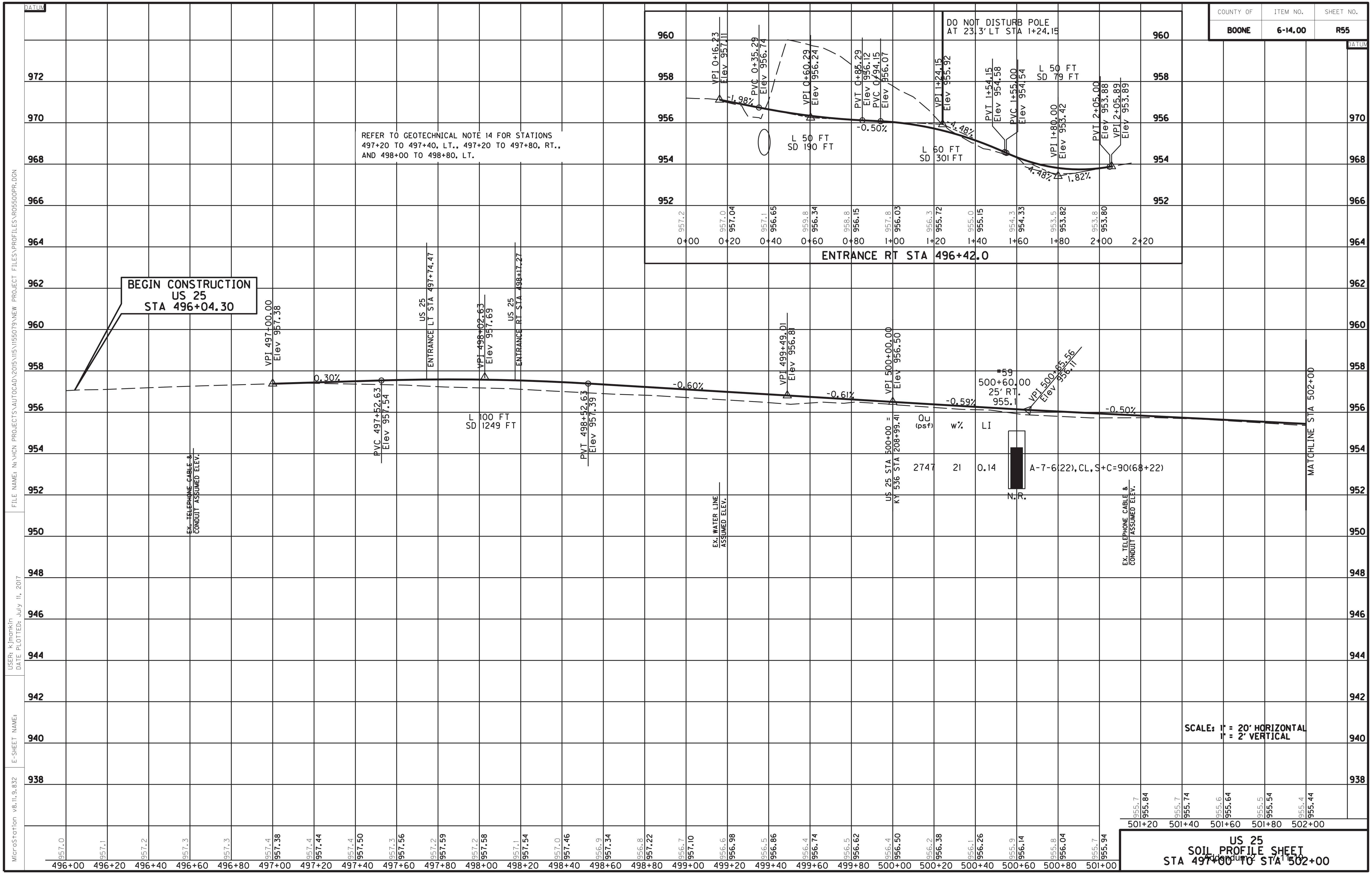
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R05300PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.292

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R55



SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25
SOIL PROFILE SHEET
STA 497+00 TO STA 502+00

Addendum 2 - 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R05500PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R57

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R05700PR.DGN

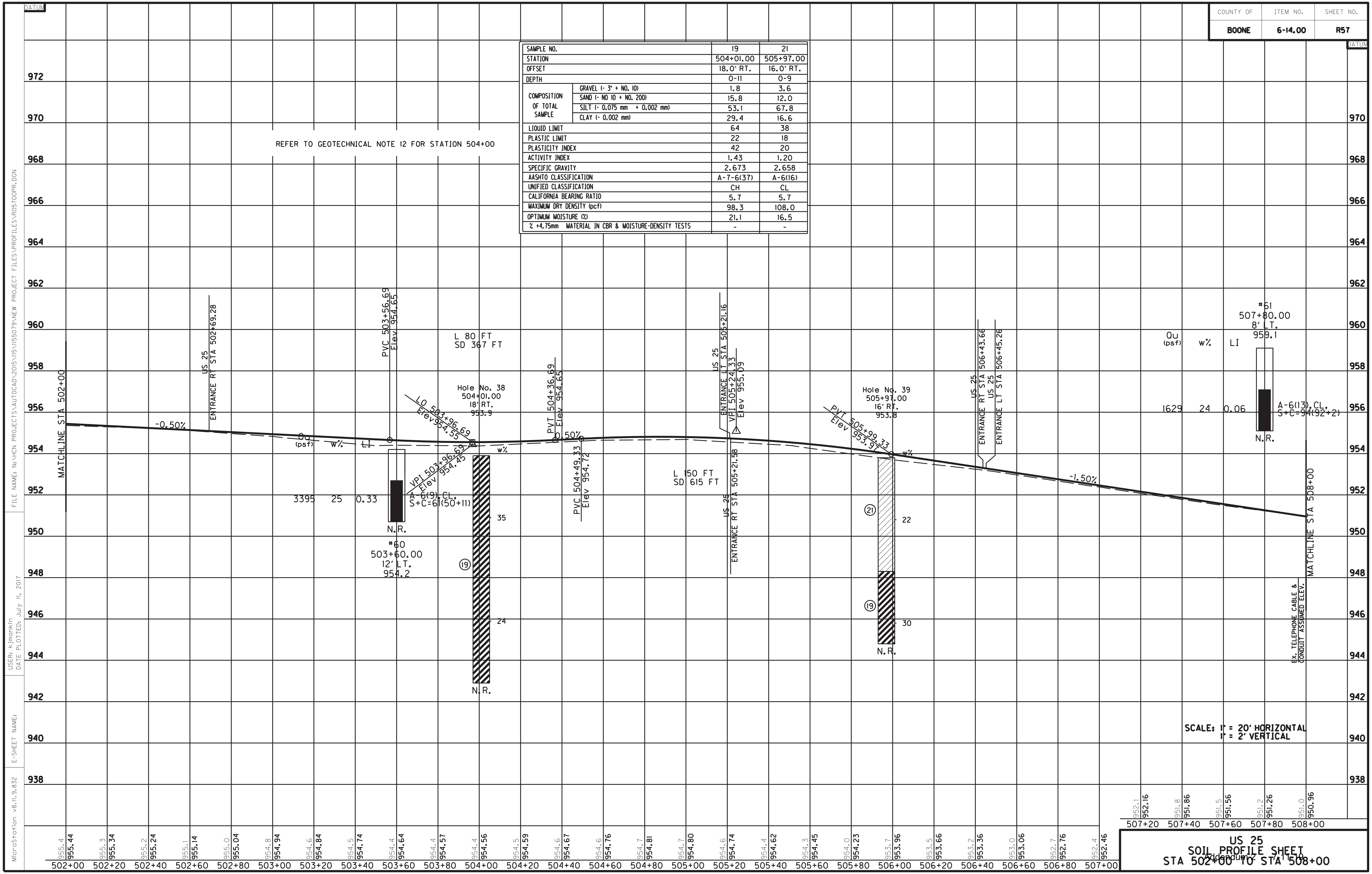
USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

SAMPLE NO.		19	21
STATION		504+01.00	505+97.00
OFFSET		18.0' RT.	16.0' RT.
DEPTH		0-11	0-9
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1.8	3.6
	SAND (- NO 10 + NO. 200)	15.8	12.0
	SILT (- 0.075 mm + 0.002 mm)	53.1	67.8
	CLAY (- 0.002 mm)	29.4	16.6
LIQUID LIMIT		64	38
PLASTIC LIMIT		22	18
PLASTICITY INDEX		42	20
ACTIVITY INDEX		1.43	1.20
SPECIFIC GRAVITY		2.673	2.658
AASHTO CLASSIFICATION		A-7-6(37)	A-6(16)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		5.7	5.7
MAXIMUM DRY DENSITY (pcf)		98.3	108.0
OPTIMUM MOISTURE (%)		21.1	16.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-

REFER TO GEOTECHNICAL NOTE 12 FOR STATION 504+00

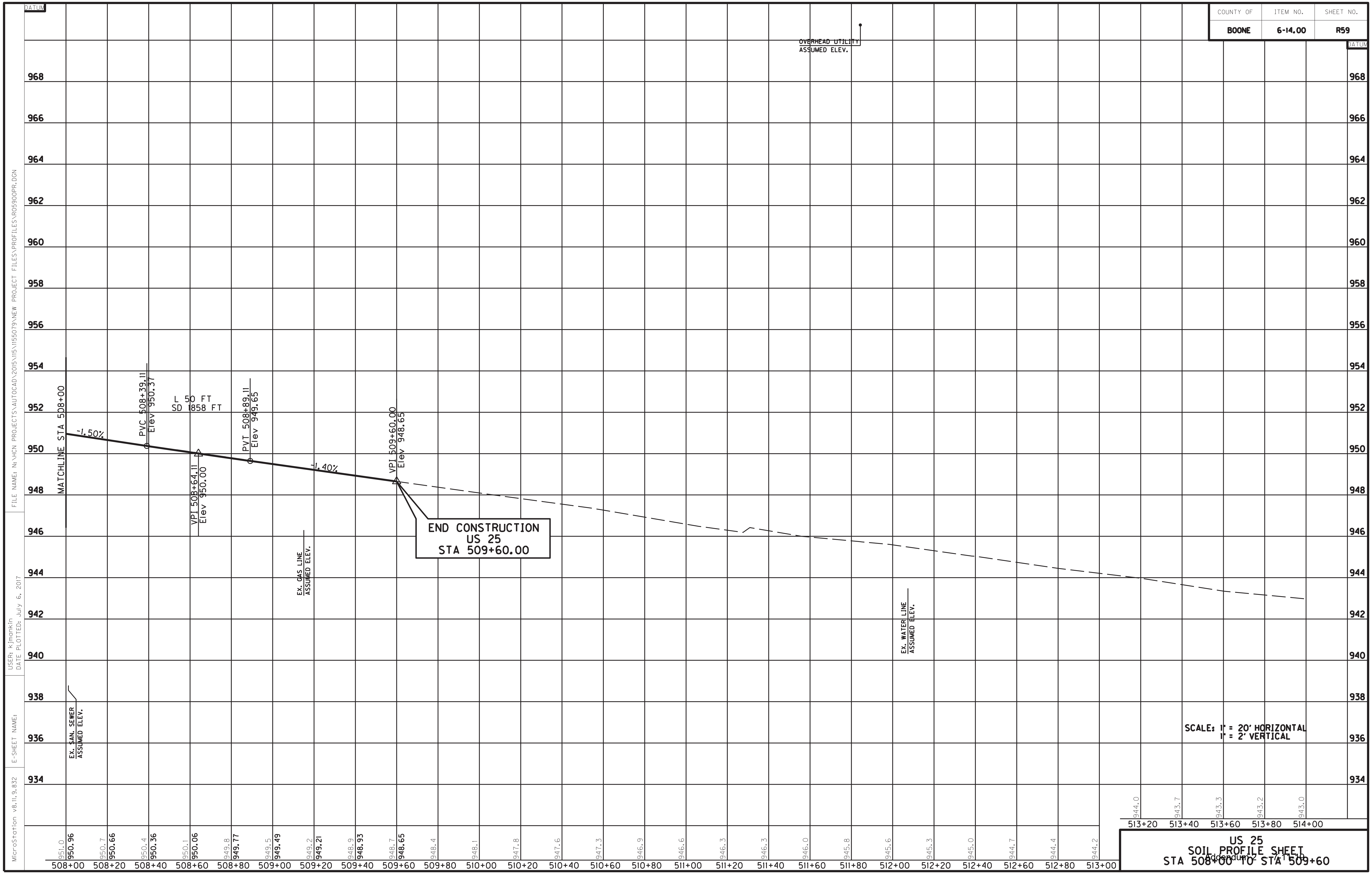


SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25
SOIL PROFILE SHEET
STA 502+00 TO STA 508+00

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R59



US 25
SOIL PROFILE SHEET
STA 508+00 TO STA 509+60

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R05900PR.DGN

USER: kjmankin
DATE PLOTTED: July 6, 2017

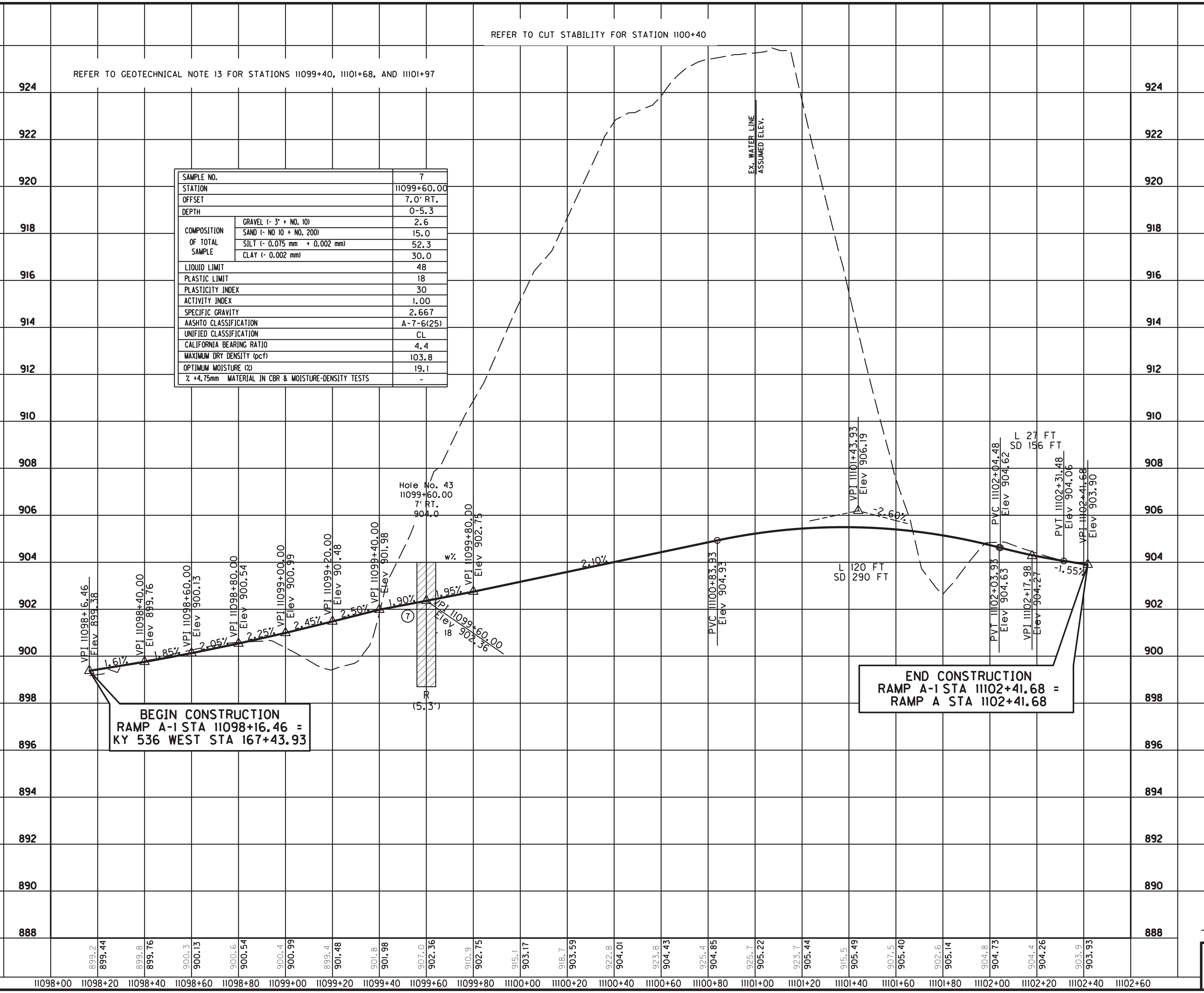
E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R66

REFER TO CUT STABILITY FOR STATION 1100+40

REFER TO GEOTECHNICAL NOTE 13 FOR STATIONS 11099+40, 11101+68, AND 11101+97



SAMPLE NO.		7
STATION		11099+60.00
OFFSET		7.0' RT.
DEPTH		0-5.3
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2.6
	SAND (- NO 10 + NO. 200)	15.0
	SILT (- 0.075 mm + 0.002 mm)	52.3
	CLAY (- 0.002 mm)	30.0
LIQUID LIMIT		48
PLASTIC LIMIT		18
PLASTICITY INDEX		30
ACTIVITY INDEX		1.00
SPECIFIC GRAVITY		2.667
AASHTO CLASSIFICATION		A-7-6(25)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		4.4
MAXIMUM DRY DENSITY (pcf)		103.8
OPTIMUM MOISTURE (%)		19.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

BEGIN CONSTRUCTION
RAMP A-1 STA 11098+16.46 =
KY 536 WEST STA 167+43.93

END CONSTRUCTION
RAMP A-1 STA 11102+41.68 =
RAMP A STA 1102+41.68

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\1155079\NEW PROJECT FILES\PROFILES\R06600PR.DGN

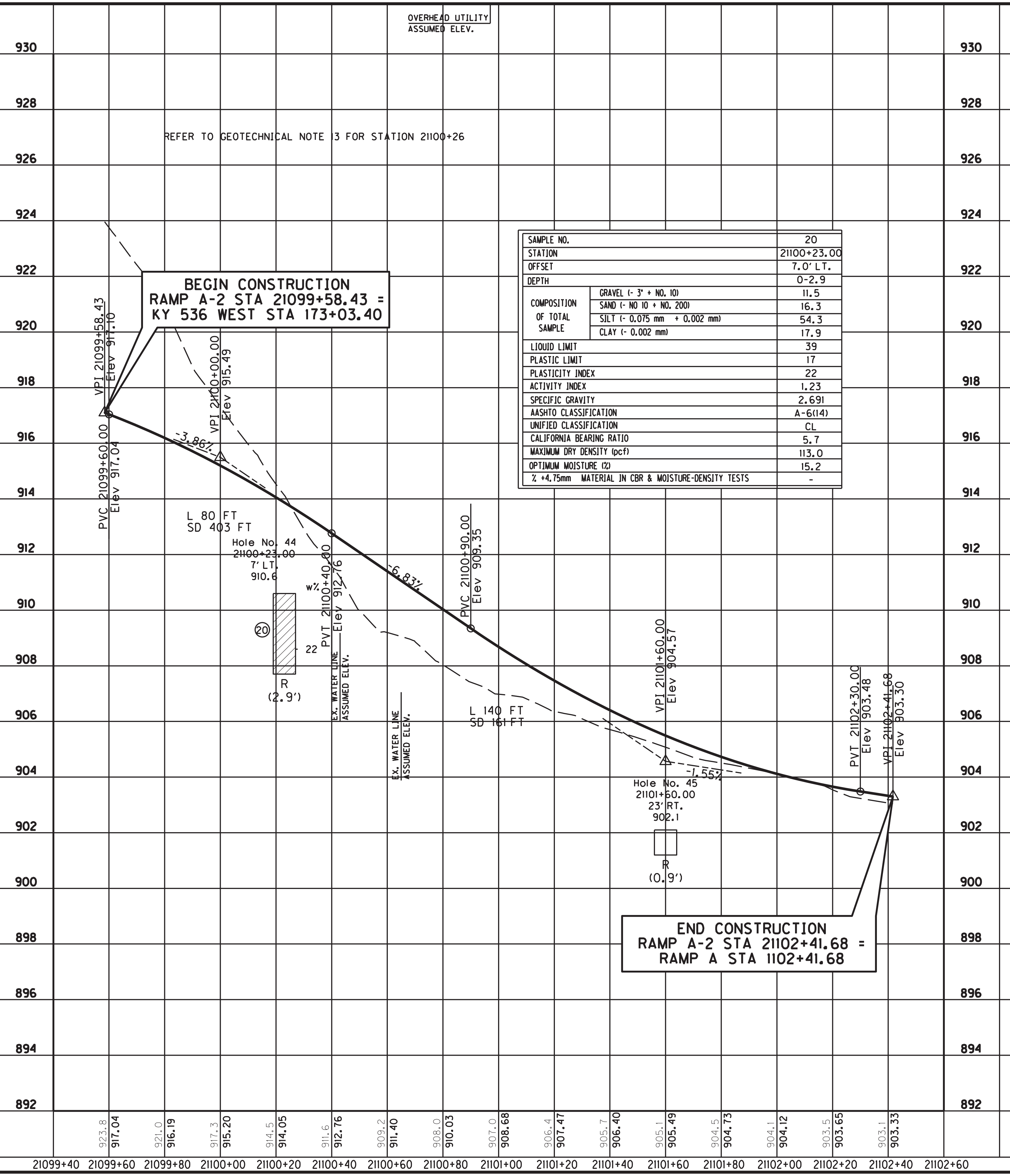
USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

RAMP A-1
SOIL PROFILE SHEET
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R67



SAMPLE NO.		20
STATION		21100+23.00
OFFSET		7.0' LT.
DEPTH		0-2.9
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	11.5
	SAND (- NO 10 + NO. 200)	16.3
	SILT (- 0.075 mm + 0.002 mm)	54.3
	CLAY (- 0.002 mm)	17.9
LIQUID LIMIT		39
PLASTIC LIMIT		17
PLASTICITY INDEX		22
ACTIVITY INDEX		1.23
SPECIFIC GRAVITY		2.691
AASHTO CLASSIFICATION		A-6(14)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		5.7
MAXIMUM DRY DENSITY (pcf)		113.0
OPTIMUM MOISTURE (%)		15.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

DATUM

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP A-2
SOIL PROFILE SHEET
Addendum 2 -- 7-11-19

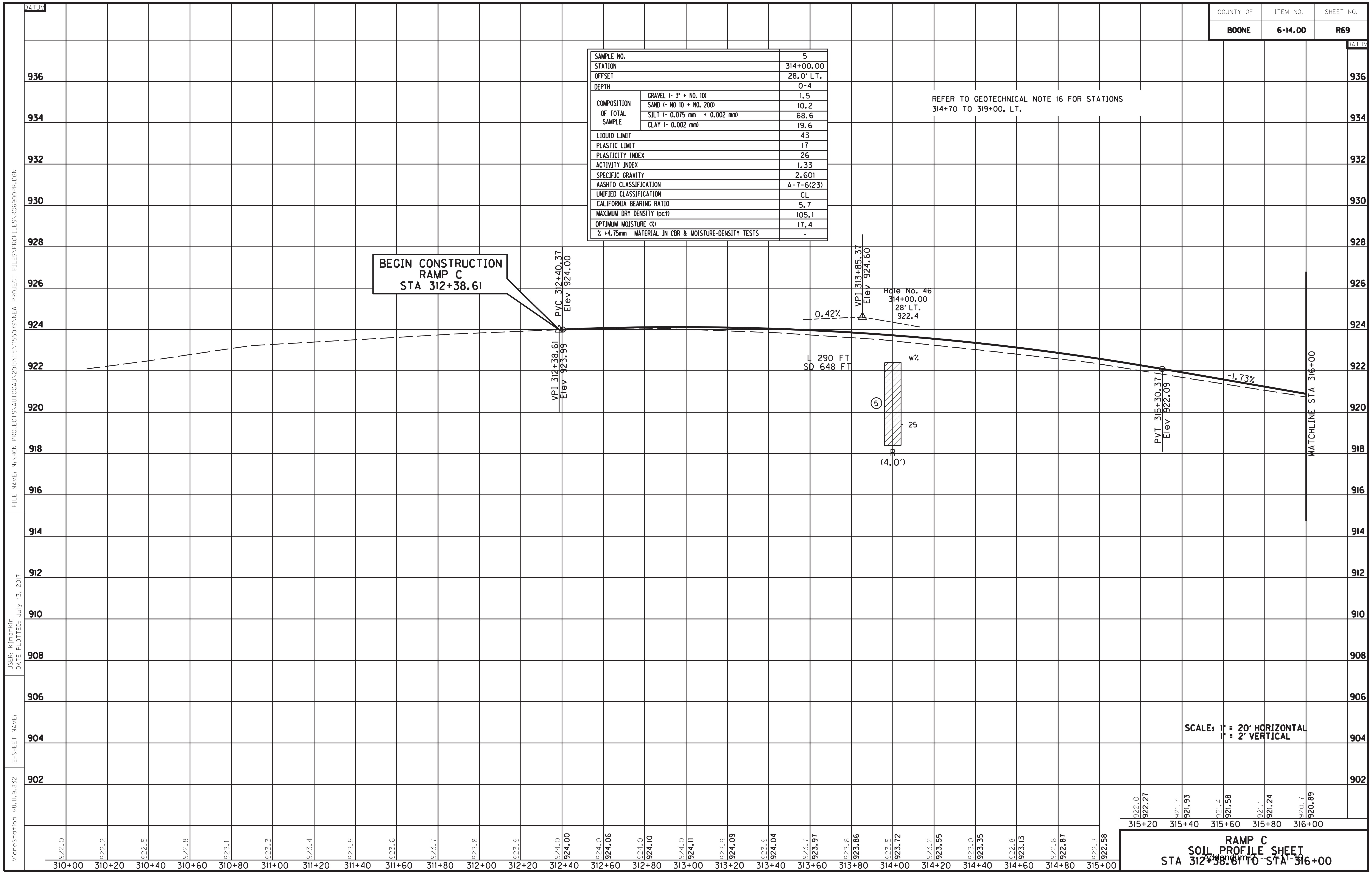
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R06700PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R69



SAMPLE NO.		5
STATION		314+00.00
OFFSET		28.0' LT.
DEPTH		0-4
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1.5
	SAND (- NO 10 + NO. 200)	10.2
	SILT (- 0.075 mm + 0.002 mm)	68.6
	CLAY (- 0.002 mm)	19.6
LIQUID LIMIT		43
PLASTIC LIMIT		17
PLASTICITY INDEX		26
ACTIVITY INDEX		1.33
SPECIFIC GRAVITY		2.601
AASHTO CLASSIFICATION		A-7-6(23)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		5.7
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		17.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

REFER TO GEOTECHNICAL NOTE 16 FOR STATIONS
314+70 TO 319+00. LT.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP C
SOIL PROFILE SHEET
STA 312+38.61 TO STA 316+00

Addendum 2 -- 7-11-19

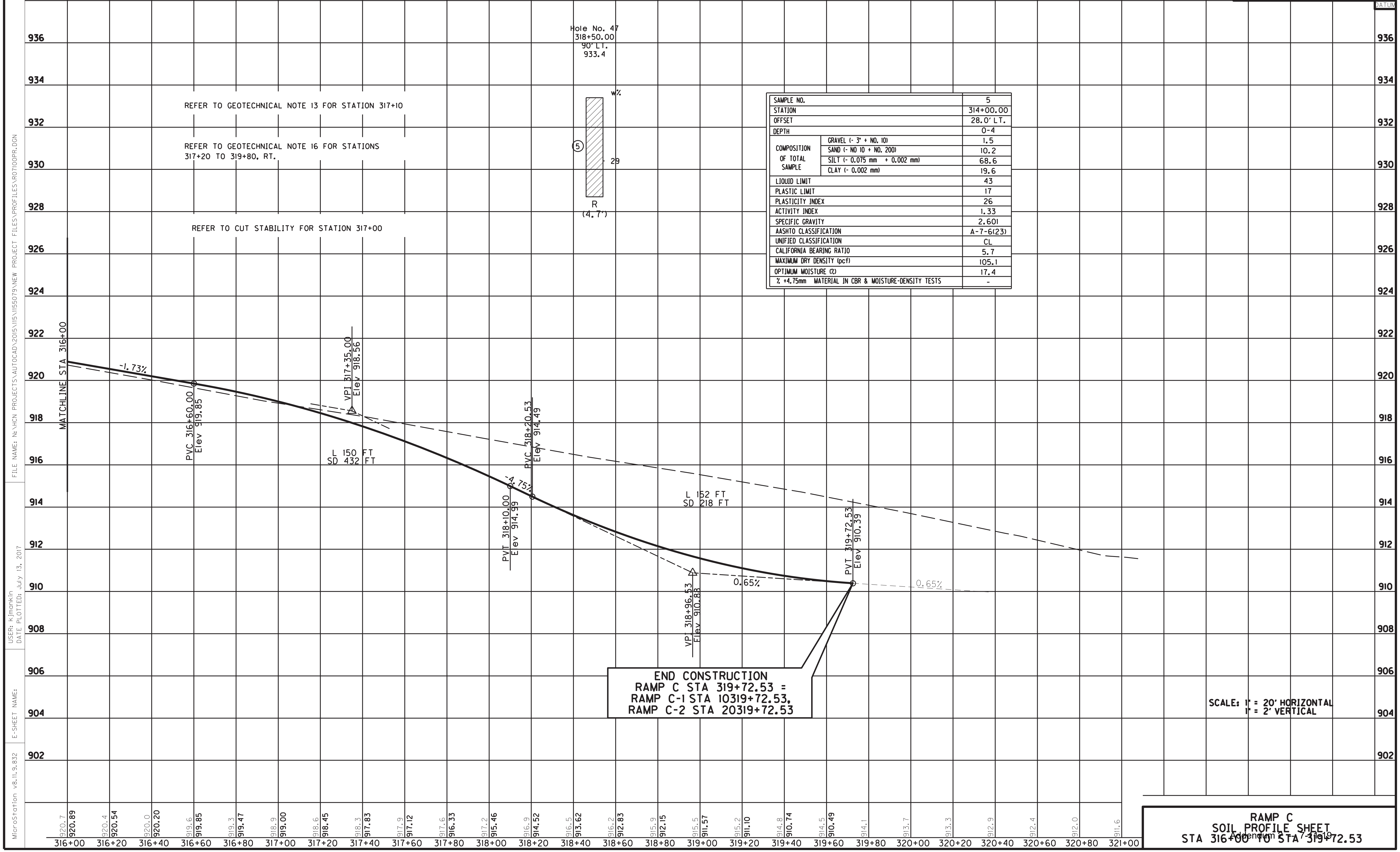
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R06900PR.DGN

USER: kjmankin
DATE PLOTTED: July 13, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R71



SAMPLE NO.		5
STATION		314+00.00
OFFSET		28.0' LT.
DEPTH		0-4
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1.5
	SAND (- NO 10 + NO. 200)	10.2
	SILT (- 0.075 mm + 0.002 mm)	68.6
	CLAY (- 0.002 mm)	19.6
LIQUID LIMIT		43
PLASTIC LIMIT		17
PLASTICITY INDEX		26
ACTIVITY INDEX		1.33
SPECIFIC GRAVITY		2.601
AASHTO CLASSIFICATION		A-7-6(23)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		5.7
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		17.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

END CONSTRUCTION
RAMP C STA 319+72.53 =
RAMP C-1 STA 10319+72.53,
RAMP C-2 STA 20319+72.53

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\PROFILES\R07100PR.DGN

USER: kjmankin
DATE PLOTTED: July 13, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

RAMP C
SOIL PROFILE SHEET
STA 316+00 TO STA 319+72.53

Addendum 2 -- 7-11-19

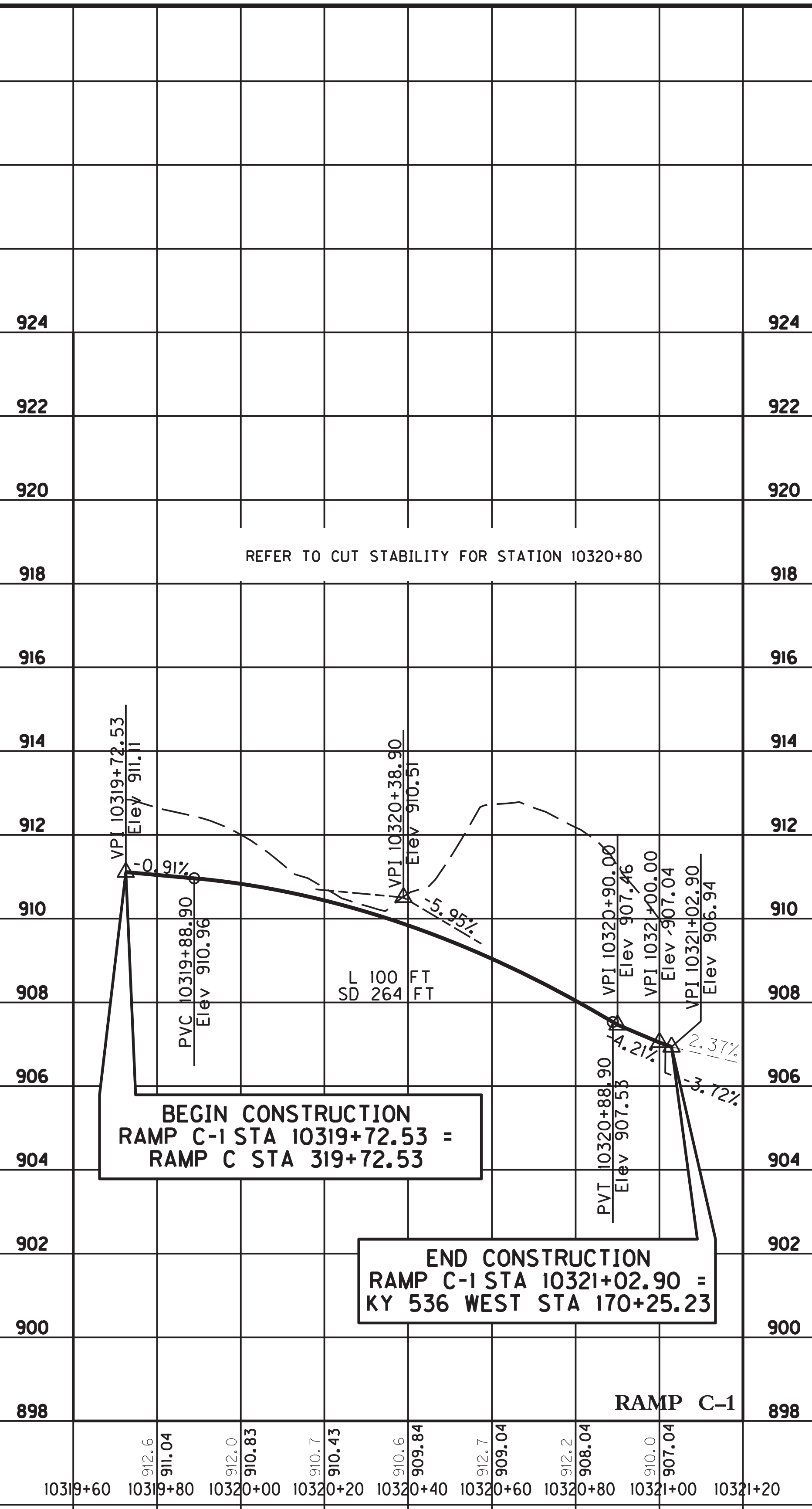
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R72

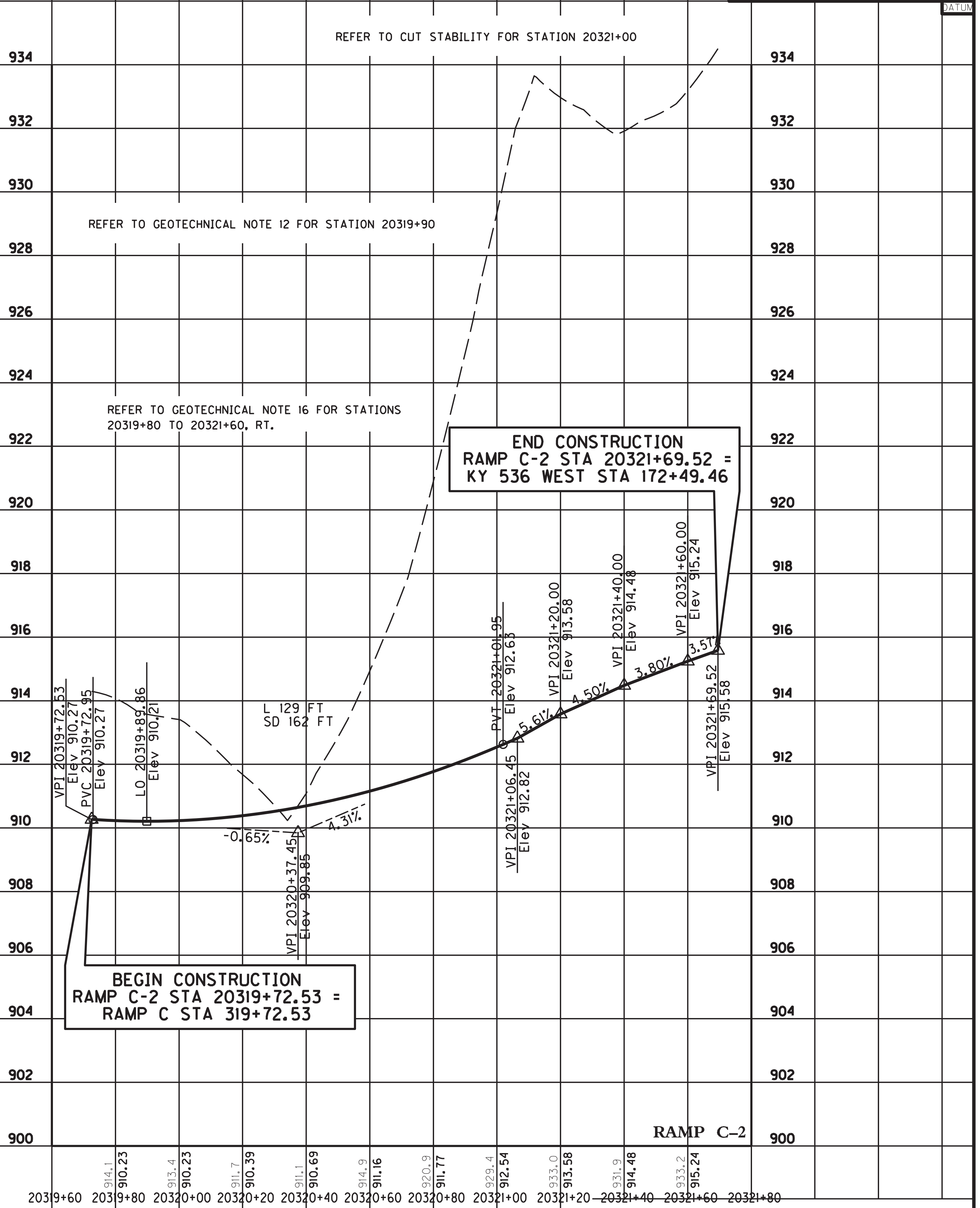
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R07200PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832





SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP C-1 & RAMP C-2
SOIL PROFILE SHEET
Addendum 2 -- 7-11-19

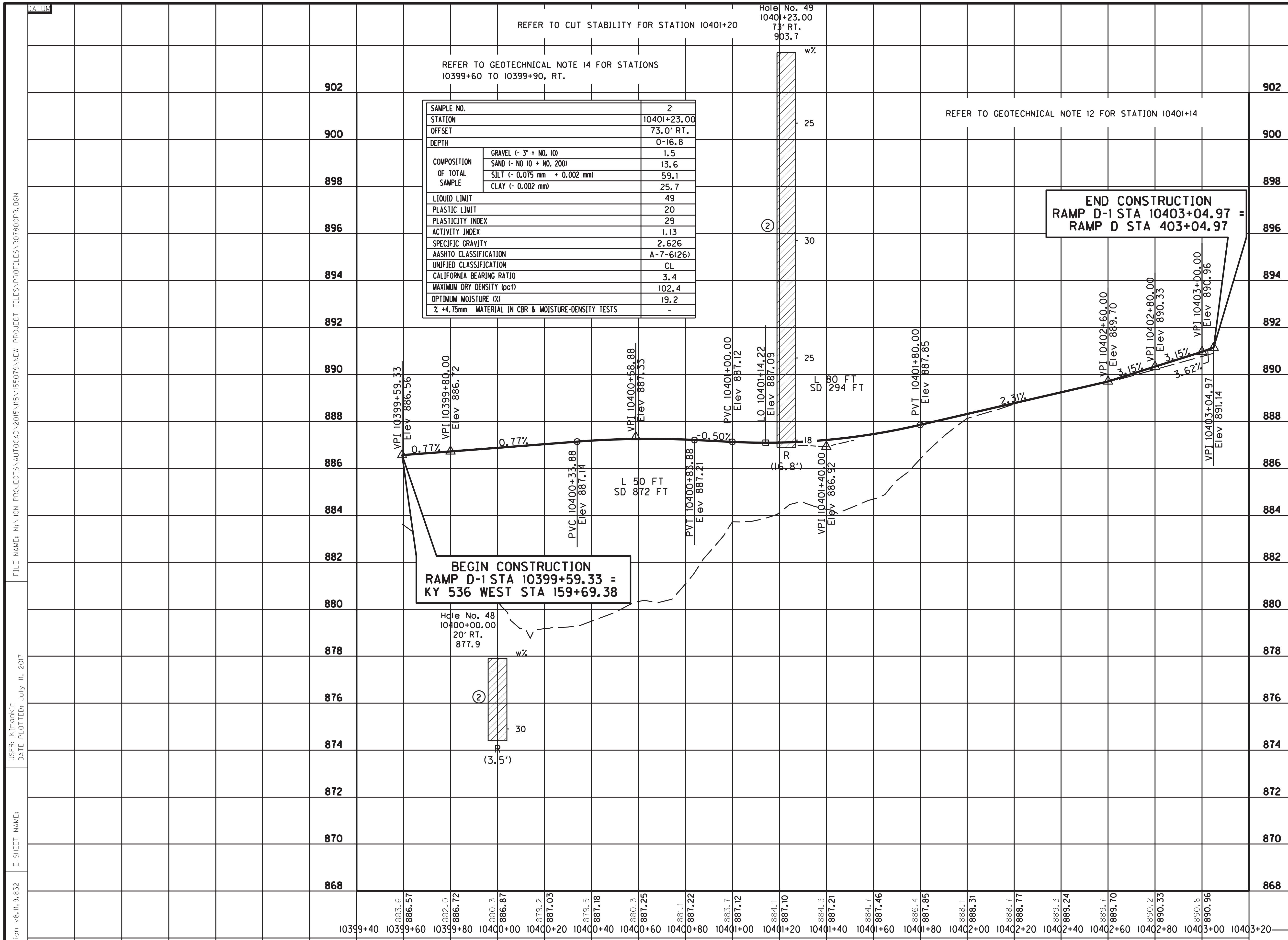
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	**R78**

REFER TO CUT STABILITY FOR STATION 10401+20

REFER TO GEOTECHNICAL NOTE 14 FOR STATIONS 10399+60 TO 10399+90, RT.

REFER TO GEOTECHNICAL NOTE 12 FOR STATION 10401+14

SAMPLE NO.		2
STATION		10401+23.00
OFFSET		73.0′ RT.
DEPTH		0-16.8
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1.5
	SAND (- NO 10 + NO. 200)	13.6
	SILT (- 0.075 mm + 0.002 mm)	59.1
	CLAY (- 0.002 mm)	25.7
LIQUID LIMIT		49
PLASTIC LIMIT		20
PLASTICITY INDEX		29
ACTIVITY INDEX		1.13
SPECIFIC GRAVITY		2.626
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		3.4
MAXIMUM DRY DENSITY (pcf)		102.4
OPTIMUM MOISTURE (%)		19.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-



SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R07800PR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

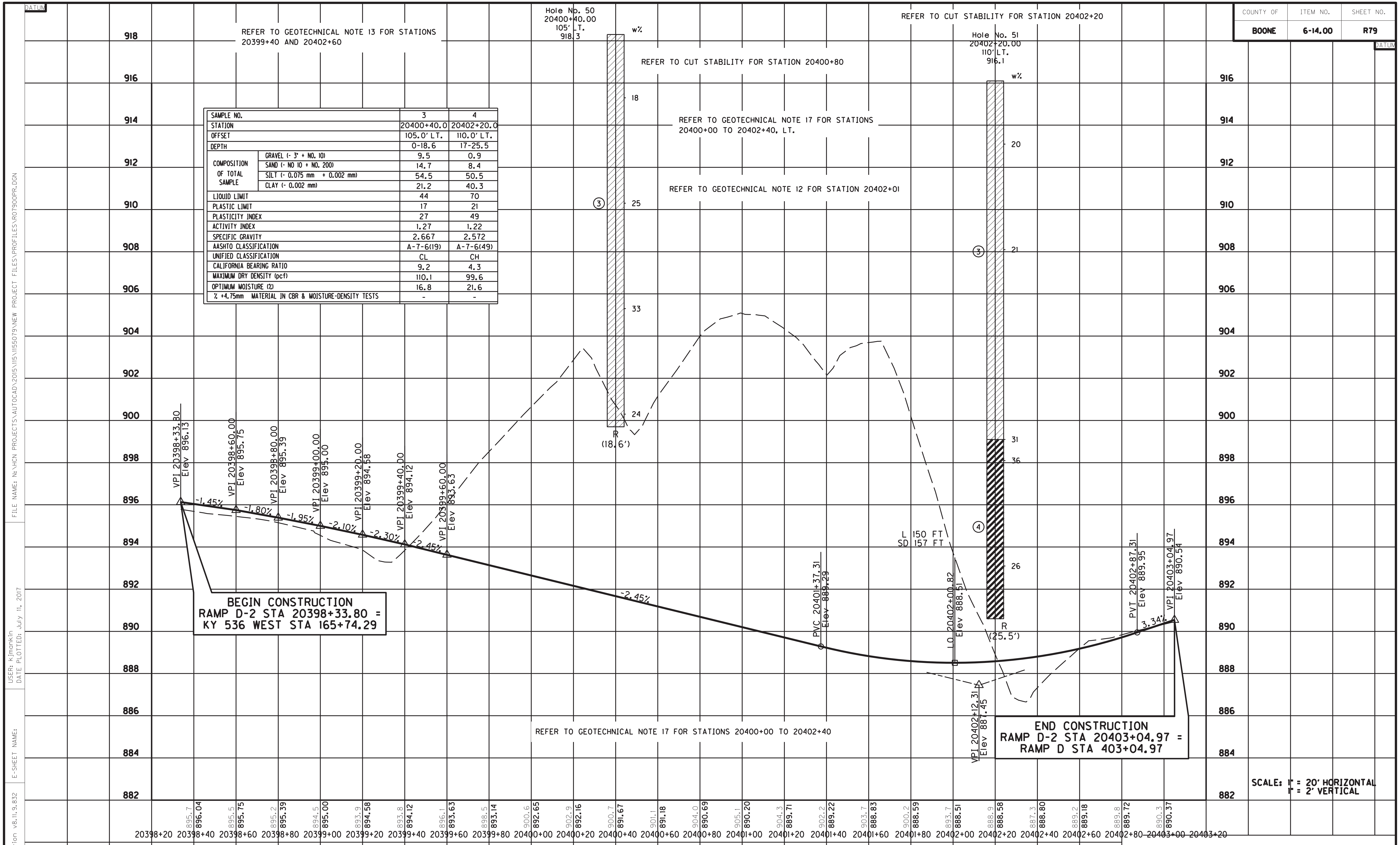
E-SHEET NAME:

MicroStation v8.11.9.832

RAMP D-1
SOIL PROFILE SHEET

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	**R79**



SAMPLE NO.		3	4
STATION		20400+40.0	20402+20.0
OFFSET		105.0' LT.	110.0' LT.
DEPTH		0-18.6	17-25.5
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9.5	0.9
	SAND (- NO 10 + NO. 200)	14.7	8.4
	SILT (- 0.075 mm + 0.002 mm)	54.5	50.5
	CLAY (- 0.002 mm)	21.2	40.3
LIQUID LIMIT		44	70
PLASTIC LIMIT		17	21
PLASTICITY INDEX		27	49
ACTIVITY INDEX		1.27	1.22
SPECIFIC GRAVITY		2.667	2.572
AASHTO CLASSIFICATION		A-7-6(19)	A-7-6(49)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		9.2	4.3
MAXIMUM DRY DENSITY (pcf)		110.1	99.6
OPTIMUM MOISTURE (%)		16.8	21.6
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-	-

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R07900PR.DGN

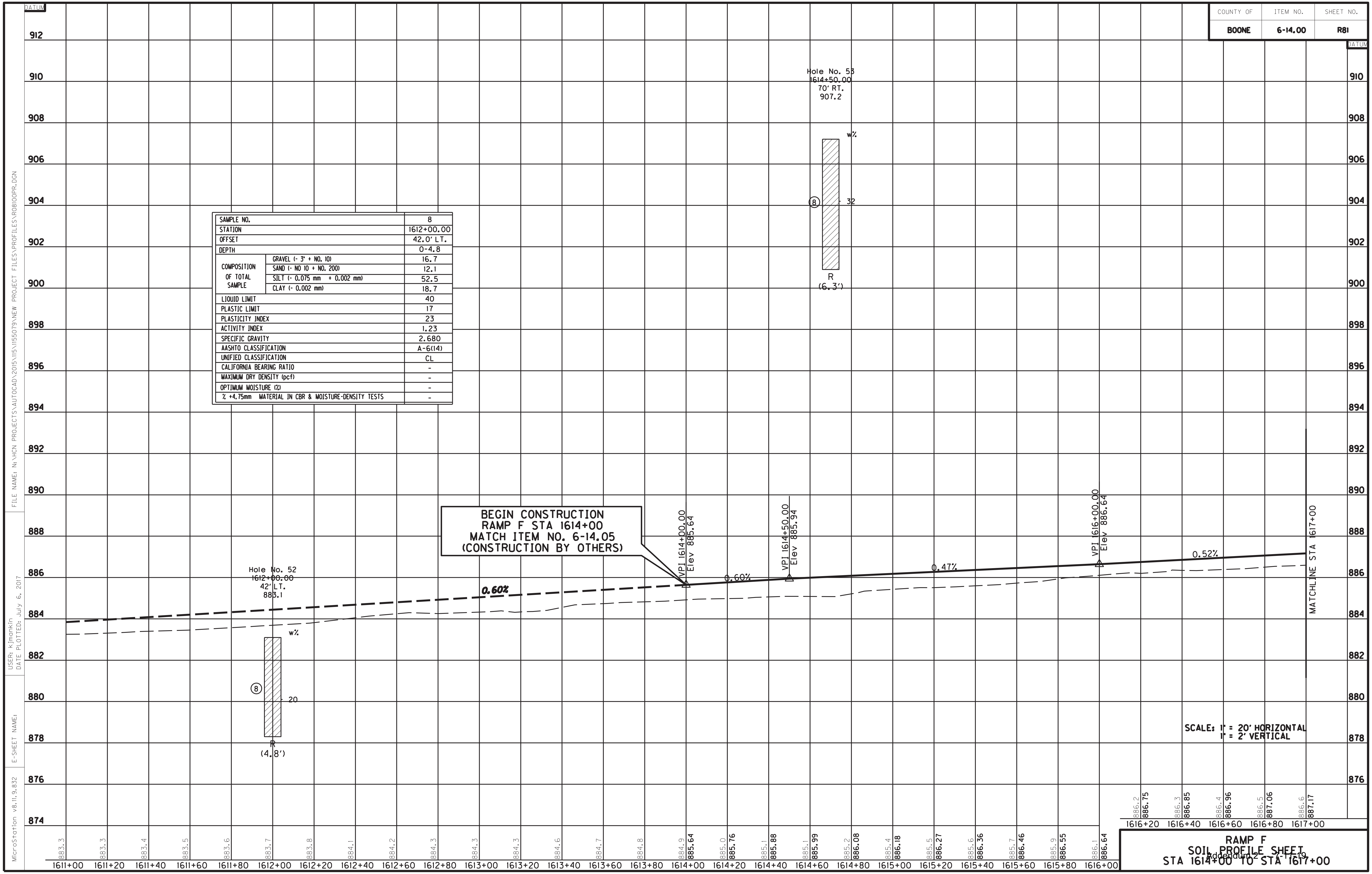
USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

RAMP D-2
SOIL PROFILE SHEET
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R81



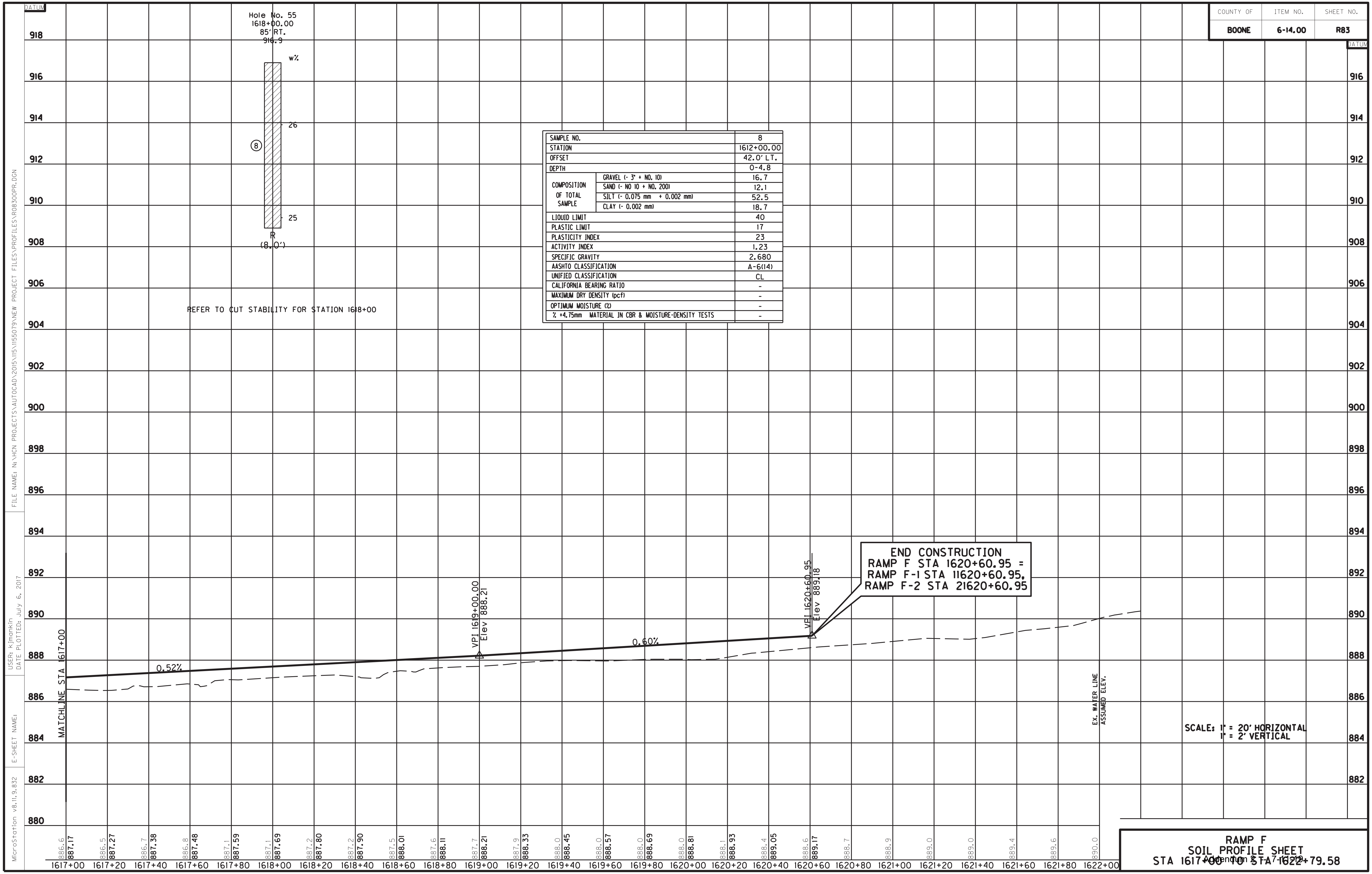
SAMPLE NO.		8
STATION		1612+00.00
OFFSET		42.0′ LT.
DEPTH		0-4.8
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	16.7
	SAND (- NO 10 + NO. 200)	12.1
	SILT (- 0.075 mm + 0.002 mm)	52.5
	CLAY (- 0.002 mm)	18.7
LIQUID LIMIT		40
PLASTIC LIMIT		17
PLASTICITY INDEX		23
ACTIVITY INDEX		1.23
SPECIFIC GRAVITY		2.680
AASHTO CLASSIFICATION		A-6(14)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		-
MAXIMUM DRY DENSITY (pcf)		-
OPTIMUM MOISTURE (%)		-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

RAMP F
SOIL PROFILE SHEET
STA 1614+00 TO STA 1617+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\1155079\NEW PROJECT FILES\PROFILES\R08100PR.DGN
USER: kjmankin
DATE PLOTTED: July 6, 2017
E-SHEET NAME:
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R83



SAMPLE NO.		8
STATION		1612+00.00
OFFSET		42.0' LT.
DEPTH		0-4.8
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	16.7
	SAND (- NO 10 + NO. 200)	12.1
	SILT (- 0.075 mm + 0.002 mm)	52.5
	CLAY (- 0.002 mm)	18.7
LIQUID LIMIT		40
PLASTIC LIMIT		17
PLASTICITY INDEX		23
ACTIVITY INDEX		1.23
SPECIFIC GRAVITY		2.680
AASHTO CLASSIFICATION		A-6(14)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		-
MAXIMUM DRY DENSITY (pcf)		-
OPTIMUM MOISTURE (%)		-
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		-

END CONSTRUCTION
RAMP F STA 1620+60.95 =
RAMP F-1 STA 11620+60.95,
RAMP F-2 STA 21620+60.95

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP F
SOIL PROFILE SHEET
STA 1617+00 TO STA 1622+79.58

Addendum 2 - 7-11-19

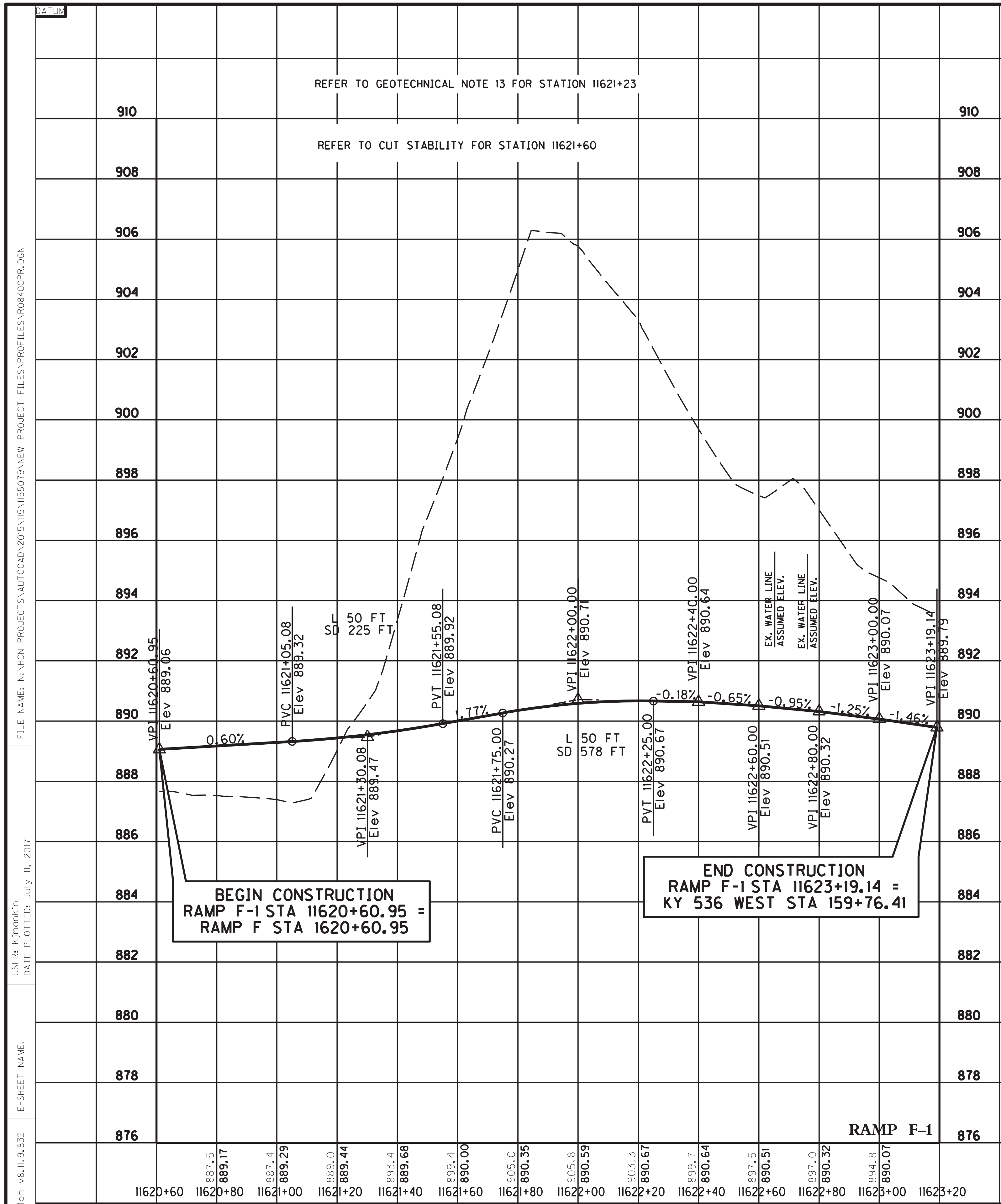
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R08300PR.DGN

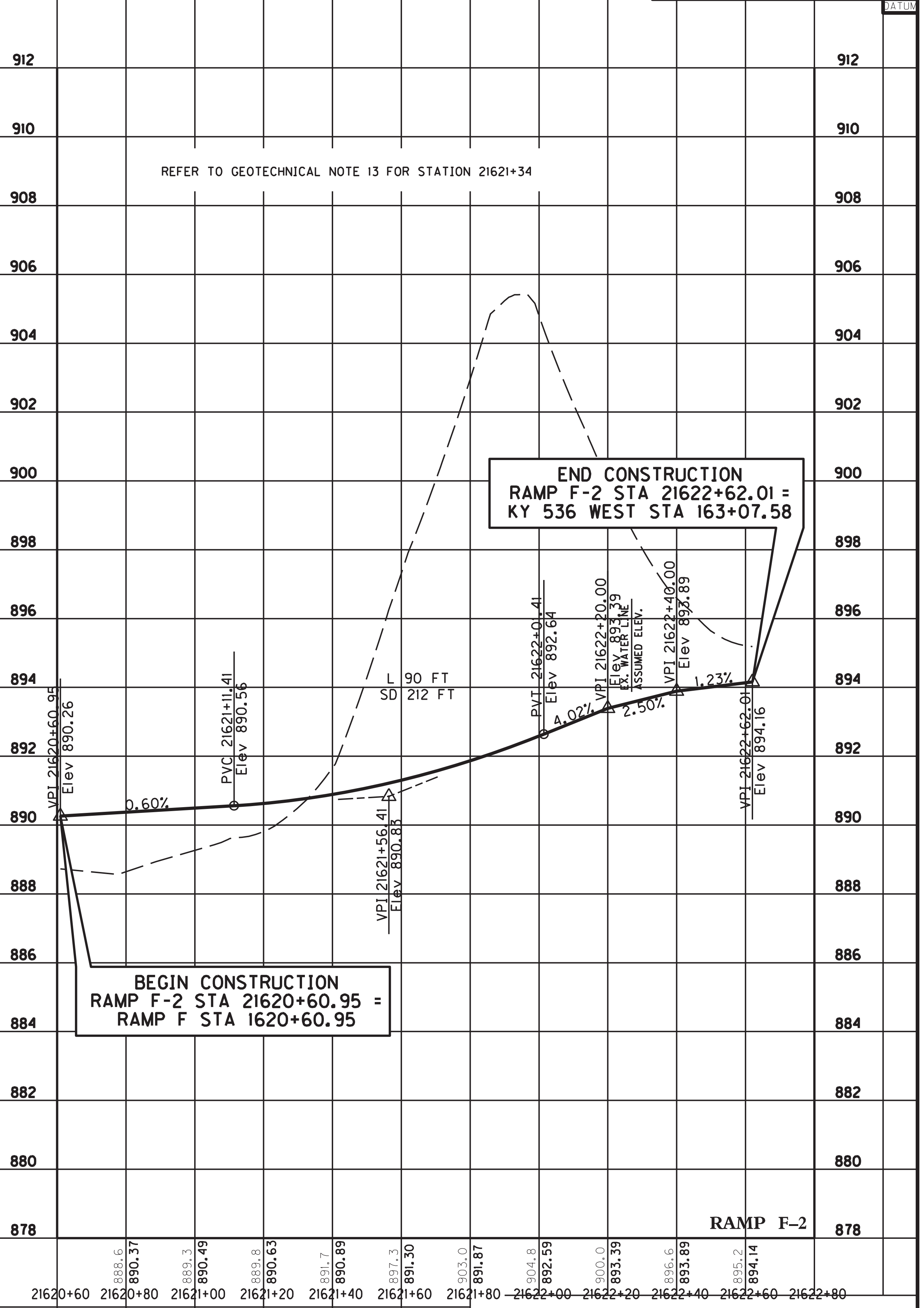
USER: kjmankin
DATE PLOTTED: July 6, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	R84





SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP F-1 & RAMP F-2
SOIL PROFILE SHEET

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\PROFILES\R0840OPR.DGN

USER: kjmankin
DATE PLOTTED: July 11, 2017

E-SHEET NAME:

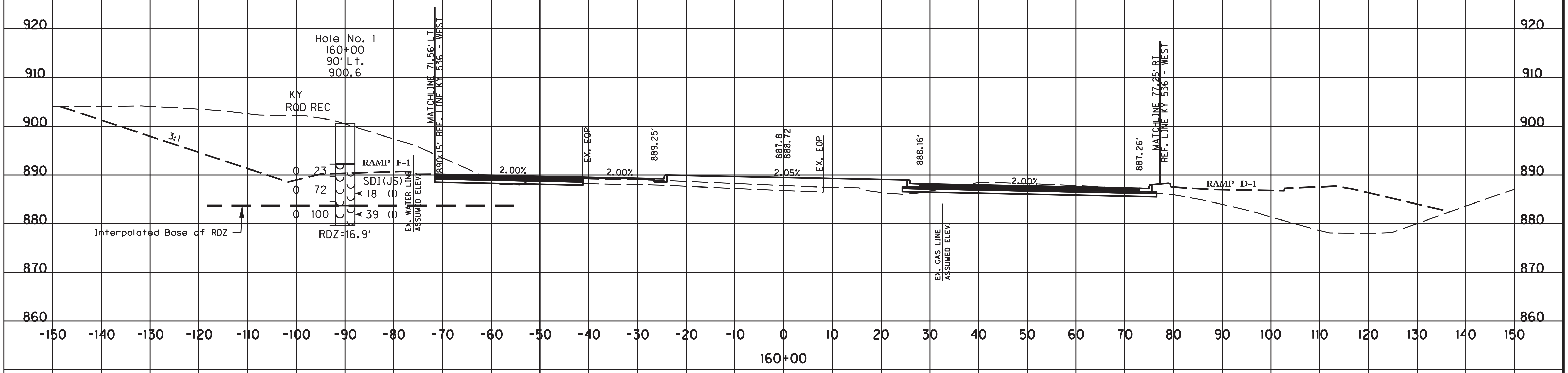
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

Cut Limits from Sta. 157+60 to Sta. 160+80
Core Log Sta. 160+00, 90′ Lt.
Elev. 900.6-892.2 Overburden
892.2-883.7 Shale: brown and gray gray with gray limestone (close fracturing, heavily weathered at fractures)
883.7-879.6 Shale: gray with gray limestone (close fracturing, heavily weathered at fractures)

ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
MAINLINE		
160+00	120′ RT.	3.5′
161+00	70′ LT.	6′
RAMP D-1		
10400+00	20′ RT.	3.5′



SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT STABILITY SECTION
KY 536
STA 160+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

USER: kjmankin
DATE PLOTTED: July 18, 2017

E-SHEET NAME:

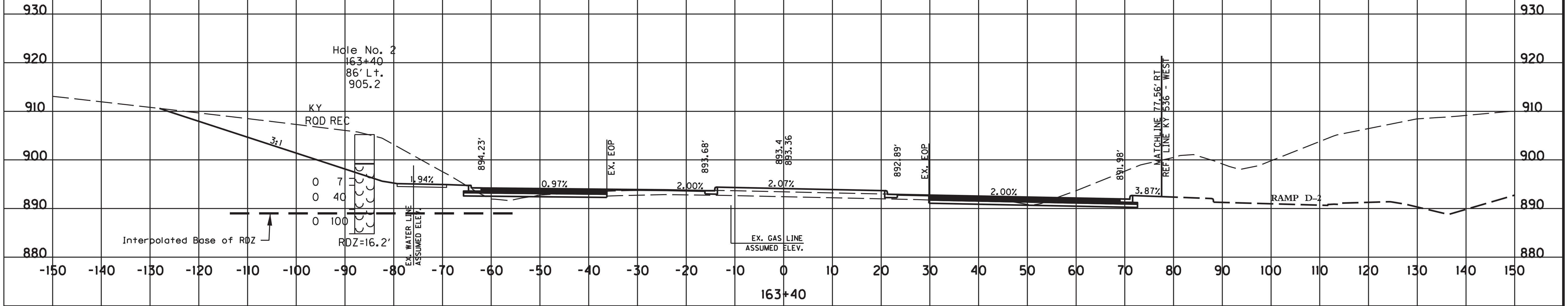
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

Cut Limits from Sta. 162+40 to Sta. 164+20
Core Log Sta. 163+40, 86′ Lt.
Elev. 905.2-896.2 Overburden
896.2-889.0 Shale: brown with gray limestone layers, (close fractures, heavily weathered fractures)
889.0-884.8 Shale: brown with gray limestone layers, (close fractures, heavily weathered at fractures)

ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
163+40	80′ RT.	11.7′



SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT STABILITY SECTION
KY 536
STA 163+40

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

USER: kjmankin
DATE PLOTTED: June 5, 2017

E-SHEET NAME:

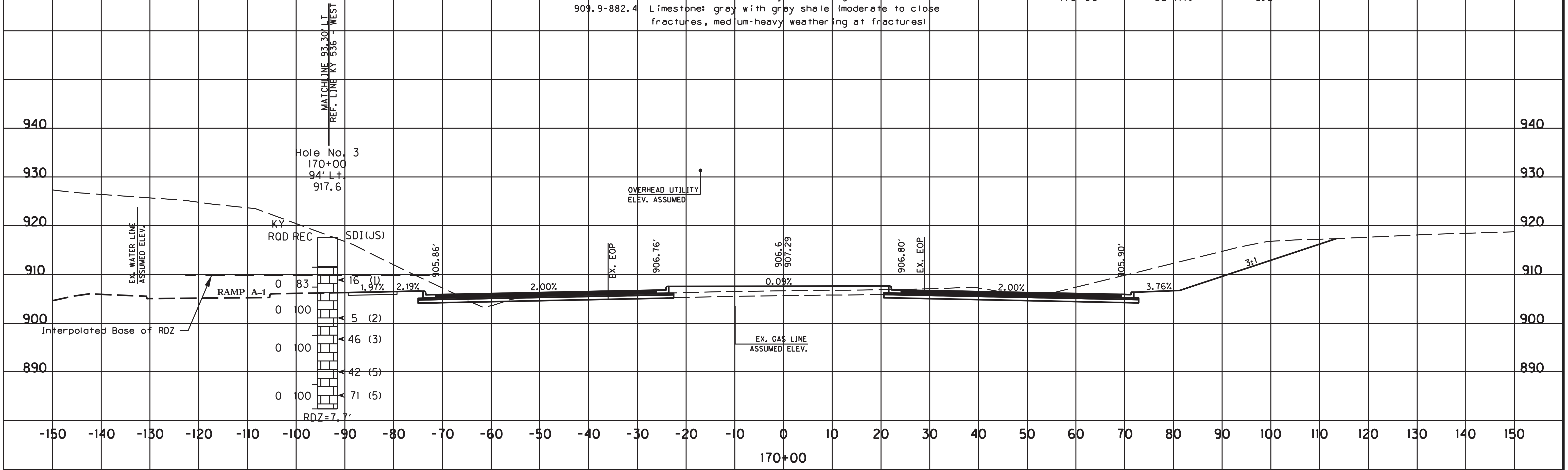
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

Cut Limits from Sta. 168+60 to Sta. 170+40
Core Log Sta. 170+00, 94' Lt.
Elev. 917.6-911.5 Overburden
911.5-909.9 ~~Limestone: gray with brown and gray weathered shale~~ (close fractures, heavy weathering at fractures)
909.9-882.4 Limestone: gray with gray shale (moderate to close fractures, medium-heavy weathering at fractures)

ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
170+00	85' RT.	6.5'



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

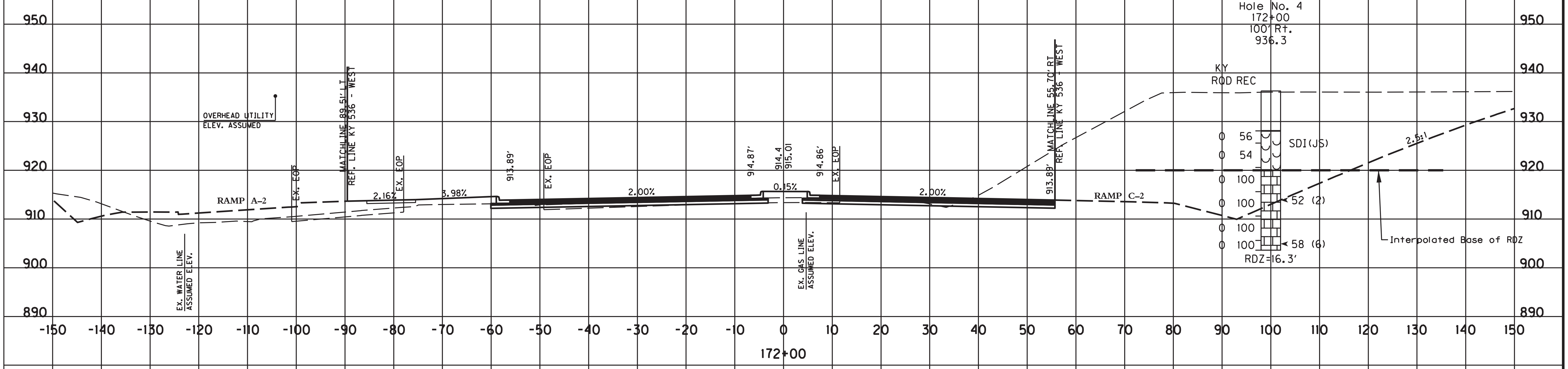
CUT STABILITY SECTION
KY 536
STA 170+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN
USER: kjmankin
DATE PLOTTED: July 18, 2017
E-SHEET NAME:
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

Cut Limits from Sta. 171+60 to Sta. 172+80
Core Log Sta. 172+00, 100' Rt.
Elev. 936.3-928.1 Overburden
928.1-920.0 Shale: brown with limestone pieces, close to moderate fractures
909.9-882.4 Limestone: gray with gray shale layers, close fractures (heavy-medium weathering at fractures)



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

CUT STABILITY SECTION
KY 536
STA 172+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

Cut Limits from Sta. 171+60 to Sta. 178+20

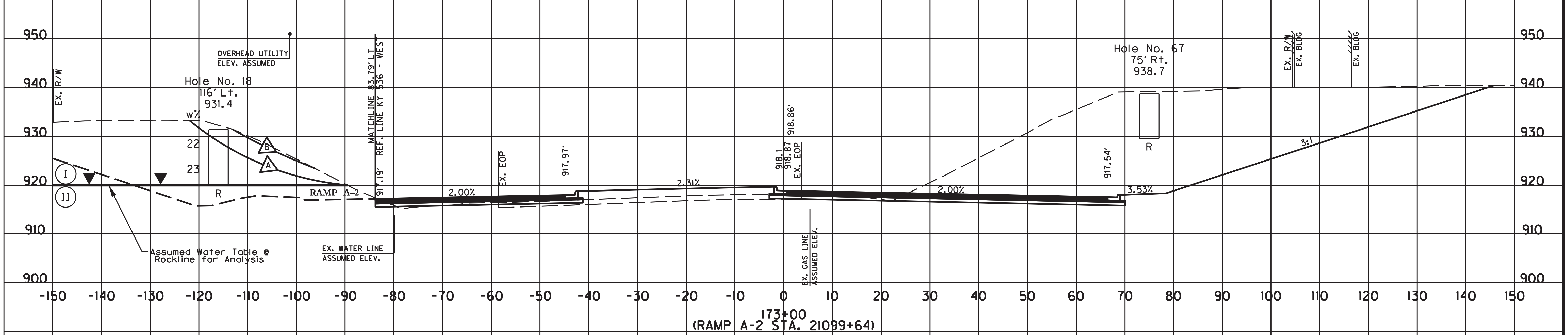
ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
173+90	75′ RT.	9.8′
174+00	95′ LT.	11.3′

FACTORS OF SAFETY		
INTERMEDIATE TERM	A	1.6
LONG TERM	B	1.5

ASSUMED SOIL STRENGTH PARAMETERS

SOIL	I	II
INTERMEDIATE TERM	γ = 128 pcf $\bar{c}$ = 0 psf $\bar{\phi}$ = 32°	γ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°
LONG TERM	γ = 128 pcf $\bar{c}$ = 0 psf $\bar{\phi}$ = 32°	γ = 150 pcf $\bar{c}$ = 3200 psf $\bar{\phi}$ = 45°



173+00
(RAMP A-2 STA. 21099+64)

SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT STABILITY SECTION
KY 536
STA 173+00

Addendum 2 – 7-11-19

MicroStation v8.11.9.832

E-SHEET NAME:

USER: kjmankin
DATE PLOTTED: June 5, 2017

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
RAMP A-1 11099+60	7′ RT.	5.3′

ASSUMED SOIL STRENGTH PARAMETERS

SOIL	I	II	III
INTERMEDIATE TERM	γ = 128 pcf $\bar{c}$ = 307 psf $\bar{\phi}$ = 18°	γ = 140 pcf $\bar{c}$ = 2000 psf $\bar{\phi}$ = 40°	γ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°
LONG TERM	γ = 128 pcf $\bar{c}$ = 61 psf $\bar{\phi}$ = 18°	γ = 140 pcf $\bar{c}$ = 1600 psf $\bar{\phi}$ = 40°	γ = 150 pcf $\bar{c}$ = 3200 psf $\bar{\phi}$ = 45°

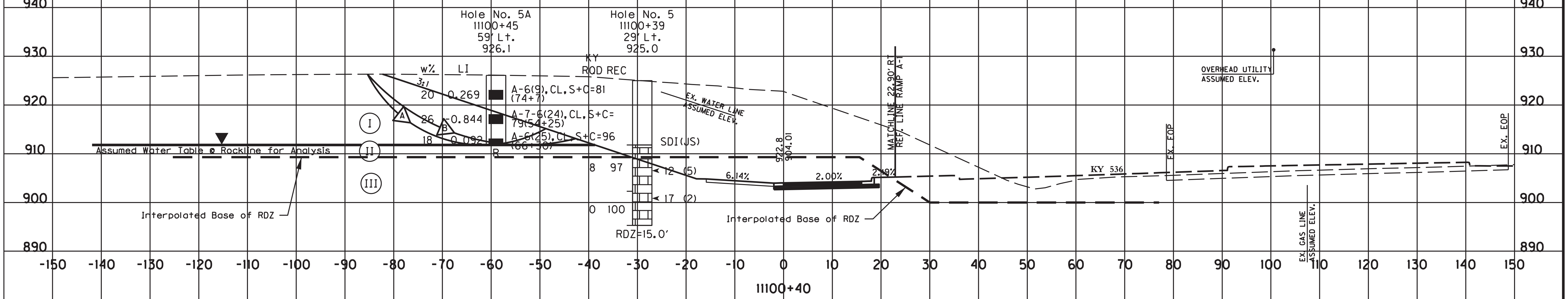
SUMMARY OF TRIAXIAL TEST DATA

STATION	RAMP A-1, 11100+45	RAMP A-1, 11100+45	RAMP A-1, 11100+45
OFFSET	59′ Lt.	59′ Lt.	59′ Lt.
DEPTH	(3-5′)	(8-10′)	(13-14.2′)
$\bar{c}$	507 psf	307 psf	0 psf
$\bar{\phi}$	32°	18°	32°

Cut Limits from Sta. 11099+20 to Sta. 11102+00
Core Log ML Sta. 11100+39, 29′ Lt.
Elev. 925.0-911.8 Overburden
911.8-909.3 Limestone: gray with brown and gray weathered shale
909.3-895.3 Limestone: gray with gray shale

FACTORS OF SAFETY

INTERMEDIATE TERM	A	3.0
LONG TERM	B	1.5



SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT STABILITY SECTION
RAMP A-1
STA 11100+40

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

USER: kjmankin
DATE PLOTTED: July 18, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
RAMP C 318+50	90' LT.	4.7'

FACTORS OF SAFETY

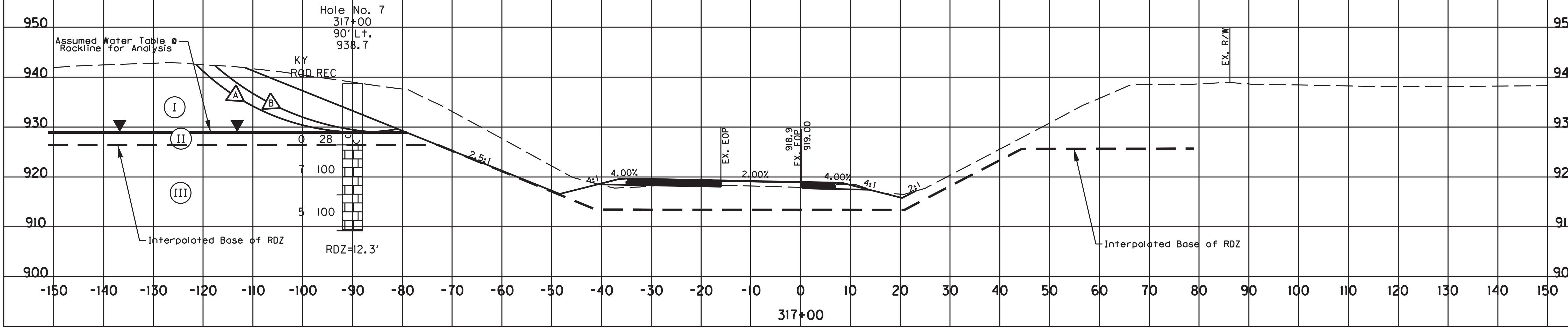
INTERMEDIATE TERM	A	2.4
LONG TERM	B	1.5

ASSUMED SOIL STRENGTH PARAMETERS

SOIL	I	II	III
INTERMEDIATE TERM	γ = 133 pcf $\bar{c}$ = 172 psf $\bar{\phi}$ = 25°	γ = 140 pcf $\bar{c}$ = 2000 psf $\bar{\phi}$ = 40°	γ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°
LONG TERM	γ = 133 pcf $\bar{c}$ = 34 psf $\bar{\phi}$ = 25°	γ = 140 pcf $\bar{c}$ = 2000 psf $\bar{\phi}$ = 40°	γ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°

Cut Limits from Sta. 314+00 to Sta. 319+60
Core Log Sta. 317+00, 90' Lt.

Elev.	
938.7-928.9	Overburden
928.9-926.4	Shale: brown with limestone
926.4-909.2	Limestone: gray with gray shale, close to moderate fracturing, heavy to medium weathering at fractures



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

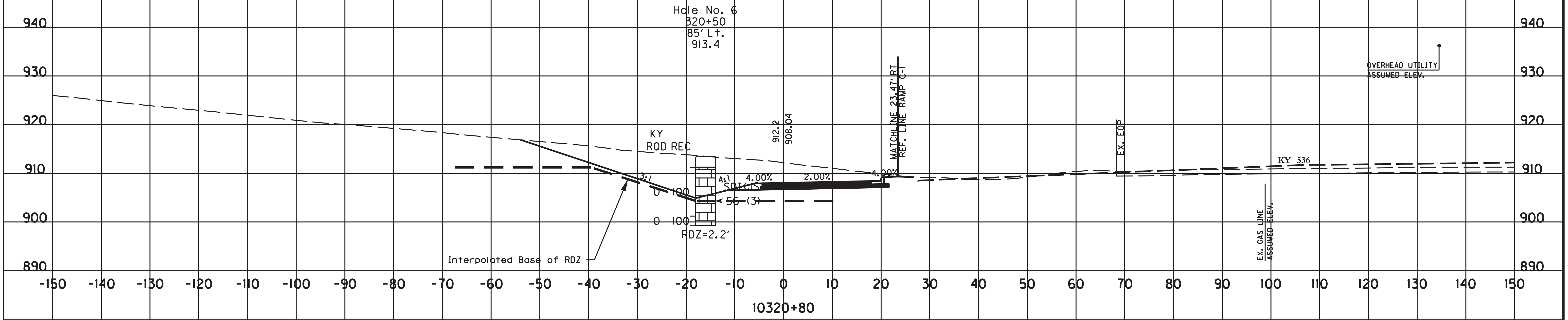
CUT STABILITY SECTION
RAMP C
STA 317+00

Addendum 2 - 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN
USER: kjmankin
DATE PLOTTED: July 12, 2017
E-SHEET NAME:
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

Cut Limits from Sta. 10319+80 to Sta. 10321+00
Core Log Ramp C, Sta. 320+50, 85′ Lt., or
approximate Ramp C-1, Sta. 10320+73, 16′ Lt.
Elev. 913.4-911.2 Overburden
911.2-899.2 Limestone: gray with gray shale, close to moderate fractures, heavy-medium weathering at fractures



SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT STABILITY SECTION
RAMP C-1
STA 10320+80

Addendum 2 -- 7-11-19

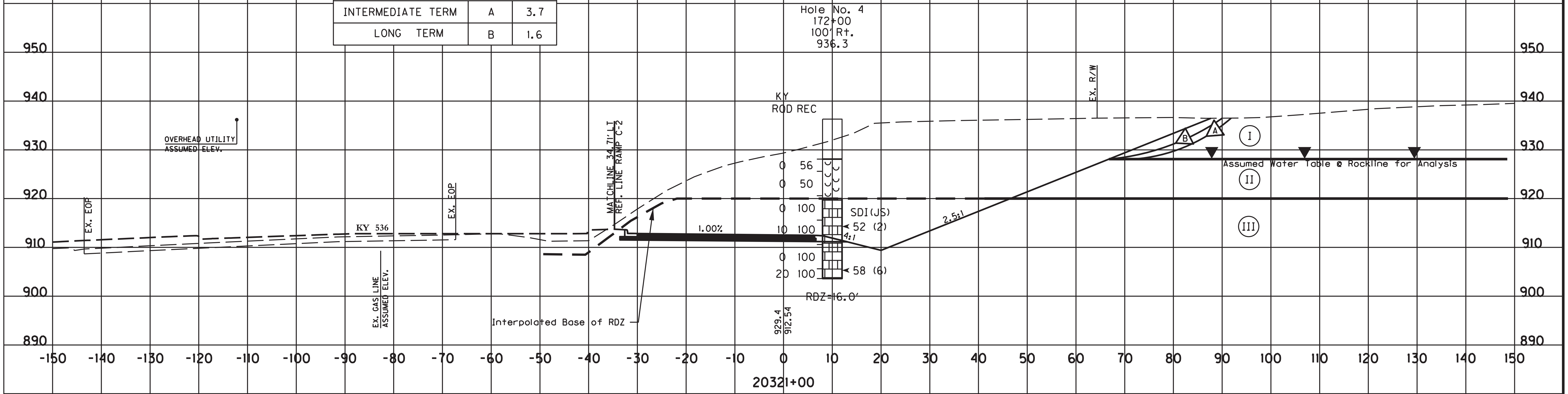
MicroStation v8.11.9.832
E-SHEET NAME:
USER: kjmankin
DATE PLOTTED: July 18, 2017
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

ASSUMED SOIL STRENGTH PARAMETERS			
SOIL	I	II	III
INTERMEDIATE TERM	γ = 128 pcf $\bar{c}$ = 307 psf $\bar{\phi}$ = 18°	γ = 140 pcf $\bar{c}$ = 2000 psf $\bar{\phi}$ = 40°	γ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°
LONG TERM	γ = 128 pcf $\bar{c}$ = 61 psf $\bar{\phi}$ = 18°	γ = 140 pcf $\bar{c}$ = 2000 psf $\bar{\phi}$ = 40°	γ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°

Cut Limits from Sta. 20319+80 to Sta. 20321+60
Core Log ML Sta. 172+00, 100′ Rt.
Elev. 936.3-928.1 Overburden
928.1-920.0 Shale: brown with limestone, close to moderate fracturing
920.0-903.6 Limestone: gray with gray shale layers, close fractures, heavy to medium weathering at fractures

FACTORS OF SAFETY		
INTERMEDIATE TERM	A	3.7
LONG TERM	B	1.6



SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT STABILITY SECTION
RAMP C-2
STA 20321+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN
USER: kjmankin
DATE PLOTTED: July 18, 2017
E-SHEET NAME:
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

Cut Limits from Sta. 10399+80 to Sta. 10402+40

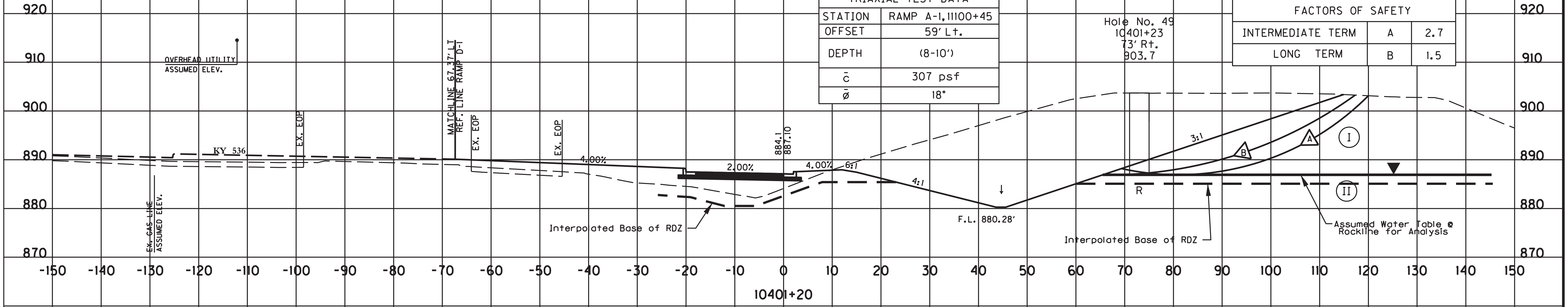
ASSUMED SOIL STRENGTH PARAMETERS		
SOIL	I	II
INTERMEDIATE TERM	γ̄ = 128 pcf c̄ = 307 psf φ̄ = 18°	γ̄ = 150 pcf c̄ = 4000 psf φ̄ = 45°
LONG TERM	γ̄ = 128 pcf c̄ = 61 psf φ̄ = 18°	γ̄ = 150 pcf c̄ = 3200 psf φ̄ = 45°

ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
ML 160+00	120' RT.	3.5'
RAMP D1 10400+00	20' RT.	3.5'

SUMMARY OF TRIAXIAL TEST DATA	
STATION	RAMP A-1, 11100+45
OFFSET	59' Lt.
DEPTH	(8-10')
c̄	307 psf
φ̄	18°

FACTORS OF SAFETY		
INTERMEDIATE TERM	A	2.7
LONG TERM	B	1.5



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

CUT STABILITY SECTION
RAMP D-1
STA 10401+20

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

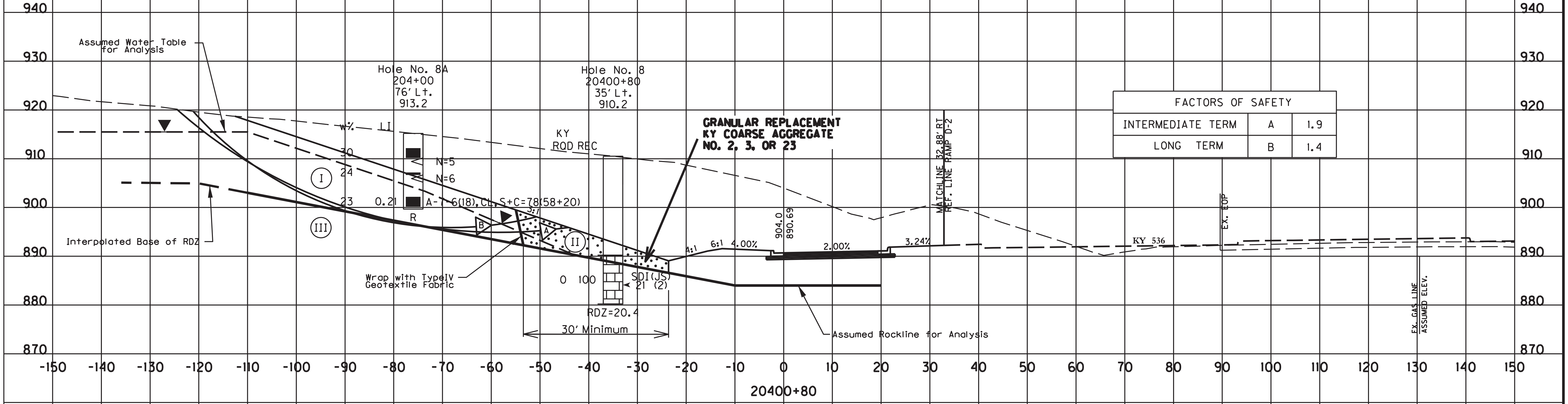
ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
ML 163+40	80′ RT.	11.7′
RAMP D2 20400+40	105′ LT.	18.6′
RAMP D2 20402+20	110′ LT.	25.5′

Cut Limits from Sta. 20399+20 to Sta. 20403+00
Core Log ML Sta. 20400+80, 35′ Lt.
Elev. 938.7-918.4 Overburden
918.4-908.4 Limestone: gray with gray shale layers, close fracturing, heavy weathering in fractures

ASSUMED SOIL STRENGTH PARAMETERS

SOIL	I	II	III
INTERMEDIATE TERM	γ = 128 pcf $\bar{c}$ = 172 psf $\bar{\phi}$ = 24°	γ = 125 pcf $\bar{c}$ = 0 psf $\bar{\phi}$ = 37°	γ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°
LONG TERM	γ = 128 pcf $\bar{c}$ = 34 psf $\bar{\phi}$ = 24°	γ = 125 pcf $\bar{c}$ = 0 psf $\bar{\phi}$ = 37°	γ = 150 pcf $\bar{c}$ = 3200 psf $\bar{\phi}$ = 45°



FACTORS OF SAFETY		
INTERMEDIATE TERM	A	1.9
LONG TERM	B	1.4

SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT STABILITY SECTION
RAMP D-2
STA 20400+80

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

Cut Limits from Sta. 20399+20 to Sta. 20403+00

ASSUMED SOIL STRENGTH PARAMETERS

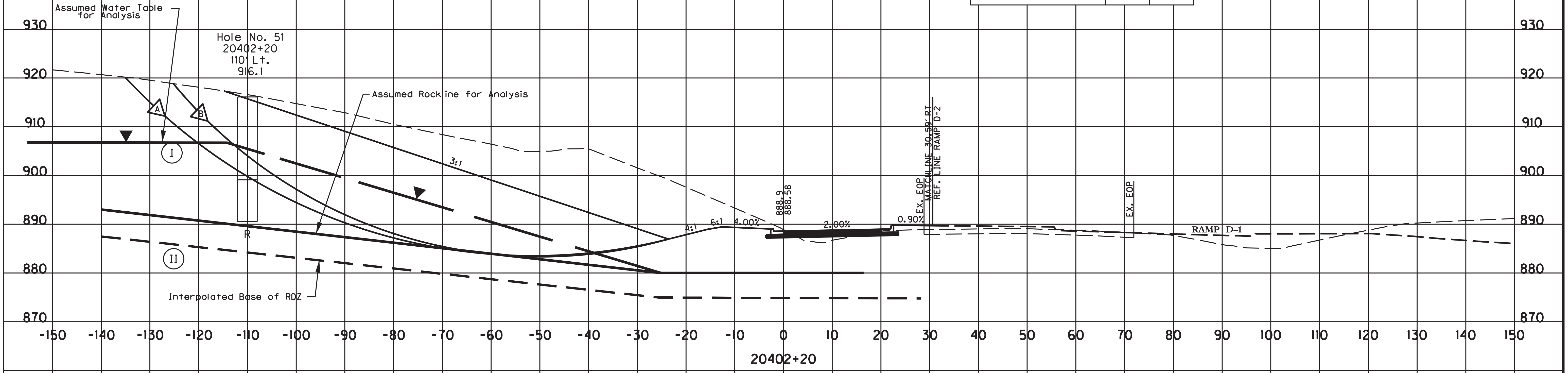
SOIL	I	II
INTERMEDIATE TERM	$\bar{\gamma}$ = 128 pcf $\bar{c}$ = 172 psf $\bar{\phi}$ = 24°	$\bar{\gamma}$ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°
LONG TERM	$\bar{\gamma}$ = 128 pcf $\bar{c}$ = 34 psf $\bar{\phi}$ = 24°	$\bar{\gamma}$ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°

ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
RAMP D2 20400+40	105′ LT.	18.6′

FACTORS OF SAFETY

INTERMEDIATE TERM	A	1.7
LONG TERM	B	1.4



SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT STABILITY SECTION
RAMP D-2
STA 20402+20

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

USER: kjmankin
DATE PLOTTED: June 5, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

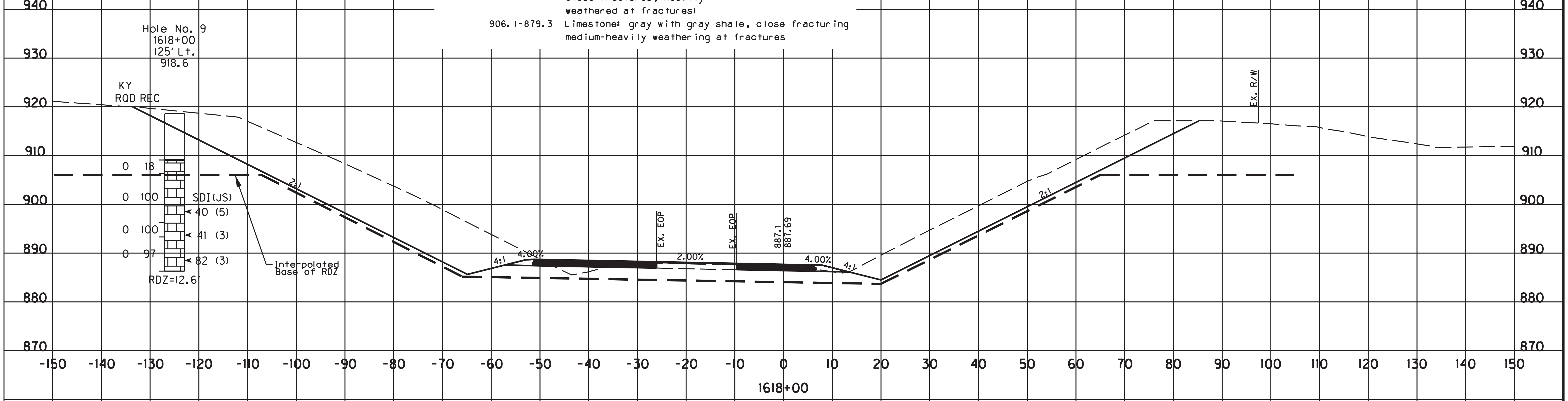
ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
1618+00	85' RT.	8'

Cut Limits from Sta. 1613+60 to Sta. 1621+00

Core Log Ramp F, Sta. 1618+00, 125' Lt.

Elev.	
918.6-909.1	Overburden
909.1-906.1	Limestone: gray with brown and gray shale, close fractures, heavily weathered at fractures)
906.1-879.3	Limestone: gray with gray shale, close fracturing medium-heavily weathering at fractures



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

CUT STABILITY SECTION
RAMP F
STA 1618+00

Addendum 2 - 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

USER: kjmankin
DATE PLOTTED: July 18, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

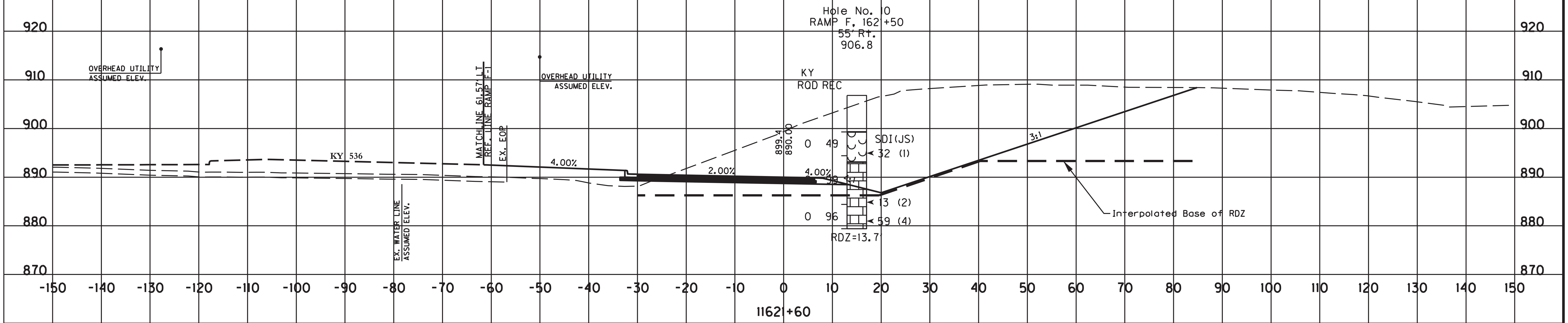
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

Cut Limits from Sta. 11620+80 to Sta. 11623+00
Core Log Ramp F, Sta. 1621+50, 55' Rt., or
approximately Ramp F-1, Sta. 11621+67, 15' Rt.

Elev.	
906.8-899.3	Overburden
899.3-893.1	Shale: brown with limestone layers
893.1-879.4	Limestone: gray with shale layers, close fractures, heavily weathered at fractures

ADDITIONAL ROCKLINE SOUNDINGS

STATION	OFFSET	DEPTH TO REFUSAL
MAINLINE 161+00	70' LT.	6'



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

CUT STABILITY SECTION
RAMP F-1
STA 11621+60

MicroStation v8.11.9.832

E-SHEET NAME:

USER: kjmankin
DATE PLOTTED: July 18, 2017

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

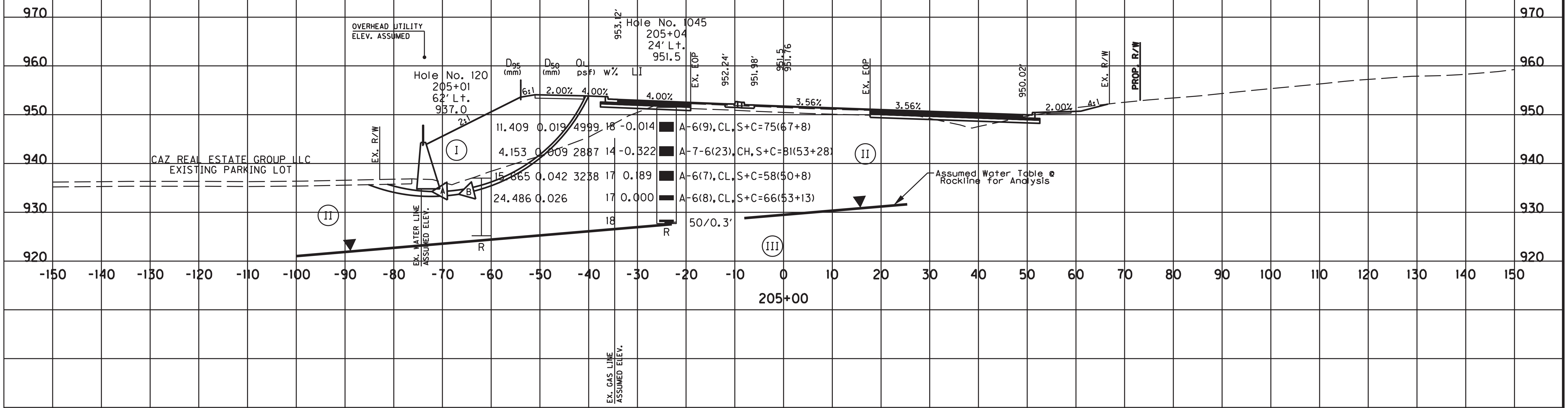
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

SUMMARY OF TRIAXIAL TEST DATA	
STATION	RAMP A-1, 11100+45
OFFSET	59' Lt.
DEPTH	(8-10')
c	374 psf
ϕ	12°
$\bar{c}$	307 psf
$\bar{\phi}$	18°

ASSUMED SOIL STRENGTH PARAMETERS

SOIL	I	II	III
SHORT TERM	γ = 115 pcf c = 0 psf ϕ = 37°	γ = 128 pcf c = 374 psf ϕ = 12°	γ = 140 pcf c = 2000 psf ϕ = 40°
LONG TERM	γ = 115 pcf $\bar{c}$ = 0 psf $\bar{\phi}$ = 37°	γ = 128 pcf $\bar{c}$ = 307 psf $\bar{\phi}$ = 18°	γ = 140 pcf $\bar{c}$ = 2000 psf $\bar{\phi}$ = 40°

FACTORS OF SAFETY		
SHORT TERM	A	1.6
LONG TERM	B	1.7



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

EMBANKMENT STABILITY SECTION
KY 536
STA 205+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

USER: kjmankin
DATE PLOTTED: July 13, 2017

E-SHEET NAME:

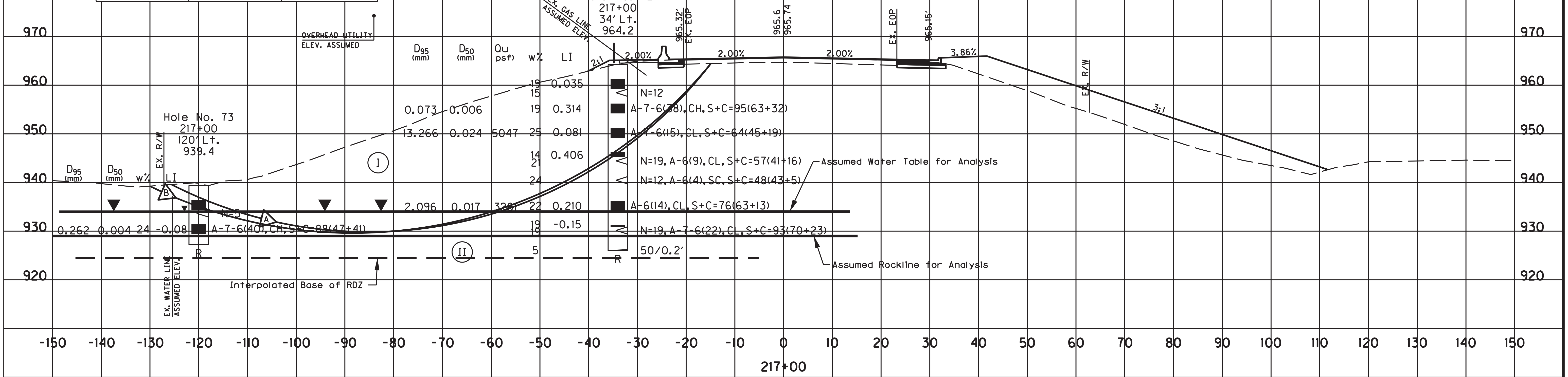
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	

ASSUMED SOIL STRENGTH PARAMETERS		
SOIL	I	II
SHORT TERM	γ = 128 pcf $\bar{c}$ = 374 psf $\bar{\phi}$ = 12°	γ = 150 pcf $\bar{c}$ = 4000 psf $\bar{\phi}$ = 45°
LONG TERM	γ = 128 pcf $\bar{c}$ = 307 psf $\bar{\phi}$ = 18°	γ = 150 pcf $\bar{c}$ = 3200 psf $\bar{\phi}$ = 45°

FACTORS OF SAFETY		
SHORT TERM	A	1.7
LONG TERM	B	2.0

SUMMARY OF TRIAXIAL TEST DATA	
STATION	RAMP A-1, 11100+45
OFFSET	59' Lt.
DEPTH	(8-10')
$\bar{c}$	307 psf
$\bar{\phi}$	18°



SCALE: 1" = 10' HORIZONTAL
1" = 10' VERTICAL

EMBANKMENT STABILITY SECTION
KY 536
STA 217+00

Addendum 2 -- 7-11-19

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

USER: kjmankin
DATE PLOTTED: July 6, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

APPENDIX C

LABORATORY TEST DATA

Summary of Undisturbed Soil Testing
Summary of Rock Tests
Laboratory Test Plots: Unconfined Compression Tests and Consolidated-Undrained Triaxial Compression Tests

SUMMARY OF UNDISTURBED SOIL TESTING

Job Name Reconstruct I-75 Interchange with KY 536
County Boone
Item No. 6-14.00

Terracon Project No. N1155079
Date: 2/23/2017

Terracon

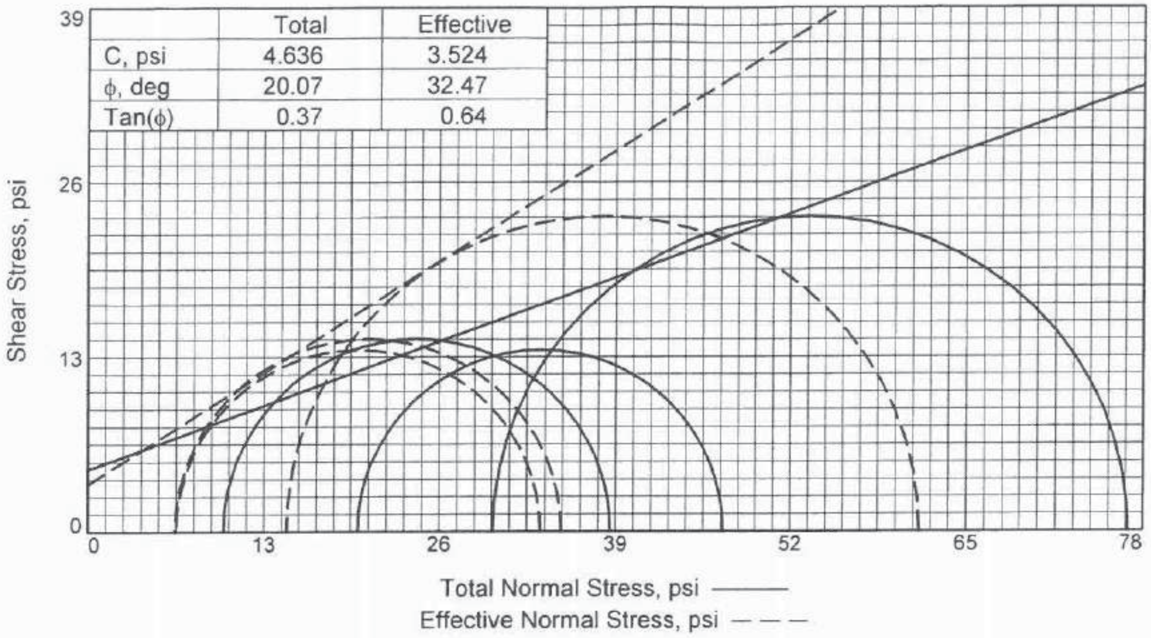
Boring No.	STA	Offset	Boring Type	Depth, ft.	Liquid Limit, LL	Plastic Limit, PL	Plasticity Index, PI	Unified Classification	Textural	AASHTO Classification	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	c (psf)	Ø (degrees)	c' (psf)	Ø' (degrees)
RAMP A1																	
5A	11100+45	59' LT	UB	3 - 5	29	16	13	CL	Sandy Lean Clay	A-6(9)	19.3	109.5	N/A	668	20.1	507	32.5
5A	11100+45	59' LT	UB	8 - 10	48	17	20	CL	Lean Clay	A-7-6(24)	23.3	100.6	N/A	374	12.2	307	18
5A	11100+45	59' LT	UB	13 -14.2	44	20	24	CL	Lean Clay	A-7-6(25)	24.7	100.9	N/A	0	21.6	0	32.3
RAMP D2																	
8A	20400+80	76' LT	UB	13-15	42	18	24	CL	Lean Clay	A-7-6(18)	16.6	113.7	N/A	59	20.1	172	24.5
BILTMORE CONNECTOR																	
57	28+50	7' LT	Pav't Core	0.9 - 2.9	39	17	22	CL	Lean Clay	A-6(19)	27.2	97.0	1522	N/A	N/A	N/A	N/A
SAM NEACE DRIVE																	
58	15+60	25' RT	Pav't Core	1 - 3	46	16	30	CL	Sandy Lean Clay	A-7-6(13)	17.9	112.0	2663	N/A	N/A	N/A	N/A
US 25																	
59	500+60	25' RT	Pav't Core	0.8 - 2.8	44	17	27	CL	Lean Clay	A-7-6(22)	23.1	105.5	2747	N/A	N/A	N/A	N/A
60	503+60	12' LT	Pav't Core	1.5 - 3.5	38	19	19	CL	Sandy Lean Clay	A-6(9)	18.3	108.1	3395	N/A	N/A	N/A	N/A
61	507+80	8' LT	Pav't Core	2 - 4	36	23	13	CL	Lean Clay	A-6(13)	27.0	91.7	1629	N/A	N/A	N/A	N/A
MAINLINE																	
72	217+00	34' LT	UB	8 - 10	55	18	37	CH	Fat Clay	A-7-6(38)	26.4	98.2	N/A	826	7.5	763	11.1
72	217+00	34' LT	UB	13 - 15	44	16	28	CL	Sandy Lean Clay	A-7-6(15)	19.3	109.8	5047	N/A	N/A	N/A	N/A
72	217+00	34' LT	UB	28 -30	38	18	20	CL	Lean Clay	A-6(14)	21.4	104.1	3261	N/A	N/A	N/A	N/A

Summary of Rock Tests

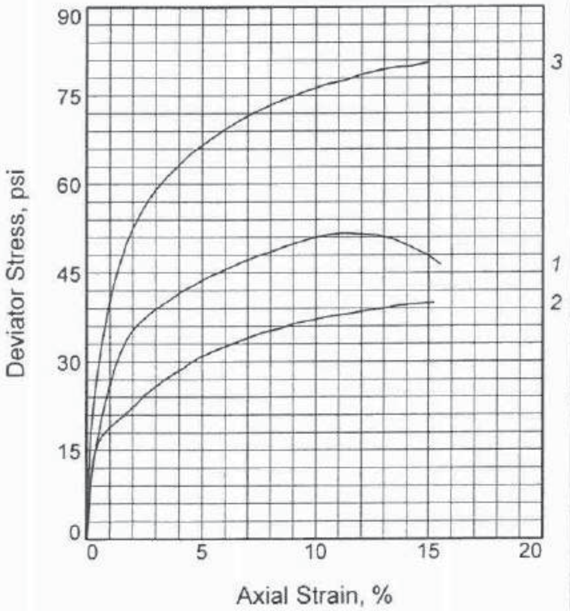
Job Name Reconstruct I-75 Interchange with KY 536
County Boone
Item No. 6-14.00

Terracon Project No. N1155079
Date: 2/27/2017

Boring No.	STA	Offset, ft.	Elev., ft.	Depth (ft.)	Material Description	SDI	JS	Rock Type (1)
Mainline								
1	160+00	-90	900.56	12.6-13.1	Brown & Gray Shale	18.1	1	Non-Durable Shale, Class III by both SDI and JS
1				18-18.5	Gray Shale	38.8	1	Non-Durable Shale, Class III by both SDI and JS
3	170+00	-94	917.6	8.1-8.5	Gray Shale	16.5	1	Non-Durable Shale, Class III by both SDI & JS
3				16.2-16.9	Gray Shale	4.8	2	Non-Durable Shale, Class III by both SDI & JS
3				21.5-21.9	Gray Shale	46.2	3	Non-Durable Shale, Class III by SDI and Class II by JS
3				26.9-27.4	Gray Shale	42.0	5	Non-Durable Shale, Class III by SDI & Class I by JS
3				33.2-33.7	Gray Shale	70.9	5	Non-Durable Shale, Class II by SDI & Class I by JS
4	172+00	100	936.2	21.8-22.2	Gray Shale	51.7	2	Non-Durable Shale, Class II by SDI & Class III by JS
4				30.7-31.3	Gray Shale	57.9	6	Non-Durable Shale, Class II by SDI & Durable Shale by JS
Ramp A1								
5	11100+39	-29	925	17.5-18.2	Gray Shale	12.4	5	Non-Durable Shale, Class III by SDI & Class I by JS
5				23.4-24.1	Gray Shale	17.5	2	Non-Durable Shale, Class III by both SDI and JS
Ramp C								
6	320+50	-85	913.4	9-9.4	Gray Shale	56.3	3	Non-Durable Shale, Class II by both SDI and JS
Ramp D2								
8	20400+80	-35	910.2	26.2-26.6	Gray Shale	21.0	2	Non-Durable Shale, Class III by both SDI and JS
Ramp F								
9	1618+00	-125	918.6	19.1-19.6	Gray Shale	39.7	5	Non-Durable Shale, Class III by SDI & Class I by JS
9				25.2-25.7	Gray Shale	41.5	3	Non-Durable Shale, Class III by SDI and Class II by JS
9				31.5-32	Gray Shale	82.4	3	Non-Durable Shale, Class I by SDI & Class II by JS
10	1621+50	55	906.8	12.5-12.9	Brown Weath. Shale	32.0	1	Non-Durable Shale, Class III by both SDI and JS
10				19.6-20.2	Gray Shale	13.1	2	Non-Durable Shale, Class III by both SDI and JS
10				25.6-26	Gray Shale	58.8	4	Non-Durable Shale, Class II by both SDI and JS
Notes	(1) Ref. KYTC GT-504							
	SD = Slake Durabilty; JS = Jar Slake							
	Per KYTC GT-608-2, typical rock cut slopes for Class III nondurable shale is 2H:1V or flatter from groundline to ditchline. Normally, these slopes are designed without a roadside ditch bench, intermediate benches, or overburden benches.							



	Total	Effective
C, psi	4.636	3.524
φ, deg	20.07	32.47
Tan(φ)	0.37	0.64



	Sample No.	1	2	3
Initial	Water Content, %	19.3	19.5	18.9
	Dry Density, pcf	109.5	105.4	110.1
	Saturation, %	99.8	90.1	98.9
	Void Ratio	0.5142	0.5731	0.5067
	Diameter, in.	2.861	2.857	2.871
	Height, in.	5.735	5.026	5.721
At Test	Water Content, %	17.9	17.6	17.7
	Dry Density, pcf	112.4	113.0	112.8
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4756	0.4677	0.4705
	Diameter, in.	2.836	2.791	2.848
	Height, in.	5.686	4.912	5.675
	Strain rate, in./min.	0.001	0.001	0.001
	Back Pressure, psi	50.00	50.00	50.00
	Cell Pressure, psi	60.00	70.00	80.00
	Fail. Stress, psi	28.61	27.00	46.87
	Excess Pore Pr., psi	3.60	13.50	15.30
	Ult. Stress, psi			
	Excess Pore Pr., psi			
	$\bar{\sigma}_1$ Failure, psi	35.01	33.50	61.57
	$\bar{\sigma}_3$ Failure, psi	6.40	6.50	14.70

Type of Test:
CU with Pore Pressures

Sample Type: ST

Description: BROWN SANDY LEAN CLAY WITH SAND

LL= 28.9 **PL=** 16.1 **PI=** 12.8

Assumed Specific Gravity= 2.656

Remarks:

Exhibit 2720

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY) CINCINNATI

Source of Sample: 5A **Depth:** ~~1.9'~~ 3-5'

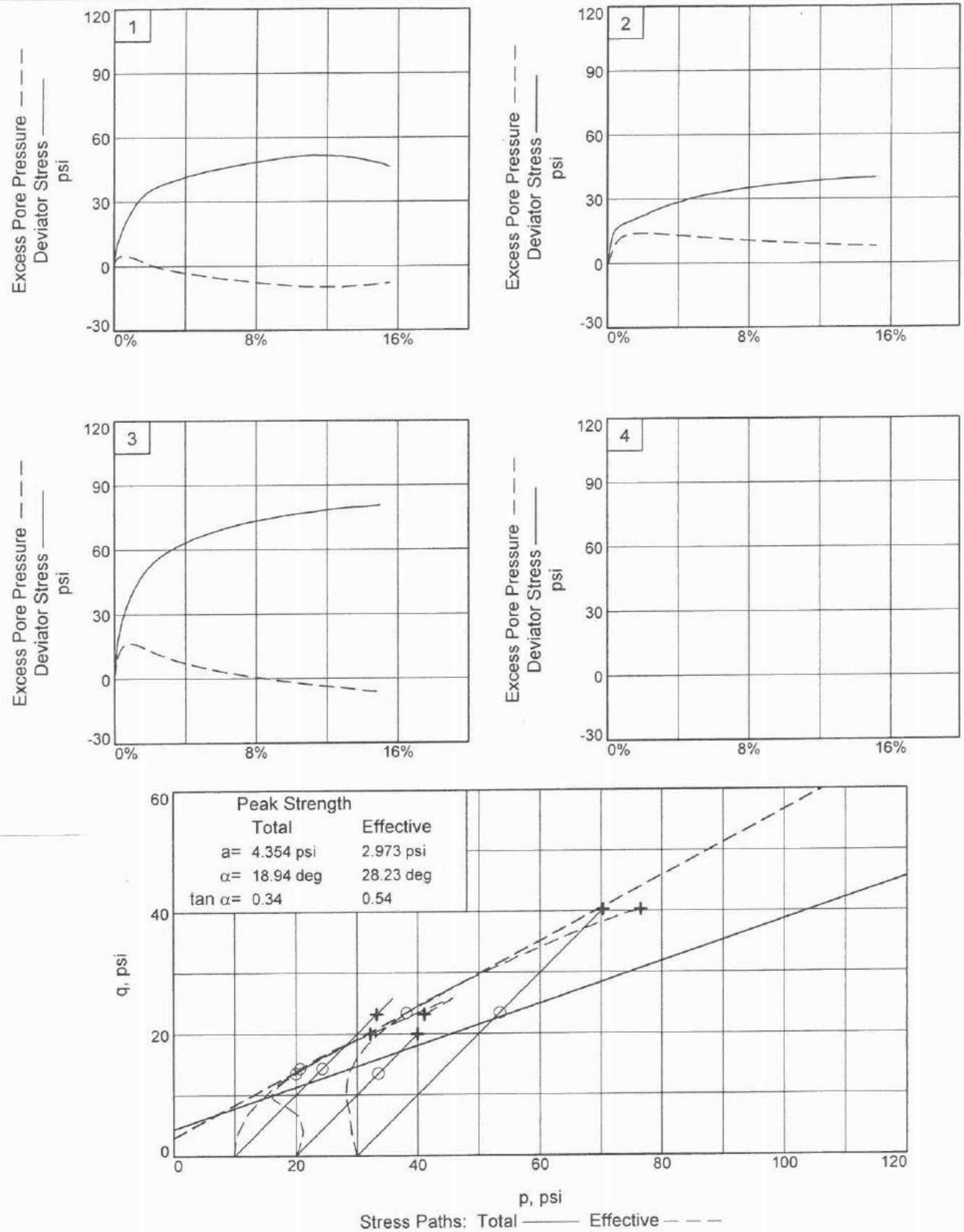
Sample Number: ST-1

Proj. No.: N1155079 **Date Sampled:** 6-15-16

TRIAXIAL SHEAR TEST REPORT

Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE **Checked By:** GS



Peak Strength

	Total	Effective
a=	4.354 psi	2.973 psi
α=	18.94 deg	28.23 deg
tan α=	0.34	0.54

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)

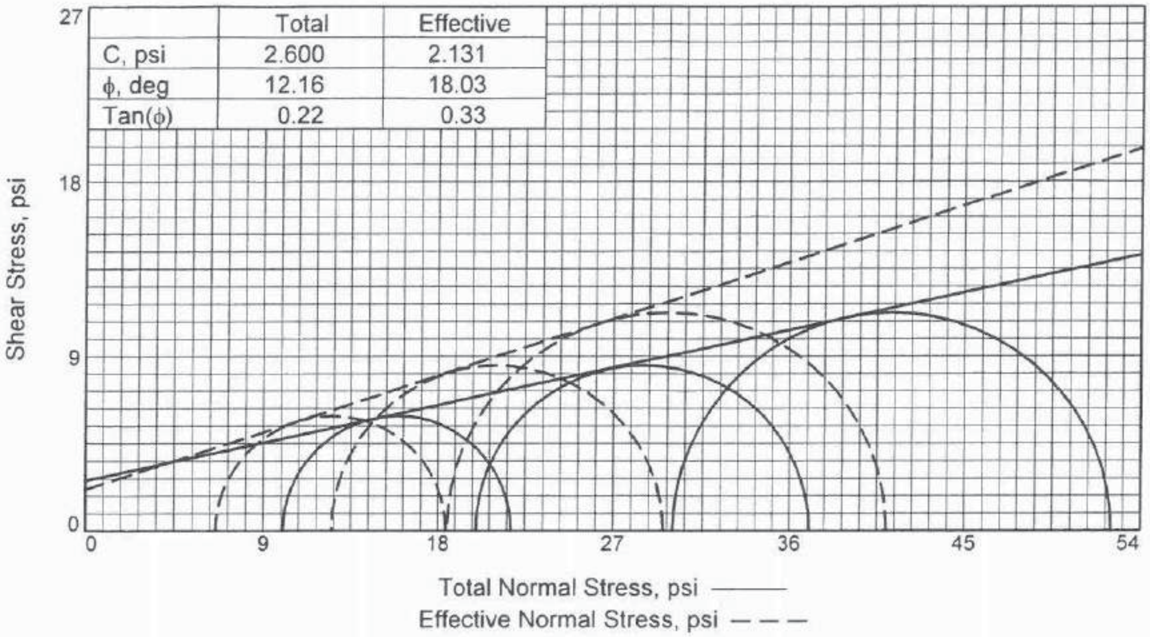
Source of Sample: 5A **Depth:** ~~1.9'~~ 3-5' **Sample Number:** ST-1

Project No.: N1155079 **Exhibit** ______

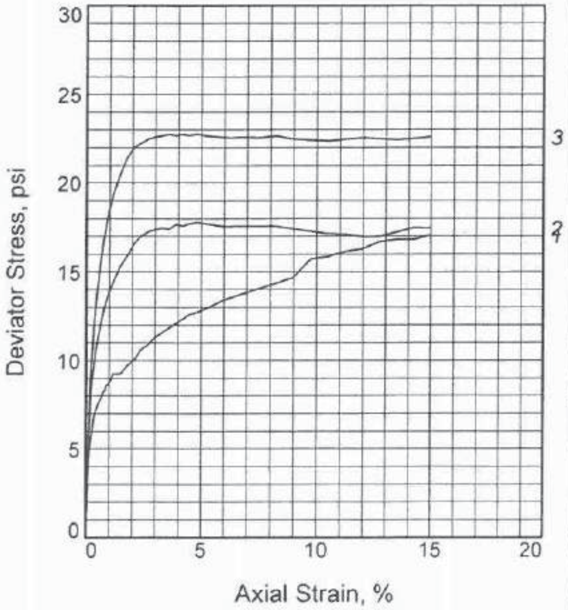
Terracon, Inc.

Tested By: FCE **Checked By:** GS

Addendum 2 -- 7-11-19



	Total	Effective
C, psi	2.600	2.131
ϕ, deg	12.16	18.03
Tan(ϕ)	0.22	0.33



Sample No.		1	2	3
Initial	Water Content, %	23.3	24.1	25.4
	Dry Density, pcf	100.6	100.9	97.2
	Saturation, %	99.6	103.9	99.5
	Void Ratio	0.6042	0.5999	0.6613
	Diameter, in.	2.882	2.900	2.894
	Height, in.	5.763	5.776	5.776
At Test	Water Content, %	22.0	21.5	22.4
	Dry Density, pcf	102.8	103.8	102.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5702	0.5553	0.5802
	Diameter, in.	2.861	2.873	2.846
	Height, in.	5.722	5.722	5.681
Strain rate, in./min.		0.000	0.000	0.000
Back Pressure, psi		60.00	60.00	60.00
Cell Pressure, psi		70.00	80.00	90.00
Fail. Stress, psi		11.82	17.02	22.49
Excess Pore Pr., psi		3.40	7.50	11.50
Ult. Stress, psi				
Excess Pore Pr., psi				
$\bar{\sigma}_1$ Failure, psi		18.42	29.52	40.99
$\bar{\sigma}_3$ Failure, psi		6.60	12.50	18.50

Type of Test:
CU with Pore Pressures

Sample Type: ST

Description: DARK BROWN LEAN CLAY WITH SAND

LL= 48.1 **PL=** 17.2 **PI=** 30.9

Specific Gravity= 2.586

Remarks:

Exhibit 2721

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY) CINCINNATI

Source of Sample: 5A **Depth:** ~~2.0'~~ 8-10'

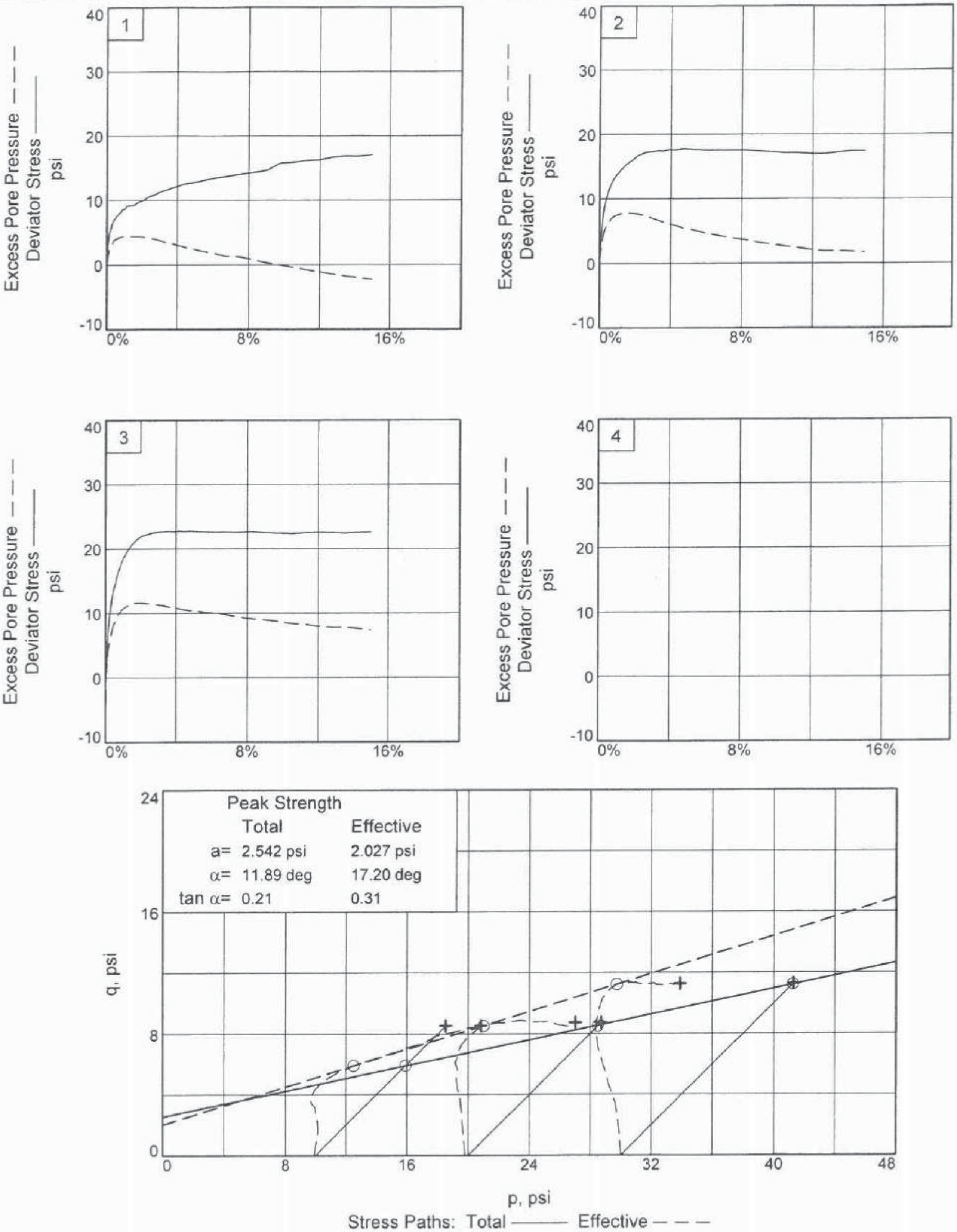
Sample Number: ST-2

Proj. No.: N1155079 **Date Sampled:** 6-24-16

TRIAXIAL SHEAR TEST REPORT

Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE **Checked By:** GS



Peak Strength

	Total	Effective
a=	2.542 psi	2.027 psi
α=	11.89 deg	17.20 deg
tan α=	0.21	0.31

Client: KTC

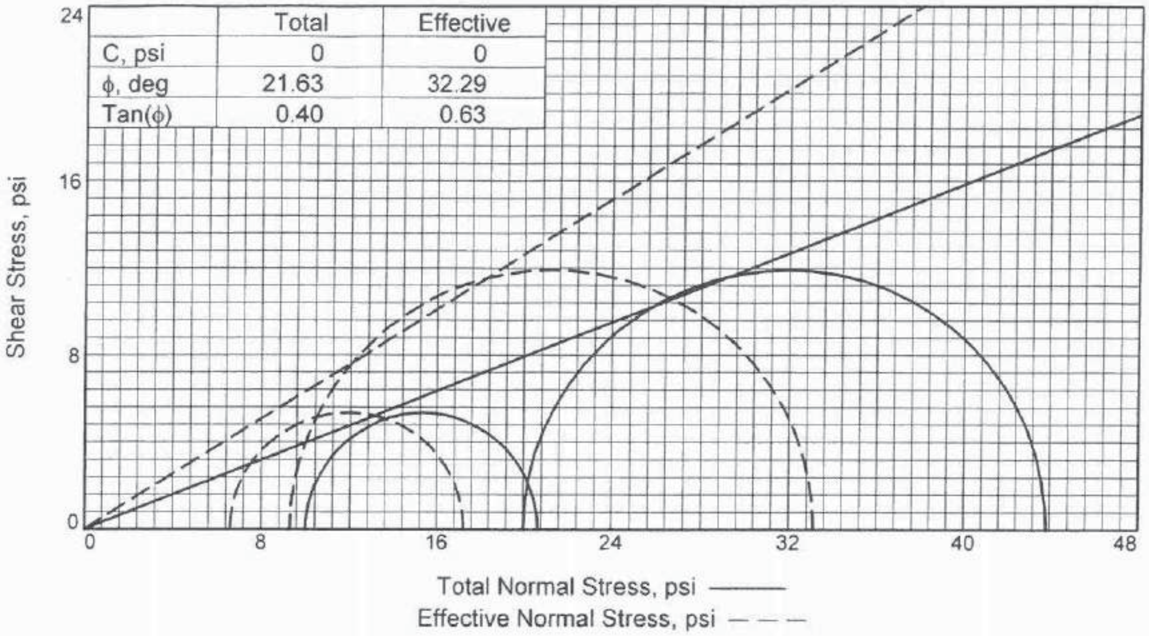
Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)

Source of Sample: 5A **Depth:** ~~2.0'~~ 8-10' **Sample Number:** ST-2

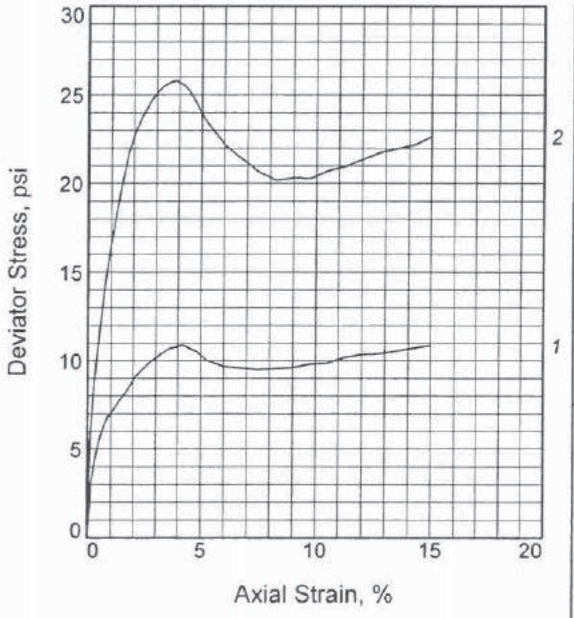
Project No.: N1155079 **Exhibit** ______

Terracon, Inc.

Tested By: FCE **Checked By:** GS



	Total	Effective
C, psi	0	0
ϕ, deg	21.63	32.29
Tan(ϕ)	0.40	0.63



	Sample No.	1	2
Initial	Water Content, %	24.7	22.0
	Dry Density, pcf	100.9	104.5
	Saturation, %	99.5	96.8
	Void Ratio	0.6709	0.6128
	Diameter, in.	2.905	2.863
	Height, in.	5.727	5.724
At Test	Water Content, %	24.1	19.8
	Dry Density, pcf	102.0	109.9
	Saturation, %	100.0	100.0
	Void Ratio	0.6517	0.5334
	Diameter, in.	2.894	2.815
	Height, in.	5.705	5.629
	Strain rate, in./min.	0.000	0.000
	Back Pressure, psi	60.00	60.00
	Cell Pressure, psi	70.00	80.00
	Fail. Stress, psi	10.67	23.84
	Excess Pore Pr., psi	3.40	10.70
	Ult. Stress, psi		
	Excess Pore Pr., psi		
	$\bar{\sigma}_1$ Failure, psi	17.27	33.14
	$\bar{\sigma}_3$ Failure, psi	6.60	9.30

Type of Test:
CU with Pore Pressures

Sample Type: ST

Description: DARK BROWN LEAN CLAY

LL= 44.3 **PL=** 19.8 **PI=** 24.5

Specific Gravity= 2.70

Remarks:

Exhibit 2722

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)
CINCINNATI

Source of Sample: 5A **Depth:** ~~1.2~~ 13-14.2

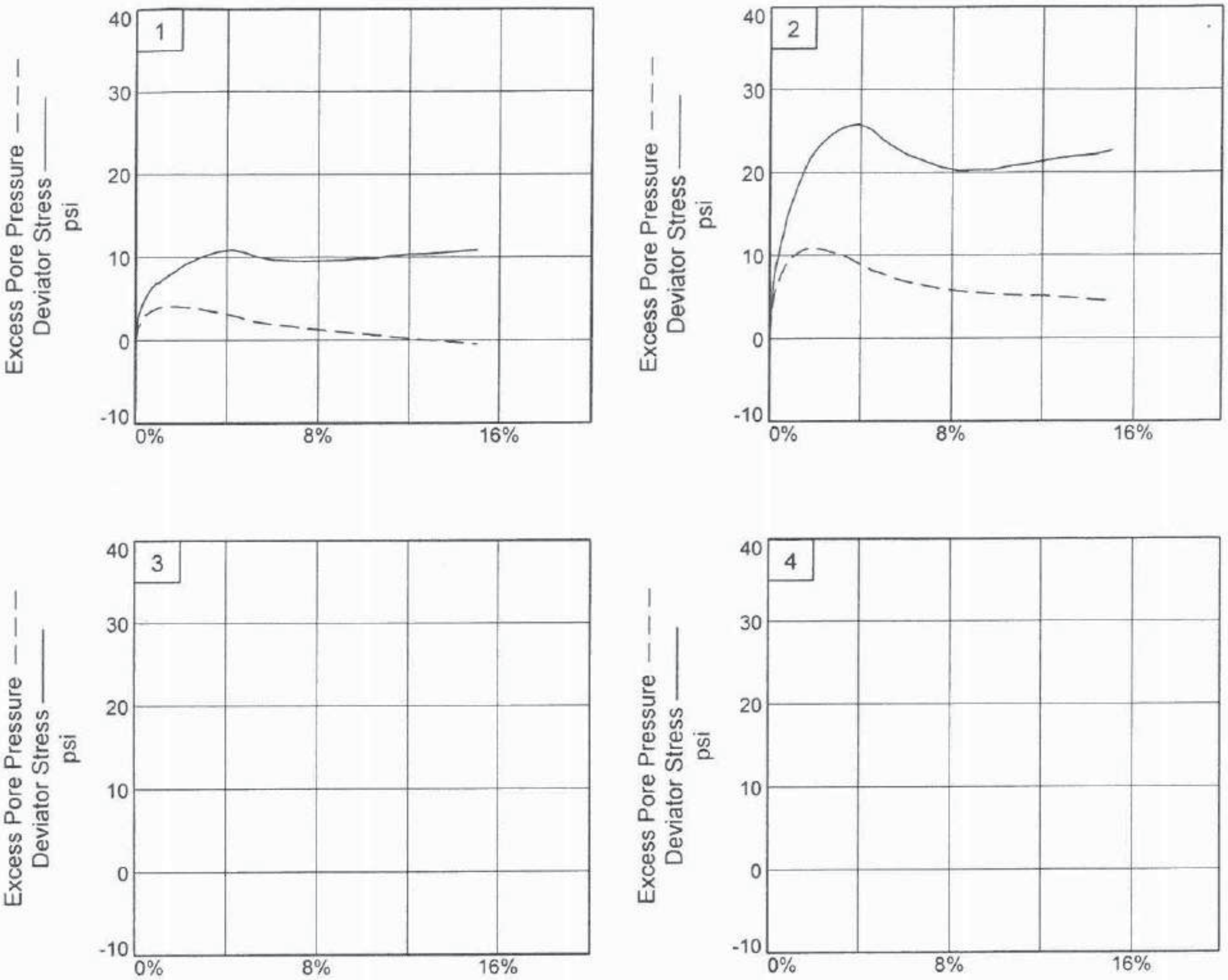
Sample Number: ST-3

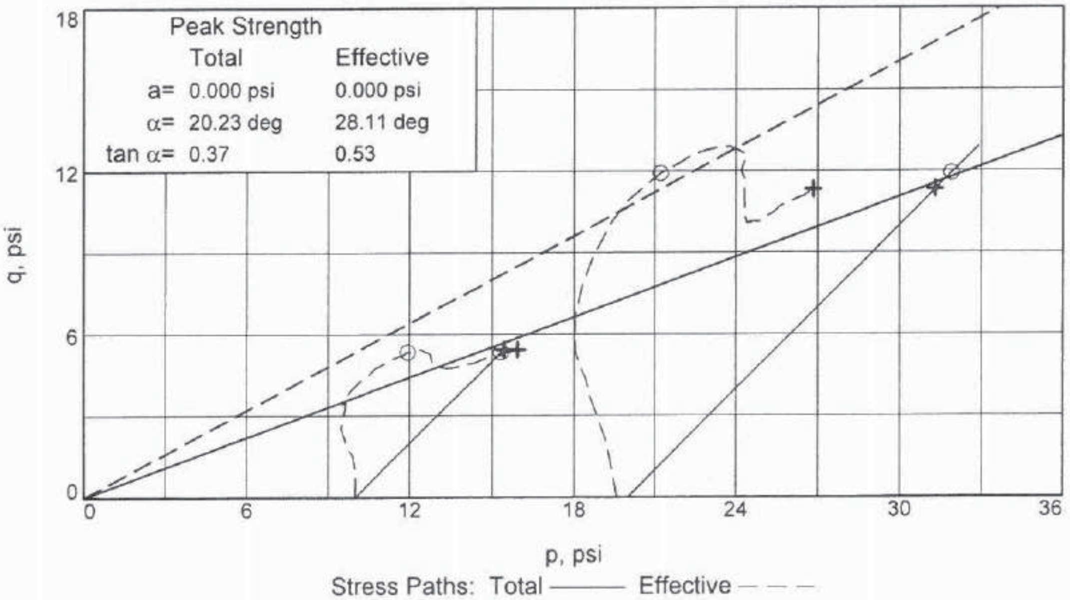
Proj. No.: N1155079 **Date Sampled:** 6-24-16

TRIAXIAL SHEAR TEST REPORT

Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE **Checked By:** GS





Client: KTC

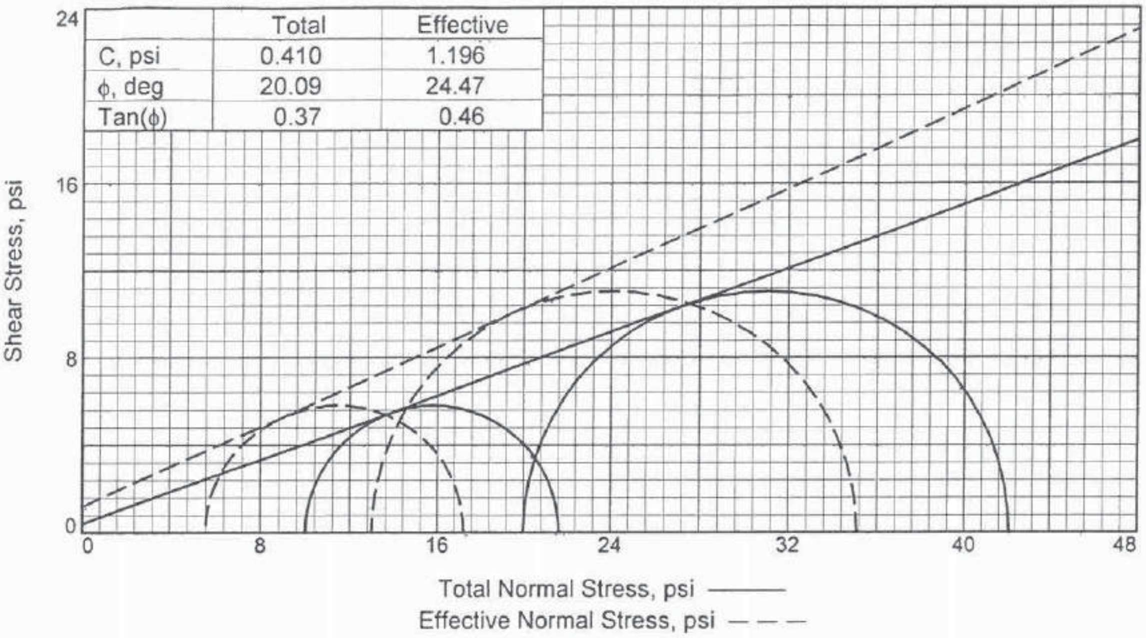
Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)

Source of Sample: 5A **Depth:** ~~1.2'~~ 13-14.2' **Sample Number:** ST-3

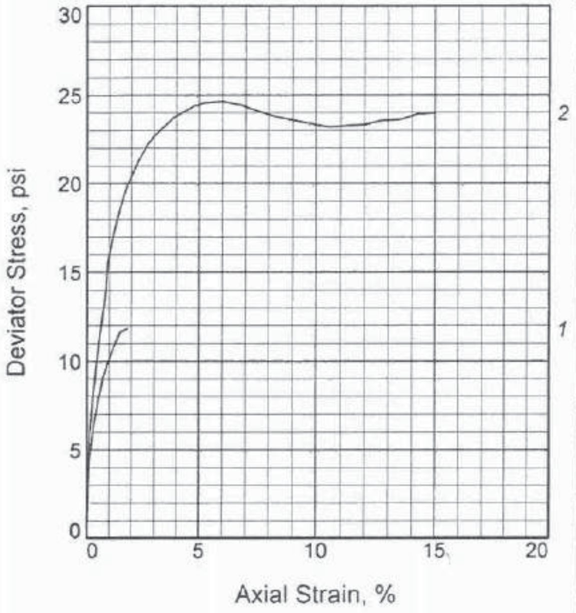
Project No.: N1155079 **Exhibit** ______

Terracon, Inc.

Tested By: FCE **Checked By:** GS



	Total	Effective
C, psi	0.410	1.196
ϕ, deg	20.09	24.47
Tan(ϕ)	0.37	0.46



	Sample No.	1	2
Initial	Water Content, %	16.6	16.6
	Dry Density, pcf	113.7	113.7
	Saturation, %	97.0	97.0
	Void Ratio	0.4541	0.4541
	Diameter, in.	2.867	2.867
	Height, in.	5.802	5.802
At Test	Water Content, %	16.9	16.4
	Dry Density, pcf	114.3	115.2
	Saturation, %	100.0	100.0
	Void Ratio	0.4466	0.4352
	Diameter, in.	2.862	2.881
	Height, in.	5.792	5.672
	Strain rate, in./min.	0.000	0.000
	Back Pressure, psi	60.00	60.00
	Cell Pressure, psi	70.00	80.00
	Fail. Stress, psi	11.64	22.10
	Excess Pore Pr., psi	4.40	7.00
	Ult. Stress, psi		
	Excess Pore Pr., psi		
	$\bar{\sigma}_1$ Failure, psi	17.24	35.10
	$\bar{\sigma}_3$ Failure, psi	5.60	13.00

Type of Test:
CU with Pore Pressures

Sample Type: ST

Description: BROWN LEAN CLAY WITH SAND

LL= 42 **PL=** 18 **PI=** 24

Specific Gravity= 2.648

Remarks:

Figure 2727

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)
CINCINNATI

Source of Sample: 8A **Depth:** 13-15'

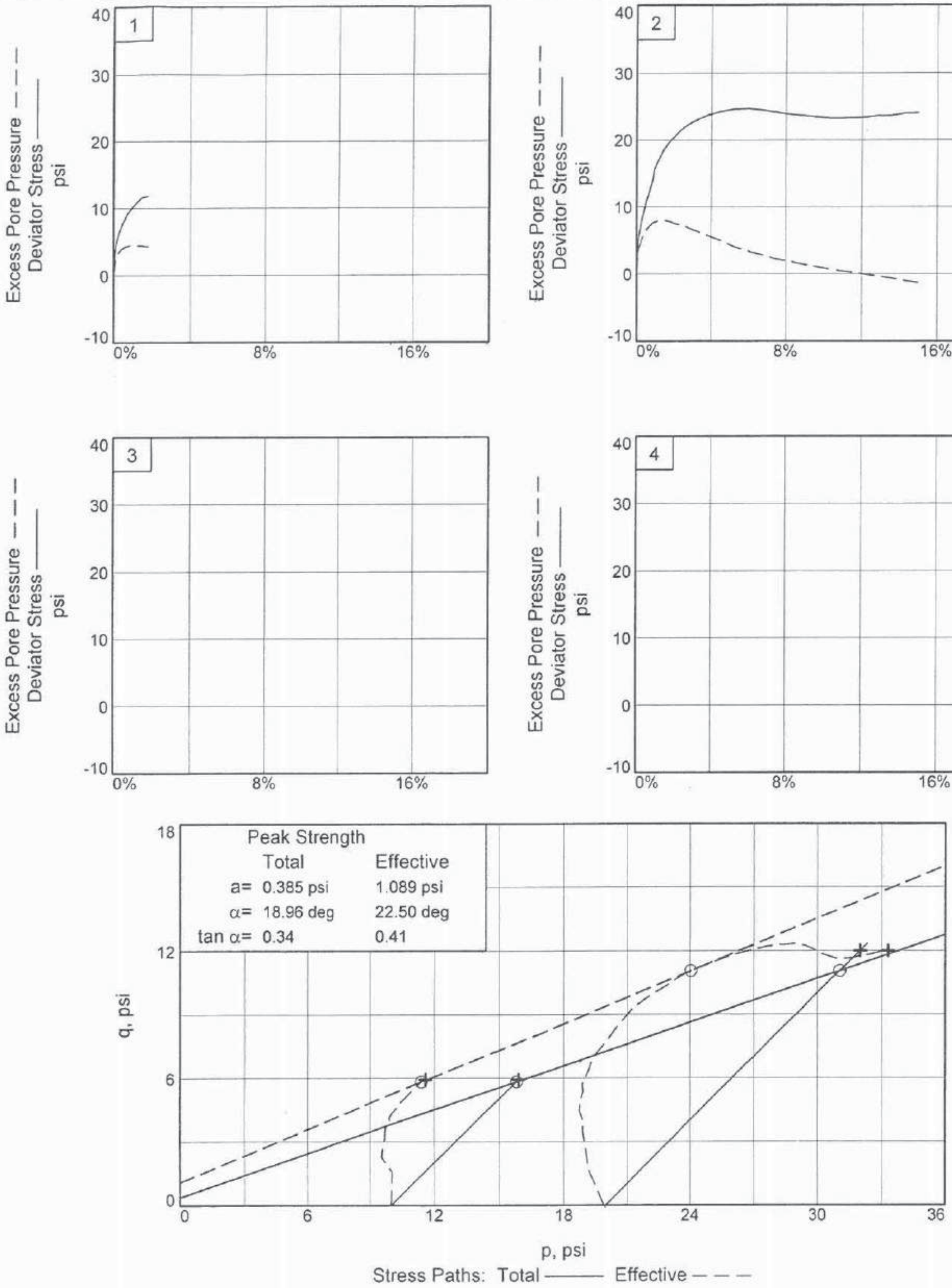
Sample Number: ST-5

Proj. No.: N1155079 **Date Sampled:** 6-21-16

TRIAXIAL SHEAR TEST REPORT

Terracon, Inc.
Cincinnati, Ohio

Tested By: FCE **Checked By:** GS



Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)

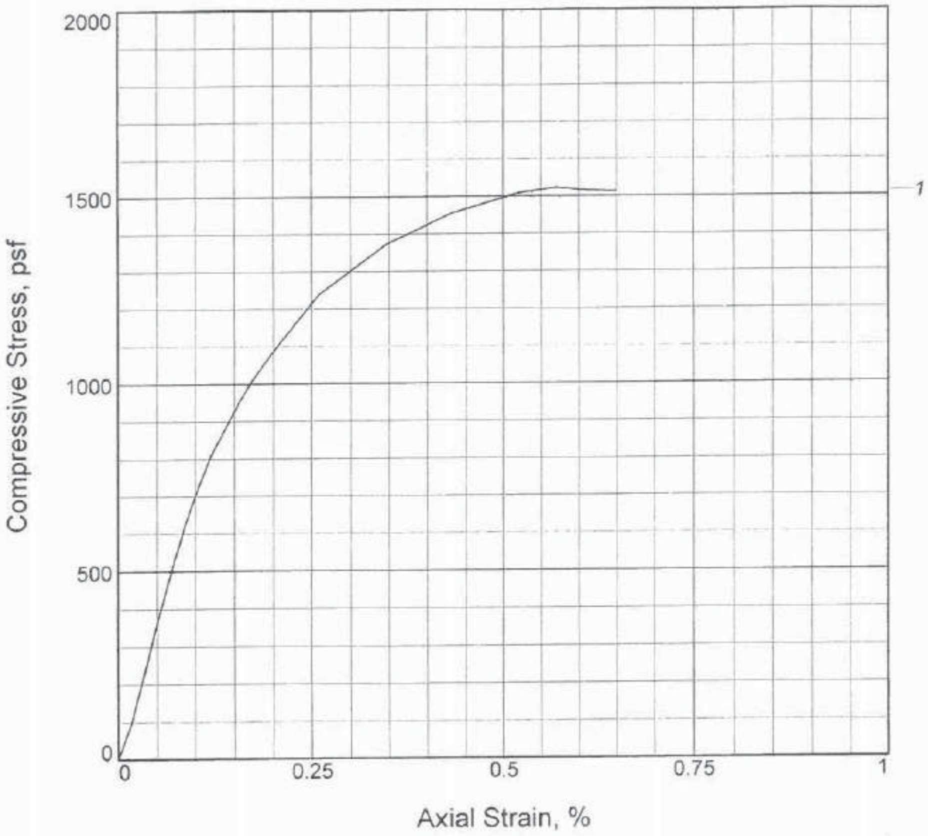
Source of Sample: 8A **Depth:** 13-15' **Sample Number:** ST-5

Project No.: N1155079 **Figure** ________

Terracon, Inc.

Tested By: FCE **Checked By:** GS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	1522.2			
Undrained shear strength, psf	761.1			
Failure strain, %	0.6			
Strain rate, in./min.	0.057			
Water content, %	27.2			
Wet density, pcf	123.4			
Dry density, pcf	97.0			
Saturation, %	98.8			
Void ratio	0.7480			
Specimen diameter, in.	2.860			
Specimen height, in.	5.770			
Height/diameter ratio	2.02			

Description: BROWN LEAN CLAY

LL = 39	**PL =** 17	**PI =** 22	**GS=** 2.716	**Type:** ST

Project No.: N1155079
Date Sampled: 7-21-16
Remarks:

Figure 4384

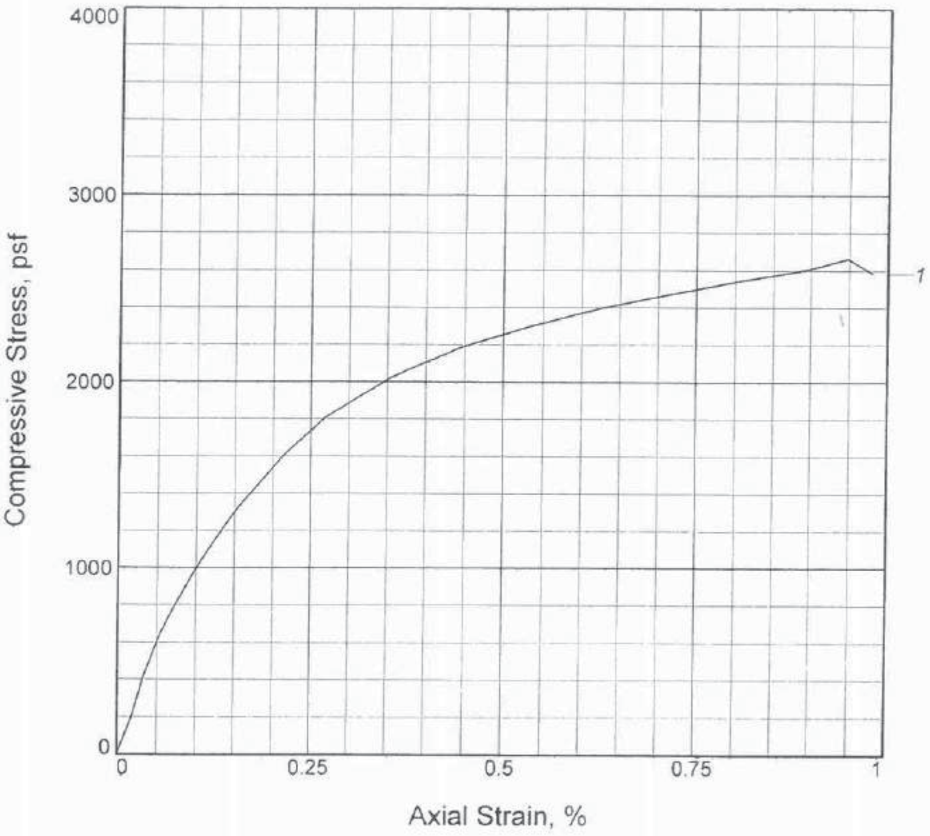
Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)
CINCINNATI
Source of Sample: 57 **Depth:** 0.9-2.9'
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Terracon, Inc.
Cincinnati, Ohio

Tested By: DB **Checked By:** GS

UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, psf	2662.9		
Undrained shear strength, psf	1331.5		
Failure strain, %	0.9		
Strain rate, in./min.	0.560		
Water content, %	17.9		
Wet density, pcf	132.1		
Dry density, pcf	112.0		
Saturation, %	98.3		
Void ratio	0.4853		
Specimen diameter, in.	2.850		
Specimen height, in.	5.610		
Height/diameter ratio	1.97		

Description: BROWN SANDY LEAN CLAY WITH GRAVEL

LL = 46	**PL =** 16	**PI =** 30	**GS=** 2.665	**Type:** ST

Project No.: N1155079

Date Sampled: 7-21-16

Remarks:

Figure 4385

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)
CINCINNATI

Source of Sample: 58 **Depth:** 1-3'

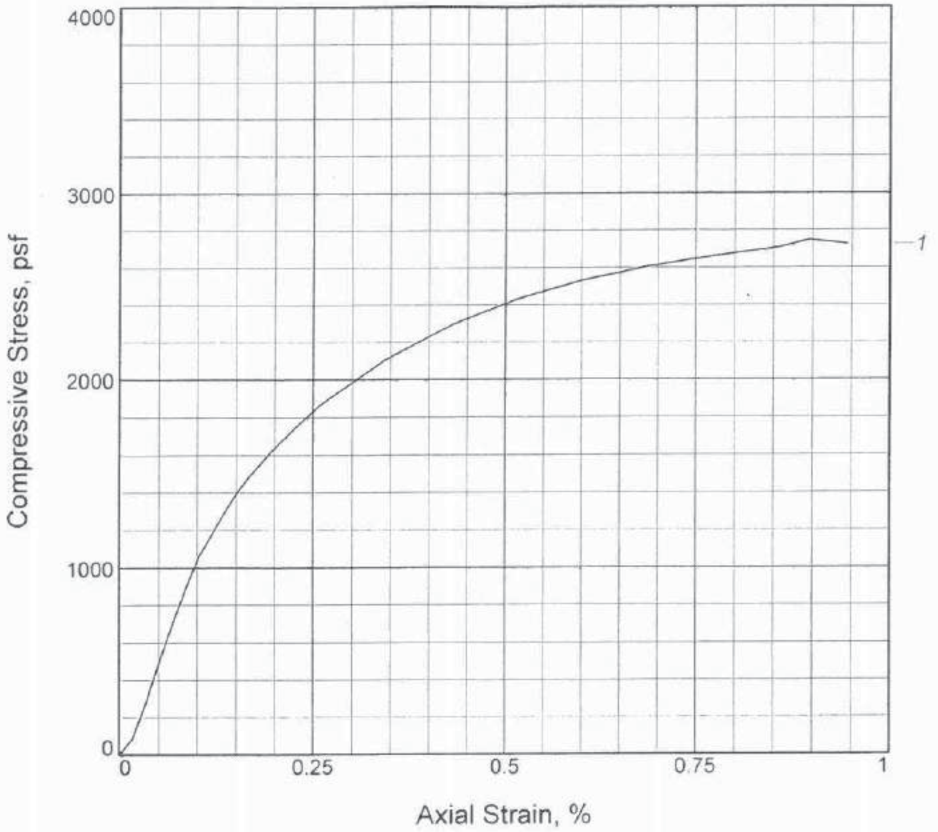
Sample Number: ST-1

UNCONFINED COMPRESSION TEST

Terracon, Inc.
Cincinnati, Ohio

Tested By: DB **Checked By:** GS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	2747.1			
Undrained shear strength, psf	1373.5			
Failure strain, %	0.9			
Strain rate, in./min.	0.058			
Water content, %	23.1			
Wet density, pcf	129.9			
Dry density, pcf	105.5			
Saturation, %	111.4			
Void ratio	0.5402			
Specimen diameter, in.	2.850			
Specimen height, in.	5.820			
Height/diameter ratio	2.04			

Description: BROWN LEAN CLAY WITH GRAVEL

LL = 44 **PL =** 17 **PI =** 27 **GS=** 2.604 **Type:** ST

Project No.: N1155079

Date Sampled: 7-21-16

Remarks:

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)
CINCINNATI

Source of Sample: 59 **Depth:** 0.8-2.8'

Sample Number: ST-2

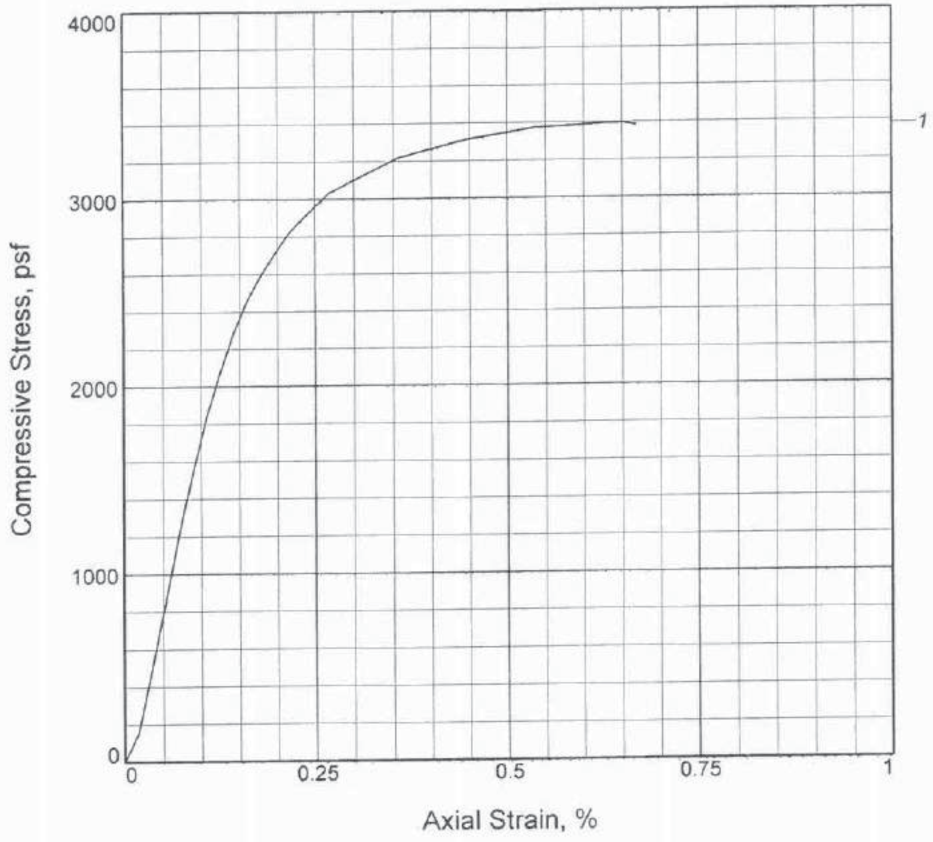
UNCONFINED COMPRESSION TEST

Terracon, Inc.
Cincinnati, Ohio

Figure 4386

Tested By: DB **Checked By:** GS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	3395.1			
Undrained shear strength, psf	1697.5			
Failure strain, %	0.7			
Strain rate, in./min.	0.056			
Water content, %	18.3			
Wet density, pcf	127.9			
Dry density, pcf	108.1			
Saturation, %	87.8			
Void ratio	0.5654			
Specimen diameter, in.	2.880			
Specimen height, in.	5.600			
Height/diameter ratio	1.94			

Description: BROWN SANDY LEAN CLAY WITH GRAVEL

LL = 38 **PL =** 19 **PI =** 19 **GS=** 2.711 **Type:** ST

Project No.: N1155079

Date Sampled: 7-22-16

Remarks:

Figure 4387

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)
CINCINNATI

Source of Sample: 60 **Depth:** 1.5-3.5'

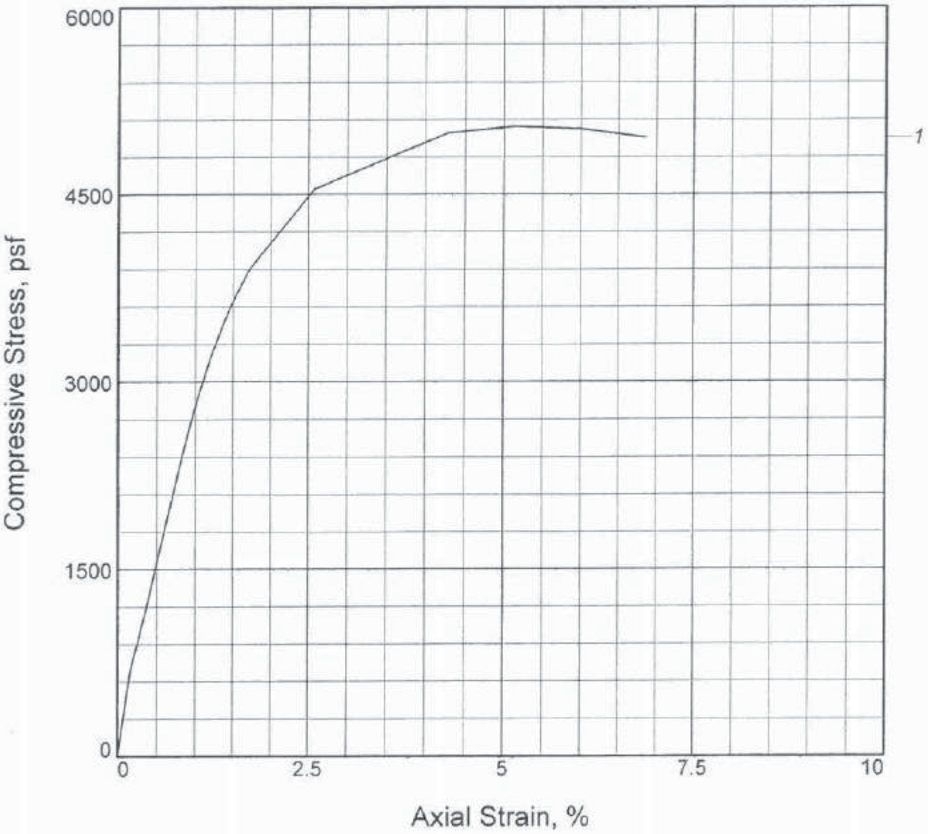
Sample Number: ST-2

UNCONFINED COMPRESSION TEST

Terracon, Inc.
Cincinnati, Ohio

Tested By: DB **Checked By:** GS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	5046.8			
Undrained shear strength, psf	2523.4			
Failure strain, %	5.1			
Strain rate, in./min.	0.058			
Water content, %	19.3			
Wet density, pcf	131.0			
Dry density, pcf	109.8			
Saturation, %	97.5			
Void ratio	0.5357			
Specimen diameter, in.	2.880			
Specimen height, in.	5.830			
Height/diameter ratio	2.02			

Description: BROWN SANDY LEAN CLAY

LL = 44 **PL =** 16 **PI =** 28 **GS=** 2.70 **Type:** ST

Project No.: N1155079

Date Sampled: 7-18-16

Remarks:

Figure 3728

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)
CINCINNATI

Source of Sample: 72 **Depth:** 13-15'

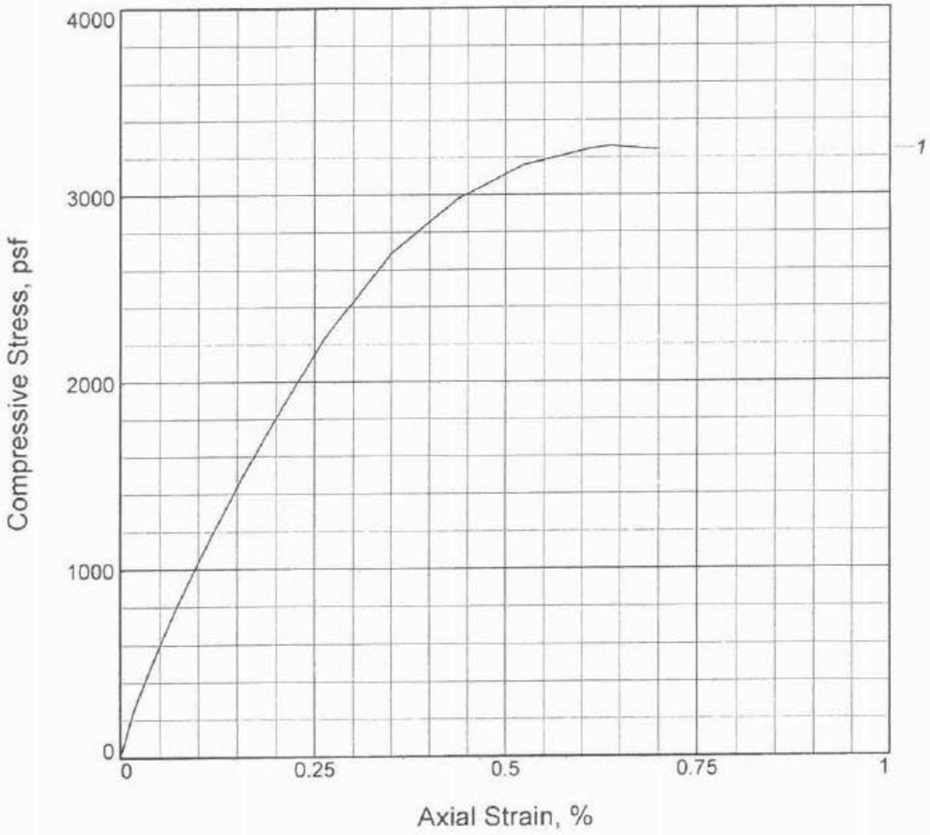
Sample Number: ST-4

UNCONFINED COMPRESSION TEST

Terracon, Inc.
Cincinnati, Ohio

Tested By: DSB **Checked By:** GS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	3260.6			
Undrained shear strength, psf	1630.3			
Failure strain, %	0.6			
Strain rate, in./min.	0.057			
Water content, %	21.4			
Wet density, pcf	126.4			
Dry density, pcf	104.1			
Saturation, %	92.6			
Void ratio	0.6278			
Specimen diameter, in.	2.860			
Specimen height, in.	5.720			
Height/diameter ratio	2.00			

Description: BROWN LEAN CLAY WITH SAND

LL = 38 **PL =** 18 **PI =** 20 **GS=** 2.714 **Type:** ST

Project No.: N1155079

Date Sampled: 7-21-16

Remarks:

Client: KTC

Project: ITEM 6-14.00, KY 536 DCD (BOONE CO., KY)
CINCINNATI

Source of Sample: 72 **Depth:** 28-30'

Sample Number: ST-8

UNCONFINED COMPRESSION TEST

Terracon, Inc.
Cincinnati, Ohio

Figure 3732

Tested By: DB **Checked By:** GS

APPENDIX D

COORDINATE DATA SUBMISSION FORM

	COORDINATE DATA SUBMISSION FORM					
KYTC Division of Structural Design - Geotechnical Branch						
County:		**Boone**				
Road Number:		**KY 536 & I-75 (Reconstruct I-75 Interchange with KY 536, Mt. Zion Road**				
Item:		**6-14.00**				
MARS		**8022203D**				
Project #:		**FD52 008 0075 177-179D**				

Hole Number	Latitude	Longitude	Station Number	Offset	Elevation	Hole Depth
1	38.9569161	-84.6368121	16000	-90	900.56	21
2	38.9568080	-84.6356245	16340	-86	905.24	20.4
3	38.9566409	-84.6333154	17000	-94	917.57	35.2
4	38.9560637	-84.6326712	17200	100	936.25	32.7
5	38.9567626	-84.6335048	1110039	-29	924.97	29.7
5A	38.9568462	-84.6335228	1110045	-59	926.14	14.2
6	38.9561120	-84.6332664	32050	-85	913.42	14.2
7	38.9551655	-84.6334795	31700	-90	938.72	29.5
8	38.9561795	-84.6356581	2040080	-35	910.22	30.3
8A	38.9565129	-84.6315209	2040080	-76	931.37	15.5
9	38.9578758	-84.6356250	161800	-125	918.56	39.3
10	38.9570019	-84.6364388	162150	55	906.83	27.4
11	38.9558275	-84.6404769	14899	-52	875.34	5.5
12	38.9566476	-84.6389968	15400	-60	882.00	7
13	38.9564795	-84.6381988	15600	65	876.25	5
14	38.9568754	-84.6375470	15800	-60	886.07	4
15	38.9563428	-84.6368890	16000	120	877.95	3.5
16	38.9568329	-84.6364697	16100	-70	895.03	6
17	38.9563547	-84.6356854	16340	80	900.30	11.7
18	38.9566387	-84.6322743	17300	-116	931.40	11.4
19	38.9561571	-84.6316012	17500	75	937.17	12
20	38.9564795	-84.6308777	17701	-51	934.71	8.3
21	38.9563956	-84.6299385	17969	-31	933.67	5.4
22	38.9560365	-84.6292292	18176	-91	937.75	8
23	38.9561130	-84.6277326	18600	46	933.04	5
24	38.9560932	-84.6263100	19000	45	935.27	5
25	38.9562160	-84.6251867	19315	55	936.09	5
26	38.9564735	-84.6238663	19700	50	944.03	5
27	38.9569100	-84.6225239	20100	65	956.90	15
28	38.9572971	-84.6224931	20180	-52	951.59	7
29	38.9573618	-84.6203664	20773	-80	946.40	12
30	38.9576721	-84.6195979	21000	-50	952.52	5
31	38.9573798	-84.6184763	21319	-56	953.06	6.2
32	38.9557672	-84.6305279	29783	-4	934.90	5
34	38.9552518	-84.6293799	2568	2	927.93	6
35	38.9571595	-84.6307240	4875	3	928.51	5.2
36	38.9558755	-84.6281589	19861	-19	930.61	6
37	38.9572464	-84.6282092	1361	-48	925.07	6
38	38.9585870	-84.6195336	50401	18	953.90	11
39	38.9591108	-84.6193681	50597	16	953.83	9

Coordinate Data

Hole Number	Latitude	Longitude	Station Number	Offset	Elevation	Hole Depth
40	38.9579960	-84.6333615	110600	-42	896.66	2
41	38.9589964	-84.6338793	111000	-30	894.04	1.5
42	38.9596879	-84.6344654	111300	-65	895.53	3.7
43	38.9565955	-84.6337233	1109960	7	904.00	5.3
44	38.9566027	-84.6324971	2110023	-7	910.61	2.9
45	38.9568914	-84.6327783	2110160	23	902.09	0.9
46	38.9543253	-84.6334321	31400	-28	922.37	4
47	38.9555721	-84.6333956	31850	-90	933.45	4.7
48	38.9563365	-84.6368853	1040000	20	877.93	3.5
49	38.9560746	-84.6366354	1040123	73	903.72	16.8
50	38.9560277	-84.6354519	2040040	-105	918.28	18.6
51	38.9559130	-84.6357049	2040220	-110	916.14	25.5
52	38.9595385	-84.6355903	161200	-42	883.12	4.8
53	38.9589073	-84.6361141	161450	70	907.24	6.3
54	38.9581681	-84.6357449	161700	-75	900.62	1
55	38.9579641	-84.6363546	161800	85	916.85	8
56	38.9571438	-84.6302330	30300	15	927.16	2.5
57	38.9552659	-84.6283913	2850	-7	919.86	2.9
58	38.9577842	-84.6279239	1560	25	921.03	3
59	38.9576766	-84.6198135	50060	25	955.09	2.8
60	38.9584991	-84.6196728	50360	-12	954.19	3.5
61	38.9596120	-84.6192859	50780	-8	959.10	4
62	38.9565074	-84.6372174	15900	70	886.24	8
63	38.9567984	-84.6359910	16237	-72	895.63	3.2
64	38.9563375	-84.6354756	16400	80	900.37	8
65	38.9562218	-84.6337234	16900	70	906.40	2.1
66	38.9561522	-84.6333787	17000	85	913.22	6.5
67	38.9561157	-84.6323097	17300	75	938.68	9.1
68	38.9561695	-84.6319877	17390	75	937.92	9.8
69	38.9566347	-84.6319281	17400	-95	939.72	11.3
70	38.9562032	-84.6308950	17700	50	933.54	9
71	38.9569418	-84.6359419	162150	-88	906.55	10.3
72	38.9576396	-84.6171400	21700	-34	964.16	38.2
73	38.9578756	-84.6171475	21700	-120	939.43	12.2
74	38.9588539	-84.6356728	161450	-57	888.53	1.7

Appendix H2 -- KY 536 (Item No. 6-14) Geotechnical Reports (Structures)

For Reference Only

6-14 Geotechnical Reports for Roadway + Structures Summary

Last Update: 6-7-19, v.0

Structure Type	Number	Structure	Alignment	Begin	End	Length	Offset	Average Height Approx.	Wall Type	Structure Number	Report Date	Page #
Retaining Walls		Retaining Wall	KY 536	164+40	168+00	360	LT	6.5	Gravity	S-039-2016	08-11-17	R9
		Retaining Wall	KY 536	174+65	175+20	55	LT	12	Soldier Pile	S-040-2016	08-11-17	R11, R13
		Retaining Wall	KY 537	179+11	181+30	219	LT	5	Std. Gravity	S-042-2016	03-07-18	R13, R15
		Retaining Wall	KY 538	183+00	184+15	115	LT	4	Std. Gravity	S-043-2016	03-07-18	R15
		Retaining Wall	KY 539	185+95	191+20	525	LT	7	Std. Gravity	S-044-2016	03-07-18	R15, R18
		Retaining Wall	KY 536	192+44	194+23	179	LT	7.5	Gravity	S-045-2016	08-11-17	R18, R21
		Retaining Wall	KY 536	201+45	203+20	175	RT	7.8	Gravity	S-046-2016	08-11-17	R24
		Retaining Wall	KY 536	203+92	205+77	185	LT	7	Gravity	S-047-2016	08-11-17	R24, R27
		Retaining Wall	Biltmore Connector	26+15	27+00	85	RT	8	Gravity	S-048-2016	08-11-17	R43
		Retaining Wall	Biltmore Connector	26+40	27+00	60	LT	5.5	Gravity	S-049-2016	08-11-17	R43
Noise Wall		Sound Wall Along I-75/I-71	I-75 / I-71 SB	00+00	24+16	2,416	RT			S-087-2018	01-25-19	R75

Roadway Reports	Number	Facility (ies) / Report Contents	Alignment	Begin	End	Length	Offset	Average Height	Wall Type	Report Number	Report Date	Page #
Roadway Report	N/A	KY 536	KY 536 I-75 (mile points)	153+00 177.659	217+47 178.345	6,447 0.686	N/A	N/A	N/A	R-047-2015	07-18-17	Overall Plans

M E M O R A N D U M

TO: William McKinney, PE
TEBM
Division of Structural Design

FROM: Bart Asher, PE, LS
Director
Division of Structural Design

BY: Michael Carpenter, PE MC
Geotechnical Branch

DATE: August 11, 2017

SUBJECT: Geotechnical Engineering Structure Foundation Report
Boone County
Reconstruct the Interchange with KY 536 (MT. Zion Road) South of Florence
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall Lt. Sta. 164+40 to 168+00
Item No. 6-14.00
Terracon Project No. N1155079

The geotechnical engineering report for this structure has been completed by Terracon Consulting Engineers and Scientists. We have reviewed and concur with the recommendations as presented in this report.

A copy of the report is attached. If you have any questions, please contact this office at 502-564-2374

cc: J. Van Zee
R. Powell
B. Yeager
R. Franxman
R. Turner
E. Drury
B. Greene
J. Schroeder (Terracon)
C. Callan-Ramler
J. Hager

Attachment

Geotechnical Engineering
Retaining Wall Report
Structure No. S-039-2016

Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
STRUCTURE No. S-039-2016
Boone County, Kentucky

August 3, 2017
Terracon Project Number N1155079

Prepared for:
Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

August 3, 2017

Kentucky Transportation Cabinet
Division of Structural Design-Geotechnical Branch
1236 Wilkinson Blvd.
Frankfort, Kentucky 40601-1200

Attn: Mr. Michael Carpenter, PE
Geotechnical Engineer
P: 502-782-3837
F: 502-564-4839
E: michael.carpenter@ky.gov

Re: Geotechnical Engineering Retaining Wall Report
Structure No. S-039-2016
Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
Boone County, Kentucky
Terracon Project Number: N1155079

Dear Mr. Carpenter:

Terracon Consultants, Inc. (Terracon) is submitting this Geotechnical Engineering Retaining Wall Report for the above referenced structure. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning the retaining wall foundations.

1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/I-71 Interchange with KY 536 (Mt. Zion Road) in Boone County, Kentucky. Stantec is the lead design engineer on the project. Terracon Consultants, Inc. was selected to perform the geotechnical services through our Statewide Engineering Contract. Terracon's services included laboratory testing and engineering services. The field exploration phase was conducted by Thelen Associates, Inc. (now Geotechnology, Inc.) working under a separate Statewide contract with KYTC.

Terracon Consultants, Inc. 611 Lunken Park Drive Cincinnati, Ohio 45226
P [513] 321 5816 terracon.com
Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

A new “double crossover diamond” interchange is planned with the KY 536 pavement lanes continuing to run beneath the existing I-75 bridge. The project involves reconstruction along KY 536 (Mt. Zion Road), new ramps, a new multi-use path along the northern edge of KY 536, as well as improvements, extensions, and realignments to various side roads that include Biltmore Blvd., Biltmore Drive, Investment Way, Sam Neace Drive, and about 1300 ft. of US 25.

This report addresses the geotechnical-recommendations for one of the proposed retaining walls on the project, namely Structure S-039-2016. The wall location is shown on the attached Project Location Map. As shown, the retaining wall is planned between about STA’s 164+40 and 168+00 along the left / upslope side of the proposed shared use path. The wall will be constructed beneath the existing interstate bridge.

A gravity retaining wall was evaluated at this location. The proposed total wall height will range from about 4.5 ft. to 8.5 ft and the length will be about 360 feet. There is a 3H:1V design backslope above the wall with no anticipated surcharge loading at the crest.

2.0 SITE TOPOGRAPHY AND GEOLOGICAL CONDITIONS

The project area lies in a dissected upland of the Outer Bluegrass Region. Ground elevations along the overall project route generally range from about Elev. 870 ft. to about 950 ft. Grades generally rise to the east. At the proposed retaining wall site, existing KY 536 surface elevations generally range from about 900 to 910 ft. The existing north spill-thru embankment is to be excavated to make room for the shared use path and retaining wall.

Surface drainage in the project vicinity is generally dendritic with most flow towards the South Branch of Gunpowder Creek, which lies west of I-75. The Ohio River lies about 8 miles north of the site and has a normal pool elevation of 455 ft.

Geologic mapping indicates the project area is underlain by limestone and shale of the Bull Fork Formation and Ordovician System. Mapping shows the limestone comprises as much as about 95 percent of the rock mass. No known karst features are mapped in the project area.

The USGS Soil Survey shows that the uppermost soils along the project site comprise mostly of Rossmoyne Silt Loam with lesser amounts of Jessup Silt Loam (a wind-blown loess) and Faywood Silty Clay (residuum).

3.0 SUBSURFACE EXPLORATIONS

An exploration plan was developed by Terracon after a review of the available plans, profiles, and cross-sections provided by Stantec. The draft exploration plan was subsequently reviewed and approved by KYTC Geotechnical Branch. Some borings were relocated during the field program due to access, utility conflicts, etc.

Six test borings were drilled along the alignment of Structure S-039-2016. These borings included four rock core holes and two undisturbed sample borings. A summary of these six borings is provided below.

Table 3.0: Summary of Test Borings

Boring	Samples	Approx. Top/Weathered Bedrock, ft.	Approx. Top/Weathered Rock Elev., ft.	Approx. Depth to RDZ, ft.
1001	2 UD’s and rock coring	8.7	893.2	11.1
1002	2 UD’s, 1 SPT	8.7	895	N/A
1003	1 UD and rock coring	6.2	899.5	10.4
1004	1 UD and rock coring	7.1	902.8	11.4
1005	1 UD and 1 SPT	Refusal @ 4.7’	900.8	N/A
1006	Rock coring	0.5	903.2	4.5

UD: Undisturbed (Shelby tube) sample
SPT: Standard Penetration Test sample
RDZ: Rock Disintegration Zone

Refer to the attached Subsurface Data Sheet for the location of the borings, subsurface logs, and soil test results.

Rock core logs below the RDZ revealed gray limestone and shale with close fractures and some heavy weathering at the fractures. Kentucky RQD values were 0% and core recoveries ranged from about 48% to 100%.

4.0 LABORATORY TESTING AND RESULTS

A laboratory testing program was assigned to the thin-walled tubes and approved by the KYTC Geotechnical Branch. The laboratory tests were conducted by Terracon in accordance with the appropriate AASHTO or Kentucky Methods as outlined in the Geotechnical Manual. The results of the laboratory tests are depicted graphically on the Subsurface Data Sheet.

The laboratory testing program on undisturbed samples in the overburden soil zone included classification and compressive strength testing; results are summarized below.

Table 4.0: Summary of Laboratory Test Results

Station	Offset	Hole	Sample	AASHTO	USCS	U.C., psf	Silt+Clay, %
164+39	82 ft. LT	1001	1	A-6(9)	CL	1541	71(61+10)
164+39	82 ft. LT	1001	2	A-6(16)	CL	3153	93(76+17)
164+76	82 ft. LT	1002	1	A-7-6(11)	CL	6935	61(42+19)
164+76	82 ft. LT	1002	2	A-6(15)	CL	-	82(64+18)
165+41	70 ft. LT	1003	1	A-7-6(15)	CL	3238	69(49+20)
167+28	75 ft. LT	1004	1	A-7-6(35)	CH	2615	95(61+34)

U.C.: Unconfined compressive strength

5.0 ENGINEERING ANALYSES

The gravity-type retaining wall for Structure S-039-2016 was analyzed at its maximum proposed height of 8.5 feet and at the design backslope of 3H:1V. Analyses included overturning, bearing capacity, and sliding. Slope stability analyses were not conducted since the embankment height and depth to bedrock were small and considered non-critical.

Two conditions were evaluated: granular wall backfill and cohesive soil backfill. For the latter case, drainage would still be required in the form of a drainage medium placed on the back face of the wall to prohibit hydrostatic pressures from developing and to allow drainage through weep holes.

For the foundation, bedrock is anticipated to be close to design foundation level (see attached subsurface profile sheet). Therefore, it is assumed that the retaining wall will be supported on bedrock or an undercut performed to bedrock and replaced with granular fill. The bearing capacity analysis was based on granular soil bearing conditions.

A summary of soil parameters used in the analyses is provided below.

Table 5.0: Summary of Assumed Soil Parameters

Item	Unit Weight, pcf	Effective Internal Friction,Φ	Cohesion, psf
Cohesive Soil Wall Backfill	125	24 degrees	0
Granular Backfill for Foundation Undercut	115	37 degrees	0
Granular Wall Backfill	115	37 degrees	0

Results of the analyses for a gravity wall are summarized below:

Overturning with cohesive soil wall backfill – satisfied safety criteria of having the resultant fall within the middle 9/10's of the foundation (for rock-bearing conditions).

Bearing Capacity – satisfied minimum safety (factored resistance greater than applied factored bearing stress).

Sliding Resistance with cohesive soil wall backfill – did not meet minimum safety criteria (factored resistance was not greater than applied factored resultant). There were two potential remedies that were evaluated to satisfy sliding. One was to utilize granular soil wall backfill instead of cohesive soil. The other was to utilize the cohesive soil wall backfill but increase the heel portion of the foundation width by 0.5 ft.

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.0 RECOMMENDATIONS

6.1 The gravity wall dimensions should meet KYTC's Standard Drawing RGX-002-09 (12-1-15), Case III with the exception listed in Item 6.3 below.

6.2 A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.3 Design the retaining wall to bear within undisturbed weathered or unweathered shale and limestone bedrock. If bedrock is not present at design bearing elevation, undercut to expose bedrock and replace with "Granular Embankment", non-erodible only, meeting the material requirements of Section 805 of the Standard Specifications for Road and Bridge Construction, current edition.

6.4 The backfill behind the wall shall consist of "Granular Embankment" extending on a 1H:1V slope from the base of the wall. The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches. Alternatively, cohesive soil backfill can be used provided the foundation width shown on KYTC Std. Dwg. RGX-002-09 (12-1-15), Case III is increased by 0.5 feet in its heel section.

6.5 Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment. The Geotextile fabric shall be in accordance with Sections 214 and 843 of the Standard Specifications, current edition.

6.6 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

6.7 If cohesive soil is used as wall backfill, a drainage medium is required on the back face of the wall to prohibit hydrostatic pressures from developing and to allow drainage through the specified weep holes.

6.8 The plans should indicate that solid rock excavation may be required to reach footing elevations.

6.9 Wall construction and backfilling should be completed in accordance with KYTC specifications.

6.10 The wall designer shall verify wall stability based upon final wall design dimensions.

7.0 PLAN NOTES

7.1 Add the attached plan sheet, “Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls” at the appropriate locations in the plans.

8.0 CLOSING

The analysis and conclusions presented in this report are based upon the data obtained from the test borings performed by others at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur away from the borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident over the short term. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If KYTC is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use by KYTC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We appreciate the opportunity to be of service to you on this project. Please contact us with any questions concerning this report.

Respectfully submitted,

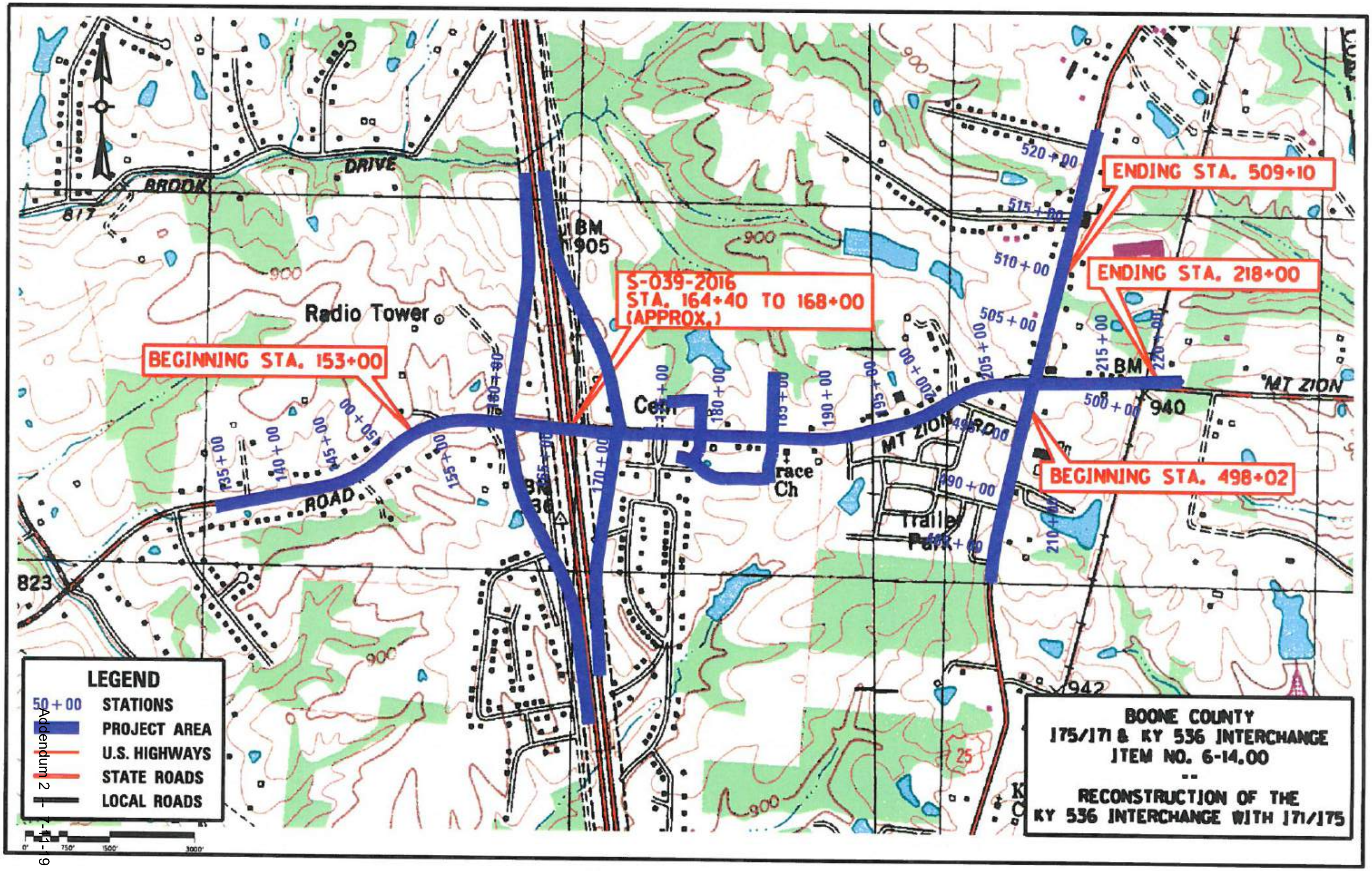
Terracon Consultants, Inc.

for Aaron J. Muck

Jess A. Schroeder, P.E.
Senior Geotechnical Engineer

Aaron J. Muck, P.E.
Senior Geotechnical Engineer

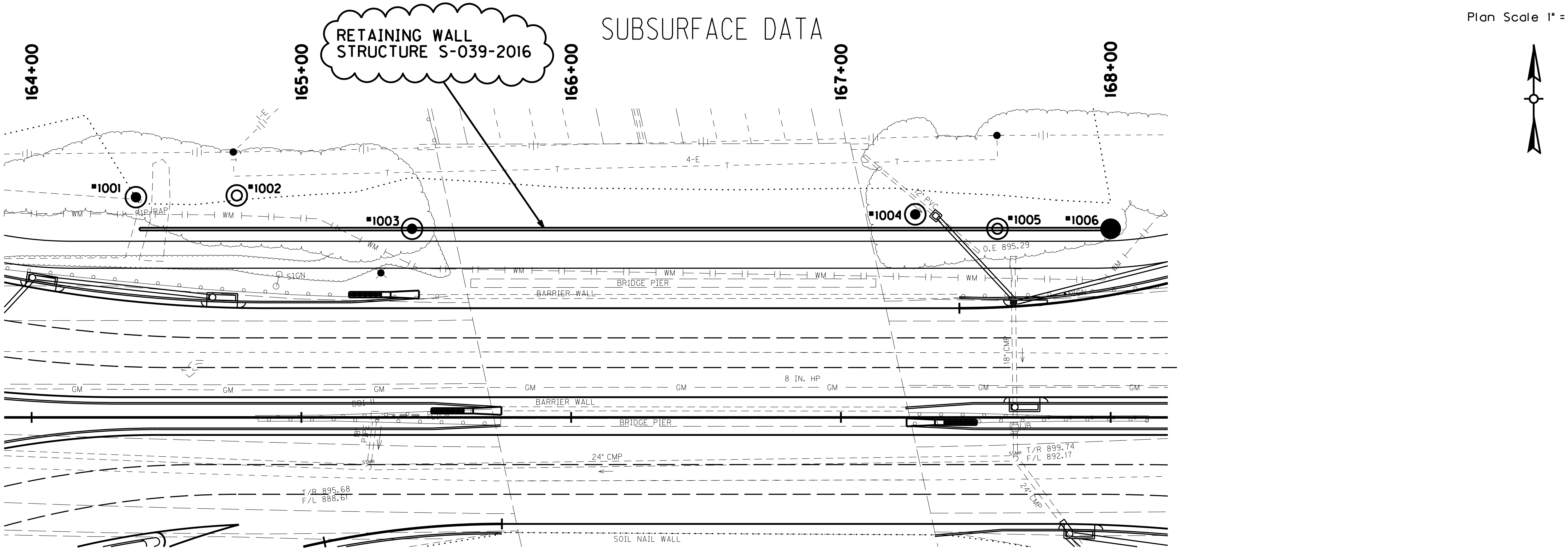
Attachments:	Project Location Plan
	Subsurface Data Sheets (3 each)
	Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls
	Coordinate Data Form
	Calculations



BOONE COUNTY
I75/I71 & KY 536 INTERCHANGE
ITEM NO. 6-14.00
--
RECONSTRUCTION OF THE
KY 536 INTERCHANGE WITH I71/I75

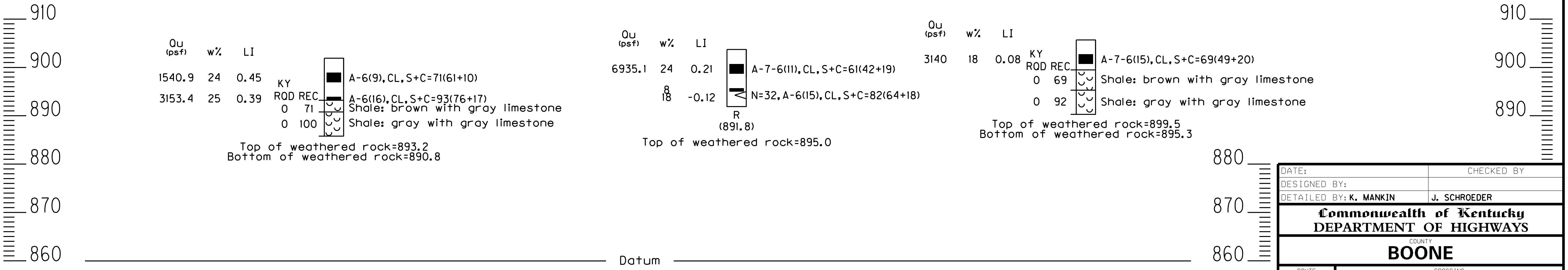
SUBSURFACE DATA

Plan Scale 1" = 20'



Hole No.	#1001	#1002	#1003
Station	164+39	164+76	165+41
Offset	82 FT. LT.	82 FT. LT.	70 FT. LT.
Elev. (Sea level datum)	901.9	903.6	905.7

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale



#1001:

Qu (psf)	w%	LI	
1540.9	24	0.45	A-6(9), CL, S+C=71(61+10)
3153.4	25	0.39	A-6(16), CL, S+C=93(76+17)

KY RQD	REC	
0	71	Shale: brown with gray limestone
0	100	Shale: gray with gray limestone

Top of weathered rock=893.2
Bottom of weathered rock=890.8

#1002:

Qu (psf)	w%	LI	
6935.1	24	0.21	A-7-6(11), CL, S+C=61(42+19)
	8 18	-0.12	N=32, A-6(15), CL, S+C=82(64+18)

R
(891.8)

Top of weathered rock=895.0

#1003:

Qu (psf)	w%	LI	
3140	18	0.08	A-7-6(15), CL, S+C=69(49+20)

KY RQD	REC	
0	69	Shale: brown with gray limestone
0	92	Shale: gray with gray limestone

Top of weathered rock=899.5
Bottom of weathered rock=895.3

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\S-039-2016.DGN

USER: kimankin
DATE PLOTTED: June 5, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 536	RETAINING WALL STA. 164+40 TO STA. 168+00

SUBSURFACE DATA

S–039–2016

SHEET 1 OF 2

ITEM NUMBER
6–14.00

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

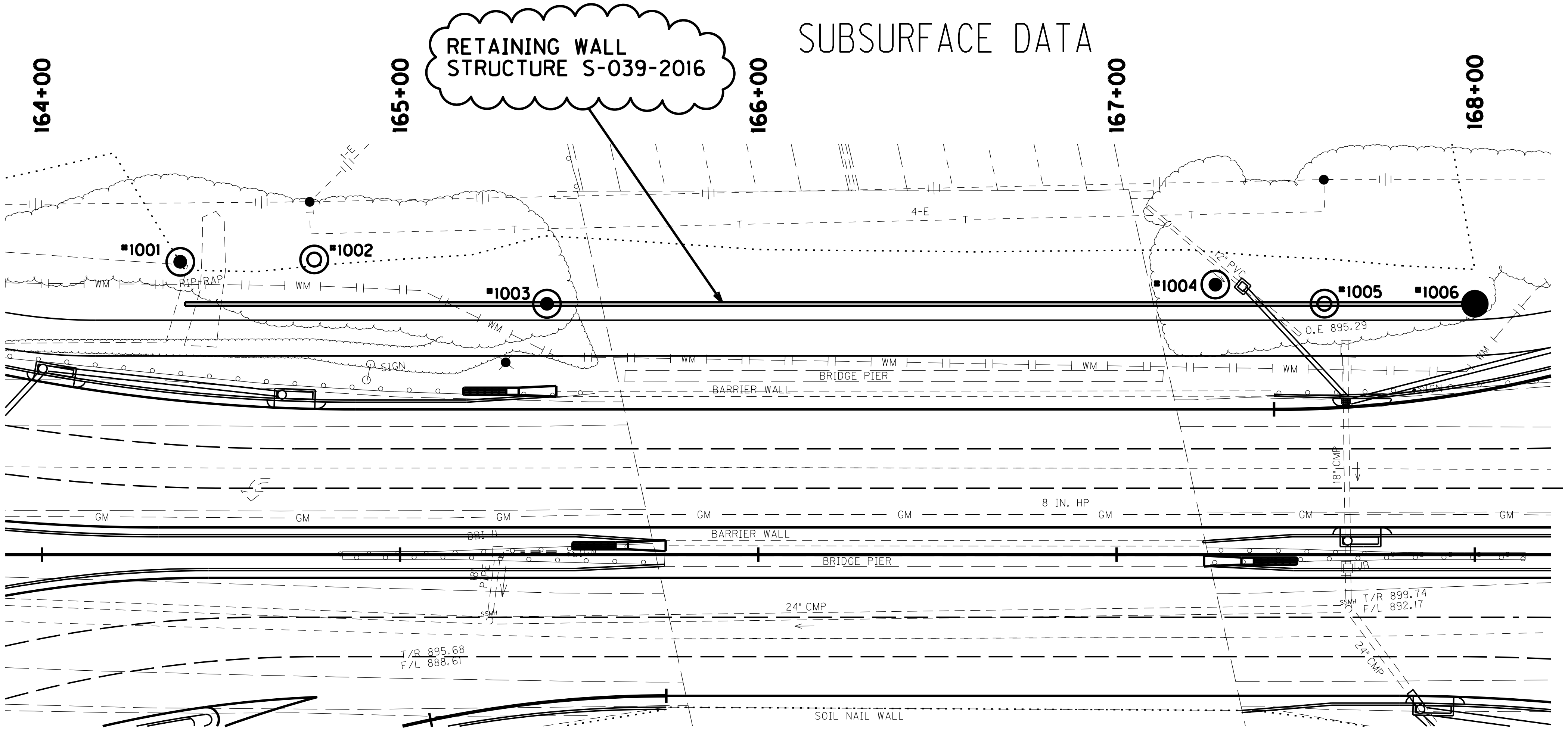
Addendum 2 7-11-19

SHEET NO.

DRAWING NO.

SUBSURFACE DATA

Plan Scale 1" = 20'



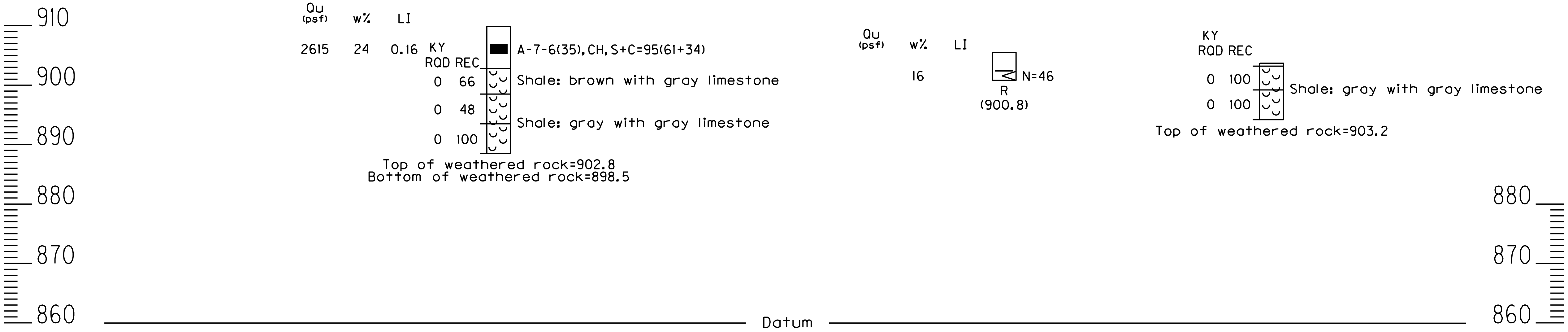
Hole No.
Station
Offset
Elev.
(Sea level datum)

#1004
167+28
75 FT. LT.
909.9

#1005
167+58
70 FT. LT.
905.5

#1006
168+00
70 FT. LT.
903.7

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale



#1004:

Qu (psf) w% LI

2615 24 0.16

KY RQD REC

A-7-6(35),CH,S+C=95(61+34)

0 66 Shale: brown with gray limestone

0 48

0 100 Shale: gray with gray limestone

Top of weathered rock=902.8
Bottom of weathered rock=898.5

#1005:

Qu (psf) w% LI

16

N=46
R
(900.8)

#1006:

KY RQD REC

0 100
0 100

Shale: gray with gray limestone

Top of weathered rock=903.2

S–039–2016

SHEET 2 OF 2

ITEM NUMBER

6–14.00

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536

CROSSING
RETAINING WALL STA. 164+40 TO STA. 168+00

SUBSURFACE DATA

PREPARED BY
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611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
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Addendum 2 - 7-11-19

SHEET NO.

DRAWING NO.

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\S-039-2016.DGN

USER: kjmankin
DATE PLOTTED: May 10, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

SUBSURFACE DATA

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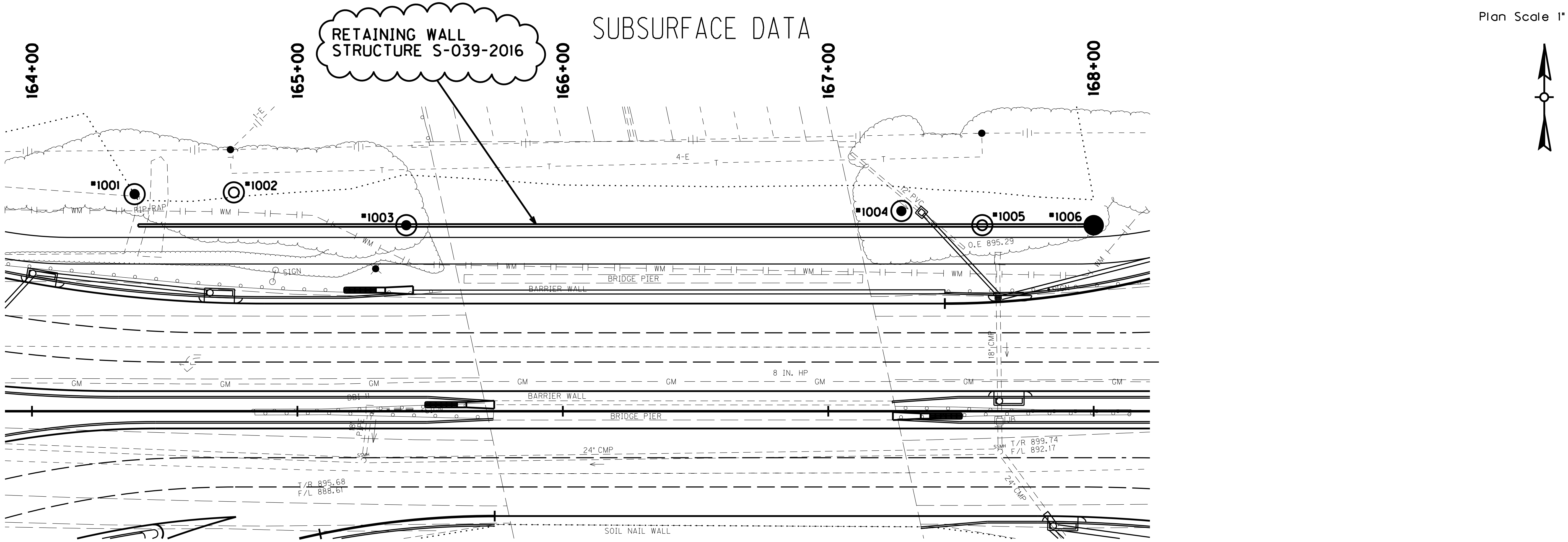

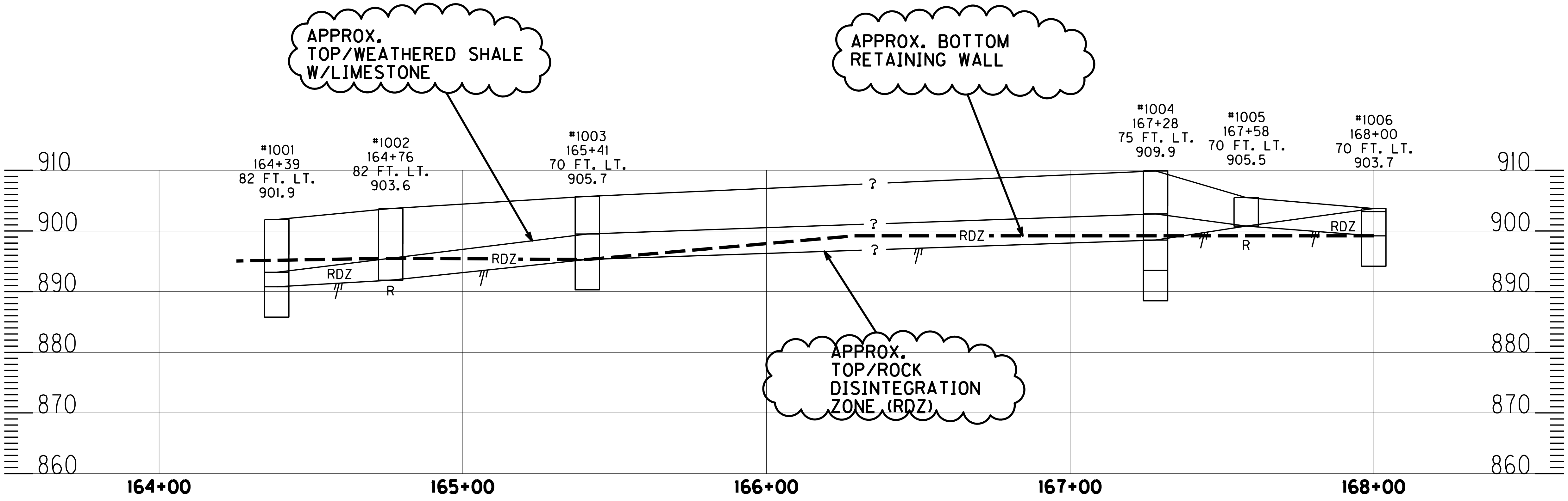

S–039–2016

SHEET 3 OF 3

ITEM NUMBER

6–14.00

DATE:
DESIGNED BY:
DETAILED BY: K. MANKIN

CHECKED BY
J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536

CROSSING
RETAINING WALL STA. 164+40 TO STA. 168+00

SUBSURFACE DATA

PREPARED BY
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PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 – 7-11-19

SHEET NO.

DRAWING NO.

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\S-039-2016.DGN

USER: kjmankin
DATE PLOTTED: June 5, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall, except for cases where the wall height (ft.) is over 8 ft. In such a case, the embedment depth shall be 1/4 H, per note 1 of Std. Dwg. RGX-002-09 (12-1-15).

Use wall dimensions in accordance with Case III of the Standard Drawing RGX-002.

Backfill this wall with Granular material as outlined on this sheet. Alternatively cohesive soil backfill can be used provided the foundation width shown on Standard Drawing RGX-002-09 (2-1-15) Case III is increased by 0.5 ft. in its heel section.

The base of the wall shall be extended to bear on weathered or unweathered bedrock. If bedrock is not present at design bearing elevation, undercut to expose bedrock and replace with "Granular Embankment", non-erodible only, meeting the material requirements of Section 805 of the Standard Specifications for Road and Bridge Construction, current edition.

Station Interval	Bearing Surface	Factored Presumptive Bearing Resistance at the Service Limit State
ML 164+40 TO 168+00, LT	Weathered or Unweathered Bedrock, or Granular Embankment after undercutting to bedrock	4.1 ksf

Use the following soil strength parameters for design:

External Backfill	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
Granular Embankment	0	37	115
Cohesive Soil (Alternate)	0	24	125

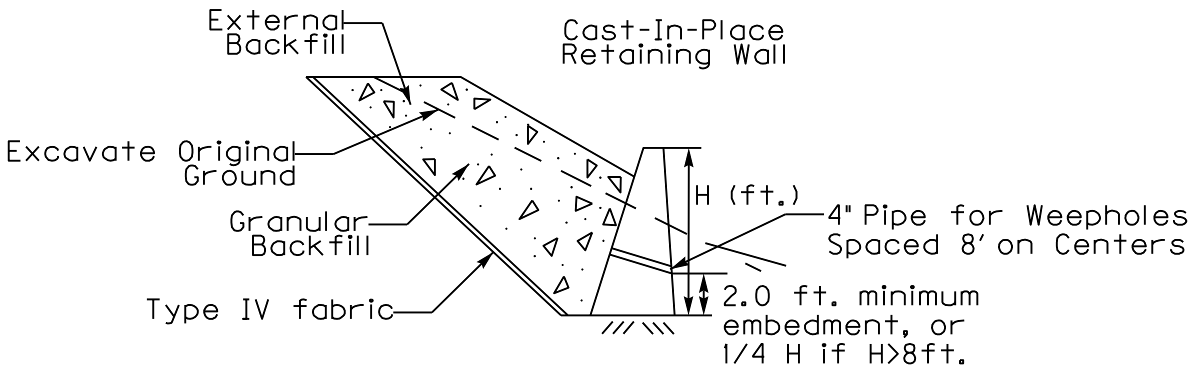
Where external granular backfill is required, place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible, as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

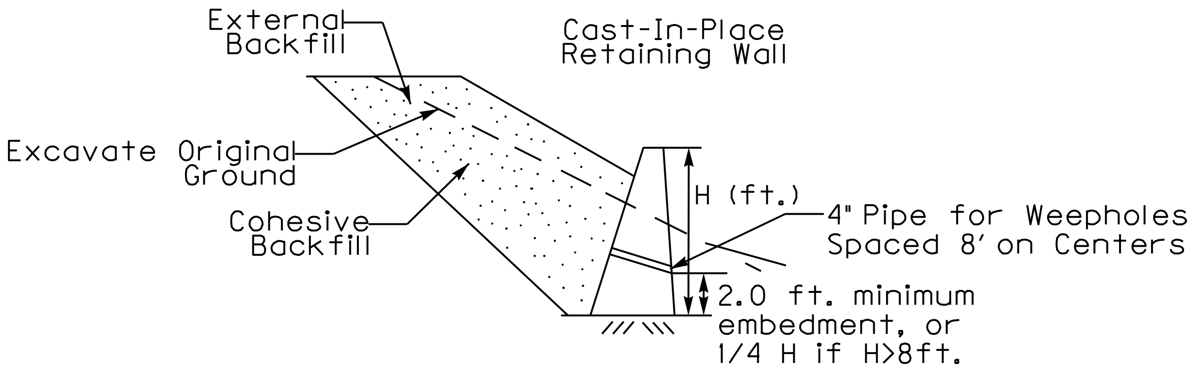
Solid rock excavation will be required for installation of this retaining wall. The footing concrete should be placed as soon as possible after the footing excavation is made. If the bedrock becomes softened at bearing elevation, the softened material shall be undercut to suitable bearing material prior to placing the concrete.

The wall designer shall verify wall stability based on final design dimensions.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE: **KY 536**
CROSSING: **RETAINING WALL @ ML STA. 164+40 TO STA. 168+00, LT**

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
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PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 – 7-11-19

SHEET NO.

DRAWING NO.

S–039–2016

ITEM NUMBER

6–014.00

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\RETAINING WALLS\GEOTECHNICAL NOTES S-039-2016.DGN

USER: kjmankin
DATE PLOTTED: August 3, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COORDINATE DATA SUBMISSION FORM - PROPOSED RETAINING WALL S-039-2016						
KYTC Division of Structural Design - Geotechnical Branch						
County:		**Boone**				
Road Number:		**KY 536 & I-75 (Reconstruct I-75 Interchange with KY 536, Mt. Zion Road**				
Item:		**6-14.00**				
MARS		**8022203D**				
Project #:		**FD52 008 0075 177-179D**				
Hole Number	**Latitude**	**Longitude**	**Station Number**	**Offset**	**Elevation**	**Hole Depth**
1001	38.9567683	-84.6352818	16439	82 LT	901.92	16.1
1002	38.9567593	-84.6351506	16476	82 LT	903.65	11.8
1003	38.9567070	-84.6349280	16541	70 LT	905.70	15.4
1004	38.9566684	-84.6342739	16728	75 LT	909.90	21.4
1005	38.9566450	-84.6341690	16758	70 LT	905.45	4.7
1006	38.9566330	-84.6340220	16800	70 LT	903.68	9.5

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 12/20/16

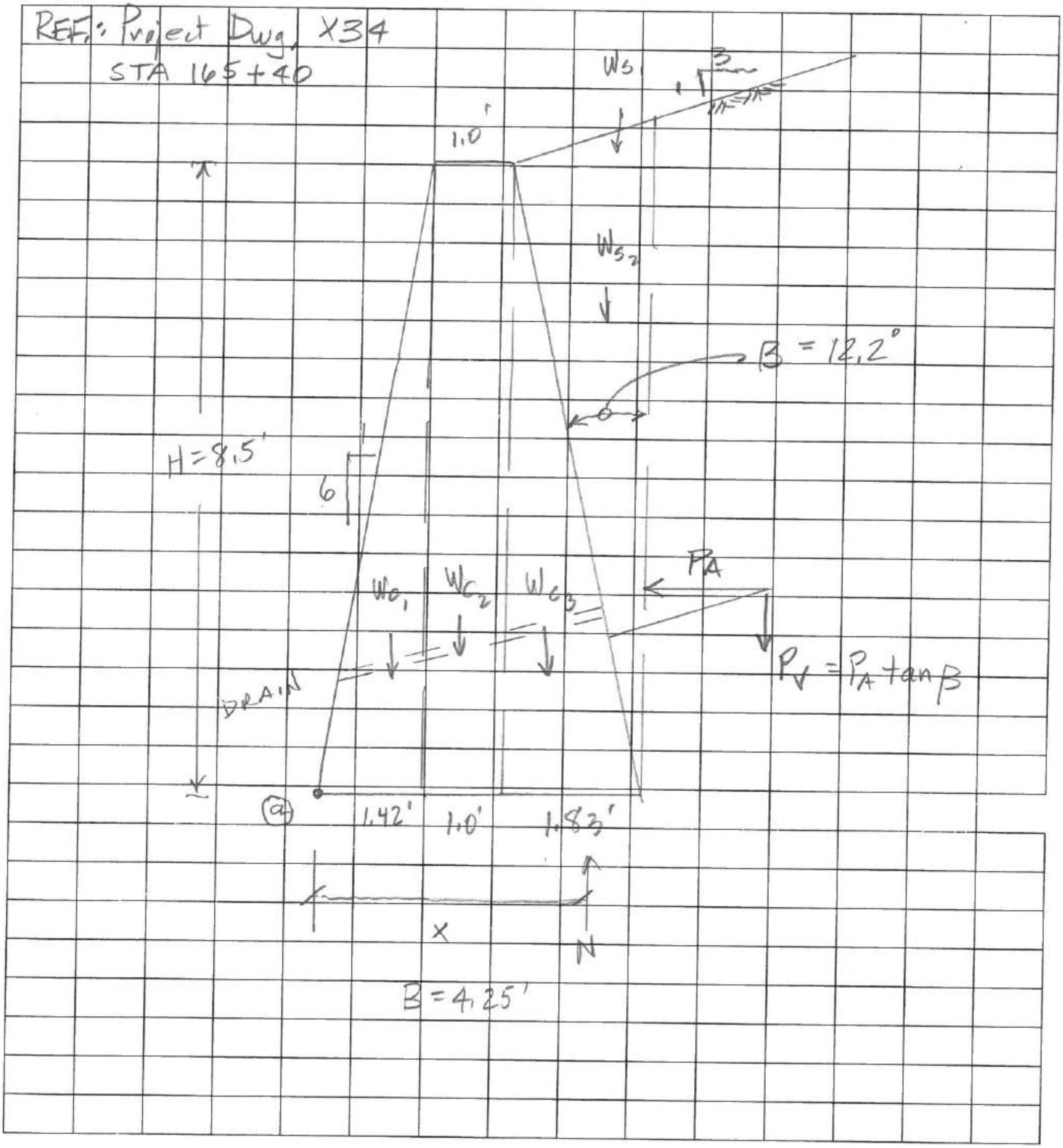
Structure No.: S-039-2016

Terracon

Sheet 1

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III



Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: 5-039-2016

Terracon

Sheet 2

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

ASSUME: Cohesive soil backfill w/drainage board (No hydrostatic pressure)

Let ϕ'backfill = 24° (Ref. NAVFAC DM7.2-39
γ = 125 pcf (lab) for CL/CH soil)

K_A (sloping b'fill @ 3:1) = 0.58 (NAVFAC DM-7.2-64)

$P_A = \frac{.125(8.5)^2}{2}(0.58) = 2.62$ k/FT.

$P_V = P_A \tan\beta = 2.62 \tan(12.2^\circ) = .57$ k/FT.

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: S-039-2016

Terracon
Sheet 3

Part 2: Check Overturning

LRFD Load Factors:

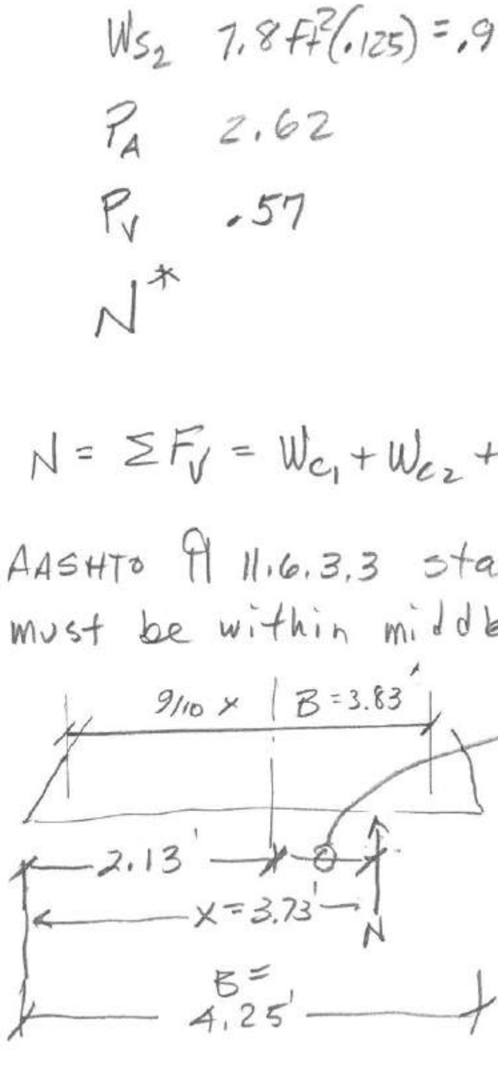
Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

AREA	UNFactored Resultant (K/Ft)	Load Factor	Factored Load (K/Ft.)	Moment Arm (ft)	Moment About ⓐ (Ft-K/Ft)
W_{C_1}	$6.04\ Ft^2(.15) = .91$	0.9	.81	.95	.77
W_{C_2}	$8.5\ Ft^2(.15) = 1.28$	0.9	1.15	1.92	2.21
W_{C_3}	$7.8\ Ft^2(.15) = 1.17$	0.9	1.05	3.03	3.18
W_{S_1}	$.56(.125) = .07$	1.0	.07	3.64	.25
W_{S_2}	$7.8\ Ft^2(.125) = .97$	1.0	.97	3.64	3.53
P_A	2.62	1.5	3.93	-2.83	-11.12
P_V	.57	1.0	.57	4.25	2.42
N^*			4.62	$-x$	$-4.62x$

$$\underset{=0}{\Sigma M_{ⓐ}} \Rightarrow 4.62x = 1.24 \qquad x = 3.73'$$

$$* \quad N = \Sigma F_V = W_{C_1} + W_{C_2} + W_{C_3} + W_{S_1} + W_{S_2} + P_V = 4.62\ ^k/_{FT},\ \text{factored}$$

AASHTO ¶ 11.6.3.3 states for foundations on rock, resultant must be within middle 9/10 of base.



e = 1.6'

$$\frac{9}{10} \times 4.25 = 3.83'$$

$$\frac{3.83}{2} = 1.91' > 1.6' \Rightarrow \text{OK} ✓$$

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: 5-039-2016

Sheet 4

Part 3: Check Bearing Capacity

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.35	*Fig. C11.56-2, page 11-11*
Concrete Weight	1.25	
Live Load Surcharge	1.75	*(applied above rear wall batter, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φb):	0.55	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent: Gravity Walls*

Nominal Bearing = qn = c x (Nc) x (1+0.3(B/L)) + (Υ x D) *Ref.: NAVFAC DM 7.2, p. 131, Fig. 1*
Factored Bearing Resistance = qn x φb, ksf
Applied Bearing = V/B, ksf

Assume bearing on granular soil backfill placed in undercut to bedrock.

Let $\phi = 37°$, $\gamma = 115$ pcf for granular fill, per KYTC

$D = 2'$

$N_q = 40$ (NAVFAC DM 7.2-131)

$N_\gamma = 55$ (")

$B = 4'$... per AASHTO, ¶10.6.1.3, eccentrically loaded footings should be evaluated for bearing resistance using an effective area $B' \times L'$, where $B' = B - 2e$ & $L' = L - 2e$. From SHT. 3, $e = 1.6' \Rightarrow B' = 4.25 - 2(1.6)$
$= 1.05'$

Nominal, Unfactored Resistance $= q_n = \gamma D N_q + \frac{\gamma B}{2} N_\gamma$
(NAVFAC DM 7.2-131)

$q_n = 0.115(2)(40) + \frac{.115(1.05)}{2}(55) = 12.5$ ksf

Factored Resistance $= q_n \times \phi_b = 12.5(.55) = \underline{6.9 \text{ ksf}}$

vs.

Applied Bearing Stress (Factored) =

$= \left[(W_{c_1} + W_{c_2} + W_{c_3})(1.25) + (W_{s_1} + W_{s2} + P_v)(1.35)\right] / B'$

$= \left[(.91 + 1.28 + 1.17)(1.25) + (.07 + .97 + .57)(1.35)\right] / 1.05' = \underline{6.1 \text{ ksf}}$

$6.9 \text{ ksf} > 6.1 \text{ ksf} \Rightarrow$ OK ✓

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)
Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft. (AASHTO Fig. 10.6.3.4-1)

Applied Horizontal Resultant = Pa, kips/ft.

Assume rock bearing or undercut to rock & backfill w/granular fill.

Assume granular b'fill is compacted to $N \cong 30$ blows/ft.
... Let $\phi' = 36°$ (AASHTO Table 10.4.6.2.4-1)

Factored Resistance = $\phi_T \, V \tan\phi$, where $V = \Sigma F_V = N$ (sht. 3 = 4.62 k/ft.)
$= 1.0(4.62)(\tan 36°) = \underline{\underline{3.36}}$ k/FT.

VS.

Applied Factored Resultant, or $P_A \times 1.5$
$= 2.62(1.5) = 3.93$ k/FT.

3.36 k/FT. $\ngtr$ 3.93 k/FT.

No Good... either widen base or use granular backfill → see sht 6 for granular b'fill option.

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: S-039-2016

Terracon
Sheet 6

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

ASSUME GRANULAR BACKFILL FOR WALL
W/ $\phi = 37°$ & $\gamma = 115$ pcf (per KYTC)
– No hydrostatic pressure – $K_A = .3$ NAVFAC DM 7.2-64

AREA	Unfactored Load, K/FT.	Load Factor / sliding & overturning	Factored Load
W_{C1}	$6.04 ft^2 (.15) = .91$	.9	.81 K/FT.
W_{C2}	$8.5 ft^2 (.15) = 1.28$	.9	1.15
W_{C3}	$7.8 ft^2 (.15) = 1.17$	.9	1.05
W_{S1}	$.56 ft^2 (.115) = .06$	1.0	.06
W_{S2}	$7.8 ft^2 (.115) = .90$	1.0	.90
P_A	$.115 \left(\frac{8.15^2}{2}\right)(.3) = 1.25$	1.5	1.88
P_V	$1.25 \tan 12.2° = .27$	1.0	.27
N*			4.24

$* N = \Sigma F_V = W_{C1} + W_{C2} + W_{C3} + W_{S1} + W_{S2} + P_V$
$= .81 + 1.15 + 1.05 + .06 + .90 + .27 = 4.24$ K/FT.

Recheck Sliding Resistance...

Factored Resistance = $\underline{\underline{3.36}}$ K/FT. (SHT. 5)

VS.

Applied factored Resultant = $P_A \times 1.5$ = $\underline{\underline{1.88}}$ K/FT.

3.36 K/FT. > 1.88 K/FT. ⇒ OK ✓

⇒ Requires Granular B'fill

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/9/17
Structure No.: 5-039-2016

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

Cohesive b'fill did not work @ std. wall dimensions
Solution #1 was to use granular b'fill.
Now look @ possible solution #2 : cohesive b'fill w/ increased base width.

Make arbitrary assumption to increase "heel" from 1.83' (shown on sht. 1) to 2.33'. All others same.
We already know overturning & brg. are OK (shts. 1-4), so just check sliding...

AREA	Unfactored Resultant, K/ft.	Load Factor	Factored Load K/ft	Moment Arm, ft.	Moment About @ ft-K/ft
W_{c1}	0.91 (sht. 3)	.90	.81	.95	.77
W_{c2}	1.28 (sht. 3)	.90	1.15	1.92	2.21
W_{c3}	9.9 ft^2(.15) = 1.49	.90	1.34	3.20	4.28
W_{s1}	.90 ft^2(.125) = .11	1.0	.11	3.97	.44
W_{s2}	9.9 ft^2(.125) = 1.24	1.0	1.24	3.97	4.92
P_A	2.62 (sht. 2)	1.5	3.93	-2.83	-11.12
P_v	.72 *	1.0	.72	4.75	3.42
$N = \Sigma F_v$			5.37	-x	-5.37x

$\Sigma M_{@} = 0$

$5.37x = 4.92$

$x = .92'$

* $\beta_{new} = 15.3°$

$P_v = P_A \tan\beta = .72$

Date: 1/9/17

Structure No.: S-039-2016

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)
Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft.
(AASHTO Fig. 10.6.3.4-1)

Applied Horizontal Resultant = Pa, kips/ft.

Bear on bedrock or undercut to bedrock & replace w/granular fill... assume granular fill has $\phi = 36°$ (sht. 5)

$\rightarrow$ 5.37 k/ft., SHT. 7

Factored Resistance $= \phi_\tau V \tan\phi = \phi_\tau N \tan\phi$

$= 1.0(5.37)(\tan 36°) = \underline{3.90}$ k/FT.

VS.

Applied Factored Resultant, or $P_A \times 1.5$

$= 2.62(1.5) = 3.93$ k/FT.

$3.90 \ngtr 3.93$ k/FT. but V. close

☆ SAY Cohesive b'fill is ok <u>iF</u> heel is increased 6", to 2.33'

(S-040-2016) Consultant

MEMORANDUM

TO: William McKinney, PE
TEBM
Division of Structural Design

FROM: Bart Asher, PE, LS
Director
Division of Structural Design

BY: Michael Carpenter, PE MC
Geotechnical Branch

DATE: August 11, 2017

SUBJECT: Geotechnical Engineering Structure Foundation Report
Boone County
Reconstruct the Interchange with KY 536 (MT. Zion Road) South of Florence
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall Lt. Sta. 174+65 to 175+20
Item No. 6-14.00
Terracon Project No. N1155079

The geotechnical engineering report for this structure has been completed by Terracon Consulting Engineers and Scientists. We have reviewed and concur with the recommendations as presented in this report.

A copy of the report is attached. If you have any questions, please contact this office at 502-564-2374

cc: J. Van Zee
R. Powell
B. Yeager
R. Franxman
R. Turner
E. Drury
B. Greene
J. Schroeder (Terracon)
C. Callan-Ramler
J. Hager

Attachment

Geotechnical Engineering Retaining Wall Report
Structure No. S-040-2016

Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
STRUCTURE No. S-040-2016
Boone County, Kentucky

August 3, 2017
Terracon Project Number N1155079

Prepared for:
Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

August 3, 2017

Kentucky Transportation Cabinet
Division of Structural Design-Geotechnical Branch
1236 Wilkinson Blvd.
Frankfort, Kentucky 40601-1200

Attn: Mr. Michael Carpenter, PE
Geotechnical Engineer
P: 502-782-3819
F: 502-564-4839
E: erik.scott@ky.gov

Re: Geotechnical Engineering Retaining Wall Report
Structure No. S-040-2016
Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
Boone County, Kentucky
Terracon Project Number: N1155079

Dear Mr. Carpenter:

Terracon Consultants, Inc. (Terracon) is submitting this Geotechnical Engineering Retaining Wall Report for the above referenced structure. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning the retaining wall foundations.

1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/I-71 Interchange with KY 536 (Mt. Zion Road) in Boone County, Kentucky. Stantec is the lead design engineer on the project. Terracon Consultants, Inc. was selected to perform the geotechnical services through our Statewide Engineering Contract. Terracon's services included laboratory testing and engineering services. The field exploration phase was conducted by Thelen Associates, Inc. (now Geotechnology, Inc.) working under a separate Statewide contract with KYTC.

A new “double crossover diamond” interchange is planned with the KY 536 pavement lanes continuing to run beneath the existing I-75 bridge. The project involves reconstruction along KY 536 (Mt. Zion Road), new ramps, a new multi-use path along the northern edge of KY 536, as well as improvements, extensions, and realignments to various side roads that include Biltmore Blvd., Biltmore Drive, Investment Way, Sam Neace Drive, and about 1300 ft. of US 25.

This report addresses the geotechnical-recommendations for one of the proposed retaining walls on the project, namely Structure S-040-2016. The wall location is shown on the attached Project Location Map. As shown, the retaining wall is proposed on the north side of KY 536 (Mt. Zion Road) at about STA 174+65 to 175+20and will be about 55 feet long. There is an existing Cincinnati Bell utility cabinet at this location which must not be disturbed. An exposed cut face of about 6.5 ft. high is planned between the utility box and new roadway. A retaining wall is required at this location, but of the type that will require no excavation into the slope to avoid disturbing the utility box. As discussed later, the recommended retaining wall type is a drilled in soldier pile wall with lagging, constructed in a “top-down” sequence so no excavation is made into the existing slope.

2.0 SITE TOPOGRAPHY AND GEOLOGICAL CONDITIONS

The project area lies in a dissected upland of the Outer Bluegrass Region. Ground elevations along the overall project route generally range from about Elev. 870 ft. to about 950 ft. Grades generally rise to the east. The existing ground surface elevation along the proposed retaining wall alignment is about 931 ft. Proposed road grade at the base of the future retaining wall ranges from about Elev. 924.5 ft. to Elev. 925 ft.

Surface drainage in the project vicinity is generally dendritic with most flow towards the South Branch of Gunpowder Creek, which lies west of I-75. The Ohio River lies about 8 miles north of the site and has a normal pool elevation of 455 ft.

Geologic mapping indicates the project area is underlain by limestone and shale of the Bull Fork Formation and Ordovician System. Mapping shows the limestone comprises as much as about 95 percent of the rock mass. No known karst features are mapped in the project area.

The USGS Soil Survey shows that the uppermost soils along the project site comprise mostly of Rossmoyne Silt Loam with lesser amounts of Jessup Silt Loam (a wind-blown loess) and Faywood Silty Clay (residuum).

3.0 SUBSURFACE EXPLORATIONS

An exploration plan was developed by Terracon after a review of the available plans, profiles, and cross-sections provided by Stantec. The draft exploration plan was subsequently reviewed and approved by KYTC Geotechnical Branch. Some borings were relocated during the field program due to access, utility conflicts, etc.

Two rock core borings were drilled along the alignment of Structure S-040-2016. A summary of the borings is provided below.

Table 3.0: Summary of Test Borings

Boring	Samples	Approx. Top/Weathered Bedrock, ft.	Approx. Top/Weathered Rock Elev., ft.	Approx. Depth to RDZ, ft.
1007	2 UD's plus rock core	11.6'	920.3	15.8'
1008	3 UD's plus rock core	13.0'	918.4	13.8'

UD: Undisturbed (Shelby tube) sample
SPT: Standard Penetration Test sample
RDZ: Rock Disintegration Zone

Refer to the attached Subsurface Data Sheet for the location of the borings, subsurface logs, and soil test results.

4.0 LABORATORY TESTING AND RESULTS

A laboratory testing program was assigned to the thin-walled tubes and approved by the KYTC Geotechnical Branch. The laboratory tests were conducted by Terracon in accordance with the appropriate AASHTO or Kentucky Methods as outlined in the Geotechnical Manual. The results of the laboratory tests are depicted graphically on the Subsurface Data Sheet.

The laboratory testing program on undisturbed samples in the overburden soil zone included classification and compressive strength testing; results are summarized on the following page.

Table 4.0: Summary of Laboratory Test Results

Station	Offset	Hole	Sample	AASHTO	USCS	U.C., psf	Silt+Clay, %
174+65	82 ft. LT	1007	1	A-7-6(29)	CL	5334	97(80+17)
174+65	82 ft. LT	1007	2	A-7-6(24)	CL	3387	82(62+20)
175+19	55 ft. LT	1008	1	A-6(11)	CL	10593	85(79+6)
175+19	55 ft. LT	1008	2	A-6(8)	CL	2535	83(73+10)
175+19	-55 ft.	1008	3	A-6(3)	SC	-	46(46+0)

5.0 ENGINEERING ANALYSES

A soldier pile wall with lagging was evaluated for this retaining wall. The proposed scheme would be to leave the existing slope and utility box undisturbed. Using a drilled pier rig, holes would be drilled parallel to the roadway to install soldier piles embedded into bedrock and at least partially backfilled with concrete. The soldier piles would be installed before any excavation is made into the slope face. That excavation would proceed incrementally on the downhill face of the solider piles while lagging is installed, thusly named “top-down construction.” The entire face of the soldier pile would not be exposed in one stage, but rather in small vertical stages as lagging is installed.

The maximum exposed face height is 6.5 feet with a horizontal back slope. Assuming that some temporary excavation would be performed on the downhill face of the soldier piles beneath final grade (to facilitate lagging installation), the analyses were based upon a total exposed face height of 8.5 feet instead of 6.5 feet.

The engineering analyses included laterally loaded pile analyses using the LPILE program. This program treats the soil as a series of discrete springs having “p-y” behavior. The analyses were based upon a pier excavation diameter of 24 inches at horizontal center-to-center of 6 and 8 feet (both were evaluated).

The analyses were based upon the assumption of steel reinforcing consisting of rolled steel sections. The LPILE input for steel Moment of Inertia for Cases 1A and 1B were 204 and 285 in^4, respectively. For Cases 2A and 2B, the input Moment of Inertia was 238 and 348 in^4, respectively. Cases 1A and 1B represented a 6 ft. pile spacing. Cases 2 A and 2B represent an 8 ft. pile spacing. Cases 1A and 2A include concrete placement in the drilled pier excavation extending from the bottom of the rock socket to the bottom of the lagging (which is 2 feet below final grade). Cases 1B and 2B include concrete backfill that extends from the bottom of the rock socket up to the top-of-weathered bedrock, which is about 5 feet below final grade at the base of the wall.

The top of the pile was assumed to be free to rotate, thus representing “free-head” conditions. In all cases, it was assumed that the soldier piles were embedded no less than 5 feet into gray shale and limestone. This condition required the pile embedment below ground surface (at the base of the wall) to be 13 feet and a total length from pile but to tip of 19.5 feet.

Schematic sketches are shown on the attached Subsurface Data Sheet.

A summary of soil parameters used in the analyses is provided below.

Table 5.0: Summary of Assumed Soil Parameters

Item	Moist Unit Weight, pcf	Cohesion, psf	ε_{50}
Existing Overburden Soil	132	2500	.02
Weathered Bedrock (1)	135	4000	.007
Unweathered (gray) Bedrock (2)	135	5400	N/A

(1) Modeled as a stiff clay

(2) Modeled as a weak rock with Initial Modulus of 500 psi and RQD of 25%.

Assumed soil loading conditions are tabulated below. The depth of 8.5 feet shown in Table 5.1 below was selected as the depth to the anticipated temporary excavation level. The horizontal load values shown are based on a factored horizontal earth pressure at 8.5 feet deep of 0.66 kips/sq. ft. This value was obtained from the following formula:

p_a (factored) = $\gamma \times H \times K_a \times f$,

where:

γ = 0.132 kips/cu. ft.

H = 8.5 ft.

K_a = 0.39, (Ref. NAVFAC DM 7.2-64, Fig. 3)

F = Load Factor = 1.5 (Ref. AASHTO LRFD Bridge Design Specifications, 7th ed., 2015, Fig. C11.56-2, p.11-11)

Table 5.1: Summary of Assumed Soil Loading (Factored Loads per LRFD)(1)

Case	Horizontal Load on Pile at top of Pile, lbs./in.	Horizontal Load on Pile at 8.5 ft. depth from top of Pile, lbs./in. (1)
1A and 1B: 6 ft. pile spacing	0	330
2A and 2B: 8 ft. pile spacing	0	440

(1) Triangular earth pressure distribution was assumed, utilizing a soil density of 128 lbs./cu. ft., Active Earth Pressure Coefficient, K_a, of 0.39 and an LRFD Load Factor of 1.5, per AASHTO LRFD Bridge Design Specifications, 7th ed., 2015, Fig. C11.56-2, p. 11-11.

LPILE analyses results of the analyses are summarized below:

Table 5.2: Summary of LPILE Analyses

Case	Spacing, ft.	Top/Concrete	Estimated Max. Horiz. Deflection, in.	Estimated Max. Moment, in.-kips	Estimated Max. Shear, kips
1A	6	Case A (1)	1.3	800	-20
1B	6	Case B (2)	2.0	1300	-30
2A	8	Case A (1)	1.75	1140	-26
2B	8	Case B (2)	2.5	1800	-43

(1) Case A is for concrete from bottom of rock socket up to bottom of lagging (2 feet below final grade at base of wall).

(2) Case B is for concrete from bottom of rock socket up top of weathered bedrock (about 5 feet below final grade at base of wall)

Plots of horizontal deflection at the top of the pile, maximum bending moment, and shear versus depth for all cases tabulated above are attached to the report along with LPILE input and output printouts.

6.0 RECOMMENDATIONS

6.1 The retaining wall type and construction sequence recommended here is intended to support the proposed cut slope while avoiding disturbance to a critical Cincinnati Bell utility cabinet at this location. A soldier pile wall with lagging is recommended with top-down construction methods. The recommended sequence would be to leave the existing slope and utility box undisturbed. Using a drilled pier rig, holes would be drilled parallel to the roadway to install soldier piles embedded into bedrock and at least partially backfilled with concrete. The soldier piles would be installed (with concrete placement) before any excavation is made into the slope face. That excavation would proceed incrementally on the downhill face of the solider piles while lagging is installed, thusly named "top-down construction." The entire face of the soldier pile would not be exposed in one stage, but rather in small vertical stages as lagging is installed. The cost of all materials, labor, and equipment needed to pre-drill and backfill the holes shall be included in the price per linear foot for "Pre-drilling Piles."

Final retaining wall design and the intended construction sequence should be reviewed by KYTC / Engineer prior to construction.

6.2 Soldier piles should be placed into pier excavations socketed no less than 5 feet into gray, unweathered shale and limestone bedrock. This equates to a soldier pile tip elevation of about Elevation 911 ft. This tip elevation is approximate and actual field conditions should govern. In no case, should the constructed pile socket depth be less than 13 feet from final grade. The designer may utilize permanent facing composed of pre-cast or cast-in-place concrete. If applicable, geocomposite wall drains should be included between any temporary and permanent facing.

6.3 Backfill around the soldier pile should consist of structural concrete up to the design elevation based upon the appropriate case selected as defined in section 5 of this report. Above the concrete elevation, flowable fill is deemed acceptable as backfill material.

6.4 Soldier pile sections should be determined from the tabulated Maximum Bending Moment values provided above. Some degree of section loss due to corrosion should be considered in selecting a soldier pile section (one method could be to increase the computed section modulus by 1.33).

6.5 Lagging between the soldier piles will require structural design to verify adequate bending resistance. For long-term support, precast or cast-in-place concrete lagging should be considered. Timber lagging could be used but would have a lesser design life. In all cases, lagging should extend 2 feet below the finished ground surface on the downhill face of the wall. Additionally, lagging must be installed between the soldier pile flanges. Fastening the lagging to the front face of the soldier piles will not be allowed. Weep holes should be incorporated into the lagging design and construction.

6.6 Construction of the retaining wall should be performed in accordance with KYTC specifications. Additionally, construction inspection by KYTC or its representative should verify pier size, spacing, depth, plumbness, bearing, steel and concrete placements, etc. meet project specifications. The wall designer shall verify wall stability based upon final wall dimensions.

The analysis and conclusions presented in this report are based upon the data obtained from the test borings performed by others at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur away from the borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident over the short term. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, and bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If KYTC is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use by KYTC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We appreciate the opportunity to be of service to you on this project. Please contact us with any questions concerning this report.

Respectfully submitted,

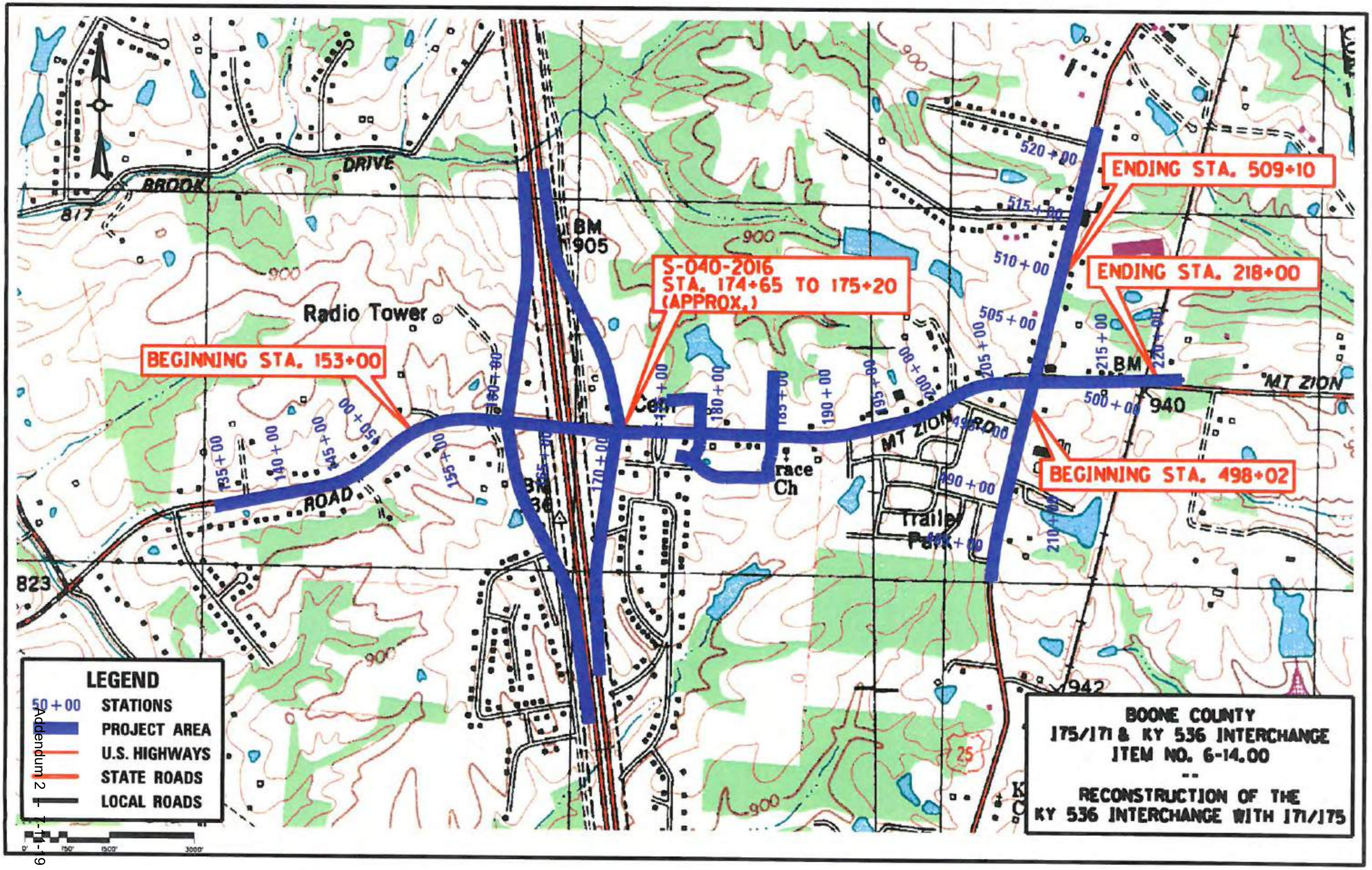
Terracon Consultants, Inc.

for Aaron J. Muck

Jess A. Schroeder, P.E.
Senior Geotechnical Engineer

Aaron J. Muck, P.E.
Senior Geotechnical Engineer

Attachments:
- Project Location Plan
- Subsurface Data Sheets
- Geotechnical Notes for Top-Down Construction of Drilled-In Soldier Pile / Lagging Wall
- Coordinate Data Form
- Calculations



BOONE COUNTY
I75/I71 & KY 536 INTERCHANGE
ITEM NO. 6-14.00
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RECONSTRUCTION OF THE
KY 536 INTERCHANGE WITH I71/I75

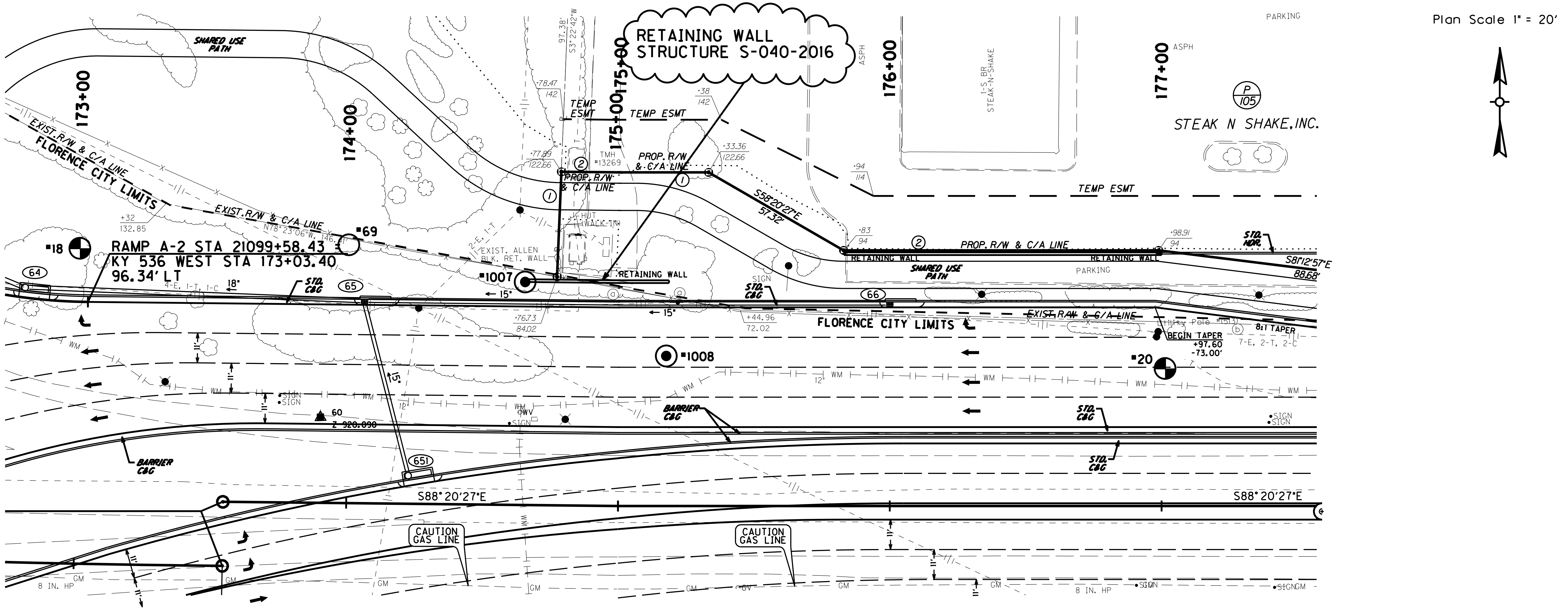
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\S-040-2016.DGN

USER: kjmankin
DATE PLOTTED: July 19, 2017

E-SHEET NAME:

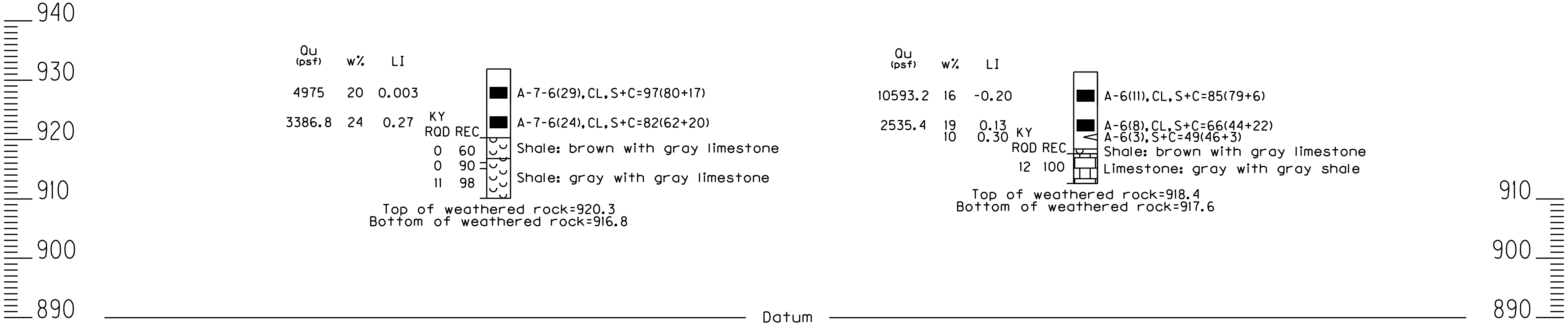
MicroStation v8.11.9.832

Plan Scale 1" = 20'



Hole No.	#1007	#1008
Station	174+65	175+18
Offset	82 FT. LT.	55 FT. LT.
Elev. (Sea level datum)	931.9	931.4

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale



#1007

Qu (psf)	w%	LI	KY RQD	REC	
4975	20	0.003			A-7-6(29),CL,S+C=97(80+17)
3386.8	24	0.27			A-7-6(24),CL,S+C=82(62+20)
			0	60	Shale: brown with gray limestone
			0	90	
			11	98	Shale: gray with gray limestone

Top of weathered rock=920.3
Bottom of weathered rock=916.8

#1008

Qu (psf)	w%	LI	KY RQD	REC	
10593.2	16	-0.20			A-6(11),CL,S+C=85(79+6)
2535.4	19	0.13			A-6(8),CL,S+C=66(44+22)
	10	0.30			A-6(3),S+C=49(46+3)
					Shale: brown with gray limestone
			12	100	Limestone: gray with gray shale

Top of weathered rock=918.4
Bottom of weathered rock=917.6

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 536	RETAINING WALL STA. 174+65 TO STA. 175+20

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 - 7-11-19

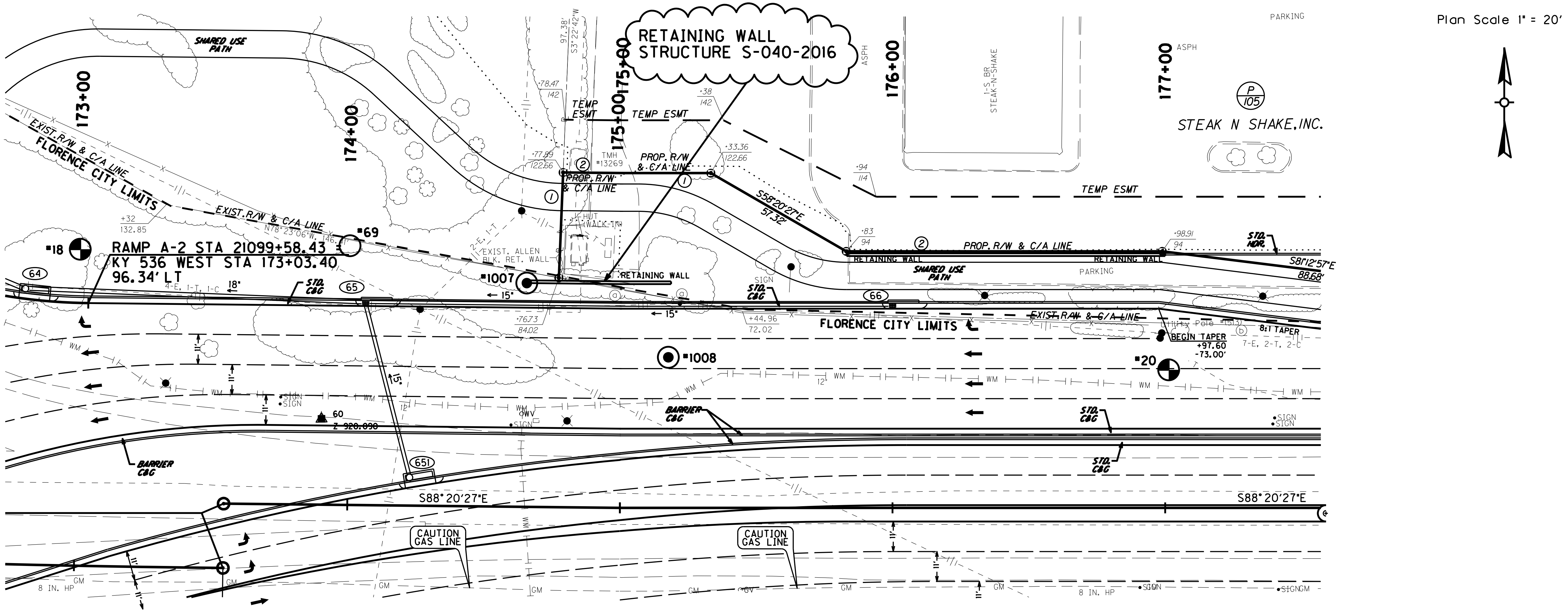
SHEET NO.

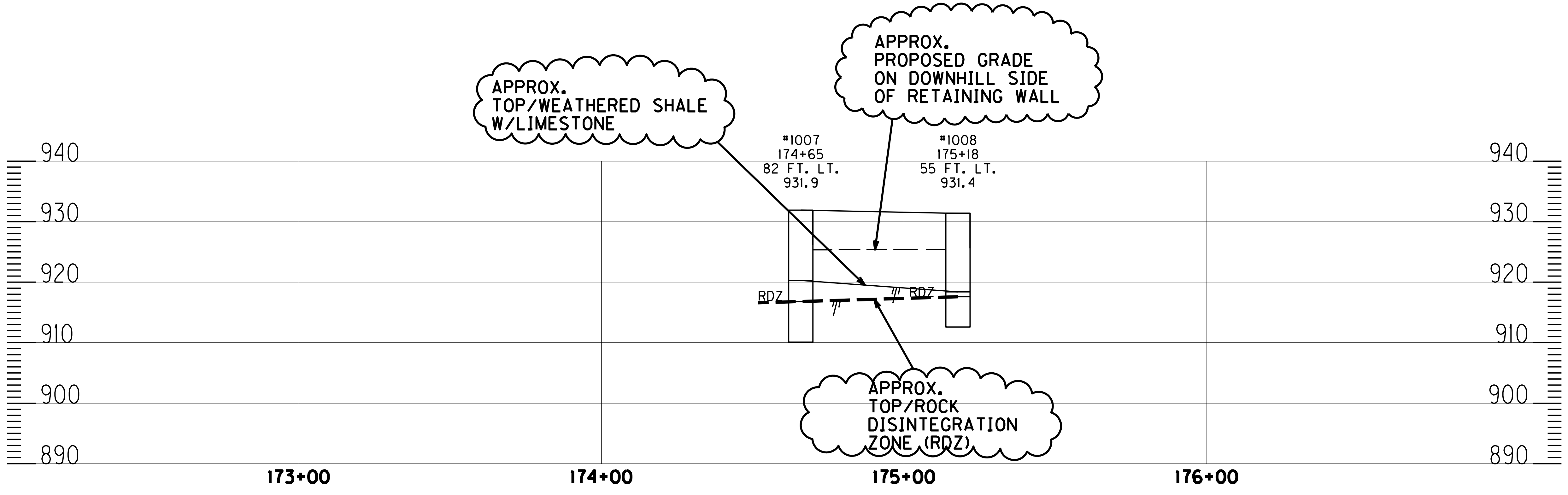
DRAWING NO.

S-040-2016

SHEET 1 OF 1

ITEM NUMBER
6-14.00





S–040–2016

SHEET 1 OF 1

ITEM NUMBER
6–14.00

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 536	RETAINING WALL STA. 174+65 TO STA. 175+20

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
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PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 – 7-11-19

SHEET NO.

DRAWING NO.

MicroStation v8.11.9.832
E-SHEET NAME:
USER: kjmankin
DATE PLOTTED: March 9, 2017
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\RETAINING WALLS\S-040-2016.DGN

GEOTECHNICAL NOTES

for Top-Down Construction of Drilled-In Soldier Pile/Lagging Wall

Station Interval
ML 174+65 TO 175+20, LT

Summary of Assumed Soil Parameters for LPILE Analyses

Item	Moist Unit Weight, pcf	Cohesion, psf	ε_{50}
Existing Overburden Soil	132	2500	.02
Weathered Bedrock (1)	135	4000	.007
Unweathered (gray) Bedrock (2)	135	5400	N/A

(1) Modeled as a stiff clay

(2) Modeled as a weak rock with Initial Modulus of 500 psi and RQD of 25%.

Assumed soil loading conditions are tabulated below.

Summary of Assumed Soil Loading (Factored Loads per LRFD)(1)

Case	Horizontal Load on Pile at top of Pile, lbs./in.	Horizontal Load on Pile at 8.5 ft. depth from top of Pile, lbs./in. (1)
1A and 1B: 6 ft. pile spacing	0	330
2A and 2B: 8 ft. pile spacing	0	440

(1) Triangular earth pressure distribution was assumed, utilizing a soil density of 128 lbs./cu. ft., Active Earth Pressure Coefficient, K_a, of 0.39 and an LRFD Load Factor of 1.5, per AASHTO LRFD Bridge Design Specifications, 7th ed., 2015, Fig. C11.56-2, p. 11-11.

NOTES:

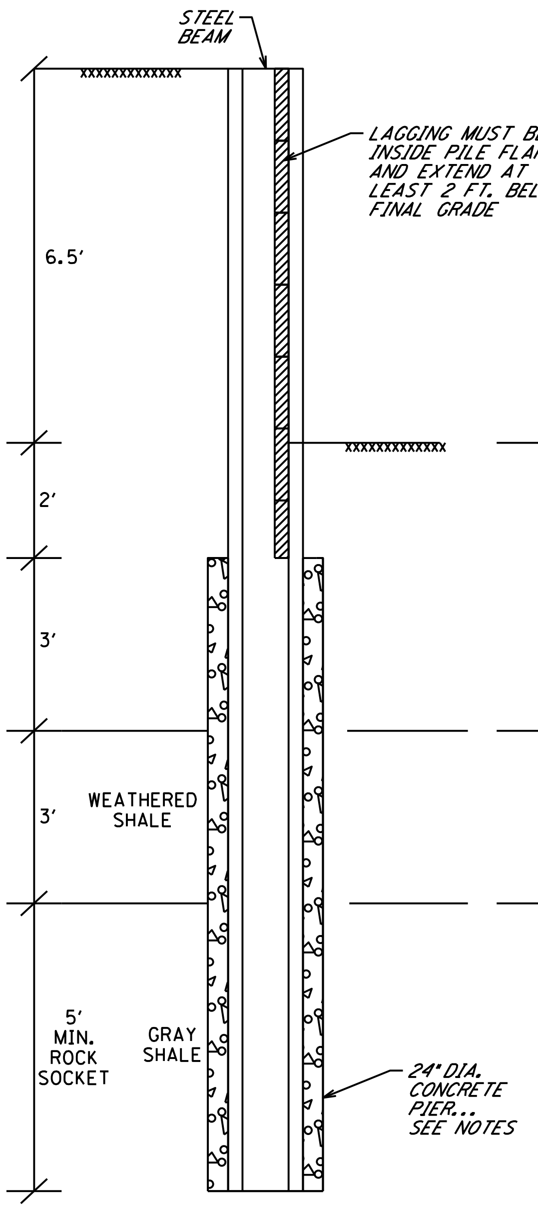
1. CONCRETE SHALL BE CLASS B CONCRETE CONFORMING TO SECTION 601 OF THE STANDARD SPECIFICATIONS; HOWEVER, PROVIDE A MIX WITH A 6 TO 10 INCH SLUMP AT THE TIME OF PLACEMENT; HIGH RANGE WATER REDUCING AND RETARDING ADMIXTURES AND FLY ASH MAY BE USED TO OBTAIN THIS SLUMP.

2. THE DRILLED-IN H-PILES SHALL BE CENTERED IN THE ROCK SOCKET AND THE CLASS B CONCRETE WILL, AT A MINIMUM, BE EXTENDED TO THE TOP OF THE ROCK SOCKET. NOTE THAT THE LPILE ANALYSIS PRESENTED HERE REPRESENT TWO DIFFERENT CASES OF CONCRETE ENCASEMENTS, AS SHOWN ON THE SCHEMATIC SKETCHES. THE FINAL DESIGN MUST BE EVALUATED FOR STABILITY.

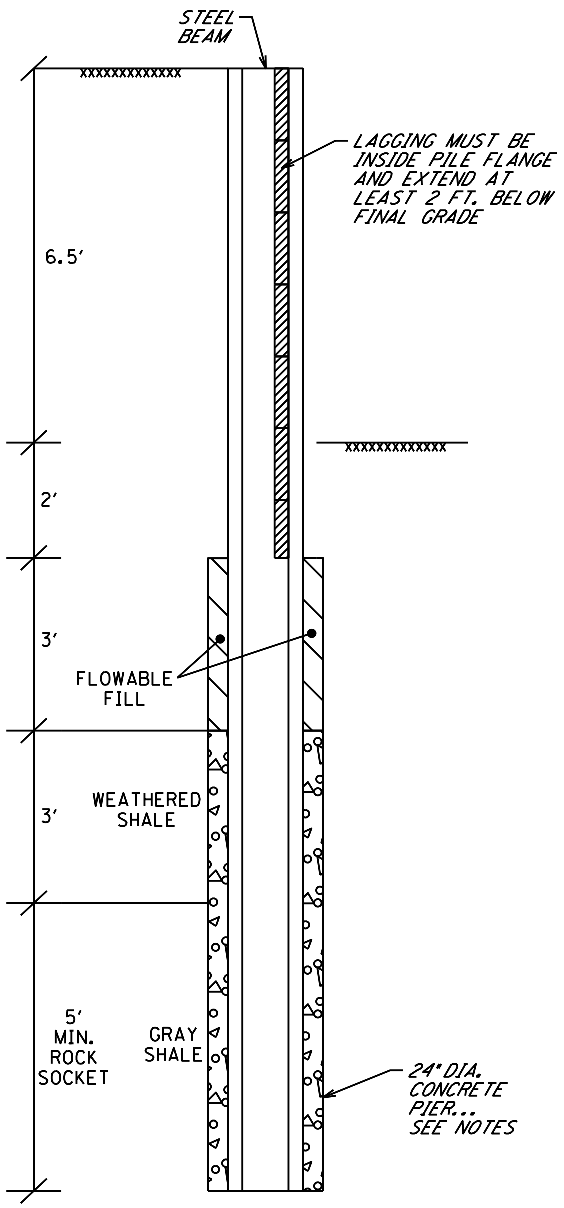
3. FLOWABLE FILL MAY BE USED ABOVE THE CONCRETE PORTION OF THE PIER BACKFILL. THE PLACEMENT OF FLOWABLE FILL MUST BE CONCURRENT WITH THE REMOVAL OF TEMPORARY CASING (IF USED) IN ORDER TO AVOID COLLAPSE OF THE HOLE.

4. CLASS B CONCRETE MAY BE EXTENDED BEYOND THE LIMITS OF THE ROCK SOCKET; HOWEVER, IT SHALL NOT BE EXTENDED BEYOND THE PLANNED DESIGN GRADE ELEVATION. THIS WOULD RESULT IN DIFFICULTIES WHEN EXCAVATING FOR PLACEMENT OF THE LAGGING AND/OR CONCRETE FACING.

5. THE COST OF ALL THE MATERIALS, LABOR, AND EQUIPMENT NEEDED TO PRE-DRILL AND BACKFILL THE HOLES SHALL BE INCLUDED IN THE PRICE PER LINEAR FOOT FOR "PRE-DRILLING PILES".



CASES 1A & 2A



CASES 1B & 2B

NOTES:
CASES 1A & 1B HAVE 6 FT. SPACING.
CASES 2A & 2B HAVE 8 FT. SPACING.

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536

CROSSING
RETAINING WALL @ ML STA. 174+65 TO STA. 175+20

SUBSURFACE DATA

S–040–2016

ITEM NUMBER
6–014.00

PREPARED BY
Terracon
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611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 7-11-19

SHEET NO.

DRAWING NO.

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\GEOTECHNICAL NOTES S-040-2016.DGN

USER: kjmankin
DATE PLOTTED: July 13, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

COORDINATE DATA SUBMISSION FORM - PROPOSED REATINING WALL S-040-2016						
KYTC Division of Structural Design - Geotechnical Branch						
County:		**Boone**				
Road Number:		**KY 536 & I-75 (Reconstruct I-75 Interchange with KY 536, Mt. Zion Road**				
Item:		**6-14.00**				
MARS		**8022203D**				
Project #:		**FD52 008 0075 177-179D**				
Hole Number	**Latitude**	**Longitude**	**Station Number**	**Offset**	**Elevation**	**Hole Depth**
1007	38.9565920	-84.6317020	17465	82 LT	931.89	21.8
1008	38.9565130	-84.6315210	17518	55 LT	931.40	18.8

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 11/3/16

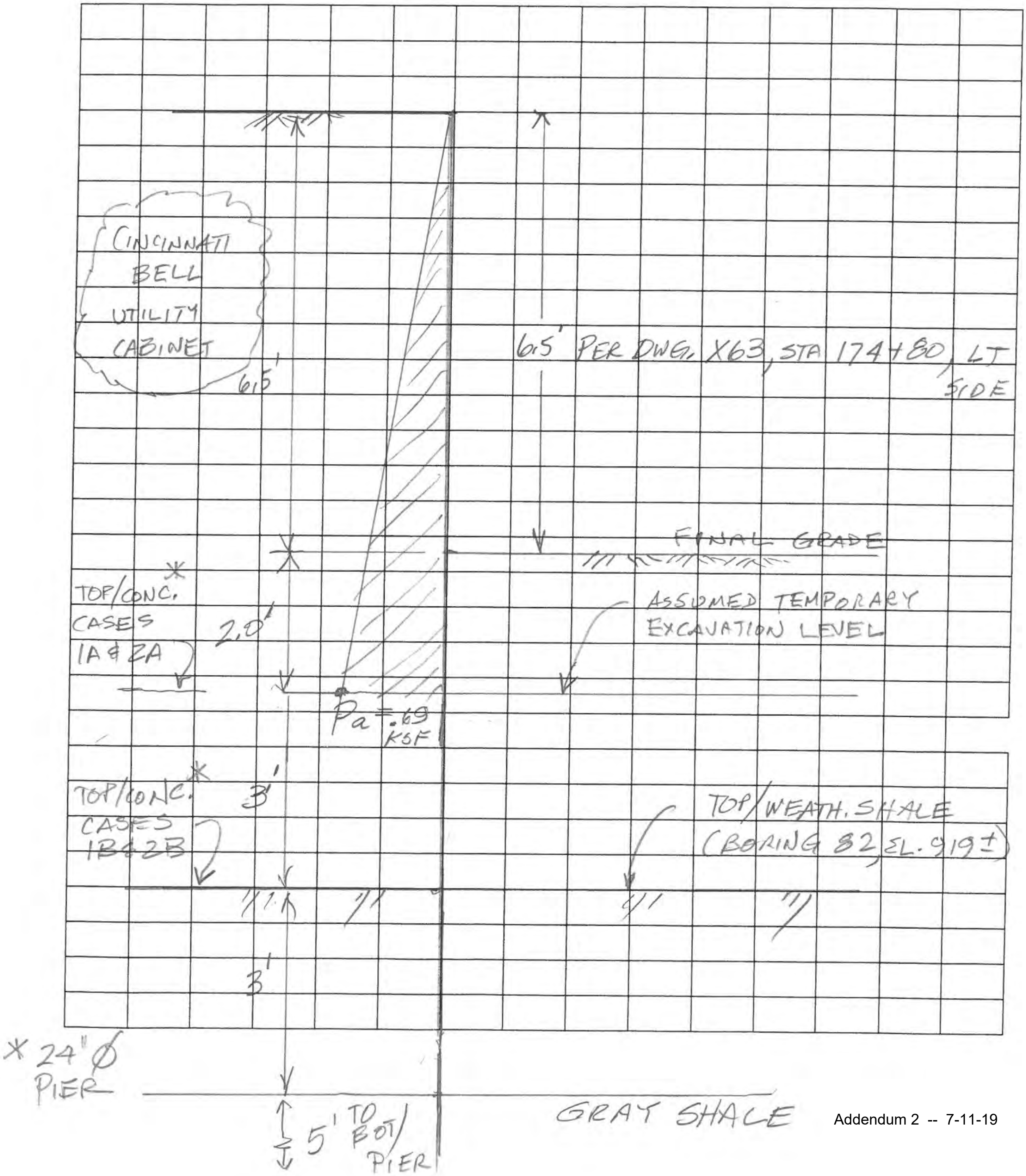
Structure No.: S-040-2016

Terracon

Sheet 1

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case N/A (SEE BELOW)



Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 11/3/16
Structure No.: S-040-2016

Terracon
Sheet 2

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case N/A

▶ COMPUTE ACTIVE EARTH PRESSURE ...

1. ASSUME EARTH PRESSURE ACTS FROM TOP-OF-WALL TO TEMPORARY EXCAVATION LEVEL ($H = 8.5'$)

2. ASSUME EXISTING SOIL HAS $\phi = 26^\circ$
(Ref. NAVFAC DM 7.2, PAGE 7.2-39 & FHWA NHI-06-088, p. 5-56)
$K_A = 0.39$ (NAVFAC DM 7.2-64, FIG. 3)

3. SOIL OVERBURDEN FROM BORINGS 1007 & 1008 SHOWED $C = 1268$ to 5297 psf & γ_T avg $= 128$ pcf

$P_a = \gamma H K_A = .132(8.5)(0.39) = 0.44$ KSF
UNFACTORED

4. APPLY LOAD FACTOR OF 1.5 per AASHTO LRFD BRIDGE DESIGN SPEC'S, 7TH ED, 2015, FIG. C11.56-2, p. 11-11

P_a (FACTORED) $= 0.44(1.5) = 0.66$ KSF

▶ PERFORM L-PILE ANALYSIS

CASE 1: 6' SPACING ⇒ $P_a = 0.66$ KSF×6' $= 3.96$ K/FT
$= 330$ lb/in.

CASE 2: 8' SPACING ⇒ $P_a = .66(8) = 5.28$ K/FT
$= 440$ lb./in.

LET $\gamma = 132$ pcf
$C = 2500$ psf

BROWN SHALE ⇒ $\gamma = 135$ pcf, $C = 4000$ psf

GRAY SHALE ⇒ $\gamma = 135$ pcf, $q_u = 75$ psi, $E = 500$ psi,
RQD = 25%

ASSUME 24" ϕ PIERS w/6 No. 8 BARS (~1% STEEL)

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 11/3/16

Structure No.: 5-040-2016

Terracon

Sheet 3

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case N/A

FOR EACH PIER SPACING (6 & 8), ASSUME THESE CASES:

(1) CONC. PIER FROM TEMPORARY EXCAV. LEVEL (BOT. / LAGGING) TO BOTTOM OF PIER @ 5 FT. INTO GRAY SHALE.

(2) CONCRETE PIER FROM TOP/WEATH. SHALE TO 5' INTO GRAY SHALE; NEGLECT PASSIVE RESISTANCE FROM TOP/GRAY SHALE UPWARDS. (CONSERVATIVE SINCE FLOWABLE FILL EXISTS).

SUMMARY:

CASE	PIER SPACING	CONC. PIER SOCKET FROM TOP/WALL	MAX. HORIZ. DEFLECTION	SECTION MODULUS	STEEL BEAM
1A	6'	BET. 8.5 & 19.5'	1.3"	26.1 in^3	W12x26
1B	6'	BET. 11.5 & 19.5'	1.8"	36.4 in^3	W12x30
2A	8'	BET. 8.5 & 19.5'	2.0"	40.9 in^3	W12x35
2B	8'	BET. 11.5 & 19.5'	2.5"	56.1 in^3	W12x45

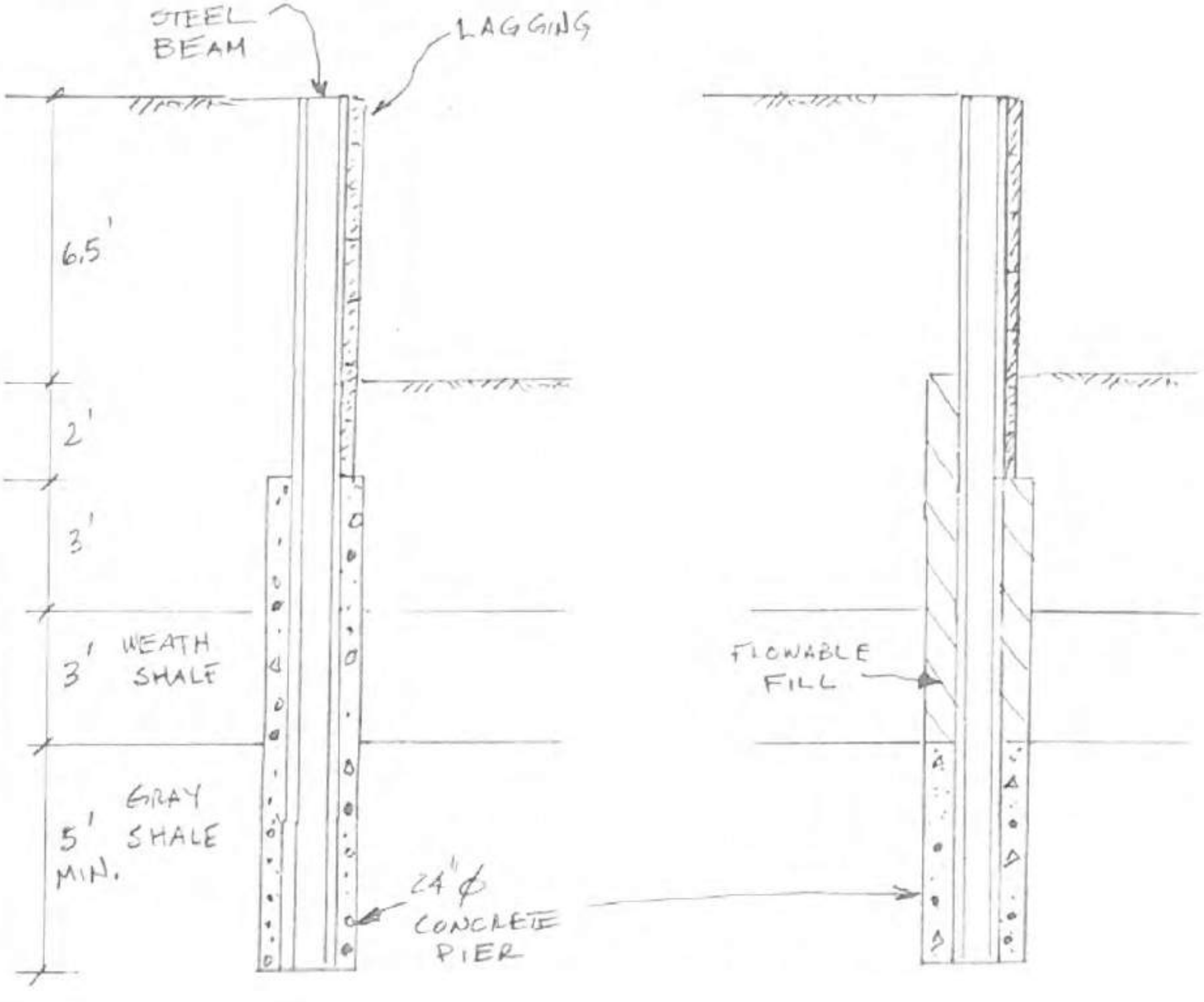
➤ SEE SCHEMATICS ON SHT 4 & ATTACHED L-PILE PRINTOUTS

Terracon

PROJECT: BOONE COUNTY, 6-0014.0 Page 4 of

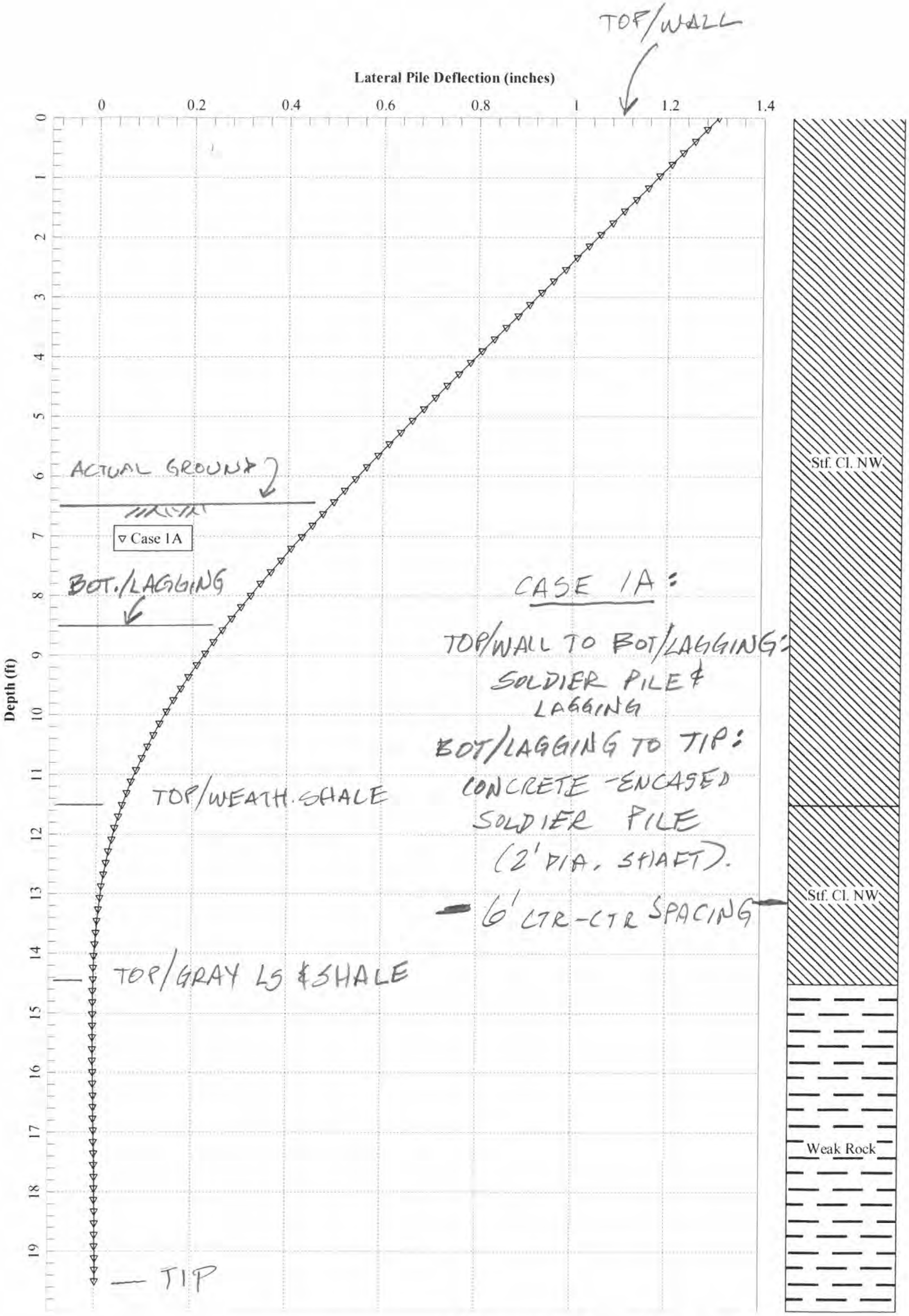
JOB NO. N1155079 Date 11/10/16 Comp. By Ft CHECKED BY:

SCHEMATICS OF ANALYSIS CASES:



CASES 1A & 2A

CASES 1B & 2B



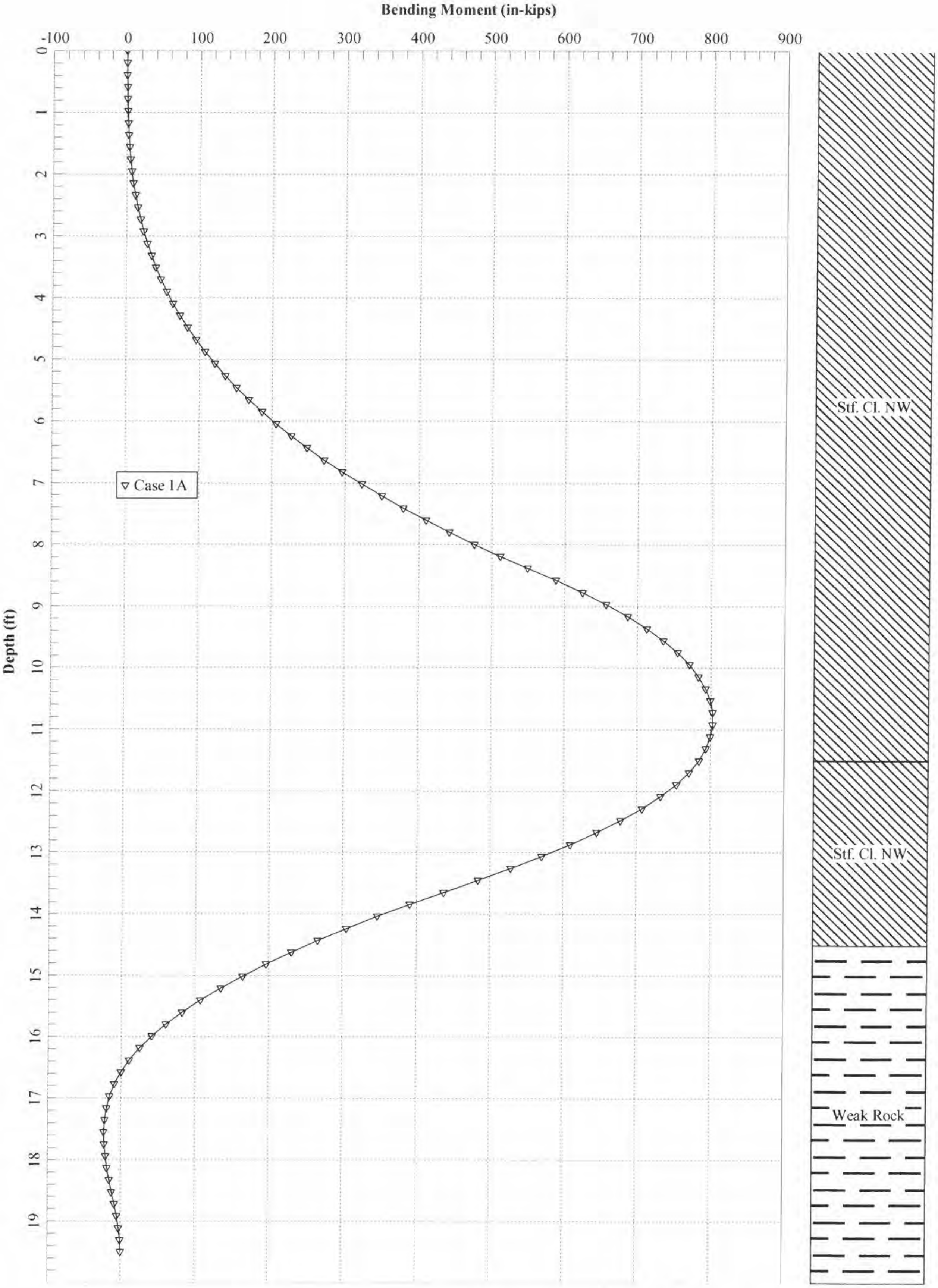
CASE 1A:

TOP/WALL TO BOT/LAGGING: SOLDIER PILE & LAGGING

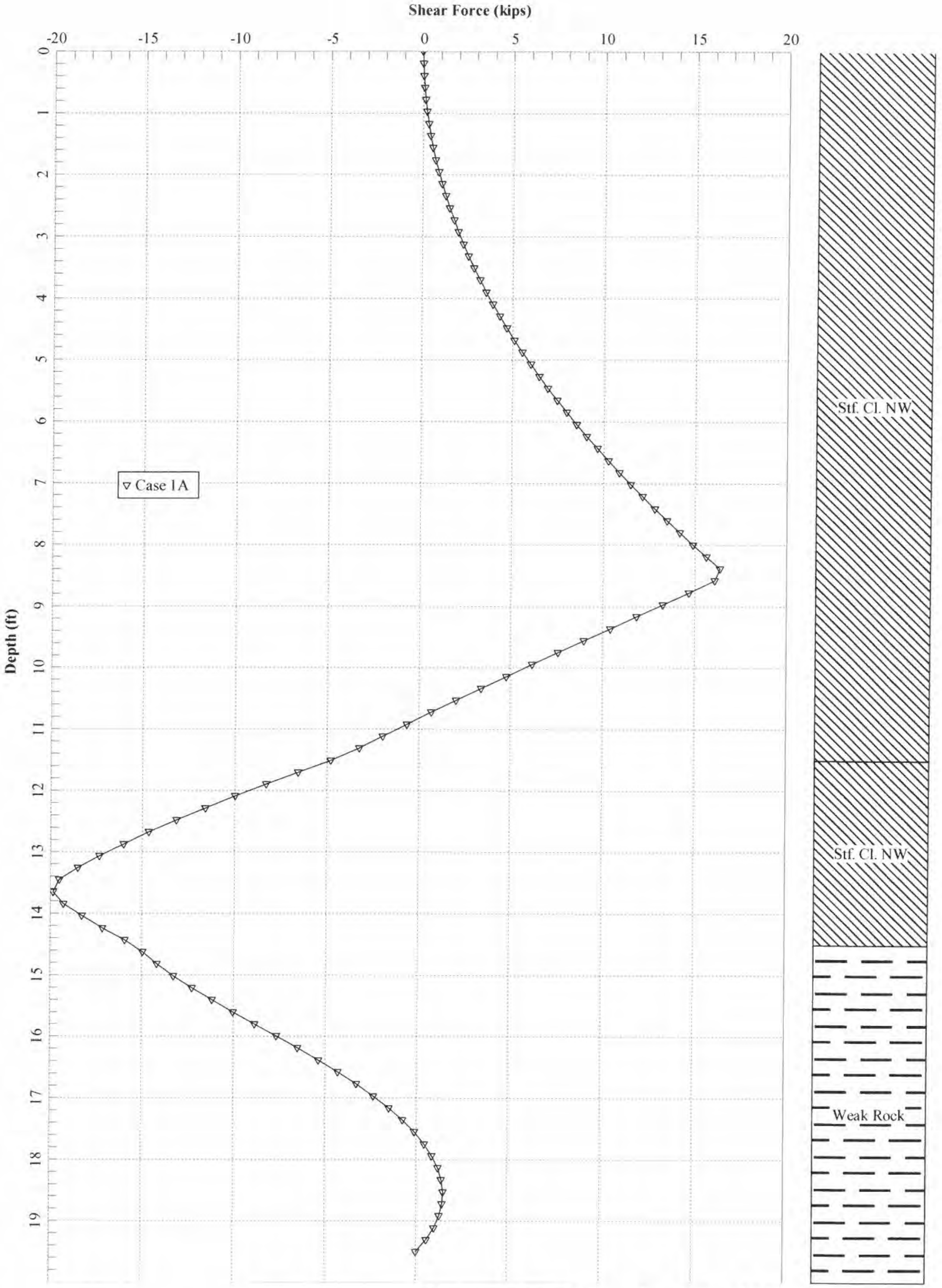
BOT/LAGGING TO TIP: CONCRETE-ENCASED SOLDIER PILE (2' DIA. SHAFT).

6' CTR-CTR SPACING

BOONE CO. 6-0014.0
S-040-2016



BOONE Co. 6-00141.0
S-040-2016



BOONE CO. 6-00140
5-040-2016

```
================================================================================

                   LPile for Windows, Version 2015-08.003

                 Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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================================================================================

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--------------------------------------------------------------------------------
                           Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\Projects\2015\N1155079\Working Files\Calculations-Analyses\LPILE\Nov 2016 - 2nd Iteration\

Name of input data file:
Case 1A, 6' spacing, 11' socket.lp8d

Name of output report file:
Case 1A, 6' spacing, 11' socket.lp8o
```

```
Name of plot output file:
Case 1A, 6' spacing, 11' socket.lp8p

Name of runtime message file:
Case 1A, 6' spacing, 11' socket.lp8r


--------------------------------------------------------------------------------
                         Date and Time of Analysis
--------------------------------------------------------------------------------

          Date:  November 11, 2016     Time:   8:50:44


--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:
```

```
--------------------------------------------------------------------------------
                        Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed                 =        500
 - Deflection tolerance for convergence                 =   1.0000E-05 in
 - Maximum allowable deflection                         =     100.0000 in
 - Number of pile increments                            =        100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis includes loading by one distributed lateral load acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats
```

```
--------------------------------------------------------------------------------
                     Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total number of pile sections                                =          1

Total length of pile                                         =       19.50 ft

Depth of ground surface below top of pile                    =        8.50 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile.

Point         Depth              Pile
                X              Diameter
                ft                in
-----       ---------        -----------
  1           0.00000        24.00000000
  2        19.5000000        24.00000000


Input Structural Properties:
----------------------------

Pile Section No. 1:

   Section Type                                           =     Elastic Pile
   Cross-sectional Shape                                  =    Circular Pile
   Section Length                                         =     19.500000 ft
   Top Width                                              =     24.000000 in
   Bottom Width                                           =     24.000000 in
   Top Area                                               =    452.389342 sq. in
   Bottom Area                                            =    452.389342 sq. in
   Moment of Inertia at Top                               =    204.000000 in^4
   Moment of Inertia at Bottom                            =    204.000000 in^4
   Elastic Modulus                                        =     29000000. lbs/in^2
```

```
--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                          =        0.000 degrees
                                                            =        0.000 radians

Pile Batter Angle                                           =        0.000 degrees
                                                            =        0.000 radians


--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is stiff clay without free water

   Distance from top of pile to top of layer                =     8.500000 ft
   Distance from top of pile to bottom of layer             =    11.500000 ft
   Effective unit weight at top of layer                    =   132.000000 pcf
   Effective unit weight at bottom of layer                 =   132.000000 pcf
   Undrained cohesion at top of layer                       =        2500. psf
   Undrained cohesion at bottom of layer                    =        2500. psf
   Epsilon-50 at top of layer                               =       0.0000
   Epsilon-50 at bottom of layer                            =       0.0000

   NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer                =    11.500000 ft
   Distance from top of pile to bottom of layer             =    14.500000 ft
```

```
   Effective unit weight at top of layer                 =   135.000000 pcf
   Effective unit weight at bottom of layer              =   135.000000 pcf
   Undrained cohesion at top of layer                    =        4000. psf
   Undrained cohesion at bottom of layer                 =        4000. psf
   Epsilon-50 at top of layer                            =       0.0000
   Epsilon-50 at bottom of layer                         =       0.0000

   NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 3 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer             =    14.500000 ft
   Distance from top of pile to bottom of layer          =    20.000000 ft
   Effective unit weight at top of layer                 =   135.000000 pcf
   Effective unit weight at bottom of layer              =   135.000000 pcf
   Uniaxial compressive strength at top of layer         =    75.000000 psi
   Uniaxial compressive strength at bottom of layer      =    75.000000 psi
   Initial modulus of rock at top of layer               =   500.000000 psi
   Initial modulus of rock at bottom of layer            =   500.000000 psi
   RQD of rock at top of layer                           =    25.000000 %
   RQD of rock at bottom of layer                        =    25.000000 %
   k rm of rock at top of layer                          =       0.0000
   k rm of rock at bottom of layer                       =       0.0000


   (Depth of lowest soil layer extends    0.50 ft below pile tip)


--------------------------------------------------------------------------------
                      Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer        Soil Type          Layer     Effective   Undrained   Uniaxial              E50
Rock Mass
Layer          Name             Depth     Unit Wt.    Cohesion      qu        RQD %      or
 Modulus
 Num.    (p-y Curve Type)        ft         pcf         psf         psi                 krm
```

```
  psi
-----  ------------------  ----------  ----------  ----------  ----------  ----------  ----------
----------
  1         Stiff Clay           8.5000    132.0000       2500.        --          --        default
   --
          w/o Free Water        11.5000    132.0000       2500.        --          --        default
   --
  2         Stiff Clay          11.5000    135.0000       4000.        --          --        default
   --
          w/o Free Water        14.5000    135.0000       4000.        --          --        default
   --
  3              Weak           14.5000    135.0000        --       75.0000     25.0000      --
 500.0000
                 Rock           20.0000    135.0000        --       75.0000     25.0000      --
 500.0000

--------------------------------------------------------------------------------
                           Static Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.


--------------------------------------------------------------------------------
                Distributed Lateral Loading Used For All Load Cases
--------------------------------------------------------------------------------

Distributed lateral load intensity defined using 2 points

Point         Depth X          Dist. Load
 No.            in               lbs/in
-----        ----------       ----------
  1             0.000            0.000
  2           102.000          330.000
```

```
--------------------------------------------------------------------------------
                Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 1

Load    Load          Condition                 Condition              Axial Thrust      Compute Top y
 No.    Type              1                         2                  Force, lbs      vs. Pile Length
-----   ----    --------------------    -----------------------    ----------------    ---------------
   1     1      V =       0.0000 lbs    M =        0.0000 in-lbs          0.0000000          Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading.
Axial thrust is assumed to be acting axially for all pile batter angles.


--------------------------------------------------------------------------------
     Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------
Moment-curvature properties were derived from elastic section properties
```

```
--------------------------------------------------------------------------------
          Computed Values of Pile Loading and Deflection
            for Lateral Loading for Load Case Number 1
--------------------------------------------------------------------------------

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head                          =         0.0 lbs
Applied moment at pile head                       =         0.0 in-lbs
Axial thrust load on pile head                    =         0.0 lbs

   Depth     Deflect.    Bending     Shear      Slope      Total     Bending   Soil Res.  Soil Spr.  Distrib.

     X          y        Moment      Force        S       Stress    Stiffness     p          Es*h      Lat.
Load
    feet      inches     in-lbs       lbs      radians     psi*      in-lb^2   lb/inch    lb/inch    lb/inch

---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
----------
      0.00     1.3049   3.36E-06  -5.13E-08   -0.01063   1.98E-07   5.92E+09       0.00       0.00
1.8926
    0.1950     1.2801     5.1817    11.0720   -0.01063     0.3048   5.92E+09       0.00       0.00
7.5706
    0.3900     1.2552    51.8169    37.6447   -0.01063     3.0481   5.92E+09       0.00       0.00
15.1412
    0.5850     1.2303   181.3591    81.9327   -0.01063    10.6682   5.92E+09       0.00       0.00
22.7118
    0.7800     1.2054   435.2619   143.9358   -0.01063    25.6036   5.92E+09       0.00       0.00
30.2824
    0.9750     1.1805   854.9787   223.6541   -0.01063    50.2929   5.92E+09       0.00       0.00
37.8529
    1.1700     1.1557      1482.   321.0876   -0.01063    87.1743   5.92E+09       0.00       0.00
45.4235
    1.3650     1.1308      2358.   436.2362   -0.01063   138.6864   5.92E+09       0.00       0.00
52.9941
    1.5600     1.1059      3524.   569.1000   -0.01063   207.2676   5.92E+09       0.00       0.00
60.5647
    1.7550     1.0811      5021.   719.6790   -0.01063   295.3563   5.92E+09       0.00       0.00
```

```
68.1353
    1.9500    1.0562      6892.  887.9732  -0.01062  405.3910  5.92E+09      0.00      0.00
75.7059
    2.1450    1.0313      9177.     1074.  -0.01062  539.8101  5.92E+09      0.00      0.00
83.2765
    2.3400    1.0065     11918.     1278.  -0.01062  701.0521  5.92E+09      0.00      0.00
90.8471
    2.5350    0.9816     15156.     1499.  -0.01061  891.5553  5.92E+09      0.00      0.00
98.4176
    2.7300    0.9568     18934.     1738.  -0.01061     1114.  5.92E+09      0.00      0.00
105.9882
    2.9250    0.9320     23292.     1995.  -0.01060     1370.  5.92E+09      0.00      0.00
113.5588
    3.1200    0.9072     28271.     2270.  -0.01059     1663.  5.92E+09      0.00      0.00
121.1294
    3.3150    0.8825     33914.     2562.  -0.01057     1995.  5.92E+09      0.00      0.00
128.7000
    3.5100    0.8577     40262.     2872.  -0.01056     2368.  5.92E+09      0.00      0.00
136.2706
    3.7050    0.8330     47355.     3200.  -0.01054     2786.  5.92E+09      0.00      0.00
143.8412
    3.9000    0.8084     55237.     3545.  -0.01052     3249.  5.92E+09      0.00      0.00
151.4118
    4.0950    0.7838     63947.     3908.  -0.01050     3762.  5.92E+09      0.00      0.00
158.9824
    4.2900    0.7593     73528.     4289.  -0.01047     4325.  5.92E+09      0.00      0.00
166.5529
    4.4850    0.7348     84021.     4688.  -0.01044     4942.  5.92E+09      0.00      0.00
174.1235
    4.6800    0.7104     95467.     5104.  -0.01040     5616.  5.92E+09      0.00      0.00
181.6941
    4.8750    0.6861    107909.     5538.  -0.01036     6348.  5.92E+09      0.00      0.00
189.2647
    5.0700    0.6619    121386.     5990.  -0.01032     7140.  5.92E+09      0.00      0.00
196.8353
    5.2650    0.6378    135942.     6459.  -0.01027     7997.  5.92E+09      0.00      0.00
204.4059
    5.4600    0.6138    151616.     6947.  -0.01021     8919.  5.92E+09      0.00      0.00
```

```
211.9765
    5.6550     0.5900    168452.      7451.   -0.01015      9909.   5.92E+09       0.00       0.00
219.5471
    5.8500     0.5663    186489.      7974.   -0.01008     10970.   5.92E+09       0.00       0.00
227.1176
    6.0450     0.5428    205770.      8514.   -0.01000     12104.   5.92E+09       0.00       0.00
234.6882
    6.2400     0.5195    226336.      9072.   -0.00991     13314.   5.92E+09       0.00       0.00
242.2588
    6.4350     0.4964    248229.      9648.   -0.00982     14602.   5.92E+09       0.00       0.00
249.8294
    6.6300     0.4736    271489.     10242.   -0.00972     15970.   5.92E+09       0.00       0.00
257.4000
    6.8250     0.4510    296159.     10853.   -0.00961     17421.   5.92E+09       0.00       0.00
264.9706
    7.0200     0.4286    322280.     11482.   -0.00948     18958.   5.92E+09       0.00       0.00
272.5412
    7.2150     0.4066    349894.     12128.   -0.00935     20582.   5.92E+09       0.00       0.00
280.1118
    7.4100     0.3849    379041.     12793.   -0.00921     22297.   5.92E+09       0.00       0.00
287.6824
    7.6050     0.3635    409763.     13475.   -0.00905     24104.   5.92E+09       0.00       0.00
295.2529
    7.8000     0.3425    442102.     14174.   -0.00888     26006.   5.92E+09       0.00       0.00
302.8235
    7.9950     0.3219    476099.     14892.   -0.00870     28006.   5.92E+09       0.00       0.00
310.3941
    8.1900     0.3018    511795.     15627.   -0.00851     30106.   5.92E+09       0.00       0.00
317.9647
    8.3850     0.2821    549233.     16380.   -0.00830     32308.   5.92E+09       0.00       0.00
325.5353
    8.5800     0.2630    588453.     16082.   -0.00807     34615.   5.92E+09  -609.6374      5425.
29.5849
    8.7750     0.2444    624497.     14689.   -0.00783     36735.   5.92E+09  -610.2380      5844.
0.00
    8.9700     0.2263    657200.     13262.   -0.00758     38659.   5.92E+09  -610.1175      6308.
0.00
    9.1650     0.2089    686562.     11835.   -0.00731     40386.   5.92E+09  -609.2553      6825.
```

```
0.00
    9.3600     0.1921    712588.      10411.   -0.00703      41917.   5.92E+09  -607.6298       7402.
0.00
    9.5550     0.1760    735287.       8992.   -0.00675      43252.   5.92E+09  -605.2173       8048.
0.00
    9.7500     0.1605    754671.       7580.   -0.00645      44392.   5.92E+09  -601.9929       8776.
0.00
    9.9450     0.1458    770760.       6176.   -0.00615      45339.   5.92E+09  -597.9291       9598.
0.00
   10.1400     0.1317    783574.       4782.   -0.00584      46093.   5.92E+09  -592.9961      10534.
0.00
   10.3350     0.1184    793142.       3402.   -0.00553      46655.   5.92E+09  -587.1607      11603.
0.00
   10.5300     0.1058    799494.       2036.   -0.00522      47029.   5.92E+09  -580.3861      12832.
0.00
   10.7250    0.09400    802669.    686.6314   -0.00490      47216.   5.92E+09  -572.6307      14255.
0.00
   10.9200    0.08290    802708.   -643.0475   -0.00458      47218.   5.92E+09  -563.8470      15915.
0.00
   11.1150    0.07255    799659.      -1951.   -0.00427      47039.   5.92E+09  -553.9802      17868.
0.00
   11.3100    0.06294    793577.      -3234.   -0.00395      46681.   5.92E+09  -542.9658      20188.
0.00
   11.5050    0.05406    784523.      -4771.   -0.00364      46148.   5.92E+09  -770.5720      33356.
0.00
   11.7000    0.04591    771248.      -6552.   -0.00333      45368.   5.92E+09  -751.2419      38294.
0.00
   11.8950    0.03847    753861.      -8285.   -0.00303      44345.   5.92E+09  -729.7923      44394.
0.00
   12.0900    0.03173    732477.      -9964.   -0.00274      43087.   5.92E+09  -705.9870      52071.
0.00
   12.2850    0.02566    707227.     -11585.   -0.00245      41602.   5.92E+09  -679.5005      61958.
0.00
   12.4800    0.02025    678257.     -13141.   -0.00218      39897.   5.92E+09  -649.8619      75079.
0.00
   12.6750    0.01547    645729.     -14622.   -0.00192      37984.   5.92E+09  -616.3507      93207.
0.00
   12.8700    0.01129    609825.     -16019.   -0.00167      35872.   5.92E+09  -577.7779     119745.
```

```
0.00
    13.0650     0.00767     570758.     -17318.    -0.00143       33574.    5.92E+09   -531.9589     162248.
0.00
    13.2600     0.00458     528778.     -18495.    -0.00122       31105.    5.92E+09   -474.1339     242150.
0.00
    13.4550     0.00198     484202.     -19506.    -0.00102       28482.    5.92E+09   -389.7627     460429.
0.00
    13.6500   -1.72E-04     437492.     -19846.   -8.33E-04       25735.    5.92E+09     99.2308    1350817.
0.00
    13.8450    -0.00192     391325.     -19265.   -6.70E-04       23019.    5.92E+09    397.0021     483915.
0.00
    14.0400    -0.00331     347332.     -18261.   -5.23E-04       20431.    5.92E+09    460.7768     326203.
0.00
    14.2350    -0.00437     305862.     -17137.   -3.94E-04       17992.    5.92E+09    500.4966     268030.
0.00
    14.4300    -0.00515     267133.     -15933.   -2.81E-04       15714.    5.92E+09    528.1855     239964.
0.00
    14.6250    -0.00568     231295.     -14955.   -1.82E-04       13606.    5.92E+09    307.9056     126750.
0.00
    14.8200    -0.00600     197144.     -14168.   -9.77E-05       11597.    5.92E+09    364.2521     141960.
0.00
    15.0150    -0.00614     164987.     -13260.   -2.60E-05        9705.    5.92E+09    412.4994     157170.
0.00
    15.2100    -0.00613     135089.     -12249.    3.33E-05        7946.    5.92E+09    451.2821     172380.
0.00
    15.4050    -0.00599     107661.     -11160.    8.13E-05        6333.    5.92E+09    479.8408     187590.
0.00
    15.6000    -0.00575      82862.     -10016.    1.19E-04        4874.    5.92E+09    497.9375     202800.
0.00
    15.7950    -0.00543      60788.      -8841.    1.47E-04        3576.    5.92E+09    505.7674     218010.
0.00
    15.9900    -0.00506      41484.      -7660.    1.68E-04        2440.    5.92E+09    503.8715     233220.
0.00
    16.1850    -0.00464      24940.      -6494.    1.81E-04        1467.    5.92E+09    493.0492     248430.
0.00
    16.3800    -0.00421      11094.      -5362.    1.88E-04    652.6091    5.92E+09    474.2774     263640.
0.00
    16.5750    -0.00376   -153.8483      -4282.    1.90E-04      9.0499    5.92E+09    448.6328     278850.
```

```
0.00
  16.7700  -0.00332    -8946.     -3269.  1.88E-04  526.2070  5.92E+09  417.2235    294060.
0.00
  16.9650  -0.00288   -15453.     -2335.  1.83E-04  908.9788  5.92E+09  381.1278    309270.
0.00
  17.1600  -0.00246   -19873.     -1490.  1.76E-04     1169.  5.92E+09  341.3423    324480.
0.00
  17.3550  -0.00206   -22424.  -740.7154  1.68E-04     1319.  5.92E+09  298.7398    339690.
0.00
  17.5500  -0.00167   -23339.   -93.9666  1.59E-04     1373.  5.92E+09  254.0370    354900.
0.00
  17.7450  -0.00131   -22864.   446.3508  1.50E-04     1345.  5.92E+09  207.7728    370110.
0.00
  17.9400 -9.73E-04   -21250.   876.9910  1.41E-04     1250.  5.92E+09  160.2957    385320.
0.00
  18.1350 -6.53E-04   -18759.      1195.  1.33E-04     1103.  5.92E+09  111.7631    400530.
0.00
  18.3300 -3.50E-04   -15656.      1399.  1.26E-04  920.9694  5.92E+09   62.1486    415740.
0.00
  18.5250 -6.12E-05   -12213.      1485.  1.21E-04  718.4231  5.92E+09   11.2620    430950.
0.00
  18.7200  2.16E-04    -8708.      1450.  1.17E-04  512.2494  5.92E+09  -41.2218    446160.
0.00
  18.9150  4.85E-04    -5429.      1289.  1.14E-04  319.3530  5.92E+09  -95.7219    461370.
0.00
  19.1100  7.50E-04    -2674.   998.7366  1.12E-04  157.2880  5.92E+09 -152.6995    476580.
0.00
  19.3050   0.00101 -754.9128   571.3453  1.12E-04   44.4066  5.92E+09 -212.5923    491790.
0.00
  19.5000   0.00127      0.00       0.00  1.12E-04      0.00  5.92E+09 -275.7370    253500.
0.00

* The above values of total stress are combined axial and bending stresses.


Output Summary for Load Case No. 1:

Pile-head deflection             =     1.30493573 inches
```

```
Computed slope at pile head       =    -0.01063161 radians
Maximum bending moment            =        802708. inch-lbs
Maximum shear force               =        -19846. lbs
Depth of maximum bending moment   =    10.92000000 feet below pile head
Depth of maximum shear force      =    13.65000000 feet below pile head
Number of iterations              =             25
Number of zero deflection points =              2


--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 1
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =              0. lbs
Moment     =              0. in-lbs
Axial Load =              0. lbs


    Pile        Pile Head       Maximum       Maximum
   Length       Deflection      Moment         Shear
    feet          inches        ln-lbs          lbs
 ------------  ------------  ------------  ------------
    19.50000    1.30493573       802708.       -19846.
    18.52500    1.29068311       792828.       -19494.
    17.55000    1.32078061       807640.       -19742.
    16.57500    1.34216917       810298.       -20785.
    15.60000    1.48248554       791834.       -23718.
    14.62500    3.43218551       750354.       -26419.
    13.65000   10.30913747       706092.       -28035.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:
```

```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians


Load Load                  Load                  Axial    Pile-head  Pile-head  Max Shear Max Moment
Case Type   Pile-head      Type      Pile-head   Loading  Deflection Rotation    in Pile    in Pile
 No.  1      Load 1         2         Load 2      lbs      inches     radians     lbs        in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
  1  V, lb       0.00  M, in-lb        0.00       0.00     1.3049   -0.01063    -19846.    802708.

Maximum pile-head deflection =     1.304935735 inches
Maximum pile-head rotation   =    -0.010631612 radians

--------------------------------------------------------------------------------
                       Summary of Warning Messages
--------------------------------------------------------------------------------

The following warning was reported 3114 times

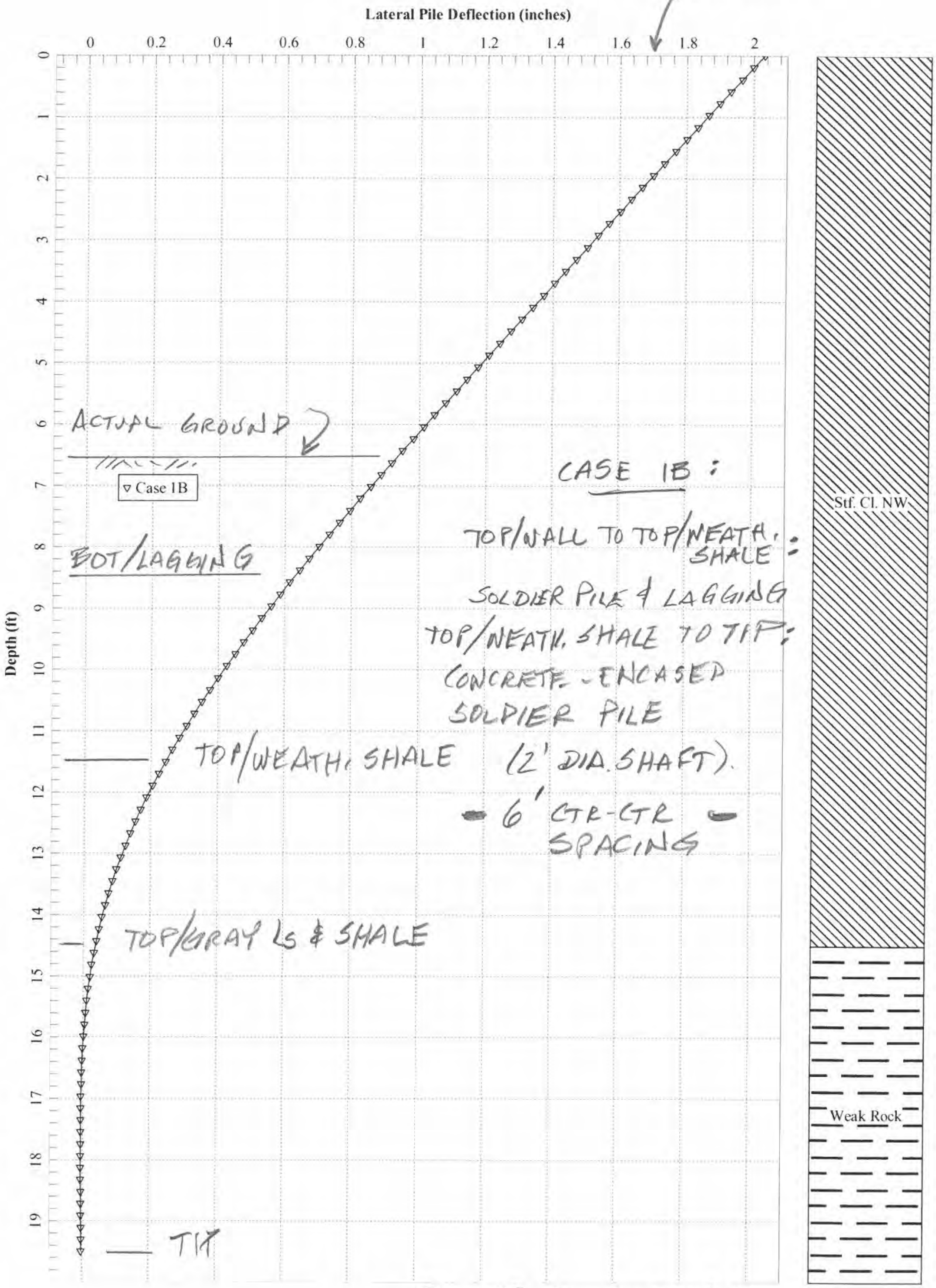

**** Warning ****

An unreasonable input value for the compressive strength has been specified
for a soil defined using the weak rock criteria.  The input value is less
than 100 psi.  You should check your input data for correctness.


The analysis ended normally.
```

Addendum 2 -- 7-11-19

TOP/WALL



ACTUAL GROUND

BOT/LAGGING

TOP/WEATH. SHALE

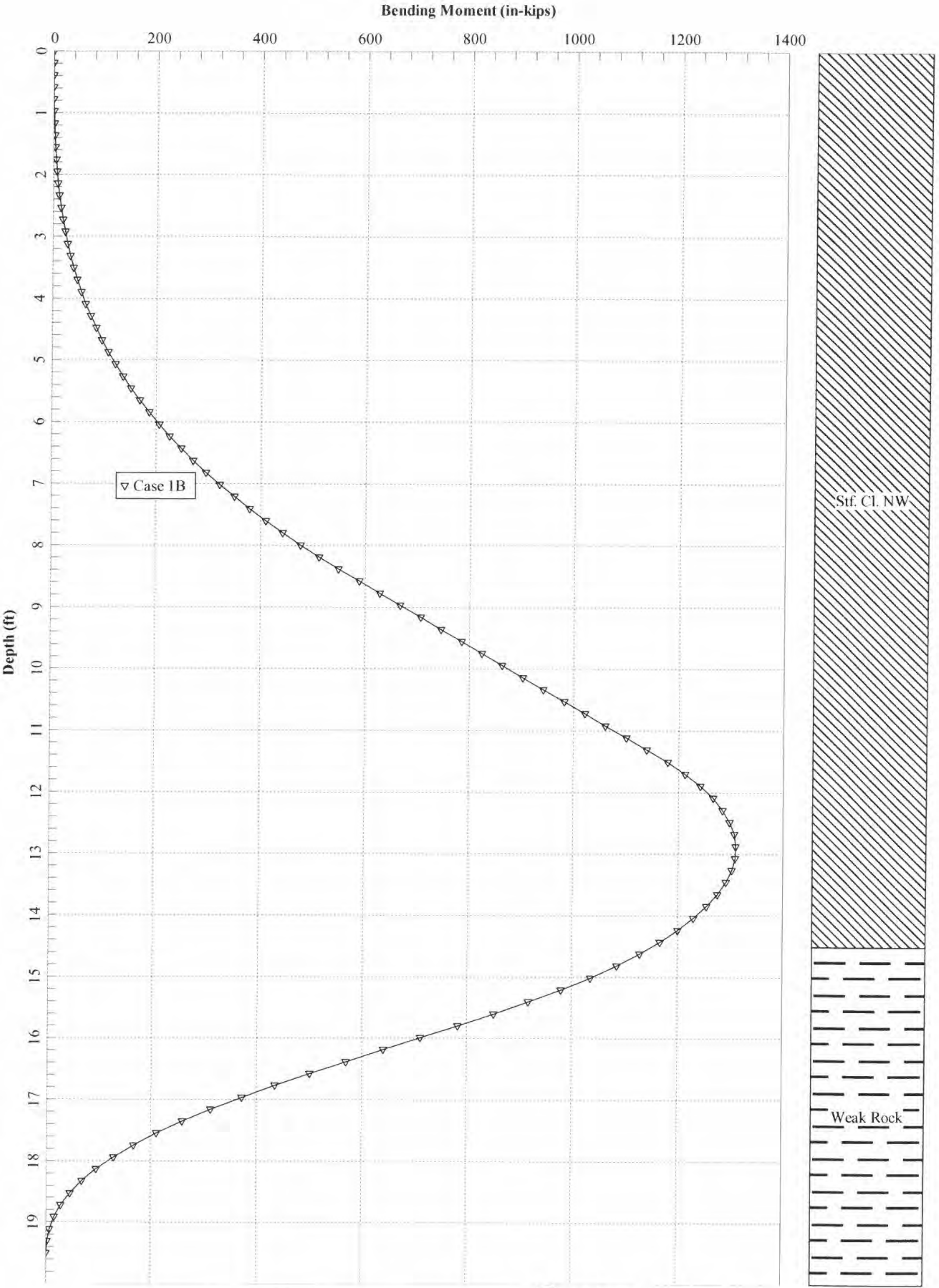
TOP/GRAY LS & SHALE

TIP

CASE 1B:

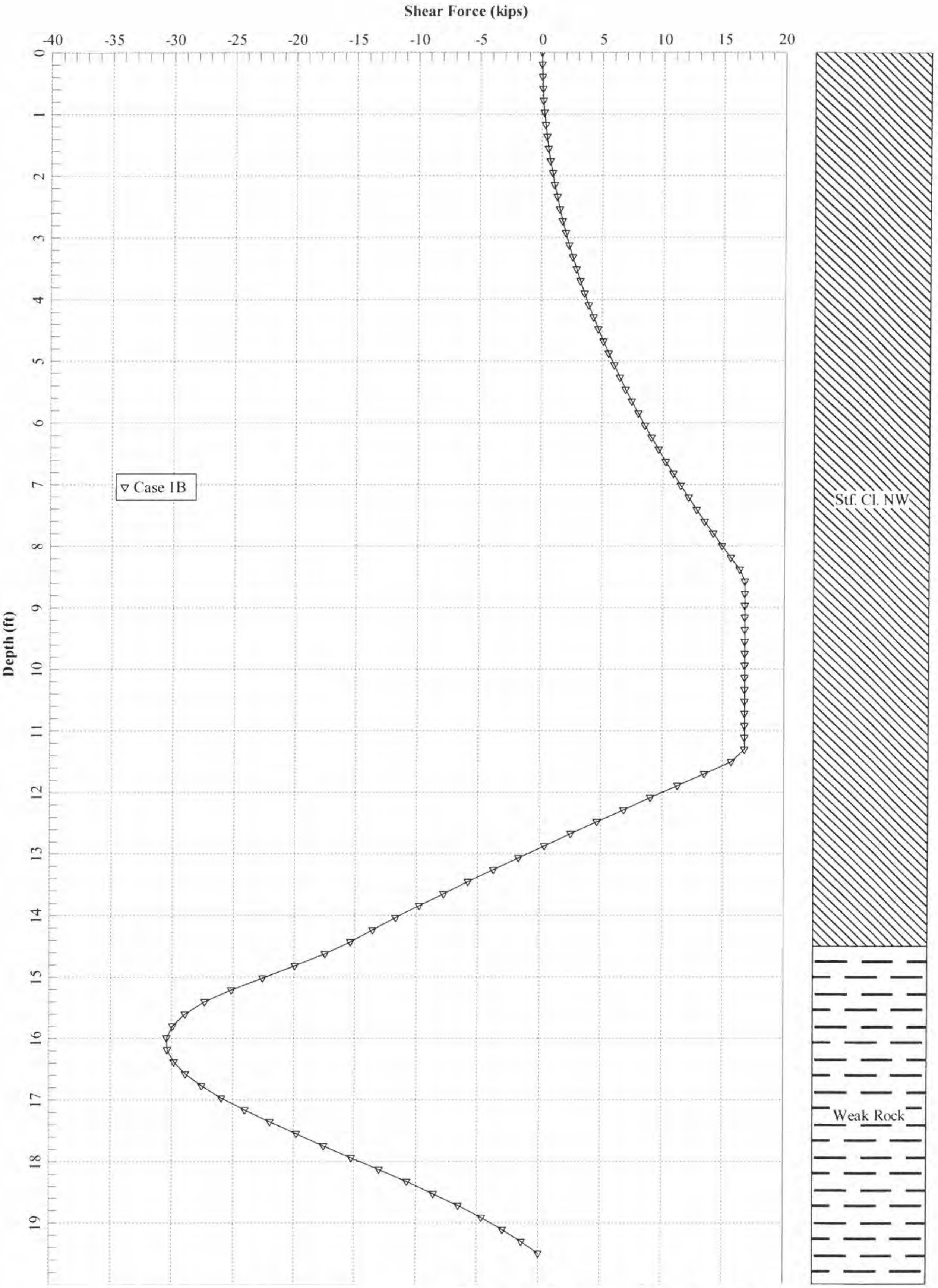
TOP/WALL TO TOP/WEATH. SHALE:
SOLDIER PILE & LAGGING
TOP/WEATH. SHALE TO TIP:
CONCRETE-ENCASED
SOLDIER PILE
(2' DIA. SHAFT).
– 6' CTR-CTR –
SPACING

BOONE CO. 6-0014.0
S-040-2016



BOONE CO. 6-094.0

5-040-2016



BOONE CO. 6-0014.0
S-040-2016

Addendum 2 -- 7-11-19

```
===============================================================================

                LPile for Windows, Version 2015-08.003

              Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method
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===============================================================================

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-------------------------------------------------------------------------------
                          Files Used for Analysis
-------------------------------------------------------------------------------

Path to file locations:
\Projects\2015\N1155079\Working Files\Calculations-Analyses\LPILE\Nov 2016 - 2nd Iteration\

Name of input data file:
Case 1B, 6' spacing, 8' socket.lp8d

Name of output report file:
Case 1B, 6' spacing, 8' socket.lp8o
```

```
Name of plot output file:
Case 1B, 6' spacing, 8' socket.lp8p

Name of runtime message file:
Case 1B, 6' spacing, 8' socket.lp8r


--------------------------------------------------------------------------------
                        Date and Time of Analysis
--------------------------------------------------------------------------------

           Date:  November 11, 2016     Time:   8:56:02


--------------------------------------------------------------------------------
                              Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:
```

```
--------------------------------------------------------------------------------
                           Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed                       =        500
 - Deflection tolerance for convergence                       =   1.0000E-05 in
 - Maximum allowable deflection                               =     100.0000 in
 - Number of pile increments                                  =        100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis includes loading by one distributed lateral load acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats
```

```
--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total number of pile sections                                  =          1

Total length of pile                                           =      19.50 ft

Depth of ground surface below top of pile                      =      11.50 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile.

Point         Depth           Pile
                X           Diameter
               ft              in
-----       ---------      -----------
  1           0.00000      24.00000000
  2        19.5000000      24.00000000


Input Structural Properties:
----------------------------

Pile Section No. 1:

   Section Type                                          =    Elastic Pile
   Cross-sectional Shape                                 =   Circular Pile
   Section Length                                        =    19.500000 ft
   Top Width                                             =    24.000000 in
   Bottom Width                                          =    24.000000 in
   Top Area                                              =   452.389342 sq. in
   Bottom Area                                           =   452.389342 sq. in
   Moment of Inertia at Top                              =   285.000000 in^4
   Moment of Inertia at Bottom                           =   285.000000 in^4
   Elastic Modulus                                       =    29000000. lbs/in^2
```

```
--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                     =         0.000 degrees
                                                       =         0.000 radians

Pile Batter Angle                                      =         0.000 degrees
                                                       =         0.000 radians


--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 2 layers

Layer 1 is stiff clay without free water

   Distance from top of pile to top of layer           =     11.500000 ft
   Distance from top of pile to bottom of layer        =     14.500000 ft
   Effective unit weight at top of layer               =    135.000000 pcf
   Effective unit weight at bottom of layer            =    135.000000 pcf
   Undrained cohesion at top of layer                  =         4000. psf
   Undrained cohesion at bottom of layer               =         4000. psf
   Epsilon-50 at top of layer                          =        0.0000
   Epsilon-50 at bottom of layer                       =        0.0000

   NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 2 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer           =     14.500000 ft
   Distance from top of pile to bottom of layer        =     20.000000 ft
```

```
    Effective unit weight at top of layer               =   135.000000 pcf
    Effective unit weight at bottom of layer            =   135.000000 pcf
    Uniaxial compressive strength at top of layer       =    75.000000 psi
    Uniaxial compressive strength at bottom of layer    =    75.000000 psi
    Initial modulus of rock at top of layer             =   500.000000 psi
    Initial modulus of rock at bottom of layer          =   500.000000 psi
    RQD of rock at top of layer                         =    25.000000 %
    RQD of rock at bottom of layer                      =    25.000000 %
    k rm of rock at top of layer                        =       0.0000
    k rm of rock at bottom of layer                     =       0.0000


    (Depth of lowest soil layer extends    0.50 ft below pile tip)



--------------------------------------------------------------------------------
                        Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer         Soil Type          Layer     Effective   Undrained   Uniaxial                  E50
Rock Mass
Layer            Name            Depth     Unit Wt.    Cohesion       qu        RQD %        or
 Modulus
 Num.    (p-y Curve Type)         ft          pcf         psf         psi                    krm
   psi
-----  ------------------   ----------  ----------  ----------  ----------  ----------  ----------
----------
  1        Stiff Clay         11.5000    135.0000       4000.         --          --      default
   --
         w/o Free Water       14.5000    135.0000       4000.         --          --      default
   --
  2          Weak             14.5000    135.0000        --        75.0000     25.0000       --
 500.0000
             Rock             20.0000    135.0000        --        75.0000     25.0000       --
 500.0000

--------------------------------------------------------------------------------
```

```
                    Static Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.


--------------------------------------------------------------------------------
              Distributed Lateral Loading Used For All Load Cases
--------------------------------------------------------------------------------

Distributed lateral load intensity defined using 2 points

Point        Depth X         Dist. Load
 No.           in              lbs/in
-----       ----------       ----------
  1          0.000            0.000
  2        102.000          330.000


--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 1

Load    Load       Condition              Condition            Axial Thrust    Compute Top y
 No.    Type          1                      2                  Force, lbs     vs. Pile Length
-----   ----   --------------------   ----------------------   --------------  ---------------
  1      1     V =        0.0000 lbs  M =        0.0000 in-lbs      0.0000000        Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
```

```
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading.
Axial thrust is assumed to be acting axially for all pile batter angles.



--------------------------------------------------------------------------------
     Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------
Moment-curvature properties were derived from elastic section properties




--------------------------------------------------------------------------------
                 Computed Values of Pile Loading and Deflection
                   for Lateral Loading for Load Case Number 1
--------------------------------------------------------------------------------

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head                             =          0.0 lbs
Applied moment at pile head                          =          0.0 in-lbs
Axial thrust load on pile head                       =          0.0 lbs

   Depth    Deflect.    Bending     Shear      Slope      Total     Bending   Soil Res.  Soil Spr.  Distrib.

     X         y        Moment      Force        S        Stress   Stiffness      p        Es*h       Lat.
Load
    feet     inches     in-lbs       lbs      radians     psi*      in-lb^2    lb/inch    lb/inch    lb/inch
```

```
---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
----------
      0.00     2.0329   1.34E-05   1.43E-07   -0.01413   5.64E-07   8.26E+09       0.00       0.00
1.8926
    0.1950     1.9999     5.1817    11.0720   -0.01413     0.2182   8.26E+09       0.00       0.00
7.5706
    0.3900     1.9668    51.8169    37.6447   -0.01413     2.1818   8.26E+09       0.00       0.00
15.1412
    0.5850     1.9338   181.3591    81.9327   -0.01413     7.6362   8.26E+09       0.00       0.00
22.7118
    0.7800     1.9007   435.2619   143.9358   -0.01413    18.3268   8.26E+09       0.00       0.00
30.2824
    0.9750     1.8677   854.9787   223.6541   -0.01412    35.9991   8.26E+09       0.00       0.00
37.8529
    1.1700     1.8346      1482.   321.0876   -0.01412    62.3984   8.26E+09       0.00       0.00
45.4235
    1.3650     1.8016      2358.   436.2362   -0.01412    99.2703   8.26E+09       0.00       0.00
52.9941
    1.5600     1.7685      3524.   569.1000   -0.01412   148.3599   8.26E+09       0.00       0.00
60.5647
    1.7550     1.7355      5021.   719.6790   -0.01412   211.4129   8.26E+09       0.00       0.00
68.1353
    1.9500     1.7024      6892.   887.9732   -0.01412   290.1746   8.26E+09       0.00       0.00
75.7059
    2.1450     1.6694      9177.      1074.   -0.01412   386.3904   8.26E+09       0.00       0.00
83.2765
    2.3400     1.6364     11918.      1278.   -0.01411   501.8057   8.26E+09       0.00       0.00
90.8471
    2.5350     1.6033     15156.      1499.   -0.01411   638.1659   8.26E+09       0.00       0.00
98.4176
    2.7300     1.5703     18934.      1738.   -0.01411   797.2165   8.26E+09       0.00       0.00
105.9882
    2.9250     1.5373     23292.      1995.   -0.01410   980.7028   8.26E+09       0.00       0.00
113.5588
    3.1200     1.5043     28271.      2270.   -0.01409      1190.   8.26E+09       0.00       0.00
121.1294
    3.3150     1.4714     33914.      2562.   -0.01408      1428.   8.26E+09       0.00       0.00
128.7000
```

```
    3.5100      1.4384     40262.      2872.   -0.01407     1695.  8.26E+09       0.00       0.00
136.2706
    3.7050      1.4055     47355.      3200.   -0.01406     1994.  8.26E+09       0.00       0.00
143.8412
    3.9000      1.3726     55237.      3545.   -0.01405     2326.  8.26E+09       0.00       0.00
151.4118
    4.0950      1.3397     63947.      3908.   -0.01403     2693.  8.26E+09       0.00       0.00
158.9824
    4.2900      1.3069     73528.      4289.   -0.01401     3096.  8.26E+09       0.00       0.00
166.5529
    4.4850      1.2742     84021.      4688.   -0.01399     3538.  8.26E+09       0.00       0.00
174.1235
    4.6800      1.2415     95467.      5104.   -0.01396     4020.  8.26E+09       0.00       0.00
181.6941
    4.8750      1.2088    107909.      5538.   -0.01393     4544.  8.26E+09       0.00       0.00
189.2647
    5.0700      1.1763    121386.      5990.   -0.01390     5111.  8.26E+09       0.00       0.00
196.8353
    5.2650      1.1438    135942.      6459.   -0.01387     5724.  8.26E+09       0.00       0.00
204.4059
    5.4600      1.1114    151616.      6947.   -0.01382     6384.  8.26E+09       0.00       0.00
211.9765
    5.6550      1.0791    168452.      7451.   -0.01378     7093.  8.26E+09       0.00       0.00
219.5471
    5.8500      1.0469    186489.      7974.   -0.01373     7852.  8.26E+09       0.00       0.00
227.1176
    6.0450      1.0148    205770.      8514.   -0.01367     8664.  8.26E+09       0.00       0.00
234.6882
    6.2400      0.9829    226336.      9072.   -0.01361     9530.  8.26E+09       0.00       0.00
242.2588
    6.4350      0.9511    248229.      9648.   -0.01354    10452.  8.26E+09       0.00       0.00
249.8294
    6.6300      0.9195    271489.     10242.   -0.01347    11431.  8.26E+09       0.00       0.00
257.4000
    6.8250      0.8881    296159.     10853.   -0.01339    12470.  8.26E+09       0.00       0.00
264.9706
    7.0200      0.8568    322280.     11482.   -0.01330    13570.  8.26E+09       0.00       0.00
272.5412
```

```
    7.2150     0.8258     349894.     12128.    -0.01321     14732.   8.26E+09      0.00       0.00
280.1118
    7.4100     0.7950     379041.     12793.    -0.01311     15960.   8.26E+09      0.00       0.00
287.6824
    7.6050     0.7645     409763.     13475.    -0.01299     17253.   8.26E+09      0.00       0.00
295.2529
    7.8000     0.7342     442102.     14174.    -0.01287     18615.   8.26E+09      0.00       0.00
302.8235
    7.9950     0.7042     476099.     14892.    -0.01274     20046.   8.26E+09      0.00       0.00
310.3941
    8.1900     0.6746     511795.     15627.    -0.01260     21549.   8.26E+09      0.00       0.00
317.9647
    8.3850     0.6453     549233.     16380.    -0.01245     23126.   8.26E+09      0.00       0.00
325.5353
    8.5800     0.6163     588453.     16795.    -0.01229     24777.   8.26E+09      0.00       0.00
29.5849
    8.7750     0.5877     627836.     16830.    -0.01212     26435.   8.26E+09      0.00       0.00
0.00
    8.9700     0.5596     667218.     16830.    -0.01194     28093.   8.26E+09      0.00       0.00
0.00
    9.1650     0.5319     706600.     16830.    -0.01174     29752.   8.26E+09      0.00       0.00
0.00
    9.3600     0.5046     745982.     16830.    -0.01154     31410.   8.26E+09      0.00       0.00
0.00
    9.5550     0.4779     785364.     16830.    -0.01132     33068.   8.26E+09      0.00       0.00
0.00
    9.7500     0.4517     824747.     16830.    -0.01109     34726.   8.26E+09      0.00       0.00
0.00
    9.9450     0.4260     864129.     16830.    -0.01085     36384.   8.26E+09      0.00       0.00
0.00
   10.1400     0.4009     903511.     16830.    -0.01060     38043.   8.26E+09      0.00       0.00
0.00
   10.3350     0.3764     942893.     16830.    -0.01034     39701.   8.26E+09      0.00       0.00
0.00
   10.5300     0.3525     982275.     16830.    -0.01007     41359.   8.26E+09      0.00       0.00
0.00
   10.7250     0.3292    1021658.     16830.    -0.00978     43017.   8.26E+09      0.00       0.00
0.00
```

```
   10.9200      0.3067   1061040.      16830.   -0.00949       44675.   8.26E+09       0.00        0.00
0.00
   11.1150      0.2848   1100422.      16830.   -0.00918       46334.   8.26E+09       0.00        0.00
0.00
   11.3100      0.2637   1139804.      16830.   -0.00887       47992.   8.26E+09       0.00        0.00
0.00
   11.5050      0.2433   1179186.      15719.   -0.00854       49650.   8.26E+09  -949.4550       9131.
0.00
   11.7000      0.2237   1213370.      13500.   -0.00820       51089.   8.26E+09  -946.8803       9903.
0.00
   11.8950      0.2050   1242368.      11289.   -0.00785       52310.   8.26E+09  -943.1149      10768.
0.00
   12.0900      0.1870   1266203.       9088.   -0.00750       53314.   8.26E+09  -938.1231      11740.
0.00
   12.2850      0.1699   1284901.       6900.   -0.00714       54101.   8.26E+09  -931.8660      12837.
0.00
   12.4800      0.1536   1298496.       4728.   -0.00677       54674.   8.26E+09  -924.3014      14082.
0.00
   12.6750      0.1382   1307030.       2576.   -0.00640       55033.   8.26E+09  -915.3824      15501.
0.00
   12.8700      0.1236   1310552.   446.1356   -0.00603       55181.   8.26E+09  -905.0568      17130.
0.00
   13.0650      0.1100   1309118.      -1658.   -0.00566       55121.   8.26E+09  -893.2658      19009.
0.00
   13.2600     0.09715   1302793.      -3733.   -0.00529       54854.   8.26E+09  -879.9421      21195.
0.00
   13.4550     0.08520   1291649.      -5774.   -0.00492       54385.   8.26E+09  -865.0075      23757.
0.00
   13.6500     0.07411   1275770.      -7779.   -0.00456       53717.   8.26E+09  -848.3700      26787.
0.00
   13.8450     0.06386   1255245.      -9742.   -0.00420       52852.   8.26E+09  -829.9187      30409.
0.00
   14.0400     0.05445   1230175.     -11661.   -0.00385       51797.   8.26E+09  -809.5180      34790.
0.00
   14.2350     0.04585   1200673.     -13528.   -0.00351       50555.   8.26E+09  -786.9970      40166.
0.00
   14.4300     0.03804   1166862.     -15341.   -0.00317       49131.   8.26E+09  -762.1352      46877.
0.00
```

```
   14.6250    0.03101   1128878.    -17443.   -0.00285     47532.  8.26E+09     -1034.     78029.
0.00
   14.8200    0.02473   1085231.    -19939.   -0.00253     45694.  8.26E+09     -1100.    104077.
0.00
   15.0150    0.01917   1035561.    -22568.   -0.00223     43603.  8.26E+09     -1147.    140055.
0.00
   15.2100    0.01429    979610.    -25142.   -0.00195     41247.  8.26E+09     -1052.    172380.
0.00
   15.4050    0.01006    917897.    -27317.   -0.00168     38648.  8.26E+09  -806.2913    187590.
0.00
   15.6000    0.00644    851768.    -28913.   -0.00143     35864.  8.26E+09  -557.8266    202800.
0.00
   15.7950    0.00338    782585.    -29934.   -0.00120     32951.  8.26E+09  -314.8599    218010.
0.00
   15.9900   8.41E-04    711678.    -30400.  -9.84E-04     29965.  8.26E+09   -83.8269    233220.
0.00
   16.1850   -0.00123    640312.    -30346.  -7.93E-04     26960.  8.26E+09   130.1497    248430.
0.00
   16.3800   -0.00287    569658.    -29816.  -6.21E-04     23986.  8.26E+09   323.2025    263640.
0.00
   16.5750   -0.00413    500774.    -28861.  -4.70E-04     21085.  8.26E+09   492.6377    278850.
0.00
   16.7700   -0.00507    434588.    -27540.  -3.37E-04     18298.  8.26E+09   636.8308    294060.
0.00
   16.9650   -0.00571    371889.    -25911.  -2.23E-04     15658.  8.26E+09   755.1076    309270.
0.00
   17.1600   -0.00611    313324.    -24036.  -1.26E-04     13193.  8.26E+09   847.6138    324480.
0.00
   17.3550   -0.00630    259401.    -21973.  -4.52E-05     10922.  8.26E+09   915.1773    339690.
0.00
   17.5500   -0.00632    210489.    -19780.   2.13E-05      8863.  8.26E+09   959.1688    354900.
0.00
   17.7450   -0.00620    166829.    -17510.   7.47E-05      7024.  8.26E+09   981.3621    370110.
0.00
   17.9400   -0.00597    128542.    -15211.   1.17E-04      5412.  8.26E+09   983.8012    385320.
0.00
   18.1350   -0.00566     95642.    -12926.   1.48E-04      4027.  8.26E+09   968.6724    400530.
0.00
```

```
   18.3300   -0.00528     68047.    -10695.   1.71E-04      2865.  8.26E+09   938.1876    415740.
0.00
   18.5250   -0.00486     45588.     -8551.   1.88E-04      1919.  8.26E+09   894.4782    430950.
0.00
   18.7200   -0.00440     28027.     -6522.   1.98E-04      1180.  8.26E+09   839.5020    446160.
0.00
   18.9150   -0.00393     15063.     -4633.   2.04E-04   634.2436  8.26E+09   774.9639    461370.
0.00
   19.1100   -0.00345      6343.     -2905.   2.07E-04   267.0619  8.26E+09   702.2510    476580.
0.00
   19.3050   -0.00296      1467.     -1355.   2.08E-04    61.7853  8.26E+09   622.3830    491790.
0.00
   19.5000   -0.00247       0.00       0.00   2.08E-04       0.00  8.26E+09   535.9778    253500.
0.00

* The above values of total stress are combined axial and bending stresses.


Output Summary for Load Case No. 1:

Pile-head deflection              =     2.03292980 inches
Computed slope at pile head       =    -0.01412514 radians
Maximum bending moment            =       1310552. inch-lbs
Maximum shear force               =        -30400. lbs
Depth of maximum bending moment   =    12.87000000 feet below pile head
Depth of maximum shear force      =    15.99000000 feet below pile head
Number of iterations              =             20
Number of zero deflection points  =              1


--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 1
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear       =             0. lbs
```

```
Moment      =              0. in-lbs
Axial Load =               0. lbs

    Pile       Pile Head      Maximum       Maximum
   Length     Deflection      Moment         Shear
    feet        inches        ln-lbs          lbs
------------ ------------ ------------  ------------
   19.50000   2.03292980    1310552.        -30400.
   18.52500   2.14445484    1340374.        -35107.
   17.55000   2.55774949    1310199.        -43744.
   16.57500   8.34851668    1273599.        -47381.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians


Load Load                Load                        Axial    Pile-head  Pile-head  Max Shear Max Moment
Case Type   Pile-head    Type      Pile-head       Loading  Deflection  Rotation    in Pile    in Pile
 No.  1      Load 1       2         Load 2          lbs       inches     radians      lbs       in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
  1  V, lb       0.00  M, in-lb        0.00       0.00     2.0329   -0.01413    -30400.   1310552.

Maximum pile-head deflection =     2.032929801 inches
Maximum pile-head rotation    =   -0.014125144 radians

--------------------------------------------------------------------------------
                           Summary of Warning Messages
```

```
--------------------------------------------------------------------------------

The following warning was reported 3326 times

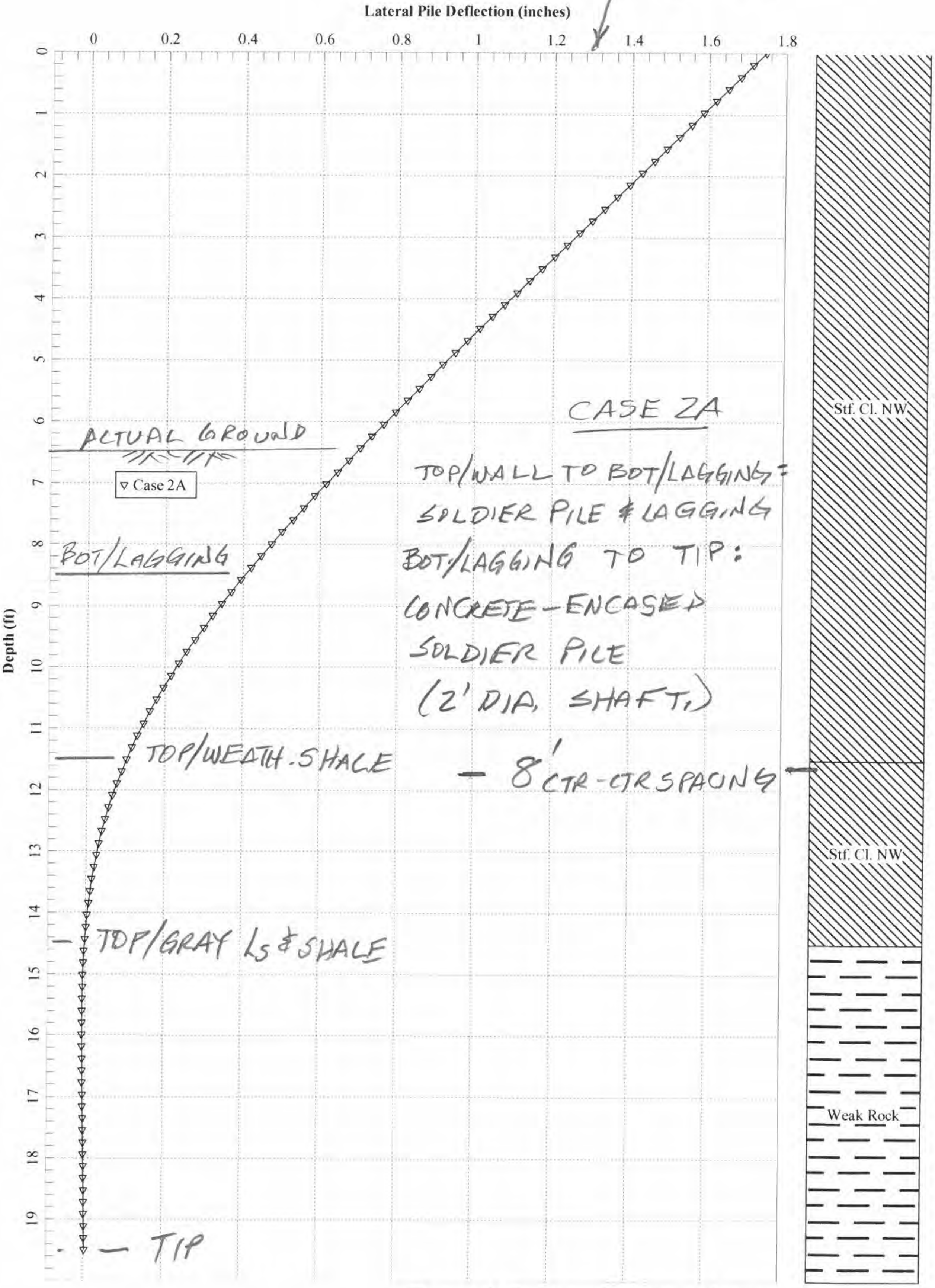

**** Warning ****

An unreasonable input value for the compressive strength has been specified
for a soil defined using the weak rock criteria.  The input value is less
than 100 psi.  You should check your input data for correctness.


The analysis ended normally.
```

Addendum 2 -- 7-11-19

TOP/WALL



CASE 2A

ACTUAL GROUND

TOP/WALL TO BOT/LAGGING = SOLDIER PILE & LAGGING

BOT/LAGGING

BOT/LAGGING TO TIP: CONCRETE-ENCASED SOLDIER PILE (2' DIA. SHAFT.)

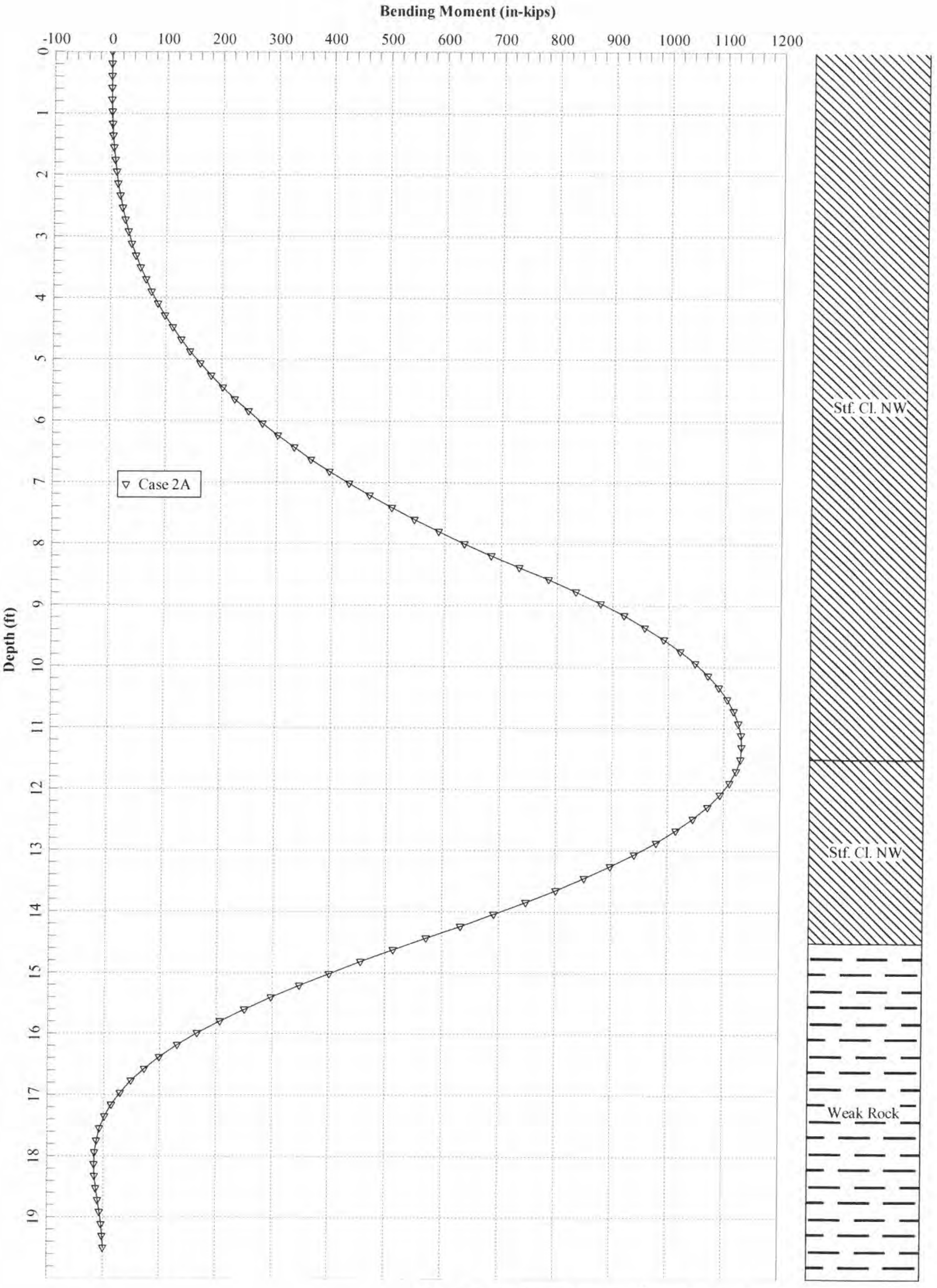
TOP/WEATH. SHALE

8' CTR-CTR SPACING

TOP/GRAY LS & SHALE

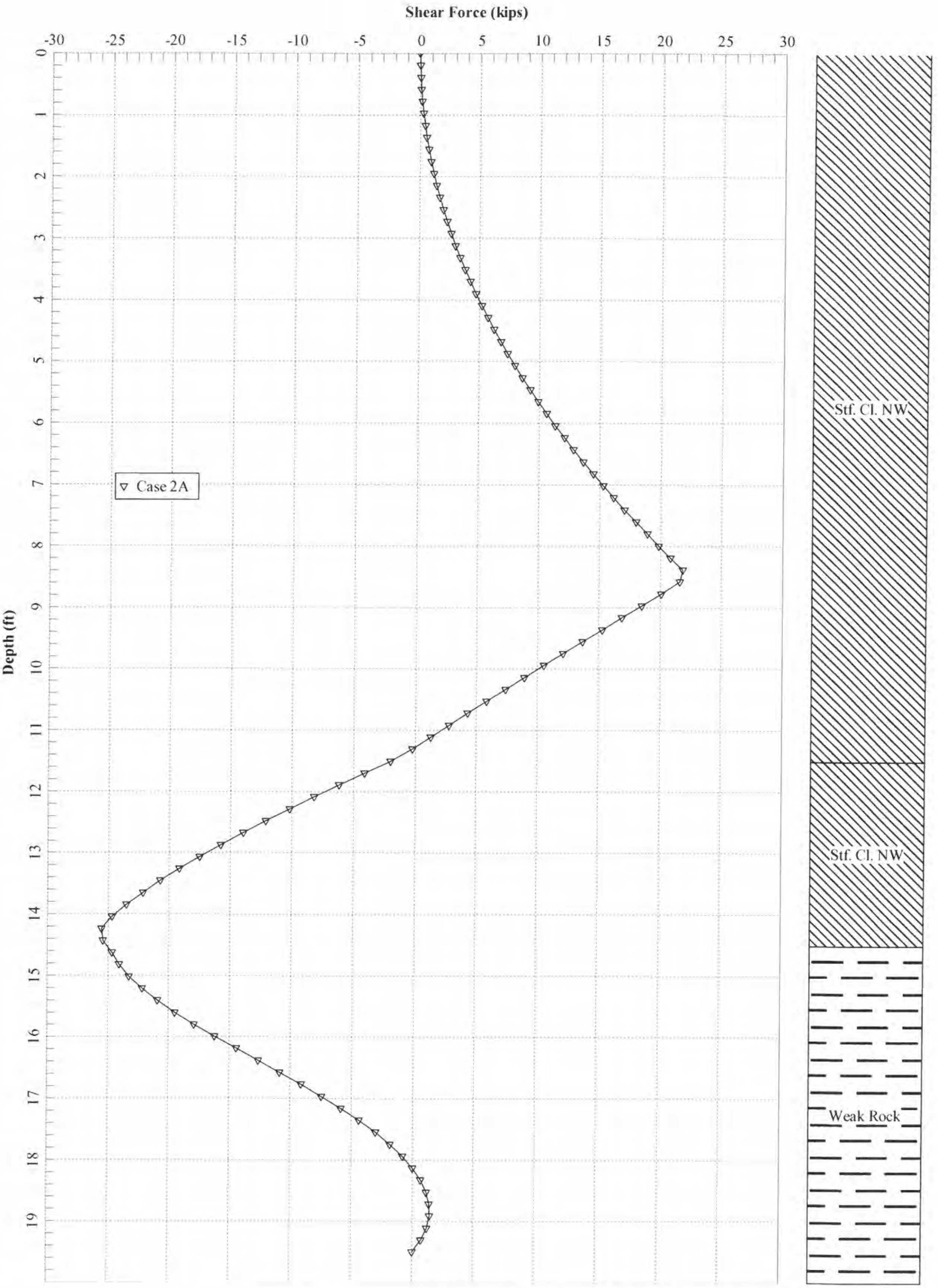
TIP

BOONE CO. 6-0014.0
S-040-2016



BOONE CO. 6-0014.0
S-040 - 2016

Addendum 2 -- 7-11-19



BOONE CO. 6-0014.0
S-040-2016

Addendum 2 -- 7-11-19

```
===============================================================================

                  LPile for Windows, Version 2015-08.003

                Analysis of Individual Piles and Drilled Shafts
               Subjected to Lateral Loading Using the p-y Method
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===============================================================================

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-------------------------------------------------------------------------------
                          Files Used for Analysis
-------------------------------------------------------------------------------

Path to file locations:
\Projects\2015\N1155079\Working Files\Calculations-Analyses\LPILE\Nov 2016 - 2nd Iteration\

Name of input data file:
Case 2A, 8' spacing, 11' socket.lp8d

Name of output report file:
Case 2A, 8' spacing, 11' socket.lp8o
```

```
Name of plot output file:
Case 2A, 8' spacing, 11' socket.lp8p

Name of runtime message file:
Case 2A, 8' spacing, 11' socket.lp8r


--------------------------------------------------------------------------------
                          Date and Time of Analysis
--------------------------------------------------------------------------------

           Date:  November 11, 2016     Time:   8:56:44


--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Project Name:

Job Number:

Client:

Engineer:

Description:
```

```
--------------------------------------------------------------------------------
                          Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed                  =         500
 - Deflection tolerance for convergence                  =  1.0000E-05 in
 - Maximum allowable deflection                          =    100.0000 in
 - Number of pile increments                             =         100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis includes loading by one distributed lateral load acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats
```

```
--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total number of pile sections                               =         1

Total length of pile                                        =       19.50 ft

Depth of ground surface below top of pile                   =        8.50 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile.

Point          Depth            Pile
                 X            Diameter
                 ft              in
-----        ---------       -----------
  1            0.00000       24.00000000
  2          19.5000000      24.00000000


Input Structural Properties:
---------------------------

Pile Section No. 1:

   Section Type                                             =    Elastic Pile
   Cross-sectional Shape                                    =   Circular Pile
   Section Length                                           =    19.500000 ft
   Top Width                                                =    24.000000 in
   Bottom Width                                             =    24.000000 in
   Top Area                                                 =   452.389342 sq. in
   Bottom Area                                              =   452.389342 sq. in
   Moment of Inertia at Top                                 =   238.000000 in^4
   Moment of Inertia at Bottom                              =   238.000000 in^4
   Elastic Modulus                                          =    29000000. lbs/in^2
```

```
--------------------------------------------------------------------------------
                     Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                        =        0.000 degrees
                                                          =        0.000 radians

Pile Batter Angle                                         =        0.000 degrees
                                                          =        0.000 radians


--------------------------------------------------------------------------------
                     Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is stiff clay without free water

   Distance from top of pile to top of layer              =     8.500000 ft
   Distance from top of pile to bottom of layer           =    11.500000 ft
   Effective unit weight at top of layer                  =   132.000000 pcf
   Effective unit weight at bottom of layer               =   132.000000 pcf
   Undrained cohesion at top of layer                     =        2500. psf
   Undrained cohesion at bottom of layer                  =        2500. psf
   Epsilon-50 at top of layer                             =       0.0000
   Epsilon-50 at bottom of layer                          =       0.0000

   NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 2 is stiff clay without free water

   Distance from top of pile to top of layer              =    11.500000 ft
   Distance from top of pile to bottom of layer           =    14.500000 ft
```

```
    Effective unit weight at top of layer                  =   135.000000 pcf
    Effective unit weight at bottom of layer               =   135.000000 pcf
    Undrained cohesion at top of layer                     =        4000. psf
    Undrained cohesion at bottom of layer                  =        4000. psf
    Epsilon-50 at top of layer                             =       0.0000
    Epsilon-50 at bottom of layer                          =       0.0000

    NOTE: Default values for Epsilon-50 will be computed for this layer.

 Layer 3 is weak rock, p-y criteria by Reese, 1997

    Distance from top of pile to top of layer              =    14.500000 ft
    Distance from top of pile to bottom of layer           =    20.000000 ft
    Effective unit weight at top of layer                  =   135.000000 pcf
    Effective unit weight at bottom of layer               =   135.000000 pcf
    Uniaxial compressive strength at top of layer          =    75.000000 psi
    Uniaxial compressive strength at bottom of layer       =    75.000000 psi
    Initial modulus of rock at top of layer                =   500.000000 psi
    Initial modulus of rock at bottom of layer             =   500.000000 psi
    RQD of rock at top of layer                            =    25.000000 %
    RQD of rock at bottom of layer                         =    25.000000 %
    k rm of rock at top of layer                           =       0.0000
    k rm of rock at bottom of layer                        =       0.0000


    (Depth of lowest soil layer extends    0.50 ft below pile tip)



 --------------------------------------------------------------------------------
                         Summary of Input Soil Properties
 --------------------------------------------------------------------------------

 Layer        Soil Type          Layer     Effective    Undrained    Uniaxial                    E50
 Rock Mass
 Layer          Name             Depth      Unit Wt.    Cohesion        qu          RQD %         or
  Modulus
  Num.    (p-y Curve Type)        ft          pcf          psf          psi                       krm
```

```
  psi
-----  ------------------  ----------  ----------  ----------  ----------  ----------  ----------
----------
  1        Stiff Clay          8.5000    132.0000       2500.      --          --        default
  --
         w/o Free Water       11.5000    132.0000       2500.      --          --        default
  --
  2        Stiff Clay         11.5000    135.0000       4000.      --          --        default
  --
         w/o Free Water       14.5000    135.0000       4000.      --          --        default
  --
  3           Weak            14.5000    135.0000       --       75.0000     25.0000       --
 500.0000
              Rock            20.0000    135.0000       --       75.0000     25.0000       --
 500.0000

--------------------------------------------------------------------------------
                            Static Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.


--------------------------------------------------------------------------------
              Distributed Lateral Loading Used For All Load Cases
--------------------------------------------------------------------------------

Distributed lateral load intensity defined using 2 points

Point          Depth X          Dist. Load
 No.             in               lbs/in
-----         ----------        ----------
  1              0.000              0.000
  2            102.000            440.000
```

```
--------------------------------------------------------------------------------
              Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 1

Load    Load         Condition                 Condition            Axial Thrust     Compute Top y
 No.    Type             1                         2                 Force, lbs      vs. Pile Length
-----   ----   --------------------   ----------------------    ---------------   ---------------
   1      1    V =       0.0000 lbs   M =       0.0000 in-lbs         0.0000000          Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading.
Axial thrust is assumed to be acting axially for all pile batter angles.


--------------------------------------------------------------------------------
    Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------
Moment-curvature properties were derived from elastic section properties
```

```
-----------------------------------------------------------------------------
                 Computed Values of Pile Loading and Deflection
                  for Lateral Loading for Load Case Number 1
-----------------------------------------------------------------------------

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head                            =         0.0 lbs
Applied moment at pile head                         =         0.0 in-lbs
Axial thrust load on pile head                      =         0.0 lbs

   Depth    Deflect.   Bending    Shear      Slope      Total     Bending   Soil Res.  Soil Spr.  Distrib.

     X         y       Moment     Force        S        Stress   Stiffness     p          Es*h      Lat.
Load
    feet     inches    in-lbs      lbs      radians      psi*     in-lb^2    lb/inch    lb/inch    lb/inch

---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
----------
      0.00    1.7477  -3.08E-06  -5.98E-08   -0.01372  1.55E-07   6.90E+09      0.00       0.00
2.5235
    0.1950    1.7156     6.9089    14.7626   -0.01372    0.3483   6.90E+09      0.00       0.00
10.0941
    0.3900    1.6835    69.0892    50.1930   -0.01372    3.4835   6.90E+09      0.00       0.00
20.1882
    0.5850    1.6514   241.8122   109.2436   -0.01372   12.1922   6.90E+09      0.00       0.00
30.2824
    0.7800    1.6193   580.3492   191.9144   -0.01372   29.2613   6.90E+09      0.00       0.00
40.3765
    0.9750    1.5872      1140.   298.2055   -0.01372   57.4776   6.90E+09      0.00       0.00
50.4706
    1.1700    1.5551      1976.   428.1168   -0.01372   99.6278   6.90E+09      0.00       0.00
60.5647
    1.3650    1.5230      3144.   581.6483   -0.01372  158.4987   6.90E+09      0.00       0.00
70.6588
    1.5600    1.4909      4698.   758.8001   -0.01372  236.8772   6.90E+09      0.00       0.00
80.7529
    1.7550    1.4588      6695.   959.5721   -0.01371  337.5500   6.90E+09      0.00       0.00
```

```
90.8471
    1.9500     1.4267      9189.      1184.   -0.01371  463.3040   6.90E+09       0.00       0.00
100.9412
    2.1450     1.3947     12236.      1432.   -0.01371  616.9258   6.90E+09       0.00       0.00
111.0353
    2.3400     1.3626     15891.      1704.   -0.01370  801.2024   6.90E+09       0.00       0.00
121.1294
    2.5350     1.3305     20209.      1999.   -0.01370      1019.   6.90E+09       0.00       0.00
131.2235
    2.7300     1.2985     25245.      2318.   -0.01369      1273.   6.90E+09       0.00       0.00
141.3176
    2.9250     1.2665     31056.      2660.   -0.01368      1566.   6.90E+09       0.00       0.00
151.4118
    3.1200     1.2345     37695.      3026.   -0.01367      1901.   6.90E+09       0.00       0.00
161.5059
    3.3150     1.2025     45219.      3416.   -0.01365      2280.   6.90E+09       0.00       0.00
171.6000
    3.5100     1.1706     53682.      3829.   -0.01364      2707.   6.90E+09       0.00       0.00
181.6941
    3.7050     1.1387     63141.      4266.   -0.01362      3184.   6.90E+09       0.00       0.00
191.7882
    3.9000     1.1068     73649.      4727.   -0.01359      3713.   6.90E+09       0.00       0.00
201.8824
    4.0950     1.0751     85263.      5211.   -0.01357      4299.   6.90E+09       0.00       0.00
211.9765
    4.2900     1.0433     98038.      5719.   -0.01354      4943.   6.90E+09       0.00       0.00
222.0706
    4.4850     1.0117    112028.      6251.   -0.01350      5648.   6.90E+09       0.00       0.00
232.1647
    4.6800     0.9802    127290.      6806.   -0.01346      6418.   6.90E+09       0.00       0.00
242.2588
    4.8750     0.9487    143878.      7384.   -0.01341      7254.   6.90E+09       0.00       0.00
252.3529
    5.0700     0.9174    161848.      7987.   -0.01336      8160.   6.90E+09       0.00       0.00
262.4471
    5.2650     0.8862    181255.      8613.   -0.01330      9139.   6.90E+09       0.00       0.00
272.5412
    5.4600     0.8551    202155.      9262.   -0.01324     10193.   6.90E+09       0.00       0.00
```

```
282.6353
     5.6550     0.8242    224602.      9935.    -0.01317      11324.   6.90E+09       0.00       0.00
292.7294
     5.8500     0.7935    248652.     10632.    -0.01309      12537.   6.90E+09       0.00       0.00
302.8235
     6.0450     0.7630    274360.     11352.    -0.01300      13833.   6.90E+09       0.00       0.00
312.9176
     6.2400     0.7327    301782.     12097.    -0.01290      15216.   6.90E+09       0.00       0.00
323.0118
     6.4350     0.7026    330972.     12864.    -0.01279      16688.   6.90E+09       0.00       0.00
333.1059
     6.6300     0.6728    361986.     13655.    -0.01268      18251.   6.90E+09       0.00       0.00
343.2000
     6.8250     0.6433    394879.     14470.    -0.01255      19910.   6.90E+09       0.00       0.00
353.2941
     7.0200     0.6141    429707.     15309.    -0.01241      21666.   6.90E+09       0.00       0.00
363.3882
     7.2150     0.5852    466525.     16171.    -0.01226      23522.   6.90E+09       0.00       0.00
373.4824
     7.4100     0.5567    505387.     17057.    -0.01209      25482.   6.90E+09       0.00       0.00
383.5765
     7.6050     0.5286    546350.     17966.    -0.01191      27547.   6.90E+09       0.00       0.00
393.6706
     7.8000     0.5010    589469.     18899.    -0.01172      29721.   6.90E+09       0.00       0.00
403.7647
     7.9950     0.4738    634798.     19856.    -0.01151      32007.   6.90E+09       0.00       0.00
413.8588
     8.1900     0.4471    682394.     20836.    -0.01129      34406.   6.90E+09       0.00       0.00
423.9529
     8.3850     0.4210    732311.     21840.    -0.01105      36923.   6.90E+09       0.00       0.00
434.0471
     8.5800     0.3954    784604.     21604.    -0.01079      39560.   6.90E+09  -675.0747      3995.
39.4465
     8.7750     0.3705    833418.     20068.    -0.01052      42021.   6.90E+09  -677.1345      4277.
0.00
     8.9700     0.3462    878523.     18482.    -0.01023      44295.   6.90E+09  -678.5050      4586.
0.00
     9.1650     0.3226    919913.     16894.    -0.00992      46382.   6.90E+09  -679.1678      4927.
```

```
0.00
    9.3600     0.2997    957585.      15304.    -0.00960      48282.   6.90E+09  -679.1039       5302.
0.00
    9.5550     0.2776    991538.      13716.    -0.00927      49993.   6.90E+09  -678.2929       5717.
0.00
    9.7500     0.2563   1021776.      12131.    -0.00893      51518.   6.90E+09  -676.7135       6178.
0.00
    9.9450     0.2358   1048310.      10550.    -0.00858      52856.   6.90E+09  -674.3428       6691.
0.00
   10.1400     0.2162   1071151.       8976.    -0.00822      54008.   6.90E+09  -671.1563       7265.
0.00
   10.3350     0.1974   1090317.       7410.    -0.00786      54974.   6.90E+09  -667.1278       7910.
0.00
   10.5300     0.1794   1105830.       5855.    -0.00748      55756.   6.90E+09  -662.2285       8638.
0.00
   10.7250     0.1623   1117717.       4312.    -0.00711      56355.   6.90E+09  -656.4274       9463.
0.00
   10.9200     0.1461   1126009.       2784.    -0.00673      56774.   6.90E+09  -649.6902      10403.
0.00
   11.1150     0.1308   1130744.       1272.    -0.00634      57012.   6.90E+09  -641.9791      11481.
0.00
   11.3100     0.1165   1131964.  -219.5541    -0.00596      57074.   6.90E+09  -633.2515      12725.
0.00
   11.5050     0.1030   1129717.      -2020.    -0.00558      56961.   6.90E+09  -905.2131      20575.
0.00
   11.7000    0.09035   1122513.      -4120.    -0.00520      56597.   6.90E+09  -889.7929      23045.
0.00
   11.8950    0.07864   1110437.      -6182.    -0.00482      55988.   6.90E+09  -872.6274      25966.
0.00
   12.0900    0.06781   1093582.      -8201.    -0.00444      55139.   6.90E+09  -853.6007      29457.
0.00
   12.2850    0.05784   1072054.     -10174.    -0.00408      54053.   6.90E+09  -832.5681      33680.
0.00
   12.4800    0.04873   1045967.     -12095.    -0.00372      52738.   6.90E+09  -809.3449      38863.
0.00
   12.6750    0.04045   1015448.     -13959.    -0.00337      51199.   6.90E+09  -783.6880      45337.
0.00
   12.8700    0.03297    980638.     -15760.    -0.00303      49444.   6.90E+09  -755.2659      53601.
```

```
0.00
   13.0650    0.02627    941693.    -17490.    -0.00270     47480.   6.90E+09  -723.6067     64448.
0.00
   13.2600    0.02032    898785.    -19142.    -0.00239     45317.   6.90E+09  -688.0025     79226.
0.00
   13.4550    0.01508    852110.    -20704.    -0.00209     42964.   6.90E+09  -647.3160    100435.
0.00
   13.6500    0.01052    801891.    -22163.    -0.00181     40431.   6.90E+09  -599.5349    133375.
0.00
   13.8450    0.00659    748388.    -23497.    -0.00155     37734.   6.90E+09  -540.5312    191886.
0.00
   14.0400    0.00326    691927.    -24666.    -0.00131     34887.   6.90E+09  -459.2043    329770.
0.00
   14.2350   4.74E-04    632950.    -25537.    -0.00108     31913.   6.90E+09  -284.6632   1404749.
0.00
   14.4300   -0.00181    572415.    -25394.   -8.78E-04     28861.   6.90E+09   406.5280    526168.
0.00
   14.6250   -0.00364    514106.    -24688.   -6.94E-04     25921.   6.90E+09   196.9462    126750.
0.00
   14.8200   -0.00506    456876.    -24099.   -5.29E-04     23036.   6.90E+09   306.7350    141960.
0.00
   15.0150   -0.00611    401325.    -23259.   -3.84E-04     20235.   6.90E+09   410.6406    157170.
0.00
   15.2100   -0.00685    348022.    -22188.   -2.57E-04     17547.   6.90E+09   504.8418    172380.
0.00
   15.4050   -0.00732    297484.    -20911.   -1.48E-04     14999.   6.90E+09   586.5200    187590.
0.00
   15.6000   -0.00754    250157.    -19460.   -5.47E-05     12613.   6.90E+09   653.7662    202800.
0.00
   15.7950   -0.00757    206410.    -17870.    2.27E-05     10407.   6.90E+09   705.4762    218010.
0.00
   15.9900   -0.00744    166526.    -16177.    8.59E-05      8396.   6.90E+09   741.2391    233220.
0.00
   16.1850   -0.00717    130701.    -14419.    1.36E-04      6590.   6.90E+09   761.2212    248430.
0.00
   16.3800   -0.00680     99044.    -12632.    1.75E-04      4994.   6.90E+09   766.0482    263640.
0.00
   16.5750   -0.00635     71581.    -10851.    2.04E-04      3609.   6.90E+09   756.6912    278850.
```

```
0.00
   16.7700   -0.00584    48262.      -9106.   2.24E-04      2433.   6.90E+09   734.3558    294060.
0.00
   16.9650   -0.00530    28963.      -7428.   2.38E-04      1460.   6.90E+09   700.3798    309270.
0.00
   17.1600   -0.00473    13500.      -5841.   2.45E-04   680.6849   6.90E+09   656.1395    324480.
0.00
   17.3550   -0.00415     1630.      -4367.   2.47E-04    82.1743   6.90E+09   602.9677    339690.
0.00
   17.5500   -0.00357    -6939.      -3028.   2.46E-04   349.8687   6.90E+09   542.0839    354900.
0.00
   17.7450   -0.00300   -12540.      -1838.   2.43E-04   632.2527   6.90E+09   474.5379    370110.
0.00
   17.9400   -0.00244   -15542.   -813.6397   2.38E-04   783.6260   6.90E+09   401.1689    385320.
0.00
   18.1350   -0.00188   -16348.     33.1447   2.33E-04   824.2443   6.90E+09   322.5785    400530.
0.00
   18.3300   -0.00135   -15387.    690.3326   2.28E-04   775.8050   6.90E+09   239.1206    415740.
0.00
   18.5250  -8.19E-04   -13117.       1147.   2.23E-04   661.3490   6.90E+09   150.9078    430950.
0.00
   18.7200  -3.03E-04   -10020.       1391.   2.19E-04   505.2304   6.90E+09    57.8348    446160.
0.00
   18.9150   2.05E-04    -6607.       1411.   2.16E-04   333.1446   6.90E+09   -40.3798    461370.
0.00
   19.1100   7.08E-04    -3415.       1195.   2.14E-04   172.2069   6.90E+09  -144.1325    476580.
0.00
   19.3050    0.00121    -1013.    729.7943   2.14E-04    51.0615   6.90E+09  -253.8534    491790.
0.00
   19.5000    0.00171      0.00        0.00   2.13E-04       0.00   6.90E+09  -369.9024    253500.
0.00

* The above values of total stress are combined axial and bending stresses.


Output Summary for Load Case No. 1:

Pile-head deflection                =      1.74773905 inches
```

```
Computed slope at pile head      =    -0.01371921 radians
Maximum bending moment           =       1131964. inch-lbs
Maximum shear force              =        -25537. lbs
Depth of maximum bending moment  =    11.31000000 feet below pile head
Depth of maximum shear force     =    14.23500000 feet below pile head
Number of iterations             =             25
Number of zero deflection points =              2


--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 1
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear      =             0. lbs
Moment     =             0. in-lbs
Axial Load =             0. lbs

    Pile        Pile Head       Maximum       Maximum
   Length       Deflection      Moment         Shear
    feet          inches        ln-lbs          lbs
------------  ------------  ------------  ------------
   19.50000    1.74773905      1131964.        -25537.
   18.52500    1.73287522      1118072.        -25149.
   17.55000    1.77290119      1137010.        -25922.
   16.57500    1.86775241      1133009.        -29919.
   15.60000    2.81925639      1071876.        -32941.
   14.62500    9.58131280      1001257.        -35475.
   13.65000   62.97324732       963379.        -41067.

--------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
--------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:
```

```
Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians


Load Load                  Load                    Axial    Pile-head  Pile-head  Max Shear Max Moment
Case Type   Pile-head      Type      Pile-head    Loading   Deflection  Rotation   in Pile    in Pile
 No.  1      Load 1         2         Load 2        lbs       inches     radians     lbs      in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
   1  V, lb       0.00  M, in-lb       0.00       0.00     1.7477   -0.01372    -25537.   1131964.


Maximum pile-head deflection =     1.747739047 inches
Maximum pile-head rotation   =    -0.013719208 radians

--------------------------------------------------------------------------------
                           Summary of Warning Messages
--------------------------------------------------------------------------------

The following warning was reported 3256 times

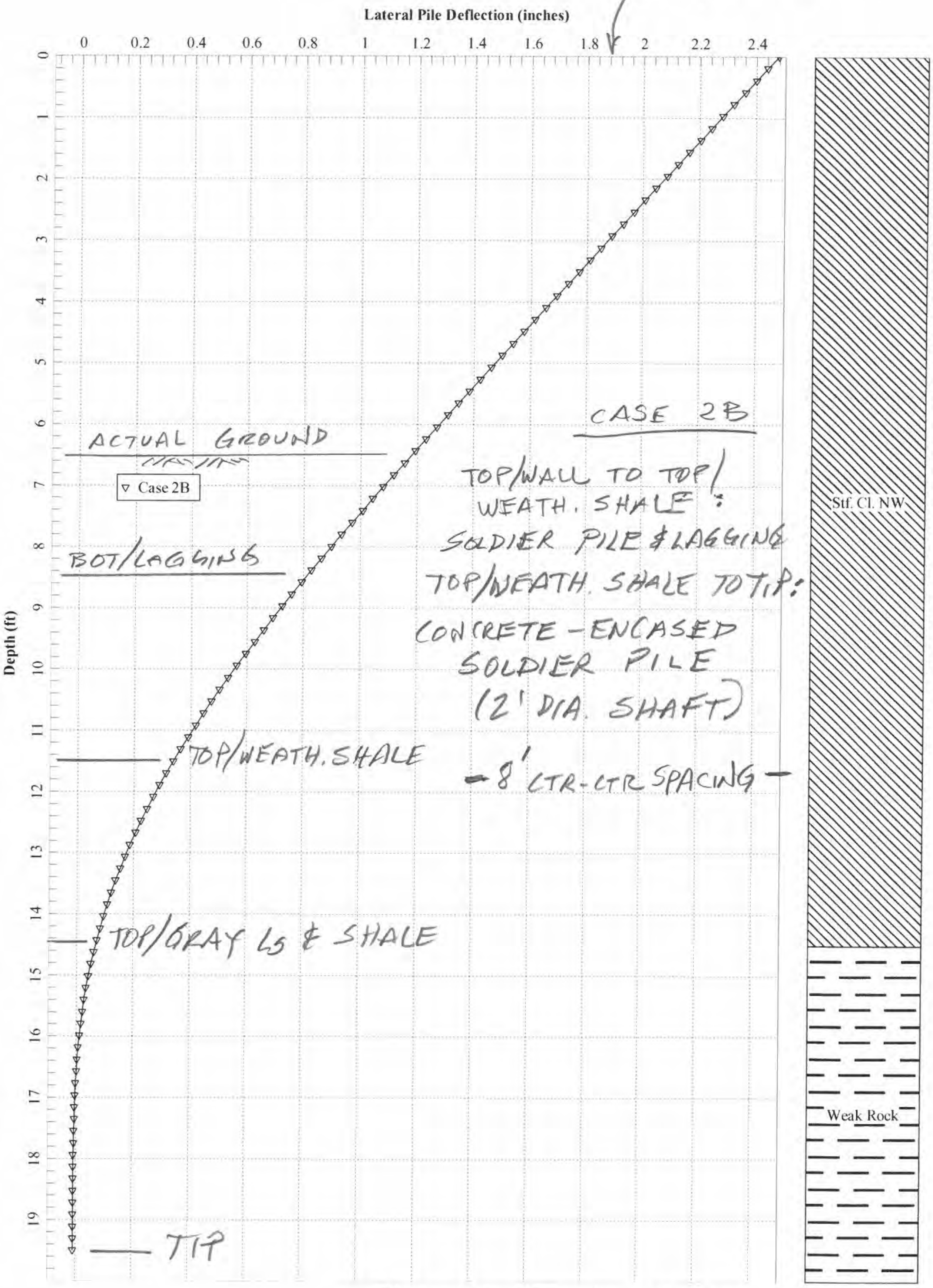

**** Warning ****

An unreasonable input value for the compressive strength has been specified
for a soil defined using the weak rock criteria.  The input value is less
than 100 psi.  You should check your input data for correctness.


The analysis ended normally.
```

Addendum 2 -- 7-11-19

TOP/WALL



CASE 2B

ACTUAL GROUND

TOP/WALL TO TOP/
WEATH. SHALE:
SOLDIER PILE & LAGGING
TOP/WEATH. SHALE TO TIP:
CONCRETE-ENCASED
SOLDIER PILE
(2' DIA. SHAFT)

BOT/LAGGING

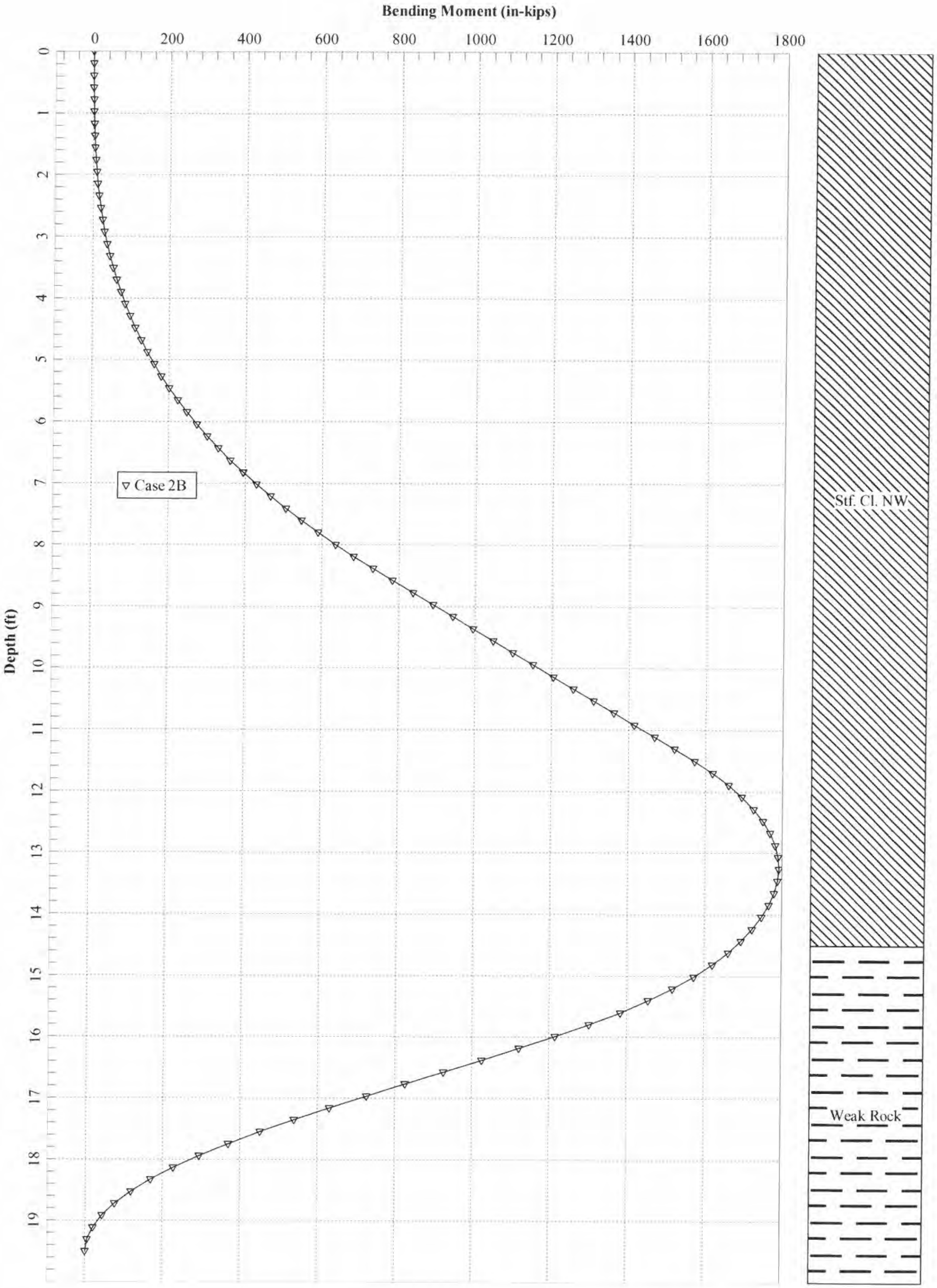
TOP/WEATH. SHALE

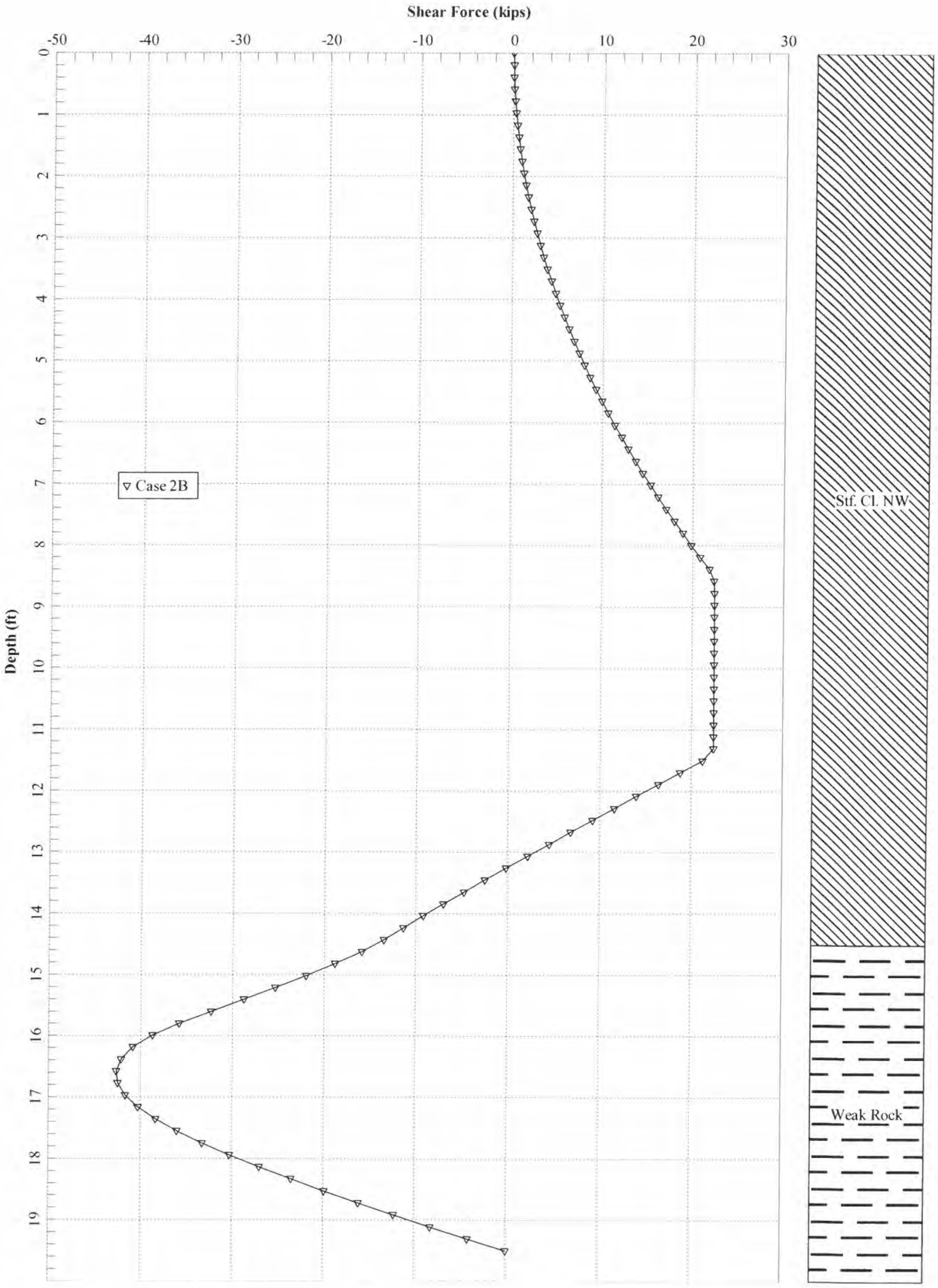
8' CTR-CTR SPACING

TOP/GRAY LS & SHALE

TIP

BOONE CO. 6-00140
S-040-2016


Bending Moment (in-kips)
0
200
400
600
800
1000
1200
1400
1600
1800
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
▽ Case 2B
Stf. Cl. NW
Weak Rock


Shear Force (kips)
-50
-40
-30
-20
-10
0
10
20
30
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
▽ Case 2B
Stf. Cl. NW
Weak Rock

```
================================================================================

                    LPile for Windows, Version 2015-08.003

                  Analysis of Individual Piles and Drilled Shafts
                 Subjected to Lateral Loading Using the p-y Method
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================================================================================

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--------------------------------------------------------------------------------
                          Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:
\Projects\2015\N1155079\Working Files\Calculations-Analyses\LPILE\Nov 2016 - 2nd Iteration\

Name of input data file:
Case 2B, 8' spacing, 8' socket.lp8d

Name of output report file:
Case 2B, 8' spacing, 8' socket.lp8o
```

```
Name of plot output file:
Case 2B, 8' spacing, 8' socket.lp8p

Name of runtime message file:
Case 2B, 8' spacing, 8' socket.lp8r


-------------------------------------------------------------------------------
                           Date and Time of Analysis
-------------------------------------------------------------------------------

               Date:  November 11, 2016     Time:   8:58:31


-------------------------------------------------------------------------------
                               Problem Title
-------------------------------------------------------------------------------

Project Name:


Job Number:


Client:


Engineer:


Description:
```

```
--------------------------------------------------------------------------------
                         Program Options and Settings
--------------------------------------------------------------------------------

Computational Options:
 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed                    =        500
 - Deflection tolerance for convergence                    =   1.0000E-05 in
 - Maximum allowable deflection                            =     100.0000 in
 - Number of pile increments                               =        100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis includes loading by one distributed lateral load acting on pile
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats
```

```
--------------------------------------------------------------------------------
                     Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total number of pile sections                              =         1

Total length of pile                                       =        19.50 ft

Depth of ground surface below top of pile                  =        11.50 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile.

Point         Depth              Pile
                X              Diameter
                ft                in
-----       ---------        -----------
  1           0.00000        24.00000000
  2        19.5000000        24.00000000


Input Structural Properties:
----------------------------

Pile Section No. 1:

   Section Type                                            =    Elastic Pile
   Cross-sectional Shape                                   =   Circular Pile
   Section Length                                          =    19.500000 ft
   Top Width                                               =    24.000000 in
   Bottom Width                                            =    24.000000 in
   Top Area                                                =   452.389342 sq. in
   Bottom Area                                             =   452.389342 sq. in
   Moment of Inertia at Top                                =   348.000000 in^4
   Moment of Inertia at Bottom                             =   348.000000 in^4
   Elastic Modulus                                         =    29000000. lbs/in^2
```

```
--------------------------------------------------------------------------------
                       Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                          =        0.000 degrees
                                                            =        0.000 radians

Pile Batter Angle                                           =        0.000 degrees
                                                            =        0.000 radians

--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 2 layers

Layer 1 is stiff clay without free water

   Distance from top of pile to top of layer                =    11.500000 ft
   Distance from top of pile to bottom of layer             =    14.500000 ft
   Effective unit weight at top of layer                    =   135.000000 pcf
   Effective unit weight at bottom of layer                 =   135.000000 pcf
   Undrained cohesion at top of layer                       =        4000. psf
   Undrained cohesion at bottom of layer                    =        4000. psf
   Epsilon-50 at top of layer                               =       0.0000
   Epsilon-50 at bottom of layer                            =       0.0000

   NOTE: Default values for Epsilon-50 will be computed for this layer.

Layer 2 is weak rock, p-y criteria by Reese, 1997

   Distance from top of pile to top of layer                =    14.500000 ft
   Distance from top of pile to bottom of layer             =    20.000000 ft
```

```
   Effective unit weight at top of layer                   =   135.000000 pcf
   Effective unit weight at bottom of layer                =   135.000000 pcf
   Uniaxial compressive strength at top of layer           =    75.000000 psi
   Uniaxial compressive strength at bottom of layer        =    75.000000 psi
   Initial modulus of rock at top of layer                 =   500.000000 psi
   Initial modulus of rock at bottom of layer              =   500.000000 psi
   RQD of rock at top of layer                             =    25.000000 %
   RQD of rock at bottom of layer                          =    25.000000 %
   k rm of rock at top of layer                            =       0.0000
   k rm of rock at bottom of layer                         =       0.0000


   (Depth of lowest soil layer extends    0.50 ft below pile tip)



--------------------------------------------------------------------------------
                   Summary of Input Soil Properties
--------------------------------------------------------------------------------

Layer        Soil Type          Layer     Effective   Undrained   Uniaxial               E50
Rock Mass
Layer          Name             Depth     Unit Wt.    Cohesion      qu        RQD %       or
 Modulus
 Num.     (p-y Curve Type)       ft         pcf         psf         psi                   krm
  psi
-----   -----------------   ----------  ----------  ----------  ----------  ----------  ----------
----------
  1         Stiff Clay         11.5000    135.0000      4000.        --          --      default
   --
          w/o Free Water       14.5000    135.0000      4000.        --          --      default
   --
  2            Weak            14.5000    135.0000        --       75.0000     25.0000      --
 500.0000
               Rock            20.0000    135.0000        --       75.0000     25.0000      --
 500.0000

--------------------------------------------------------------------------------
```

```
                          Static Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.


--------------------------------------------------------------------------------
              Distributed Lateral Loading Used For All Load Cases
--------------------------------------------------------------------------------

Distributed lateral load intensity defined using 2 points

Point           Depth X           Dist. Load
 No.              in               lbs/in
-----          ----------        ----------
  1               0.000             0.000
  2             102.000           440.000



--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 1

Load   Load        Condition            Condition           Axial Thrust    Compute Top y
 No.   Type           1                    2                 Force, lbs    vs. Pile Length
-----  ----  --------------------  ----------------------  ---------------  ---------------
   1     1   V =       0.0000 lbs  M =       0.0000 in-lbs       0.0000000        Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
```

```
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading.
Axial thrust is assumed to be acting axially for all pile batter angles.


--------------------------------------------------------------------------------
     Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------
Moment-curvature properties were derived from elastic section properties



--------------------------------------------------------------------------------
                  Computed Values of Pile Loading and Deflection
                    for Lateral Loading for Load Case Number 1
--------------------------------------------------------------------------------

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head                                 =          0.0 lbs
Applied moment at pile head                              =          0.0 in-lbs
Axial thrust load on pile head                           =          0.0 lbs

   Depth    Deflect.    Bending     Shear      Slope      Total     Bending   Soil Res.  Soil Spr.  Distrib.

     X         y        Moment      Force        S        Stress   Stiffness      p        Es*h       Lat.
Load
    feet     inches     in-lbs       lbs      radians      psi*     in-lb^2   lb/inch    lb/inch    lb/inch
```

```
---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
----------
      0.00     2.4789  -1.23E-05       0.00   -0.01676   4.23E-07   1.01E+10       0.00       0.00
2.5235
    0.1950     2.4397     6.9089    14.7627   -0.01676     0.2382   1.01E+10       0.00       0.00
10.0941
    0.3900     2.4004    69.0892    50.1930   -0.01676     2.3824   1.01E+10       0.00       0.00
20.1882
    0.5850     2.3612   241.8122   109.2436   -0.01676     8.3384   1.01E+10       0.00       0.00
30.2824
    0.7800     2.3220   580.3492   191.9144   -0.01676    20.0120   1.01E+10       0.00       0.00
40.3765
    0.9750     2.2827      1140.   298.2055   -0.01676    39.3094   1.01E+10       0.00       0.00
50.4706
    1.1700     2.2435      1976.   428.1168   -0.01676    68.1362   1.01E+10       0.00       0.00
60.5647
    1.3650     2.2043      3144.   581.6483   -0.01676   108.3986   1.01E+10       0.00       0.00
70.6588
    1.5600     2.1651      4698.   758.8001   -0.01676   162.0022   1.01E+10       0.00       0.00
80.7529
    1.7550     2.1258      6695.   959.5721   -0.01676   230.8532   1.01E+10       0.00       0.00
90.8471
    1.9500     2.0866      9189.      1184.   -0.01676   316.8573   1.01E+10       0.00       0.00
100.9412
    2.1450     2.0474     12236.      1432.   -0.01676   421.9205   1.01E+10       0.00       0.00
111.0353
    2.3400     2.0082     15891.      1704.   -0.01675   547.9487   1.01E+10       0.00       0.00
121.1294
    2.5350     1.9690     20209.      1999.   -0.01675   696.8478   1.01E+10       0.00       0.00
131.2235
    2.7300     1.9298     25245.      2318.   -0.01674   870.5238   1.01E+10       0.00       0.00
141.3176
    2.9250     1.8906     31056.      2660.   -0.01674      1071.   1.01E+10       0.00       0.00
151.4118
    3.1200     1.8515     37695.      3026.   -0.01673      1300.   1.01E+10       0.00       0.00
161.5059
    3.3150     1.8124     45219.      3416.   -0.01672      1559.   1.01E+10       0.00       0.00
171.6000
```

```
     3.5100     1.7732     53682.      3829.  -0.01671      1851.  1.01E+10       0.00       0.00
 181.6941
     3.7050     1.7342     63141.      4266.  -0.01669      2177.  1.01E+10       0.00       0.00
 191.7882
     3.9000     1.6951     73649.      4727.  -0.01668      2540.  1.01E+10       0.00       0.00
 201.8824
     4.0950     1.6561     85263.      5211.  -0.01666      2940.  1.01E+10       0.00       0.00
 211.9765
     4.2900     1.6171     98038.      5719.  -0.01664      3381.  1.01E+10       0.00       0.00
 222.0706
     4.4850     1.5782    112028.      6251.  -0.01661      3863.  1.01E+10       0.00       0.00
 232.1647
     4.6800     1.5394    127290.      6806.  -0.01659      4389.  1.01E+10       0.00       0.00
 242.2588
     4.8750     1.5006    143878.      7384.  -0.01656      4961.  1.01E+10       0.00       0.00
 252.3529
     5.0700     1.4619    161848.      7987.  -0.01652      5581.  1.01E+10       0.00       0.00
 262.4471
     5.2650     1.4233    181255.      8613.  -0.01648      6250.  1.01E+10       0.00       0.00
 272.5412
     5.4600     1.3848    202155.      9262.  -0.01644      6971.  1.01E+10       0.00       0.00
 282.6353
     5.6550     1.3464    224602.      9935.  -0.01639      7745.  1.01E+10       0.00       0.00
 292.7294
     5.8500     1.3081    248652.     10632.  -0.01633      8574.  1.01E+10       0.00       0.00
 302.8235
     6.0450     1.2699    274360.     11352.  -0.01627      9461.  1.01E+10       0.00       0.00
 312.9176
     6.2400     1.2319    301782.     12097.  -0.01620     10406.  1.01E+10       0.00       0.00
 323.0118
     6.4350     1.1941    330972.     12864.  -0.01613     11413.  1.01E+10       0.00       0.00
 333.1059
     6.6300     1.1564    361986.     13655.  -0.01605     12482.  1.01E+10       0.00       0.00
 343.2000
     6.8250     1.1190    394879.     14470.  -0.01596     13617.  1.01E+10       0.00       0.00
 353.2941
     7.0200     1.0817    429707.     15309.  -0.01587     14817.  1.01E+10       0.00       0.00
 363.3882
```

```
     7.2150      1.0447     466525.     16171.   -0.01576     16087.   1.01E+10       0.00        0.00
373.4824
     7.4100      1.0080     505387.     17057.   -0.01565     17427.   1.01E+10       0.00        0.00
383.5765
     7.6050      0.9715     546350.     17966.   -0.01553     18840.   1.01E+10       0.00        0.00
393.6706
     7.8000      0.9353     589469.     18899.   -0.01540     20327.   1.01E+10       0.00        0.00
403.7647
     7.9950      0.8994     634798.     19856.   -0.01525     21890.   1.01E+10       0.00        0.00
413.8588
     8.1900      0.8639     682394.     20836.   -0.01510     23531.   1.01E+10       0.00        0.00
423.9529
     8.3850      0.8287     732311.     21840.   -0.01494     25252.   1.01E+10       0.00        0.00
434.0471
     8.5800      0.7940     784604.     22394.   -0.01476     27055.   1.01E+10       0.00        0.00
39.4465
     8.7750      0.7597     837114.     22440.   -0.01457     28866.   1.01E+10       0.00        0.00
0.00
     8.9700      0.7258     889624.     22440.   -0.01437     30677.   1.01E+10       0.00        0.00
0.00
     9.1650      0.6924     942133.     22440.   -0.01416     32487.   1.01E+10       0.00        0.00
0.00
     9.3600      0.6595     994643.     22440.   -0.01394     34298.   1.01E+10       0.00        0.00
0.00
     9.5550      0.6272    1047152.     22440.   -0.01370     36109.   1.01E+10       0.00        0.00
0.00
     9.7500      0.5954    1099662.     22440.   -0.01345     37919.   1.01E+10       0.00        0.00
0.00
     9.9450      0.5642    1152172.     22440.   -0.01319     39730.   1.01E+10       0.00        0.00
0.00
    10.1400      0.5337    1204681.     22440.   -0.01292     41541.   1.01E+10       0.00        0.00
0.00
    10.3350      0.5038    1257191.     22440.   -0.01263     43351.   1.01E+10       0.00        0.00
0.00
    10.5300      0.4745    1309700.     22440.   -0.01233     45162.   1.01E+10       0.00        0.00
0.00
    10.7250      0.4460    1362210.     22440.   -0.01202     46973.   1.01E+10       0.00        0.00
0.00
```

```
   10.9200     0.4183  1414720.     22440.  -0.01170     48783.  1.01E+10       0.00       0.00
0.00
   11.1150     0.3913  1467229.     22440.  -0.01137     50594.  1.01E+10       0.00       0.00
0.00
   11.3100     0.3651  1519739.     22440.  -0.01102     52405.  1.01E+10       0.00       0.00
0.00
   11.5050     0.3397  1572248.     21233.  -0.01066     54215.  1.01E+10     -1032.      7110.
0.00
   11.7000     0.3151  1619107.     18818.  -0.01029     55831.  1.01E+10     -1032.      7659.
0.00
   11.8950     0.2915  1660317.     16406.  -0.00991     57252.  1.01E+10     -1030.      8268.
0.00
   12.0900     0.2688  1695888.     13999.  -0.00952     58479.  1.01E+10     -1027.      8943.
0.00
   12.2850     0.2469  1725834.     11600.  -0.00913     59512.  1.01E+10     -1023.      9697.
0.00
   12.4800     0.2260  1750178.      9212.  -0.00872     60351.  1.01E+10     -1018.     10539.
0.00
   12.6750     0.2061  1768947.      6837.  -0.00832     60998.  1.01E+10     -1012.     11486.
0.00
   12.8700     0.1871  1782178.      4479.  -0.00791     61454.  1.01E+10     -1004.     12554.
0.00
   13.0650     0.1691  1789911.      2141.  -0.00749     61721.  1.01E+10  -994.7333     13765.
0.00
   13.2600     0.1521  1792198.  -174.2676  -0.00708     61800.  1.01E+10  -984.2233     15147.
0.00
   13.4550     0.1360  1789096.     -2463.  -0.00666     61693.  1.01E+10  -972.2512     16731.
0.00
   13.6500     0.1209  1780669.     -4723.  -0.00625     61402.  1.01E+10  -958.7520     18559.
0.00
   13.8450     0.1067  1766994.     -6948.  -0.00584     60931.  1.01E+10  -943.6514     20686.
0.00
   14.0400    0.09357  1748151.     -9137.  -0.00543     60281.  1.01E+10  -926.8633     23178.
0.00
   14.2350    0.08135  1724233.    -11284.  -0.00503     59456.  1.01E+10  -908.2866     26128.
0.00
   14.4300    0.07005  1695341.    -13385.  -0.00463     58460.  1.01E+10  -887.8005     29655.
0.00
```

```
    14.6250     0.05968    1661589.     -15849.    -0.00424      57296.   1.01E+10      -1218.      47757.
0.00
    14.8200     0.05021    1621167.     -18811.    -0.00386      55902.   1.01E+10      -1313.      61188.
0.00
    15.0150     0.04162    1573555.     -21976.    -0.00349      54261.   1.01E+10      -1393.      78289.
0.00
    15.2100     0.03388    1518319.     -25308.    -0.00313      52356.   1.01E+10      -1455.     100511.
0.00
    15.4050     0.02697    1455114.     -28766.    -0.00279      50176.   1.01E+10      -1500.     130147.
0.00
    15.6000     0.02085    1383694.     -32304.    -0.00246      47714.   1.01E+10      -1524.     171070.
0.00
    15.7950     0.01547    1303930.     -35774.    -0.00214      44963.   1.01E+10      -1442.     218010.
0.00
    15.9900     0.01081    1216271.     -38721.    -0.00185      41940.   1.01E+10      -1077.     233220.
0.00
    16.1850     0.00680    1122713.     -40827.    -0.00158      38714.   1.01E+10  -722.3198     248430.
0.00
    16.3800     0.00341    1025200.     -42121.    -0.00133      35352.   1.01E+10  -383.8935     263640.
0.00
    16.5750    5.67E-04     925586.     -42650.    -0.00111      31917.   1.01E+10   -67.6007     278850.
0.00
    16.7700    -0.00177     825601.     -42468.   -9.03E-04      28469.   1.01E+10   222.5039     294060.
0.00
    16.9650    -0.00366     726834.     -41642.   -7.23E-04      25063.   1.01E+10   483.7974     309270.
0.00
    17.1600    -0.00516     630716.     -40239.   -5.66E-04      21749.   1.01E+10   714.9757     324480.
0.00
    17.3550    -0.00631     538514.     -38331.   -4.30E-04      18569.   1.01E+10   915.9193     339690.
0.00
    17.5500    -0.00717     451326.     -35987.   -3.16E-04      15563.   1.01E+10       1088.     354900.
0.00
    17.7450    -0.00779     370094.     -33274.   -2.20E-04      12762.   1.01E+10       1232.     370110.
0.00
    17.9400    -0.00820     295605.     -30252.   -1.43E-04      10193.   1.01E+10       1351.     385320.
0.00
    18.1350    -0.00846     228512.     -26978.   -8.25E-05       7880.   1.01E+10       1448.     400530.
0.00
```

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   18.3300   -0.00859    169346.    -23499.  -3.64E-05      5840.   1.01E+10      1526.    415740.
0.00
   18.5250   -0.00863    118535.    -19855.  -3.03E-06      4087.   1.01E+10      1589.    430950.
0.00
   18.7200   -0.00860     76425.    -16077.   1.96E-05      2635.   1.01E+10      1640.    446160.
0.00
   18.9150   -0.00854     43296.    -12188.   3.35E-05      1493.   1.01E+10      1683.    461370.
0.00
   19.1100   -0.00845     19383.     -8207.   4.07E-05   668.3806   1.01E+10      1720.    476580.
0.00
   19.3050   -0.00835      4889.     -4142.   4.35E-05   168.6005   1.01E+10      1754.    491790.
0.00
   19.5000   -0.00824      0.00       0.00    4.41E-05      0.00    1.01E+10      1786.    253500.
0.00

* The above values of total stress are combined axial and bending stresses.


Output Summary for Load Case No. 1:

Pile-head deflection              =    2.47888677 inches
Computed slope at pile head       =   -0.01676434 radians
Maximum bending moment            =      1792198. inch-lbs
Maximum shear force               =       -42650. lbs
Depth of maximum bending moment   =   13.26000000 feet below pile head
Depth of maximum shear force      =   16.57500000 feet below pile head
Number of iterations              =            21
Number of zero deflection points  =             1


--------------------------------------------------------------------------------
            Pile-head Deflection vs. Pile Length for Load Case 1
--------------------------------------------------------------------------------

Boundary Condition Type 1, Shear and Moment

Shear        =                 0. lbs
```

```
Moment      =             0. in-lbs
Axial Load =              0. lbs

    Pile        Pile Head       Maximum       Maximum
   Length      Deflection       Moment         Shear
    feet         inches         ln-lbs          lbs
 ------------ ------------ ------------ ------------
   19.50000    2.47888677     1792198.       -42650.
   18.52500    2.79538726     1821480.       -54840.
   17.55000    4.99822059     1752627.       -61220.

---------------------------------------------------------------------------------
            Summary of Pile-head Responses for Conventional Analyses
---------------------------------------------------------------------------------

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians


Load Load                Load                       Axial    Pile-head  Pile-head  Max Shear Max Moment
Case Type   Pile-head    Type      Pile-head      Loading   Deflection  Rotation    in Pile    in Pile
 No.  1      Load 1       2         Load 2          lbs       inches     radians      lbs       in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
  1  V, lb       0.00  M, in-lb        0.00        0.00     2.4789   -0.01676    -42650.   1792198.


Maximum pile-head deflection =     2.478886773 inches
Maximum pile-head rotation   =    -0.016764339 radians

---------------------------------------------------------------------------------
                           Summary of Warning Messages
---------------------------------------------------------------------------------
```

```
The following warning was reported 3565 times


**** Warning ****

An unreasonable input value for the compressive strength has been specified
for a soil defined using the weak rock criteria.  The input value is less
than 100 psi.  You should check your input data for correctness.


The analysis ended normally.
```

S-042-2016

cc: J. Van Zee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
Stantec

M E M O R A N D U M

TO: Bart Asher, P.E.
Division of Structural Design

FROM: Michael Carpenter, P.E. MC
Geotechnical Branch Manager

DATE: March 7, 2018

SUBJECT: Boone County
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall at Mainline STA 179+11 to 181+30, Left Side
Item No. 6-14.00
Geotechnical Engineering Structure Foundation Report

1.0 Introduction

The geotechnical investigation for this structure has been completed. The .DGN file for the Geotechnical Note Sheet for Cast-In-Place Non-Reinforced Gravity Walls has been made available on Projectwise and through email for inclusion in the project plans. This project is to reconstruct I-75/71 interchange at KY 536 and provide improvements along the KY 536 corridor. This structure is located about 0.25 miles east of the 1-75/71 interchange with KY 536.

2.0 Site Geologic Conditions

This structure is located in the Union Geologic Quadrangle (GQ-779). The geologic mapping indicates that the bedrock at this site consist is part of the Bull Fork Formation.

3.0 Field Investigation

Due to property access issues no drilling was completed for this structure. Instead conservative assumptions for soil bearing strata have been applied based on area soil properties observed during drilling and analysis of other structures along this project site.

5.0 Engineering Analysis

The proposed standard gravity wall at this location will undergo loading due to the presence of a multiuse path within the influence zone of the supported back fill material. It is Branch practice to analyze gravity wall geometry to ensure that it can withstand loading induced by construction and maintenance operations along the multiuse path.

Analyses indicate that a Standard Gravity Wall with an equivalent depth of soil surcharge of 2 feet may be utilized at this location with minor changes. These changes include utilizing external granular backfill and increasing the base width dimension (B) of the wall by 8 inches. By following these requirements, checks for eccentricity (overturning), bearing capacity, and sliding were satisfied

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternative. The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

6.0 Foundation Recommendations

6.1 Use wall dimensions in accordance with Case I of Standard Drawing RGX-002 except that the base widths (B) shall be increased by 2/3 foot beneath its heel section. Use a soil surcharge of 2 feet because of anticipated construction loads located within the 1:1 zone of influence but more than 1 foot beyond the backface of the wall (the backface is taken as the pressure surface being considered).

6.2 The backfill behind the wall shall consist of "Granular Embankment" extending on a 1H:1V slope from the base of the wall. The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches.

6.3 Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment. The Geotextile fabric shall be in accordance with Section 214 and 843 of the Standard Specifications, current edition.

6.4 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals

6.5 The wall designer shall verify wall stability based on final wall design dimensions.

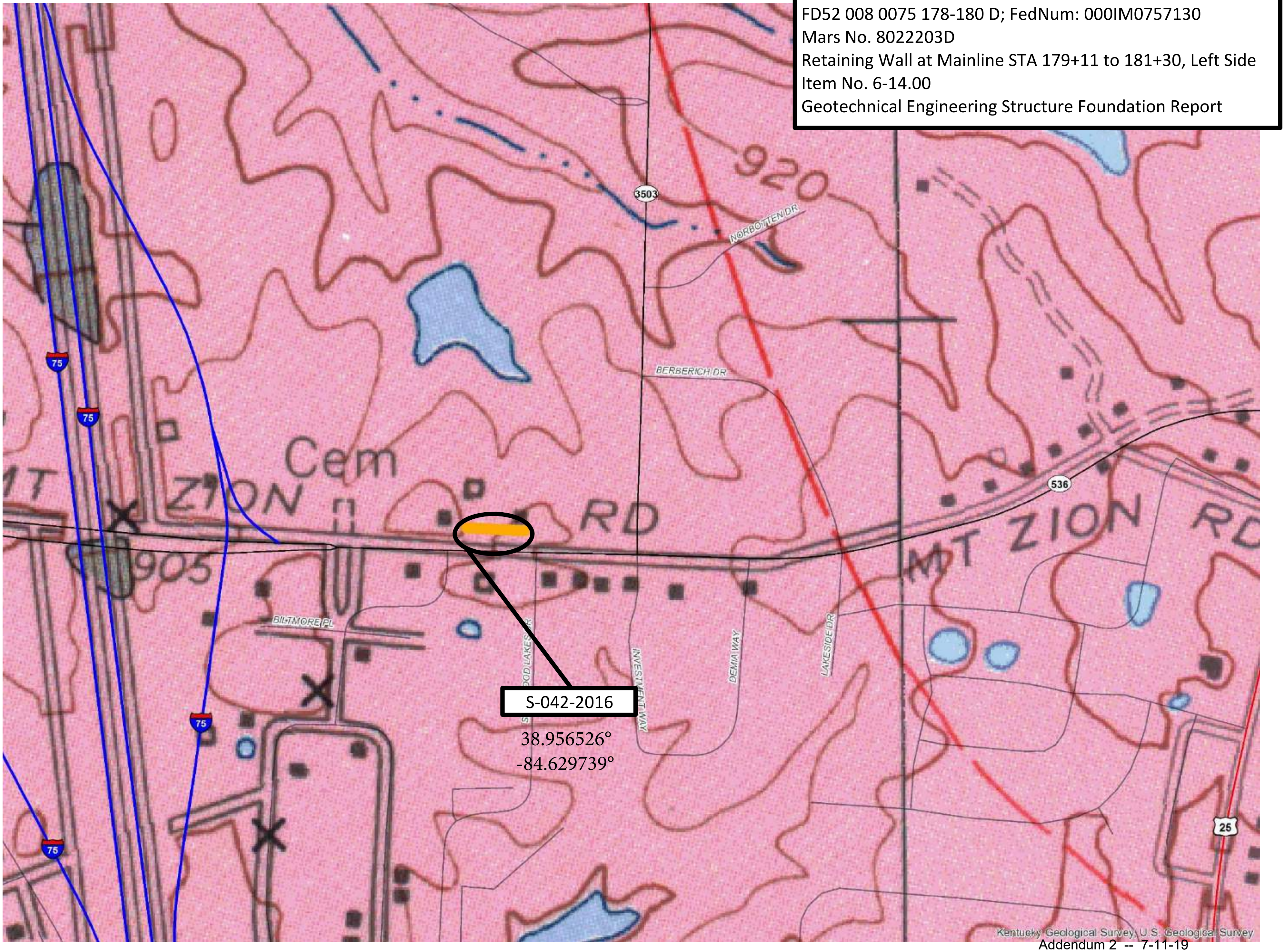
7.0 Plan Notes

7.1 Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls," at the appropriate locations in the plans.

Attachments:

- **Project Location Map**
- **Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls**

Boone County
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall at Mainline STA 179+11 to 181+30, Left Side
Item No. 6-14.00
Geotechnical Engineering Structure Foundation Report



Addendum 2 -- 7-11-19

SHEET LOCATION:
FILE NAME: $$$$design$file$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Construct walls with external granular backfill, use wall dimensions in accordance with Case I of the Standard Drawing RGX-002 except that the base widths (B) shall be increased by a minimum of 2/3 ft beneath its heel section.

Bearing Surface	Nominal Bearing Resistance	Factored Nominal Bearing Resistance at the Service Limit State
Soil	4.6 ksf	1.5 ksf

Use the following soil strength parameters for design:

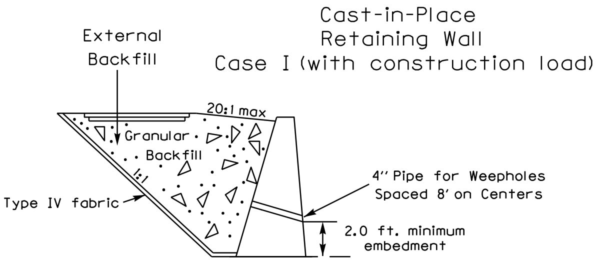
	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Embankment	0	38	115
Foundation Soils			
Existing	950	0	120

External granular backfill is required. Place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric between all soil to granular backfill interfaces in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

If undercutting is required the undercut should expose suitable stiff to very stiff cohesive soils or bedrock and be backfilled with class B concrete. Granular embankment shall not be allowed for use to backfill the undercut.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



DATE: 5-MARCH-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	M. CARPENTER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 536	Retaining Wall @ 179+11 to 181+30, Lt.

S–042–16

ITEM NUMBER
6–14.00

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

S-043-2016

cc: J. Van Zee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
Stantec

M E M O R A N D U M

TO: Bart Asher, P.E.
Division of Structural Design

FROM: Michael Carpenter, P.E. MC
Geotechnical Branch Manager

DATE: March 7, 2018

SUBJECT: Boone County
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall at Mainline STA 183+00 to 184+15, Left Side
Item No. 6-14.00
Geotechnical Engineering Structure Foundation Report

1.0 Introduction

The geotechnical investigation for this structure has been completed. The .DGN file for the Geotechnical Note Sheet for Cast-In-Place Non-Reinforced Gravity Walls has been made available on Projectwise and through email for inclusion in the project plans. This project is to reconstruct I-75/71 interchange at KY 536 and provide improvements along the KY 536 corridor. This structure is located about 0.32 miles east of the 1-75/71 interchange with KY 536.

2.0 Site Geologic Conditions

This structure is located in the Union Geologic Quadrangle (GQ-779). The geologic mapping indicates that the bedrock at this site consist is part of the Bull Fork Formation.

3.0 Field Investigation

Due to property access issues no drilling was completed for this structure. Instead conservative assumptions for soil bearing strata have been applied based on area soil properties observed during drilling and analysis of other structures along this project site.

5.0 Engineering Analysis

The proposed standard gravity wall at this location will undergo loading due to the presence of a multiuse path within the influence zone of the supported back fill material. It is Branch practice to analyze gravity wall geometry to ensure that it can withstand loading induced by construction and maintenance operations along the multiuse path.

Analyses indicate that a Standard Gravity Wall with an equivalent depth of soil surcharge of 2 feet may be utilized at this location with minor changes. These changes include utilizing external granular backfill and increasing the base width dimension (B) of the wall by 8 inches. By following these requirements, checks for eccentricity (overturning), bearing capacity, and sliding were satisfied

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternative. The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

6.0 Foundation Recommendations

6.1 Use wall dimensions in accordance with Case I of Standard Drawing RGX-002 except that the base widths (B) shall be increased by 2/3 foot beneath its heel section. Use a soil surcharge of 2 feet because of anticipated construction loads located within the 1:1 zone of influence but more than 1 foot beyond the backface of the wall (the backface is taken as the pressure surface being considered).

6.2 The backfill behind the wall shall consist of "Granular Embankment" extending on a 1H:1V slope from the base of the wall. The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches.

6.3 Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment. The Geotextile fabric shall be in accordance with Section 214 and 843 of the Standard Specifications, current edition.

6.4 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals

6.5 The wall designer shall verify wall stability based on final wall design dimensions.

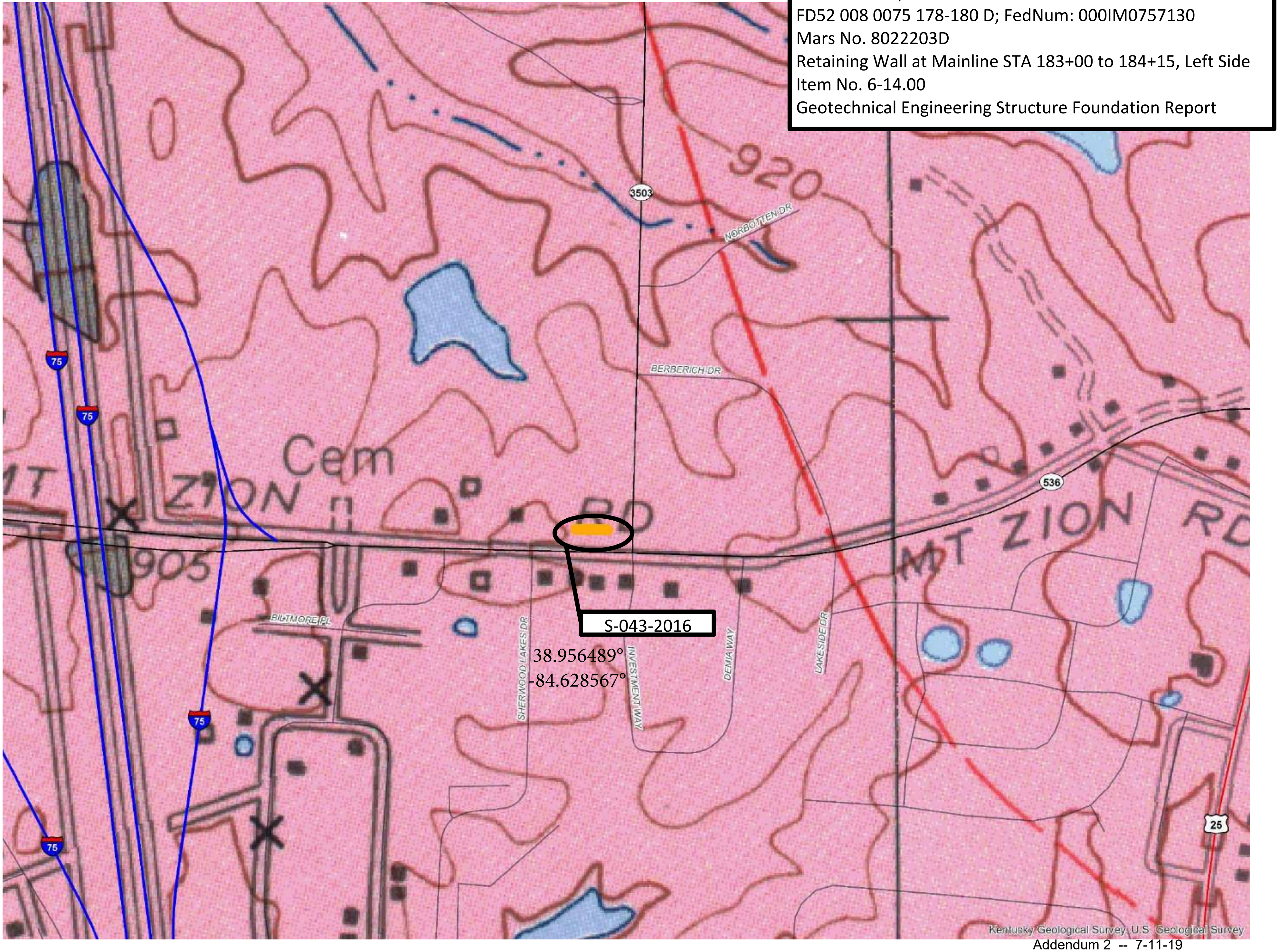
7.0 Plan Notes

7.1 Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls," at the appropriate locations in the plans.

Attachments:

- **Project Location Map**
- **Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls**

Boone County
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall at Mainline STA 183+00 to 184+15, Left Side
Item No. 6-14.00
Geotechnical Engineering Structure Foundation Report



S-043-2016

38.956489°
-84.628567°

Kentucky Geological Survey, U.S. Geological Survey

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Construct walls with external granular backfill, use wall dimensions in accordance with Case I of the Standard Drawing RGX-002 except that the base widths (B) shall be increased by a minimum of 2/3 ft beneath its heel section.

Bearing Surface	Nominal Bearing Resistance	Factored Nominal Bearing Resistance at the Service Limit State
Soil	4.6 ksf	1.5 ksf

Use the following soil strength parameters for design:

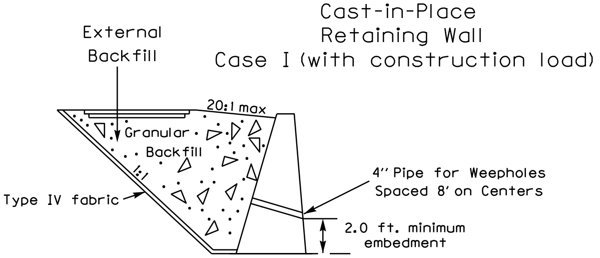
	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Embankment	0	38	115
Foundation Soils			
Existing	950	0	120

External granular backfill is required. Place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric between all soil to granular backfill interfaces in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

If undercutting is required the undercut should expose suitable stiff to very stiff cohesive soils or bedrock and be backfilled with class B concrete. Granular embankment shall not be allowed for use to backfill the undercut.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



DATE: 5-MARCH-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	M. CARPENTER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536

CROSSING
Retaining Wall @ 183+00 to 184+15, Lt.

SUBSURFACE DATA

S–043–16

ITEM NUMBER
6–14.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

S-044-2016

cc: J. Van Zee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
Stantec

M E M O R A N D U M

TO: Bart Asher, P.E.
Division of Structural Design

FROM: Michael Carpenter, P.E. MC
Geotechnical Branch Manager

DATE: March 7, 2018

SUBJECT: Boone County
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall at Mainline STA 185+95 to 191+20, Left Side
Item No. 6-14.00
Geotechnical Engineering Structure Foundation Report

1.0 Introduction

The geotechnical investigation for this structure has been completed. The .DGN file for the Geotechnical Note Sheet for Cast-In-Place Non-Reinforced Gravity Walls has been made available on Projectwise and through email for inclusion in the project plans. This project is to reconstruct I-75/71 interchange at KY 536 and provide improvements along the KY 536 corridor. This structure is located about 0.37 miles east of the 1-75/71 interchange with KY 536.

2.0 Site Geologic Conditions

This structure is located in the Union Geologic Quadrangle (GQ-779). The geologic mapping indicates that the bedrock at this site consist is part of the Bull Fork Formation.

3.0 Field Investigation

Due to property access issues no drilling was completed for this structure. Instead conservative assumptions for soil bearing strata have been applied based on area soil properties observed during drilling and analysis of other structures along this project site.

5.0 Engineering Analysis

The proposed standard gravity wall at this location will undergo loading due to the presence of a multiuse path within the influence zone of the supported back fill material. It is Branch practice to analyze gravity wall geometry to ensure that it can withstand loading induced by construction and maintenance operations along the multiuse path.

Analyses indicate that a Standard Gravity Wall with an equivalent depth of soil surcharge of 2 feet may be utilized at this location with minor changes. These changes include utilizing external granular backfill and increasing the base width dimension (B) of the wall by 8 inches. By following these requirements, checks for eccentricity (overturning), bearing capacity, and sliding were satisfied

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternative. The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

6.0 Foundation Recommendations

6.1 Use wall dimensions in accordance with Case I of Standard Drawing RGX-002 except that the base widths (B) shall be increased by 2/3 foot beneath its heel section. Use a soil surcharge of 2 feet because of anticipated construction loads located within the 1:1 zone of influence but more than 1 foot beyond the backface of the wall (the backface is taken as the pressure surface being considered).

6.2 The backfill behind the wall shall consist of "Granular Embankment" extending on a 1H:1V slope from the base of the wall. The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches.

6.3 Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment. The Geotextile fabric shall be in accordance with Section 214 and 843 of the Standard Specifications, current edition.

6.4 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals

6.5 The wall designer shall verify wall stability based on final wall design dimensions.

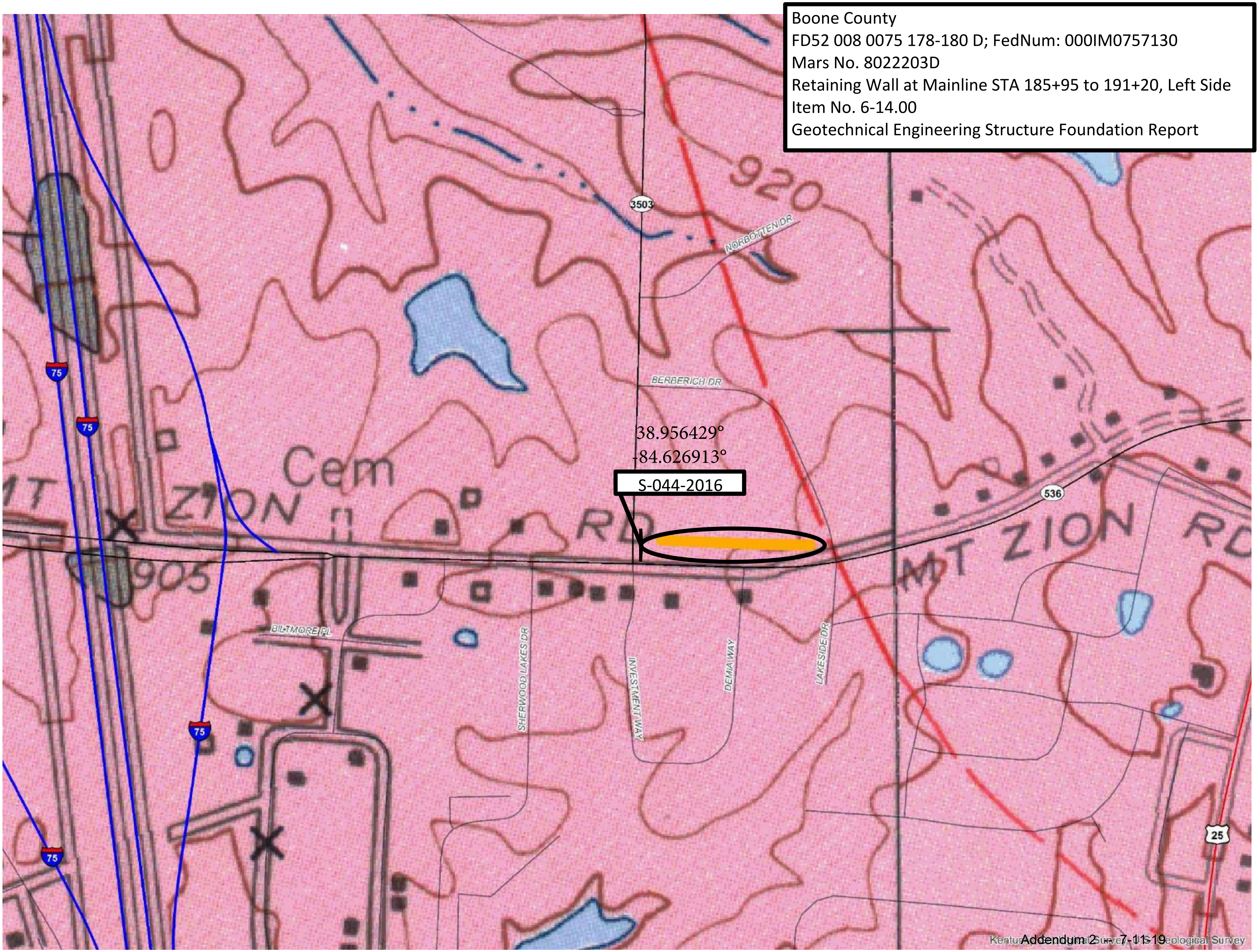
7.0 Plan Notes

7.1 Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls," at the appropriate locations in the plans.

Attachments:

- **Project Location Map**
- **Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls**

Boone County
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall at Mainline STA 185+95 to 191+20, Left Side
Item No. 6-14.00
Geotechnical Engineering Structure Foundation Report



Kentucky Geological Survey

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Construct walls with external granular backfill, use wall dimensions in accordance with Case I of the Standard Drawing RGX-002 except that the base widths (B) shall be increased by a minimum of 2/3 ft beneath its heel section.

Bearing Surface	Nominal Bearing Resistance	Factored Nominal Bearing Resistance at the Service Limit State
Soil	4.8 ksf	1.6 ksf

Use the following soil strength parameters for design:

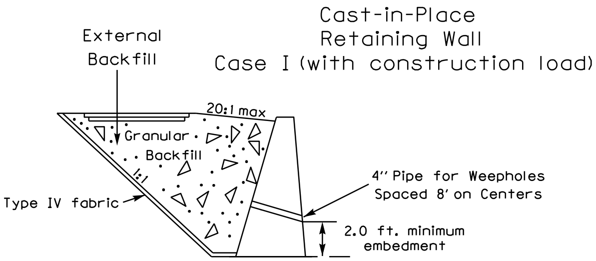
	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Embankment	0	38	115
Foundation Soils			
Existing	950	0	120

External granular backfill is required. Place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric between all soil to granular backfill interfaces in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

If undercutting is required the undercut should expose suitable stiff to very stiff cohesive soils or bedrock and be backfilled with class B concrete. Granular embankment shall not be allowed for use to backfill the undercut.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT


Cast-in-Place
Retaining Wall
Case I (with construction load)

DATE: 5-MARCH-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	M. CARPENTER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE: KY 536
CROSSING: Retaining Wall @ 185+95 to 191+20, Lt.

S–044–16
SUBSURFACE DATA

ITEM NUMBER: 6–14.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.
DRAWING NO. 00000

SHEET LOCATION:
FILE NAME: $$$$design$file$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

(S-045-2016) Consultant

MEMORANDUM

TO: William McKinney, PE
TEBM
Division of Structural Design

FROM: Bart Asher, PE, LS
Director
Division of Structural Design

BY: Michael Carpenter, PE MC
Geotechnical Branch

DATE: August 11, 2017

SUBJECT: Geotechnical Engineering Structure Foundation Report
Boone County
Reconstruct the Interchange with KY 536 (MT. Zion Road) South of Florence
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall Lt. Sta. 192+44 to 194+23
Item No. 6-14.00
Terracon Project No. N1155079

The geotechnical engineering report for this structure has been completed by Terracon Consulting Engineers and Scientists. We have reviewed and concur with the recommendations as presented in this report.

A copy of the report is attached. If you have any questions, please contact this office at 502-564-2374

cc: J. Van Zee
R. Powell
B. Yeager
R. Franxman
R. Turner
E. Drury
B. Greene
J. Schroeder (Terracon)
C. Callan-Ramler
J. Hager

Attachment

Geotechnical Engineering Retaining Wall Report Structure No. S-045-2016

Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
STRUCTURE No. S-045-2016
Boone County, Kentucky

August 3, 2017
Terracon Project Number N1155079

Prepared for:
Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

August 3, 2017

Kentucky Transportation Cabinet
Division of Structural Design-Geotechnical Branch
1236 Wilkinson Blvd.
Frankfort, Kentucky 40601-1200

Attn: Mr. Michael Carpenter
Geotechnical Engineer
P: 502-782-3837
F: 502-564-4839
E: michael.carpenter@ky.gov

Re: Geotechnical Engineering Retaining Wall Report
Structure No. S-045-2016
Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
Boone County, Kentucky
Terracon Project Number: N1155079

Dear Mr. Carpenter:

Terracon Consultants, Inc. (Terracon) is submitting this Geotechnical Engineering Retaining Wall Report for the above referenced structure. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning the retaining wall foundations.

1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/I-71 Interchange with KY 536 (Mt. Zion Road) in Boone County, Kentucky. Stantec is the lead design engineer on the project. Terracon Consultants, Inc. was selected to perform the geotechnical services through our Statewide Engineering Contract. Terracon's services included laboratory testing and engineering services. The field exploration phase was conducted by Thelen Associates, Inc. (now Geotechnology, Inc.) working under a separate Statewide contract with KYTC.

A new "double crossover diamond" interchange is planned with the KY 536 pavement lanes continuing to run beneath the existing I-75 bridge. The project involves reconstruction along KY 536 (Mt. Zion Road), new ramps, a new multi-use path along the northern edge of KY 536, as well as improvements, extensions, and realignments to various side roads that include Biltmore Blvd., Biltmore Drive, Investment Way, Sam Neace Drive, and about 1300 ft. of US 25.

This report addresses the geotechnical-recommendations for one of the proposed retaining walls on the project, namely Structure S-045-2016. The wall location is shown on the attached Project Location Map. As shown, the retaining wall is planned between about STA's 192+44 and 194+23 along the left side of the proposed shared use path. The wall will support new embankment fill that will support the shared use path.

A gravity retaining wall was evaluated at this location. The proposed total wall height will range from about 5.5 ft. to 9.5 ft. and will be about 175 feet long. The wall's back slope will be horizontal with surcharge loading from the shared use path.

2.0 SITE TOPOGRAPHY AND GEOLOGICAL CONDITIONS

The project area lies in a dissected upland of the Outer Bluegrass Region. Ground elevations along the overall project route generally range from about Elev. 870 ft. to about 950 ft. Grades generally rise to the east. At the proposed retaining wall alignment, the existing ground surface elevations generally range from about 933 to 938 ft.

Surface drainage in the project vicinity is generally dendritic with most flow towards the South Branch of Gunpowder Creek, which lies west of I-75. The Ohio River lies about 8 miles north of the site and has a normal pool elevation of 455 ft.

Geologic mapping indicates the project area is underlain by limestone and shale of the Bull Fork Formation and Ordovician System. Mapping shows the limestone comprises as much as about 95 percent of the rock mass. No known karst features are mapped in the project area.

The USGS Soil Survey shows that the uppermost soils along the project site comprise mostly of Rossmoyne Silt Loam with lesser amounts of Jessup Silt Loam (a wind-blown loess) and Faywood Silty Clay (residuum).

3.0 SUBSURFACE EXPLORATIONS

An exploration plan was developed by Terracon after a review of the available plans, profiles, and cross-sections provided by Stantec. The draft exploration plan was subsequently reviewed and approved by KYTC Geotechnical Branch. Some borings for the project were relocated during the field program due to access, utility conflicts, etc.

Five test borings were drilled along the alignment of Structure S-045-2016. All of the borings for this retaining wall were offset towards the roadway mainline due to utility conflicts. These borings included three undisturbed sample borings and two rockline soundings. A summary of these five borings is provided below.

Table 3.0: Summary of Test Borings

Boring	Samples	Approx. Top/Weathered Bedrock, ft.	Approx. Top/Weathered Rock Elev., ft.	Approx. Depth to RDZ, ft.
1031	2 UD's	Refusal @ 10.3'	926.3	N/A
1032	None	Refusal @ 11.2'	925.8	N/A
1033	1 UD, 1 SPT	8.0	929.2	N/A
1034	None	Refusal @ 11.6'	926.1	N/A
1035	2 UD's	Refusal @ 10.2'	928.0	N/A

UD: Undisturbed (Shelby tube) sample

Refer to the attached Subsurface Data Sheet for the location of the borings, subsurface logs, and soil test results.

4.0 LABORATORY TESTING AND RESULTS

A laboratory testing program was assigned to the thin-walled tubes and approved by the KYTC Geotechnical Branch. The laboratory tests were conducted by Terracon in accordance with the appropriate AASHTO or Kentucky Methods as outlined in the Geotechnical Manual. The results of the laboratory tests are depicted graphically on the Subsurface Data Sheet.

The laboratory testing program on undisturbed samples in the overburden soil zone included classification and compressive strength testing; results are summarized on the following page.

Table 4.0: Summary of Laboratory Test Results

Station	Offset	Hole	Sample	AASHTO	USCS	U.C., psf	Silt+Clay, %
192+49	25 ft. LT	1031	1	A-7-6(31)	CH	1899	85(57+28)
192+49	25 ft. LT	1031	2	A-7-6(16)	CL	-	69(44+19)
193+53	28 ft. LT	1033	1	A-7-6(22)	CL	3369	87(66+21)
193+53	28 ft. LT	1033	2	A-2-4(0)	GM	-	29(26+3)
194+20	28 ft. LT	1035	1	A-7-6(45)	CH	5085	95(57+38)
194+20	28 ft. LT	1035	2	A-7-6(22)	CL	5307	90(63+27)

U.C.: Unconfined compressive strength

5.0 ENGINEERING ANALYSES

The gravity-type retaining wall for Structure S-045-2016 was analyzed at its maximum proposed height of 9.5 feet with a horizontal backslope. The shared use path was assumed to create a surface surcharge equal to two feet of soil having a unit weight of 125 pcf. Analyses included overturning, bearing capacity, and sliding. Slope stability analyses were not conducted due to the low embankment height.

Two conditions were evaluated: granular wall backfill and cohesive soil backfill. The foundation was assumed to be bearing on at least stiff cohesive soil.

A summary of soil parameters used in the analyses is provided below.

Table 5.0: Summary of Assumed Soil Parameters

Item	Moist Unit Weight, pcf	Effective Internal Friction, Φ	Cohesion, psf
Cohesive Soil Wall Backfill	125	24 degrees	0
Granular Wall Backfill	115	37 degrees	0
Cohesive Foundation Soil		0	1350

Results of the analyses for a gravity wall are summarized below:

Overturning with cohesive soil wall backfill – satisfied safety criteria of having the resultant fall within the middle 2/3's of the foundation (for soil-bearing conditions) only if the wall base width was increased by 2.5 feet (beneath heel portion).

For granular wall backfill – satisfied safety criteria of having the resultant fall within the middle 2/3's of the foundation (for soil-bearing conditions) only if the wall base width was increased by 0.5 feet (beneath heel portion).

Bearing Capacity was evaluated for both the cohesive soil and granular soil backfill cases, having the wall base width increased by 2.5 ft. and 0.5 ft., respectively. Both cases satisfied minimum safety (factored resistance greater than applied factored bearing stress).

Sliding Resistance was evaluated for both the cohesive soil and granular soil backfill cases, having the wall base width increased by 2.5 ft. and 0.5 ft., respectively. Both cases satisfied minimum safety (factored resistance greater than applied factored bearing stress).

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.0 RECOMMENDATIONS

6.1 The gravity wall dimensions should meet KYTC's Standard Drawing RGX-002-09 (12-1-15), Case I with the exception stated below in Paragraph 6.4.

6.2 A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.3 Design the retaining wall to bear within undisturbed cohesive soil having at least "stiff to very stiff consistency." In the event that undercutting is required during construction (for example, to remove soft pockets or layers), the undercut should expose suitable stiff to very stiff cohesive soils and be backfilled with class B concrete. Granular embankment should not be allowed for use to backfill the undercut.

6.4 The backfill behind the wall shall consist of "Granular Embankment" extending on a 1H:1V slope from the base of the wall and the foundation width shown on KYTC Std. Dwg. RGX-002-09 (12-1-15), Case I should be increased by 0.5 feet in its heel section. This solution using Granular Embankment for wall backfill is considered to be more economically feasible than a cohesive soil backfill case combined with an increased wall base width by 2.5 feet (below the heel).

The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches.

6.5 Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment. The Geotextile fabric shall be in accordance with Sections 214 and 843 of the Standard Specifications, current edition.

6.6 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

6.7 Wall construction and backfilling should be completed in accordance with KYTC specifications.

7.0 PLAN NOTES

7.1 Add the attached plan sheet, “Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls” at the appropriate locations in the plans.

8.0 CLOSING

The analysis and conclusions presented in this report are based upon the data obtained from the test borings performed by others at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur away from the borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident over the short term. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If KYTC is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use by KYTC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We appreciate the opportunity to be of service to you on this project. Please contact us with any questions concerning this report.

We appreciate the opportunity to be of service to you on this project. Please contact us with any questions concerning this report.

Respectfully submitted,

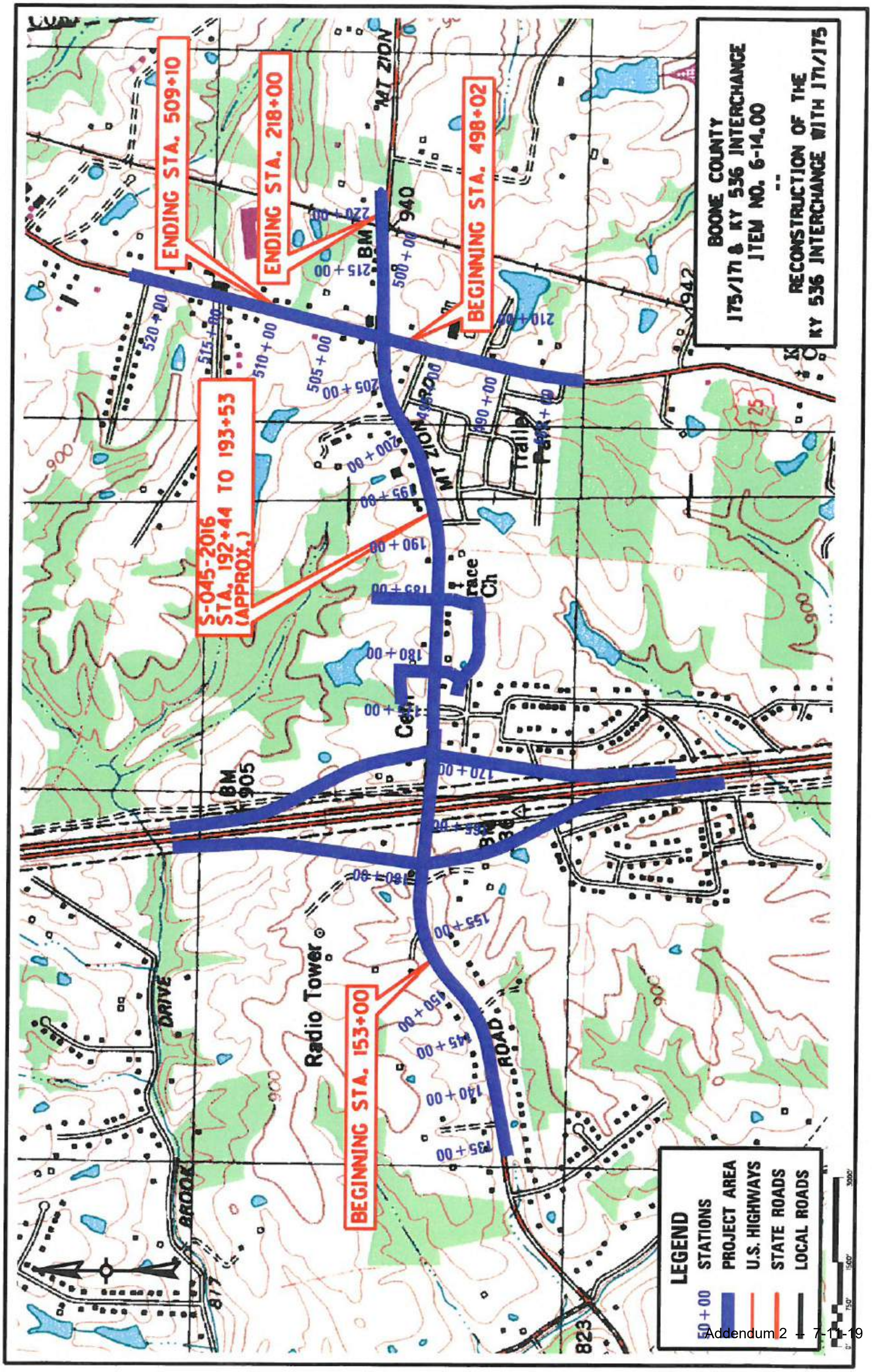
Terracon Consultants, Inc.

For Aaron J. Muck

Jess A. Schroeder, P.E.
Senior Geotechnical Engineer

Aaron J. Muck, P.E.
Senior Geotechnical Engineer

Attachments:	Project Location Plan
	Subsurface Data Sheets (2 each)
	Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls
	Coordinate Data Form
	Calculations


BOONE COUNTY
I75/I71 & KY 536 INTERCHANGE
ITEM NO. 6-14.00
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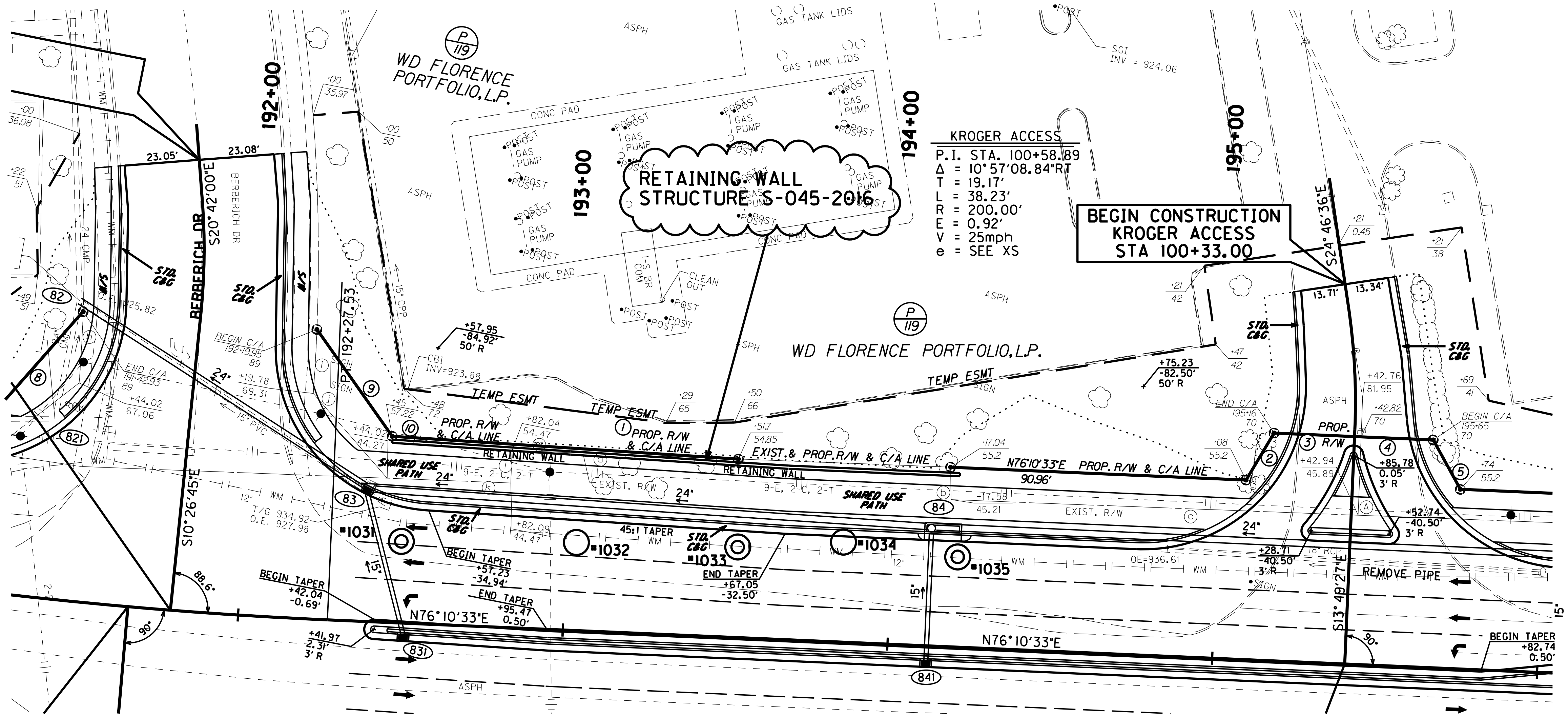
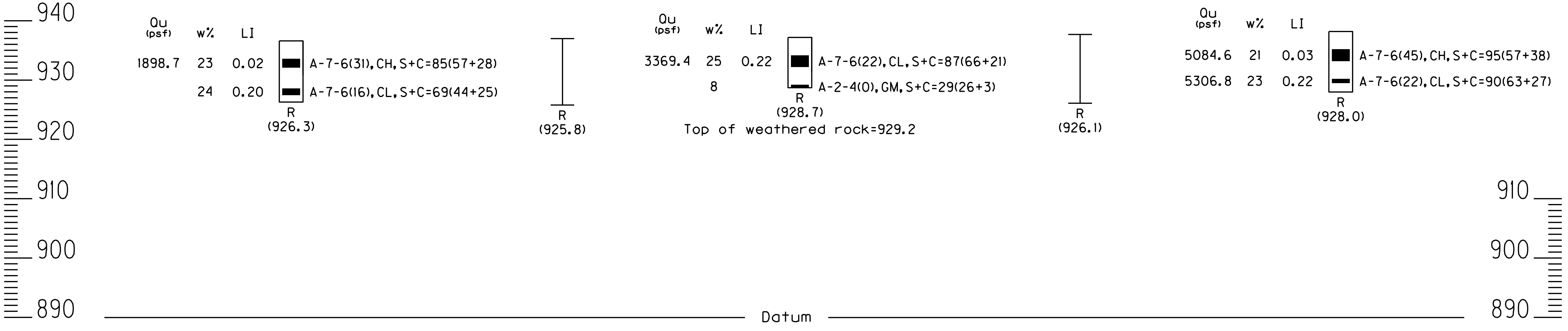
RECONSTRUCTION OF THE
KY 536 INTERCHANGE WITH I71/I75
ENDING STA. 509+10
ENDING STA. 218+00
BEGINNING STA. 498+02
S-045-2016
STA. 192+44 TO 193+53
(APPROX.)
BEGINNING STA. 153+00
MT ZION
Radio Tower
ROAD
BROOK DRIVE
Trailer Park
LEGEND
50+00 STATIONS
PROJECT AREA
U.S. HIGHWAYS
STATE ROADS
LOCAL ROADS

Plan Scale 1" = 20'



Hole No.	#1031	#1032	#1033	#1034	#1035
Station	192+49	193+03	193+53	193+85	194+20
Offset	25 FT. LT.	27 FT. LT.	28 FT. LT.	31 FT. LT.	28 FT. LT.
Elev. (Sea level datum)	936.6	937.0	937.2	937.7	938.2

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale



#1031

Qu (psf)	w%	LI	
1898.7	23	0.02	A-7-6(31), CH, S+C=85(57+28)
	24	0.20	A-7-6(16), CL, S+C=69(44+25)

R (926.3)

#1032

R (925.8)

#1033

Qu (psf)	w%	LI	
3369.4	25	0.22	A-7-6(22), CL, S+C=87(66+21)
	8		A-2-4(0), GM, S+C=29(26+3)

R (928.7)

Top of weathered rock=929.2

#1034

R (926.1)

#1035

Qu (psf)	w%	LI	
5084.6	21	0.03	A-7-6(45), CH, S+C=95(57+38)
5306.8	23	0.22	A-7-6(22), CL, S+C=90(63+27)

R (928.0)

FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\1155079\NEW PROJECT FILES\RETAINING WALLS\S-045-2016.DGN

USER: kjmankin
DATE PLOTTED: May 10, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE: KY 536
CROSSING: RETAINING WALL STA. 192+44 TO STA. 193+53

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers & Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 7-11-19

SHEET NO.

DRAWING NO.

S-045-2016

ITEM NUMBER
6-14.00

SHEET 1 OF 1

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Use wall dimensions in accordance with Case I of the Standard Drawing RGX-002-09. The base shall be increased by 0.5 ft. beneath its heel section and backfill with Granular material as outlined on this sheet.

The base of the wall shall be extended to bear on existing stiff cohesive soil.

Station Interval	Bearing Surface	Factored Presumptive Bearing Resistance at the Service Limit State
ML 192+44 TO 194+23, LT	Undisturbed Soil	2.5 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Embankment	0	37	115
Foundation Soils Existing	1350	0	128

Where external granular backfill is required, place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible, as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

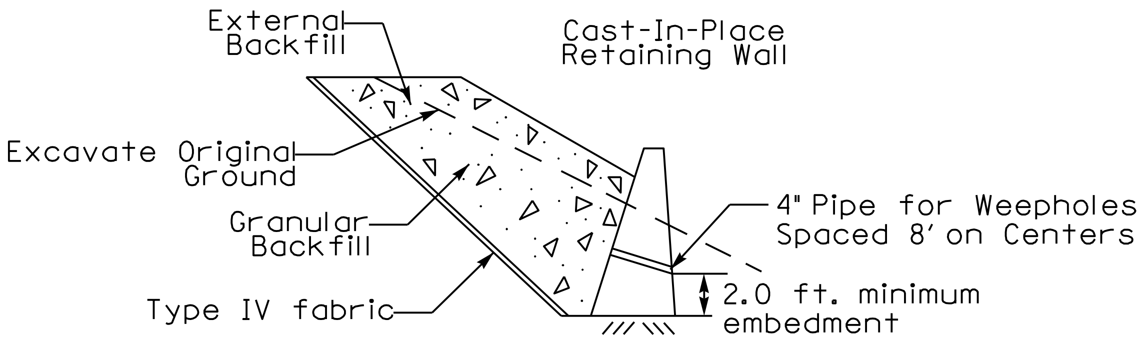
Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

The footing concrete should be placed as soon as possible after the footing excavation is made.

The wall designer shall verify wall stability based on final design dimensions.

If undercutting is required the undercut should expose suitable stiff to very stiff cohesive soils and be backfilled with class B concrete. Granular embankment shall not be allowed for use to backfill the undercut.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



S–045–2016

ITEM NUMBER
6–014.00

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 536	RETAINING WALL @ ML STA. 192+44 TO STA. 194+23, LT

SUBSURFACE DATA

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Terracon
Consulting Engineers and Scientists
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Addendum 2 – 7-11-19

SHEET NO.

DRAWING NO.

COORDINATE DATA SUBMISSION FORM - PROPOSED RETAINING WALL S-045-2016						
KYTC Division of Structural Design - Geotechnical Branch						
County:		**Boone**				
Road Number:		**KY 536 & I-75 (Reconstruct I-75 Interchange with KY 536, Mt. Zion Road**				
Item:		**6-14.00**				
MARS		**8022203D**				
Project #:		**FD52 008 0075 177-179D**				
Hole Number	**Latitude**	**Longitude**	**Station Number**	**Offset**	**Elevation**	**Hole Depth**
1031	38.9563896	-84.6254760	19249	25 LT	936.62	10.3
1032	38.9564290	-84.6252940	19303	27 LT	937.04	11.2
1033	38.9564611	-84.6251250	19353	28 LT	937.17	8.5
1034	38.9564803	-84.6250253	19385	31 LT	937.66	11.6
1035	38.9565035	-84.6248923	19420	28 LT	938.21	10.2

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: 5-045-2016

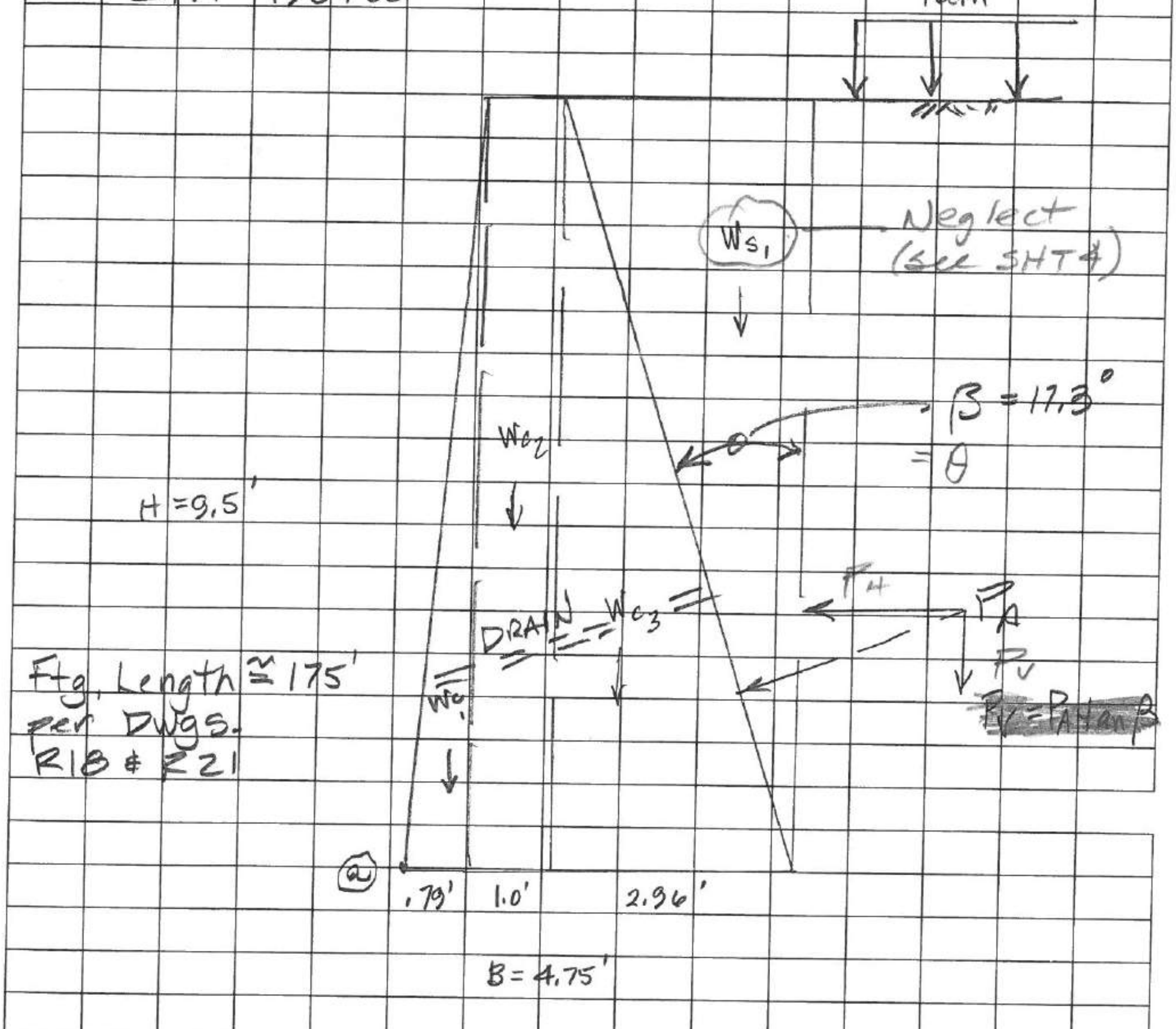
Terracon

Sheet 1

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case I

REF PROJECT DWG. X99
STA 193+00



Ftg. Length ≅ 175' per Dwgs. R18 & R21

Assume Surcharge from Multi-Purpose Path is equivalent to 2' of soil applied uniformly (rectangular distribution) per AASHTO 3.11.6.4.

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 2/3/17
Structure No.: S-045-2016

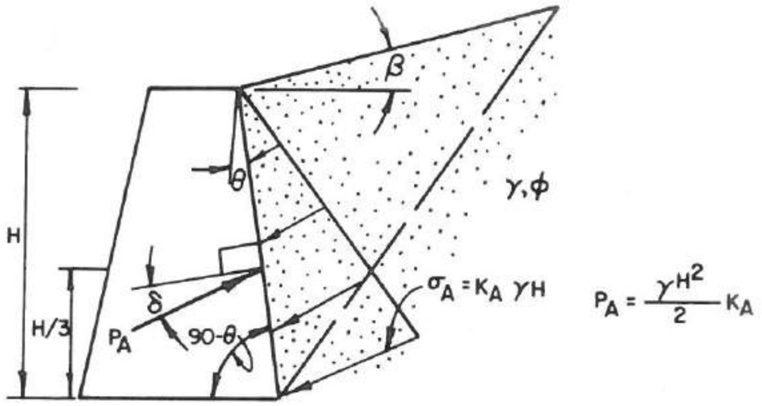
Terracon
Sheet 2

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

Assume cohesive soil backfill w/drainage
Let $\phi = 24^0$, $\gamma = 125$ pcf
(Ref.: NAVFAC DM 7.2-39, CL/CH soil)



REF: NAVFAC DM 7.2-69

$$K_A = \frac{\cos^2(\phi-\theta)}{\cos^2\theta\cos(\theta+\delta)\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\cos(\theta+\delta)\cos(\theta-\beta)}}\right]^2}$$

$\beta = 0$

$\theta = 17.3^\circ$

LET $\delta = \phi = 24^0$ (NAVFAC DM 7.2-63)

$$K_A = \frac{\cos^2(24-17.3)}{\cos^2(17.3)\cos(17.3+24)\left[1+\sqrt{\frac{\sin(24+24)\sin(24-0)}{\cos(17.3+24)\cos(17.3-0)}}\right]^2}$$

$$= \frac{.772}{.685\left(1+\sqrt{\frac{.302}{.717}}\right)^2} = \frac{.772}{.685(2.719)} = \underline{.41}$$

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 2/3/17
Structure No.: S-045-2016

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

$P_A\ (total) = P_{A_1} + P_{A_2}$, where

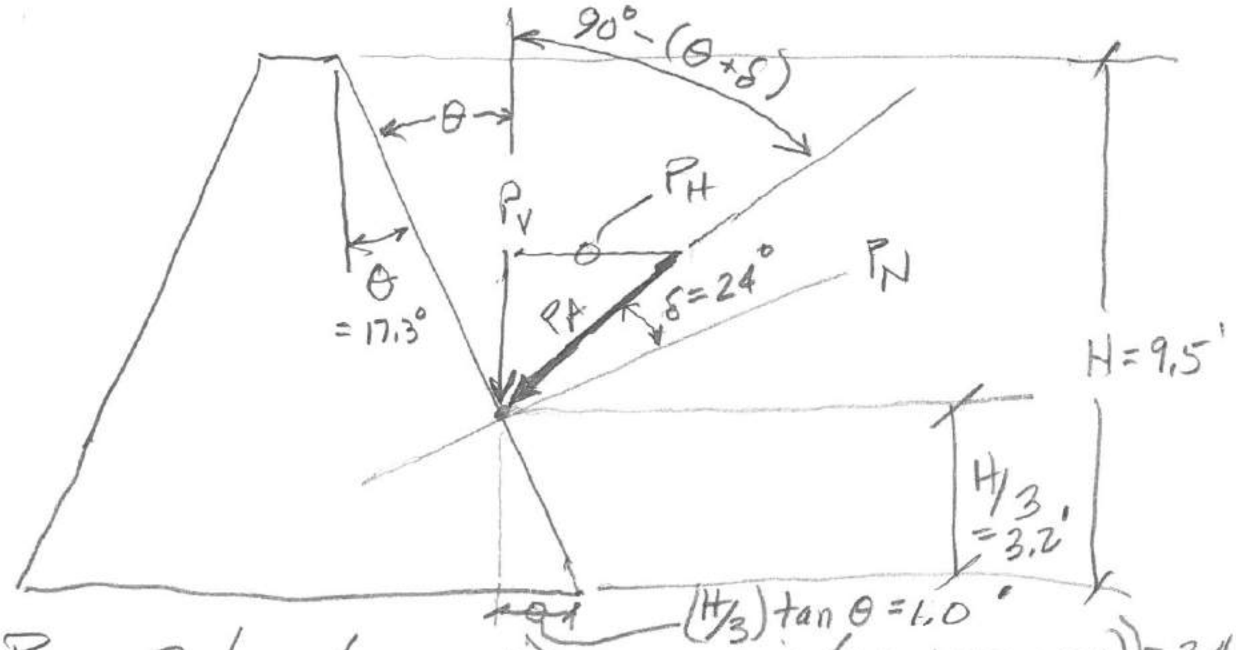
$P_{A_1} = \gamma H k_A \left(\frac{H}{2}\right) = .125(9.5)(.41)\left(\frac{9.5}{2}\right) = \underline{2.31}\ ^K/_{FT.}$

$P_{A_2} = q H k_A$, due to multi-use path surcharge

$(\text{let: } q = 2 ft. \times .125 = .25\ KSF)$

$= .25(9.5)(.41) = \underline{.97}\ ^K/_{FT.}$

$P_A\ (total) = 2.31 + .97 = \underline{3.28}\ ^K/_{FT.}$



$P_H = P_A(\sin(90 + \theta + \delta)) = 3.28 \sin(90 - (17.3 + 24)) = \underline{2.46}\ ^K/_{FT.}$

$P_V = P_A(\cos(90 - \theta + \delta)) = \underline{2.16}\ ^K/_{FT.}$

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 2/3/17

Structure No.: S-045 - 2016

Terracon

Sheet 4

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

COMPUTE P_H & P_V for P_{A_1} & P_{A_2} separately, since both have different resultant locations & moment arms.

$$P_{A_1} = 2.31\ ^{k}/FT.$$

$$P_H = P_{A_1}\left(\sin\left(90-(\theta+\delta)\right)\right)$$

$$= 2.31(\sin 48.7) = 1.74\ ^{k}/FT.$$

$$P_V = P_{A_1}\left(\cos\left(90-(\theta+\delta)\right)\right)$$

$$= 1.52\ ^{k}/FT.$$

$$P_{A_2} = 0.97\ ^{k}/FT.$$

$$P_H = P_{A_2}\left(\sin\left(90-(\theta+\delta)\right)\right)$$

$$= .73\ ^{k}/FT.$$

$$P_V = P_{A_2}\left(\cos\left(90-(\theta+\delta)\right)\right)$$

$$= .64\ ^{k}/FT.$$

Gravity Retaining Wall Calculations

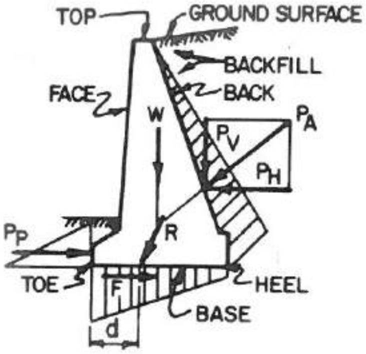
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 2/3/17
Structure No.: S-045-2016

Terracon
Sheet 5

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*



REF.: NAVFAC DM 7.2-83
& "W" IS DEFINED AS WALL WEIGHT PLUS SOIL ABOVE BASE IN FRONT OF WALL ONLY. SOIL ABOVE WALL AT REAR IS NOT CONSIDERED FOR GRAVITY WALLS.

AREA	UnFactored Resultant (K/Ft.)	LOAD FACTOR	Factored Load (K/Ft.)	ARM about @ (ft.)	Moment (ft-k/Ft.)
W_{c1}	$3,75\ ft^2(.15) = ,56$	,9	,50	,53'	,26
W_{c2}	$9,5\ ft^2(.15) = 1.4$	,9	1,26	1,29	1,63
W_{c3}	$14.1\ ft^2(.15) = 2,11$	.9	1.90	2,78	5,28
$P_H, (P_A)$	1,74	1,5	2,61	$-\frac{H}{3} = -3,2$	−8,35
$P_V, (P_A)$	1.52	1.0	1,52	$4,75-1 = 3,75$	5,70
$P_H, (P_{A_2})$	.73	1,5	1,10	$-\frac{H}{2} = -4,75$	−5,23
$P_V, (P_{A_2})$	,64	1.0	,64	$4.75-(\frac{H}{2})\tan\theta$ $= 3,27'$	2.09
$N = \Sigma F_V$			5,82	$-X$	$-5,82X$

$$\Sigma M_{@} = 0 \Rightarrow 5,82X = 1,38$$
$$X = ,24'$$

Gravity Retaining Wall Calculations

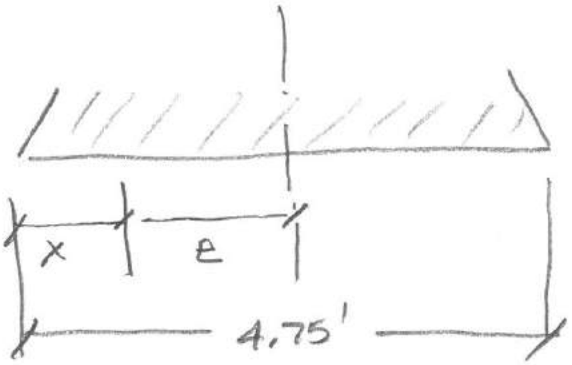
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 2/3/17
Structure No.: S-045-2016

Terracon
Sheet 6

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*



$x = ,24'$

$e = \frac{4,75}{2} - ,24 = 2,14'$

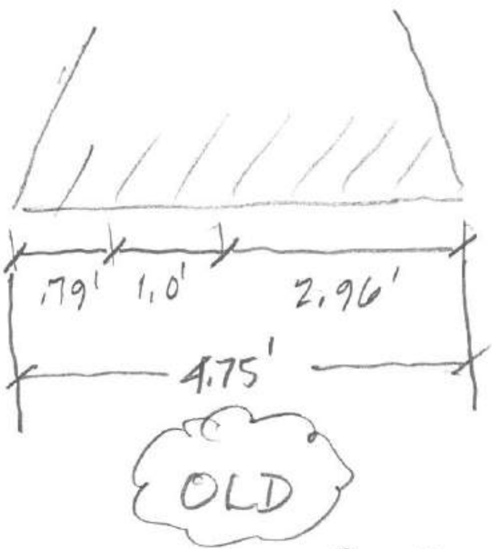
$4,75 \times \frac{2}{3} = 3,17'$

$\frac{3,17}{2} = 1,58' \not> 2,14'$

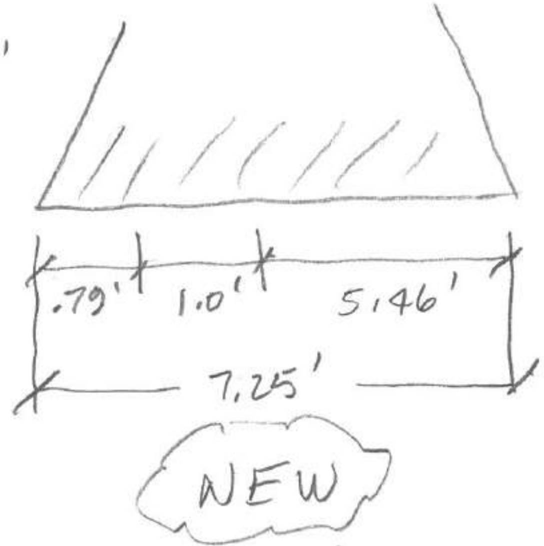
Resultant is <u>not</u> within mid-$\frac{2}{3}$'s of base.

— Need wider base —

TRY WIDENING HEEL AREA BY 2,5'...



H = 9,5'



$\beta = 17,3° = \theta$

$\beta = 29,9° = \theta$

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 2/3/17
Structure No.: S-045-2016

Terracon
Sheet 7

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

Recompute K_A (from SHT. 2)...

$$K_A = \frac{\cos^2(24-29.9)}{\cos^2(29.9)\cos(29.9+24)\left[1+\sqrt{\frac{\sin(24+24)\sin(24-0)}{\cos(29.9+24)\cos(29.9-0)}}\right]^2}$$

$$= \frac{.989}{.752(.589)\left[1+\sqrt{\frac{(.743)(.407)}{.589(.867)}}\right]^2} = \underline{\underline{.71}}$$

$$P_{A_1} = \gamma H K_A\left(\frac{H}{2}\right) = 4.00\ ^k/_{FT.}$$

$$P_H = P_{A_1}\left(\sin\left(90-(\theta+\delta)\right)\right)$$
$$= 4.0\left(\sin\left(90-(29.9+24)\right)\right)$$
$$= \underline{2.36}\ ^k/_{FT.}$$

$$P_V = P_{A_1}\left(\cos\left(90-(\theta+\delta)\right)\right)$$
$$= \underline{3.23}\ ^k/_{ft}$$

$$P_{A_2} = q H K_A = .25(9.5)(.71) = 1.69\ ^k/_{FT.}$$

$$P_H = P_{A_2}\left(\sin\left(90-(\theta+\delta)\right)\right) = \underline{1.0}\ ^k/_{FT.}$$
$$P_V = P_{A_2}\left(\cos\left(90-(\theta+\delta)\right)\right) = \underline{1.37}\ ^k/_{FT.}$$

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 2/3/17
Structure No.: S-045-2016

Terracon
Sheet 8

Part 2: Check Overturning

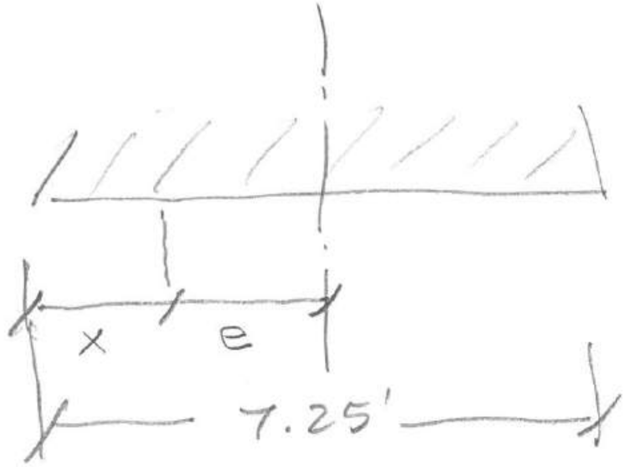
LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

Area	Unfactored Load, K/Ft.	Load Factor	Factored Load (K/Ft.)	Arm (ft.)	Moment (ft-K/Ft.)
W_{C1}	.56	.9	.50	.53'	.27
W_{C2}	1.4	.9	1.26	1.29'	1.63
W_{C3}	$25.9 ft^2(.15) = 3.89$	.9	3.50	3.61	12.64
P_H, P_{A1}	2.36	1.5	3.54	$-\frac{H}{3} = -3.2$	-11.33
P_V, P_{A1}	3.23	1.0	3.23	$7.25 - \frac{H}{3}\tan\theta = 5.43$	17.54
P_H, P_{A2}	1.0	1.5	1.5	$-\frac{H}{2} = 4.75$	-7.13
P_V, P_{A2}	1.37	1.0	1.37	$7.25 - \frac{H}{2}\tan\theta = 4.52$	6.19
$N = \Sigma F_V$			9.86	$-x$	$-9.86x$

$\Sigma M = 0 \Rightarrow 9.86x = 19.81$

$x = 2.01'$



$x = 2.01$

$e = \frac{7.25}{2} - 2.01 = 1.62'$

$7.25 \times \frac{2}{3} = 4.83'$

$\frac{4.83'}{2} = 2.42' > 1.62'$ OK ✓
(within mid 2/3's)

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 2/3/17
Structure No.: S-045 - 2016

Terracon
Sheet 9

Part 3: Check Bearing Capacity

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.35	*Fig. C11.56-2, page 11-11*
Concrete Weight	1.25	
Live Load Surcharge	1.75	*(applied above rear wall batter, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φb):	0.55	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent: Gravity Walls*

Nominal Bearing = qn = c x (Nc) x (1+0.3(B/L)) + (Υ x D) *Ref.: NAVFAC DM 7.2, p. 131, Fig. 1*
Factored Bearing Resistance = qn x φb, ksf
Applied Bearing = V/B, ksf

4 unconfined compression tests, say avg. of two lowest...

$q_{u_{AVG}} = \frac{1.9+3.4}{2} = 2,7$ ksf ⇒ let $c = \frac{2,7}{2} = 1,35$ ksF

$\gamma = 128$ pcf

$N_c = 5.53$ (NAVFAC DM 7,2-131)

$D = 2'$

Per AASHTO 10.6.1.3, eccentrically loaded footings should be evaluated for bearing resistance using an effective area $B' \times L'$, where $B' = B - 2e$ & $L' = L - 2e$

$B' = 7,25 - 2(1.62) = 4,01'$; $L' = 175 - 2(1.62) = 171,8'$

$q_n = 1,35(5,53)\left(1 + 0.3\left(\frac{4,01}{171.8}\right)\right) = 7,52$ ksf, nominal

Factored Resistance $= 7.52 \times .55 = \underline{\underline{4,13}}$ KSF

VS.

Applied stress (factored) $= \frac{W_{c_1} + W_{c_2} + W_{c_3} + P_{v_{PA_1}} + P_{v_{PA_2}}}{B'}$

$= \frac{(.56 + 1.4 + 3.89)(1,25) + (3,23 + 1,37)(1.35)}{4,01} = \underline{\underline{3,37}}$ KSF

4,13 KSF ≥ 3.37 KSF ⇒ OK ✓

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)

Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft. (AASHTO Fig. 10.6.3.4-1)

Rr = ϕτ x su applies only if bearing directly on cohesive soil. If > 6" granular material is placed below the foundation, then the lesser of the two formulas provided here applies.

Applied Horizontal Resultant = Pa, kips/ft.

Assume direct bearing on cohesive soil

$R_r = \phi_\tau \cdot S_u = 1.0(\underbrace{1.35\text{ ksf}}_{\to \text{sht. 9}}) = 1.35\text{ ksf}.$

$1.35\text{ ksf} \times B = 1.35(7.25) = \underline{9.79}\ ^{k}/\text{FT.}$

= Factored Resistance

VS,

Applied Factored Resultant =

$= P_{H_{PA_1}} + P_{H_{PA_2}} = \underbrace{2.36}_{\to \text{sht. 8}}(1.5) + \underbrace{1.0}_{\to \text{sht. 8}}(1.75)$

$= 5.29\ ^{k}/\text{FT.}$

$9.79\ ^{k}/\text{FT.} > 5.29\ ^{k}/\text{FT.}$ OK ✓

(for cohesive 6' fill & widened base by 2.5')

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 2/6/17

Structure No.: 5-045-2014

Terracon

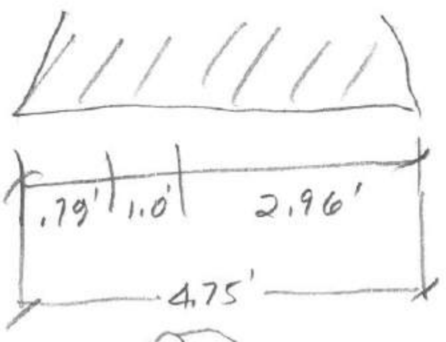
Sheet 11

Part 2: Check Overturning

LRFD Load Factors:

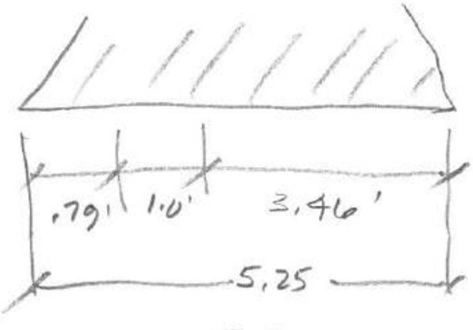
Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

TRY GRANULAR backfill and increasing base width below heel portion by 0.5'. Let $\phi = 37°$, $\gamma = 115$ pcf, per KYTC; no hydrostatic pressure



OLD

$\beta = \theta = 17.3'$



NEW

$\beta = \theta = 20.0°$

Recompute K_A (from SHT. 2)

$$K_A = \frac{\cos^2(37-20)}{\cos^2(20)\cos(20+37)\left[1+\sqrt{\frac{\sin(37+37)\sin(37-0)}{\cos(20+37)\cos(20-0)}}\right]^2} =$$

$$= \frac{.915}{.481\left[1+1.063\right]^2} = \underline{\underline{.45}}$$

$$P_{A_1} = \gamma H K_A \left(\frac{H}{2}\right) = .115(9.5)(.45)\left(\frac{9.5}{2}\right) = 2.34 \ ^K/_{FT}$$

$$P_H = P_{A_1}(\sin(90-(\theta+\delta))) = 1.27 \ ^K/_{FT}$$

$$P_V = P_{A_1}(\cos(90-(\theta+\delta))) = 1.96 \ ^K/_{FT}$$

$$P_{A_2} = qHK_A = .25(9.5)(.45) = 1.07 \ ^K/_{FT}$$

$$P_H = .58 \ ^K/_{FT}\ ;\ P_V = .90 \ ^K/_{FT}$$

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 2/6/17
Structure No.: S-045-2016

Terracon
Sheet 12

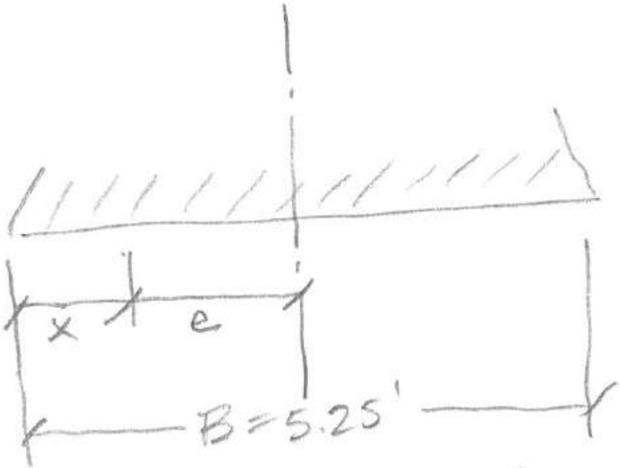
Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

Area	Unfactored Load, K/FT.	Load Factor	Factored Load, K/FT.	Arm about ⓐ	Moment (ft-K/Ft.)
W_{c1}	$3.75\ ft^2(.15) = .56$	.9	.50	.53'	.26
W_{c2}	$9.5\ ft^2(.15) = 1.4$	.9	1.26	1.29'	1.63
W_{c3}	$16.4\ ft^2(.15) = 2.47$	.9	2.22	2.94	6.53
P_H, P_{A_1}	1.27	1.5	1.91	$\left(-\frac{H}{3}\right)\tan\theta = -1.15$	-2.20
P_V, P_{A_1}	1.96	1.0	1.96	$\frac{H}{3} = 3.2$	6.21
P_H, P_{A_2}	1.07	1.5	1.61	$-\frac{H}{2} = -4.75$	-7.65
P_V, P_{A_2}	0.90	1.0	0.90	$5.25-\left(\frac{H}{2}\right)\tan\theta = 3.52$	3.17
$N = \Sigma F_V$			6.84	$-x$	$-6.84x$

$$\Sigma M = 0 \Rightarrow 6.84x = 7.93$$
$$x = 1.16'$$



$$e = \frac{5.25}{2} - x = 1.47'$$

$$5.25 \times \frac{2}{3} = 3.5'$$

$$\frac{3.5}{2} = 1.75' > 1.47' \Rightarrow OK\ ✓$$

(Resultant falls within mid. $\frac{2}{3}$'s)

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 2/6/17

Structure No.: S-045-2016

Terracon

Sheet 13

Part 3: Check Bearing Capacity

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.35	*Fig. C11.56-2, page 11-11*
Concrete Weight	1.25	
Live Load Surcharge	1.75	*(applied above rear wall batter, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φb):	0.55	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent: Gravity Walls*

Nominal Bearing = qn = c x (Nc) x (1+0.3(B/L)) + (Υ x D) *Ref.: NAVFAC DM 7.2, p. 131, Fig. 1*

Factored Bearing Resistance = qn x φb, ksf

Applied Bearing = V/B, ksf

$B' = B - 2e = 5.25 - 2(1.47) = 2.31'$

$L' = L - 2e = 175 - 2(1.47) = 172.1'$

$C = 1.35$ ksf, $\gamma = 128$ pcf, SHT. 9

$q_n = 1.35(5.53)\left(1 + 0.3\left(\frac{2.31}{172.1}\right)\right) = 7.50$ ksf, nominal

Factored Resistance $= 7.50 \times .55 = \underline{4.12}$ ksf

VS.

$$\text{Applied stress (factored)} = \frac{W_{c1} + W_{c2} + W_{c3} + P_{V_{A1}} + P_{V_{A2}}}{B'}$$

$$= \frac{(.56 + 1.4 + 2.47)(1.25) + (1.96 + 0.90)(1.35)}{2.31} = \underline{\underline{4.07}} \text{ ksf}$$

4.12 ksf > 4.07 ksf ⇒ OK ✓

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 2/6/17

Structure No.: S-045-2016

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)

Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft. (AASHTO Fig. 10.6.3.4-1)

Rr = φτ x su applies only if bearing directly on cohesive soil. If > 6" granular material is placed below the foundation, then the lesser of the two formulas provided here applies.

Applied Horizontal Resultant = Pa, kips/ft.

Assume direct bearing on cohesive soil

$$R_r = \phi_\tau \cdot S_0 = 1.0(\underbrace{1.35 \text{ ksf}}_{\to \text{sht } 9}) = 1.35 \text{ ksf}$$

$$1.35 \text{ ksf} \times B = 1.35(5.25) = \underline{7.09} \text{ k/ft.}$$

= Factored Resistance

vs.

$$\text{Applied Factored Resultant} = P_{H(PA_1)} + P_{H(PA2)}$$

$$= \underbrace{1.27(1.5) + 1.07(1.75)}_{\to \text{SHT. } 12} = \underline{3.78} \text{ k/ft.}$$

$$7.09 \text{ k/ft.} > 3.78 \text{ k/ft.} \Rightarrow \text{ok} \checkmark$$

[Thus, granular b'fill ok if base is widened 0.5']

(S-046-2016) Consultant

MEMORANDUM

TO: William McKinney, PE
TEBM
Division of Structural Design

FROM: Bart Asher, PE, LS
Director
Division of Structural Design

BY: Michael Carpenter, PE MC
Geotechnical Branch

DATE: August 11, 2017

SUBJECT: Geotechnical Engineering Structure Foundation Report
Boone County
Reconstruct the Interchange with KY 536 (MT. Zion Road) South of Florence
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall Rt. Sta. 201+45 to 203+20
Item No. 6-14.00
Terracon Project No. N1155079

The geotechnical engineering report for this structure has been completed by Terracon Consulting Engineers and Scientists. We have reviewed and concur with the recommendations as presented in this report.

A copy of the report is attached. If you have any questions, please contact this office at 502-564-2374

cc: J. Van Zee
R. Powell
B. Yeager
R. Franxman
R. Turner
E. Drury
B. Greene
J. Schroeder (Terracon)
C. Callan-Ramler
J. Hager

Attachment

Geotechnical Engineering Retaining Wall Report Structure No. S-046-2016

Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
STRUCTURE No. S-046-2016
Boone County, Kentucky

August 3, 2017
Terracon Project Number N1155079

Prepared for:
Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

August 3, 2017

Kentucky Transportation Cabinet
Division of Structural Design-Geotechnical Branch
1236 Wilkinson Blvd.
Frankfort, Kentucky 40601-1200

Attn: Mr. Michael Carpenter, PE
Geotechnical Engineer
P: 502-782-3837
F: 502-564-4839
E: michael.carpenter@ky.gov

Re: Geotechnical Engineering Retaining Wall Report
Structure No. S-046-2016
Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
Boone County, Kentucky
Terracon Project Number: N1155079

Dear Mr. Carpenter:

Terracon Consultants, Inc. (Terracon) is submitting this Geotechnical Engineering Retaining Wall Report for the above referenced structure. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning the retaining wall foundations.

1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/I-71 Interchange with KY 536 (Mt. Zion Road) in Boone County, Kentucky. Stantec is the lead design engineer on the project. Terracon Consultants, Inc. was selected to perform the geotechnical services through our Statewide Engineering Contract. Terracon's services included laboratory testing and engineering services. The field exploration phase was conducted by Thelen Associates, Inc. (now Geotechnology, Inc.) working under a separate Statewide contract with KYTC.

A new “double crossover diamond” interchange is planned with the KY 536 pavement lanes continuing to run beneath the existing I-75 bridge. The project involves reconstruction along KY 536 (Mt. Zion Road), new ramps, a new multi-use path along the northern edge of KY 536, as well as improvements, extensions, and realignments to various side roads that include Biltmore Blvd., Biltmore Drive, Investment Way, Sam Neace Drive, and about 1300 ft. of US 25.

This report addresses the geotechnical-recommendations for one of the proposed retaining walls on the project, namely Structure S-046-2016. The wall location is shown on the attached Project Location Map. As shown, the retaining wall is planned between about STA’s 201+45 and 203+20 along the right, or south side of the mainline. The wall will support new embankment fill that will support the shared use path.

A gravity retaining wall was evaluated at this location. The proposed total wall height will range from about 7 to 8.5 ft. and support a cut slope and will be about 175 feet long. The wall will have a 3H:1V back slope with no additional surcharge loading at the crest of the slope.

2.0 SITE TOPOGRAPHY AND GEOLOGICAL CONDITIONS

The project area lies in a dissected upland of the Outer Bluegrass Region. Ground elevations along the overall project route generally range from about Elev. 870 ft. to about 950 ft. Grades generally rise to the east. At the proposed retaining wall alignment, the existing ground surface elevations generally range from about 955 to 957 ft. along the existing side slope.

Surface drainage in the project vicinity is generally dendritic with most flow towards the South Branch of Gunpowder Creek, which lies west of I-75. The Ohio River lies about 8 miles north of the site and has a normal pool elevation of 455 ft.

Geologic mapping indicates the project area is underlain by limestone and shale of the Bull Fork Formation and Ordovician System. Mapping shows the limestone comprises as much as about 95 percent of the rock mass. No known karst features are mapped in the project area.

The USGS Soil Survey shows that the uppermost soils along the project site comprise mostly of Rossmoyne Silt Loam with lesser amounts of Jessup Silt Loam (a wind-blown loess) and Faywood Silty Clay (residuum).

3.0 SUBSURFACE EXPLORATIONS

An exploration plan was developed by Terracon after a review of the available plans, profiles, and cross-sections provided by Stantec. The draft exploration plan was subsequently reviewed and approved by KYTC Geotechnical Branch. Some borings were relocated during the field program due to access, utility conflicts, etc.

Seven test borings were drilled along the alignment of Structure S-046-2016. These borings included two rock core borings, one undisturbed sample boring and four rockline soundings. A summary of these seven borings is provided below.

Table 3.0: Summary of Test Borings

Boring	Samples	Approx. Top/Weathered Bedrock, ft.	Approx. Top/Weathered Rock Elev., ft.	Approx. Depth to RDZ, ft.
1036	2 UD’s and 1 SPT	13’	943.3	16’
1037	None	Refusal @ 15.2’	942.4	N/A
1038	2 UD’s and 1 SPT	12.9’	944.5	12.9’
1039	None	Refusal @ 16.7’	943.1	N/A
1040	None	Refusal @ 13.9’	942.1	N/A
1041	2 UD’s and 3 SPT’s	13.0’	942.0	N/A
1042	None	Refusal @ 17.2’	940.6	N/A

UD: Undisturbed (Shelby tube) sample
SPT: Standard Penetration Test sample

Rock core logs below the RDZ revealed gray limestone and shale with close fractures and some heavy weathering at the fractures. Kentucky RQD values were 0% and core recoveries ranged from about 92% to 100%.

Refer to the attached Subsurface Data Sheet for the location of the borings, subsurface logs, and soil test results.

4.0 LABORATORY TESTING AND RESULTS

A laboratory testing program was assigned to the thin-walled tubes and approved by the KYTC Geotechnical Branch. The laboratory tests were conducted by Terracon in accordance with the appropriate AASHTO or Kentucky Methods as outlined in the Geotechnical Manual. The results of the laboratory tests are depicted graphically on the Subsurface Data Sheet.

The laboratory testing program on undisturbed samples in the overburden soil zone included classification testing; results are summarized on the following page.

Table 4.0: Summary of Laboratory Test Results

Station	Offset	Hole	Sample	AASHTO	USCS	U.C., psf	Silt+Clay, %
201+50	55 ft. RT	1036	2	A-7-6(20)	CL	-	70(46+24)
202+40	54 ft. RT	1038	2	A-6(10)	CL	-	63(46+17)
203+21	53 ft. RT	1041	1	A-6(11)	CL	-	66(54+12)
203+21	53 ft. RT	1041	2	A-6(5)	CL	-	50(38+12)

5.0 ENGINEERING ANALYSES

The gravity-type retaining wall for Structure S-046-206 was analyzed at its maximum proposed height of 8.5 feet with a 3H:1V back slope. Analyses included overturning, bearing capacity, and sliding. Slope stability analyses were not conducted due to the low embankment height.

Two backfilling conditions were evaluated: granular wall backfill and cohesive soil wall backfill. Additionally, the foundation was assumed to bear directly on at least stiff cohesive soil.

A summary of soil parameters used in the analyses is provided below.

Table 5.0: Summary of Assumed Soil Parameters

Item	Moist Unit Weight, pcf	Effective Internal Friction, Φ	Cohesion, psf
Granular Wall Backfill	115	37 degrees	0
Cohesive Soil Wall Backfill	125	24 degrees	0
Cohesive Foundation Soil	125		1500

Results of the analyses for a gravity wall are summarized below:

Overturning with granular wall backfill – satisfied safety criteria of having the resultant fall within the middle 2/3's of the foundation (for soil-bearing conditions). The case where cohesive soil wall backfill was assumed did not satisfy overturning requirements unless the foundation width was increased beneath the "heel" portion of the base by 6 inches.

Bearing Capacity – satisfied minimum safety (factored resistance greater than applied factored bearing stress).

Sliding Resistance with either granular or cohesive soil wall backfill – satisfied minimum safety criteria (factored resistance was greater than applied factored resultant).

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.0 RECOMMENDATIONS

6.1 The gravity wall dimensions should meet KYTC's Standard Drawing RGX-002-09 (12-1-15), Case III, with the possible exception stated below in Paragraph 6.3.

6.2 A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.3 Design the retaining wall to bear directly upon stiff to very stiff undisturbed cohesive soil. In the event that undercutting is required during construction (for example, to remove soft pockets or layers), the undercut should expose suitable stiff to very stiff cohesive soils and be backfilled with class B concrete. Granular embankment should not be allowed for use to backfill the undercut.

6.4 The retaining wall should be backfilled with granular soil. Alternatively, cohesive soil backfill can be used provided the foundation width shown on KYTC Std. Dwg. RGX-002-09 (12-1-15), Case III is increased by 0.5 feet in its "heel" section.

6.5 If cohesive soil is used as wall backfill, a drainage medium is required on the back face of the wall to prohibit hydrostatic pressures from developing and to allow drainage through the specified weep holes.

6.6 Wall construction and backfilling should be completed in accordance with KYTC specifications.

7.0 PLAN NOTES

7.1 Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls" at the appropriate locations in the plans.

The analysis and conclusions presented in this report are based upon the data obtained from the test borings performed by others at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur away from the borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident over the short term. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If KYTC is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use by KYTC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We appreciate the opportunity to be of service to you on this project. Please contact us with any questions concerning this report.

Respectfully submitted,

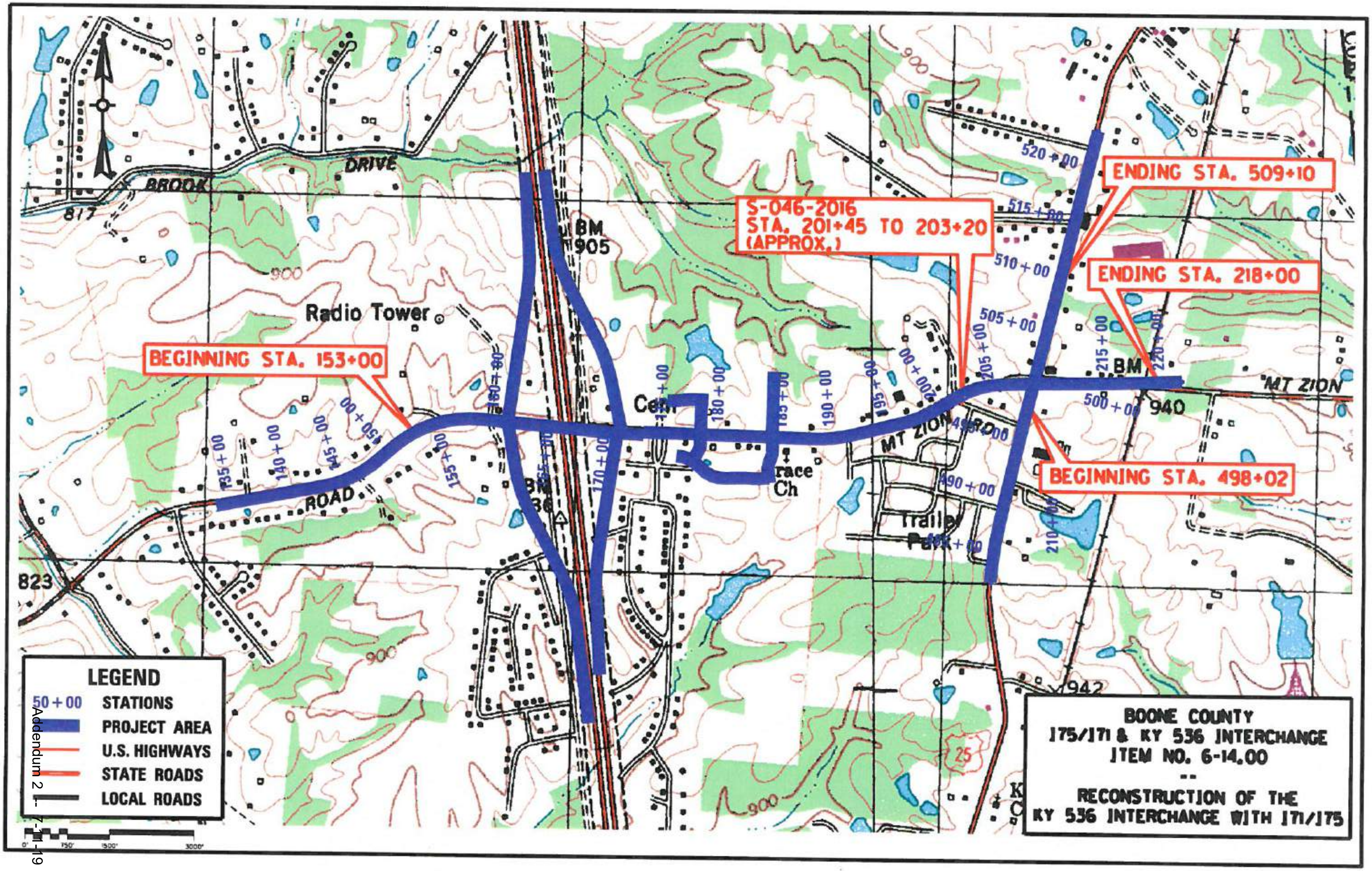
Terracon

Jess A. Schroeder, P.E.
Senior Geotechnical Engineer

for Aaron J. Muck

Aaron J. Muck, P.E.
Senior Geotechnical Engineer

Attachments:	Project Location Plan
	Subsurface Data Sheet
	Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls
	Coordinate Data Form
	Calculations



BOONE COUNTY
I75/I71 & KY 536 INTERCHANGE
ITEM NO. 6-14.00
--
RECONSTRUCTION OF THE
KY 536 INTERCHANGE WITH I71/I75

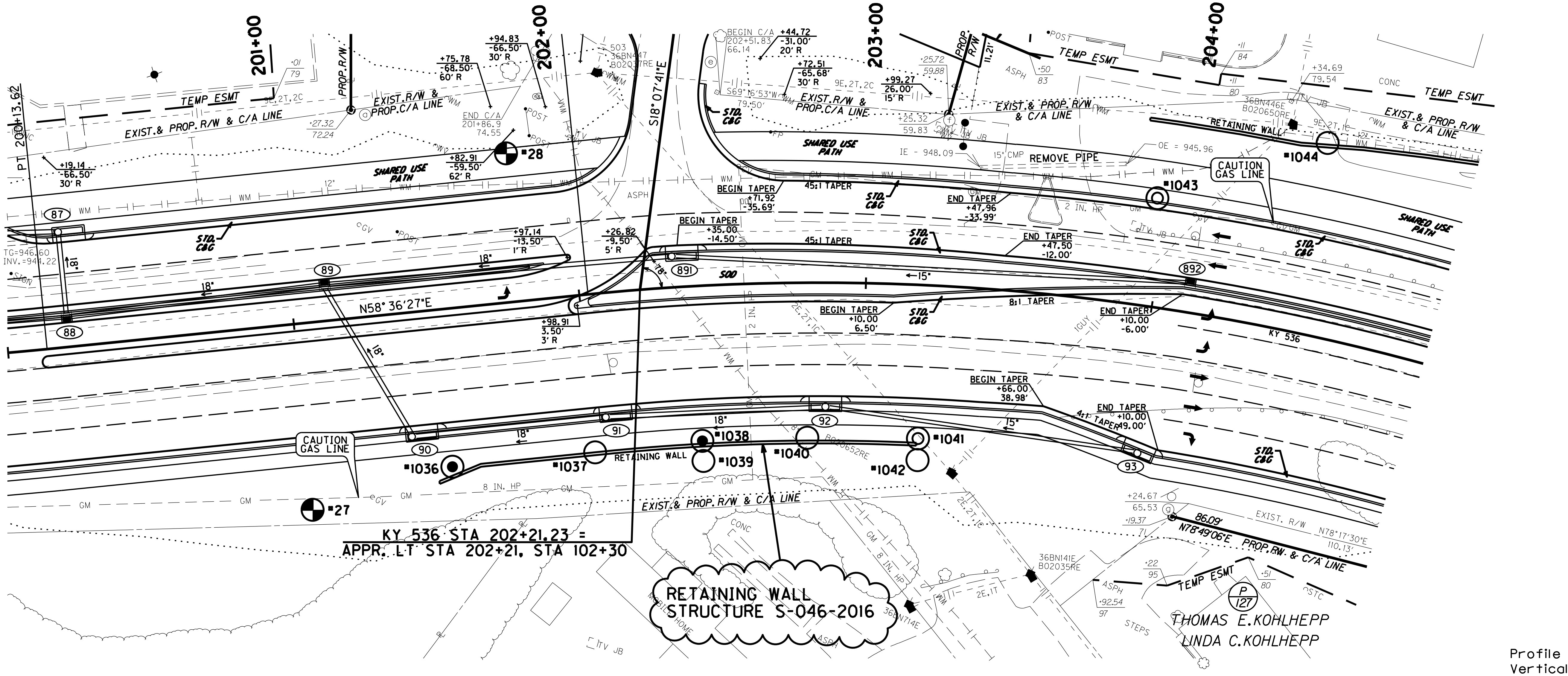
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\RETAINING WALLS\S-046-2016.DGN

USER: kjmankin
DATE PLOTTED: July 13, 2017

E-SHEET NAME:

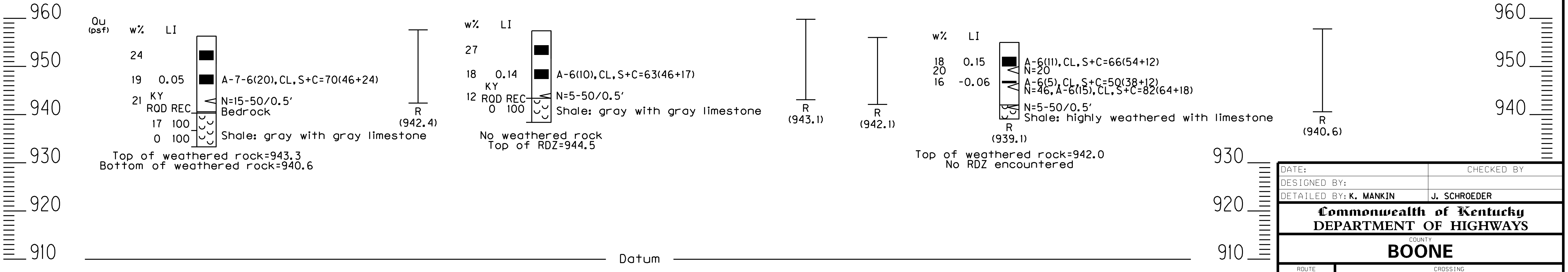
MicroStation v8.11.9.832

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	#1036	#1037	#1038	#1039	#1040	#1041	#1042
Station	201+50	202+00	202+40	202+40	202+80	203+21	203+20
Offset	55 FT. RT.	55 FT. RT.	54 FT. RT.	61 FT. RT.	54 FT. RT.	53 FT. RT.	61 FT. RT.
Elev. (Sea level datum)	956.3	957.6	957.4	959.8	956.0	955.0	957.8



DATE:
CHECKED BY
DESIGNED BY:
DETAILED BY: K. MANKIN
J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536

CROSSING
RETAINING WALL STA. 201+45 TO STA. 203+20

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 - 7-11-19

SHEET NO.

DRAWING NO.

S-046-2016

SHEET 1 OF 1

ITEM NUMBER
6-14.00

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall, except for cases where the wall height (ft.) is over 8 ft. In such a case, the embedment depth shall be 1/4 H, per note 1 of Std. Dwg. RGX-002-09 (12-1-15).

Use wall dimensions in accordance with Case III of the Standard Drawing RGX-002.

Backfill this wall with Granular material as outlined on this sheet. Alternatively cohesive soil backfill can be used provided the foundation width shown on Standard Drawing RGX-002-09 (2-1-15) Case III is increased by 0.5 ft. in its heel section.

The base of the wall shall be extended to bear on existing stiff to very stiff cohesive soil.

Station Interval	Bearing Surface	Factored Presumptive Bearing Resistance at the Service Limit State
ML 201+45 TO 203+20, RT	Undisturbed Soil	2.8 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Embankment	0	37	115
Cohesive Soil (Alternate)	0	24	125
Foundation Soils Existing	1500	125	0

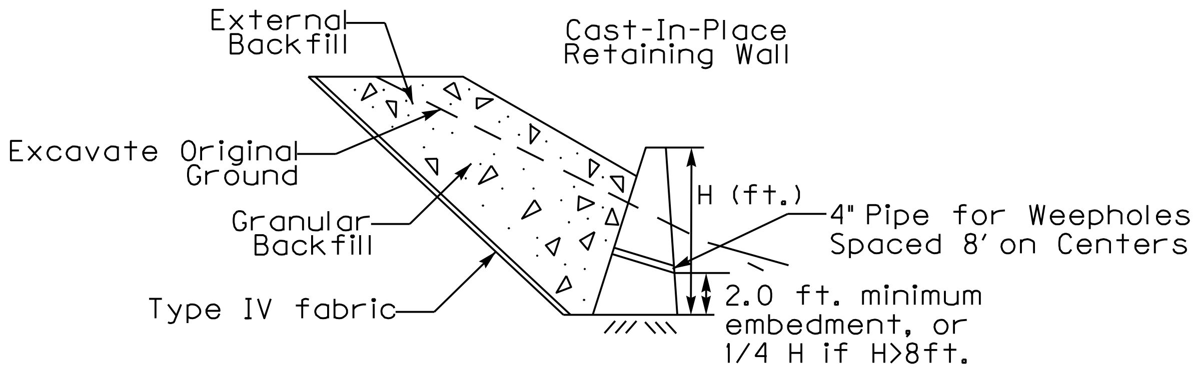
Where external granular backfill is required, place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible, as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

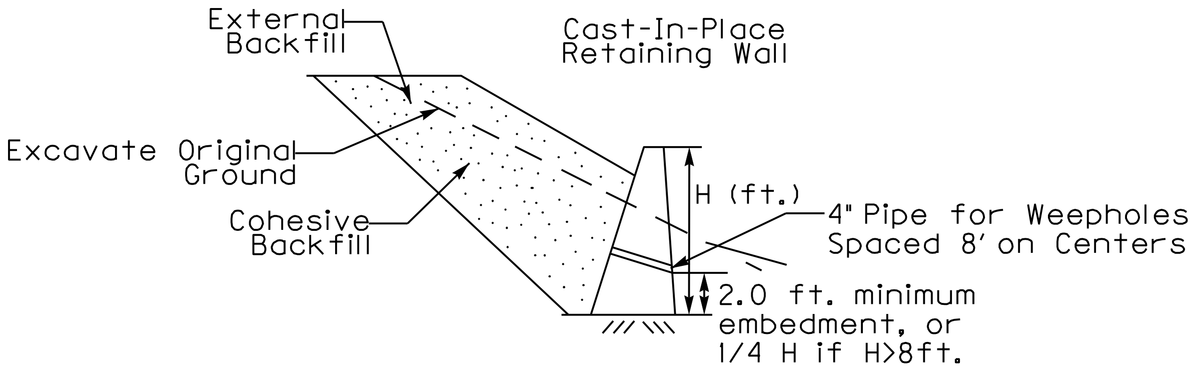
The footing concrete should be placed as soon as possible after the footing excavation is made.

The wall designer shall verify wall stability based on final design dimensions.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



S-046-2016

ITEM NUMBER
6-014.00

DATE:
CHECKED BY
DESIGNED BY:
DETAILED BY: K. MANKIN
J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536
CROSSING
RETAINING WALL @ ML STA. 201+45 TO STA. 203+20, RT

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540
Addendum 2 – 7-11-19

SHEET NO.
DRAWING NO.

MicroStation v8.11.9.832
E-SHEET NAME:
USER: kjmankin
DATE PLOTTED: August 3, 2017
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\GEOTECHNICAL NOTES S-046-2016.DGN

COORDINATE DATA SUBMISSION FORM - PROPOSED RETAINING WALL S-046-2016						
KYTC Division of Structural Design - Geotechnical Branch						
County:		**Boone**				
Road Number:		**KY 536 & I-75 (Reconstruct I-75 Interchange with KY 536, Mt. Zion Road**				
Item:		**6-14.00**				
MARS		**8022203D**				
Project #:		**FD52 008 0075 177-179D**				
Hole Number	**Latitude**	**Longitude**	**Station Number**	**Offset**	**Elevation**	**Hole Depth**
1036	38.9570040	-84.6223910	20150	55 RT	956.28	23
1037	38.9570740	-84.6222390	20200	55 RT	957.60	15.2
1038	38.9571270	-84.6221270	20240	54 RT	957.40	19
1039	38.9571100	-84.6221150	20240	61 RT	959.80	16.7
1040	38.9571730	-84.6220090	20280	54 RT	956.04	13.9
1041	38.9572164	-84.6218888	20321	53 RT	955.00	15.9
1042	38.9571960	-84.6218800	20320	61 RT	957.84	17.2

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 12/20/16

Structure No.: S-046-2016

Terracon

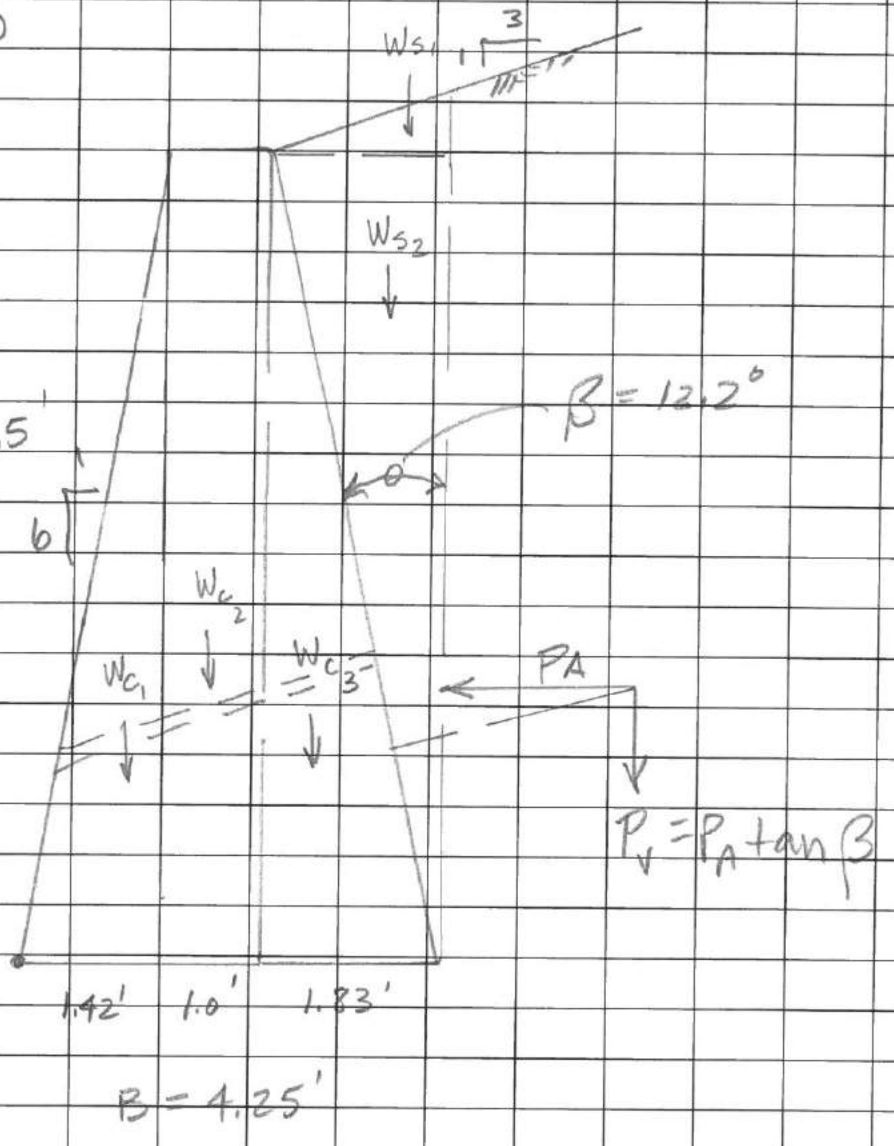
Sheet 1

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

REF. Project Dwg. X122
(STA 202+40)

FTG. LENGTH
≅ 170'
per plans



Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: S-046-2016

Terracon

Sheet 2

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

Assume: Cohesive soil backfill w/drainage board (i.e. No hydrostatic pressure)

Let $\phi'_{backfill} = 24°$ (NAVFAC DM 7.2-39 for CL/CH soil)

$\gamma = 125$ pcf

K_A (sloping b'fill @ 3:1) = 0.58 (NAVFAC DM-7.2-64)

$$P_A = 0.125 \frac{(8.5)^2}{2} (0.58) = 2.62 \ ^k/_{FT.}$$

$$P_V = 2.62 \tan 12.2° = 0.57 \ ^k/_{FT.}$$

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: S-046-2016

Terracon
Sheet 3

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

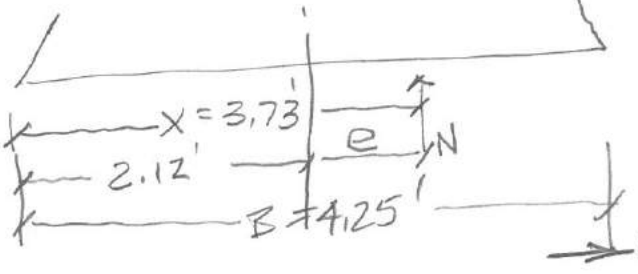
AREA	Unfactored Resultant (K/Ft.)	Load Factor	Factored Load (K/FT.)	Moment Arm (ft.)	Moment About @, ft-K/Ft.
W_{c1}	6.04 ft² (.15) = .91	0.9	.81	.95	.77
W_{c2}	8.5 ft² (.15) = 1.28	0.9	1.15	1.92	2.21
W_{c3}	7.8 ft² (.15) = 1.17	0.9	1.05	3.03	3.18
W_{s1}	.56 ft² (.125) = .07	1.0	.07	3.64	.25
W_{s2}	7.8 ft² (.125) = .97	1.0	.97	3.64	3.53
P_A	2.62	1.5	3.93	-2.83	-11.12
P_V	0.57	1.0	.57	4.25	2.42
N^*			4.62	$-x$	$-4.62x$

$$\Sigma M_{@} = 0 \Rightarrow 4.62x = 1.24$$

$* \; N = \Sigma F_V = W_{c_1} + W_{c_2} + W_{c_3} + W_{s_1} + W_{s_2} + P_V = 4.62 \, ^k/ft$, Factored

$$\left[x = 3.73' \right]$$

AASHTO 11.6.3.3 states that resultant must fall within middle 2/3 of base for soil bearing.



$e = 3.73 - 2.12 = 1.6'$

$B \times \frac{2}{3} = 4.25\left(\frac{2}{3}\right) = 2.83'$

$\frac{2.83}{2} = 1.41' \ngtr 1.6'$ NO GOOD

→ widen ftg, or use granular B'fill ←

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: S-046-2016

Terracon
Sheet 4

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

Recheck overturning w/granular backfill having $\phi = 37°$, $\gamma = 115$ pcf (per KYTC) & $K_A = 0.3$ (NAVFAC DM 7.2-64)

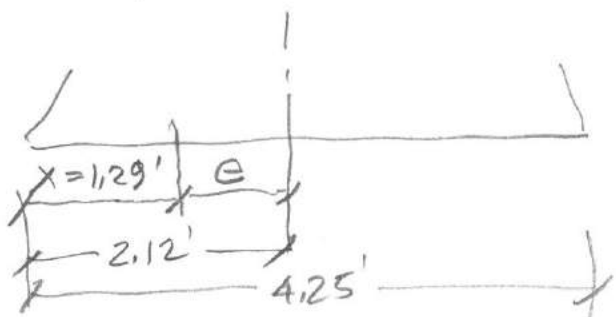
$P_A = .115\left(\frac{8.5)^2}{2}\right)(.3) = 1.25$ k/FT. ; $P_V = 1.25 \tan 12.2° = .27$ k/FT.

Area	Unfactored Load	Load Factor	Factored Load	Arm	Moment About ⓐ
W_{c1}	.91 k/FT.	.9	.81	.95'	.77 ft-k/FT.
W_{c2}	1.28	.9	1.15	1.92	2.21
W_{c3}	1.17	.9	1.05	3.03	3.18
$W_{S1} = .56(.115) = .06$		1.0	.06	3.64	.22
$W_{S2} = 7.8(.115) = .90$		1.0	.90	3.64	3.28
P_A	1.25	1.5	1.88	-2.83	-5.32
P_V	.27	1.0	.27	4.25	1.15
N			4.24	-x	-4.24x

$\Sigma M_@ = 0 \Rightarrow 4.24x = 5.49$

$N = \Sigma F_V = .81 + 1.15 + 1.05 + .06 + .90 + .27 = 4.24$ k/ft, factored

$x = \frac{5.49}{4.24} = 1.29'$



$e = 2.12 - 1.29 = .83'$

$B \times \frac{2}{3} = 4.25\left(\frac{2}{3}\right) = 2.83'$

$\frac{2.83'}{2} = 1.41' > .83' \Rightarrow$ OK ✓

← use granular B'fill

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: 5-046-2016

Terracon
Sheet 5

Part 3: Check Bearing Capacity

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.35	*Fig. C11.56-2, page 11-11*
Concrete Weight	1.25	
Live Load Surcharge	1.75	*(applied above rear wall batter, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φb):	0.55	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent: Gravity Walls*

Nominal Bearing = qn = c x (Nc) x (1+0.3(B/L)) + (ϒ x D) *Ref.: NAVFAC DM 7.2, p. 131, Fig. 1*
Factored Bearing Resistance = qn x φb, ksf
Applied Bearing = V/B, ksf

REF. BORINGS 1036-1042, NO STRENGTH TESTS. ESTIMATE "C"
$N \cong 20$ (BORING 115 OR 1037), PER NAVFAC DM 7.1-88,
ESTIMATE "C" AS 1.5 KSF (CONSERVATIVE).

$N = 5.53$ (NAVFAC DM 7.2-131)
$\gamma = 125$ (ASSUME), pcf
$D = 2'$ (")

PER AASHTO 10.6.1.3, ECCENTRICALLY LOADED FTGS. SHOULD BE EVALUATED FOR BRG. RESISTANCE USING AN EFFECTIVE AREA, $B' \times L'$, WHERE $B' = B - 2e$, $L' = L - 2e$

$e = .83' \rightarrow B' = 4.25 - 2(.8) = 2.65'; \; L' = 170 - 2(.8) = 168.4'$

$$q_n = 1.5(5.53)\left(1 + 0.3\left(\frac{2.65}{168.4}\right)\right) + 2(0.125) = 8.58 \text{ KSF}$$
(NOMINAL)

FACTORED BRG. RESISTANCE = 8.58(0.55) = 4.7 KSF

APPLIED BRG. STRESS = ΣF_V (FACTORED)

$$= \left[W_{c1} + W_{c2} + W_{c3} + W_{s1} + W_{s2} + P_V\right] / B'$$

$$= (.91 + 1.28 + 1.17)(1.25) + (.06 + .9)(1.35) + .27(1.35) / B'$$

$$= \frac{5.86 \text{ K/FT}}{2.65 \text{ FT.}} = 2.21 \text{ KSF}$$

4.7 KSF > 2.21 KSF ⇒ OK ✓

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/17/17
Structure No.: S-046-2016

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)
Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft.
(AASHTO Fig. 10.6.3.4-1)

Applied Horizontal Resultant = Pa, kips/ft.

$R_r = \phi_\tau \times S_u$ governs if bearing directly on cohesive soil. However, if >6" granular fill is placed below the wall foundation, the lesser of the two formulas shown above applies.

For this case, assume cohesive soil bearing.

From SHT. 5, Let C = 1.5 KSF

$$R_r = \phi_\tau \times S_u = 1.0(1.5) = \underline{\underline{1.5}}\ \text{KSF} = \text{Factored Resistance}$$

$$\text{VS.} \quad 1.5\,\text{KSF} \times B = 1.5(4.25) = \underline{6.38}\ ^{K}/\text{FT.}$$

$$\text{Applied factored Resultant} = P_A \times 1.5 = 1.25(1.5) = \underline{\underline{1.88}}\ ^{K}/\text{FT}$$

↳ SHT 4, Granular B'fill

$$6.38\ ^{K}/\text{FT.} > 1.88\ ^{K}/\text{FT.}$$

OK ✓ FOR GRANULAR WALL BACKFILL

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/9/17
Structure No.: S-046-2016

Terracon
Sheet 7

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

Repeat analysis w/ cohesive b'fill but arbitrarily increase heel from 1.83' to 2.83' (all other dimensions remain same).

$\beta_{new} = 18.4°$

$P_A = 2.62$ K/FT. (sht. 2)

$P_V = P_A \tan\beta = .87$ K/FT.

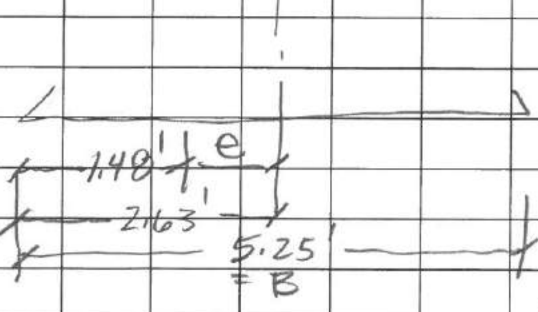
Check Overturning...

AREA	Unfactored Resultant, K/FT	Load Factor	Factored Load, K/FT.	Moment Arm, ft	Moment about @, ft-K/FT.
W_{c1}	.91 (sht. 3)	.90	.81	.95	.77
W_{c2}	1.28 (sht. 3)	.90	1.15	1.92	2.21
W_{c3}	12.03 ft² (.15) = 1.80	.90	1.62	3.36	5.44
W_{s1}	1.33 ft² (.125) = .17	1.0	.17	4.31	.73
W_{s2}	12.03 ft² (.125) = 1.50	1.0	1.50	4.31	6.47
P_A	2.62	1.5	3.93	-2.83	-11.12
P_V	.87	1.0	.87	5.25	4.57
$N = \Sigma F_V$			6.12	$-X$	$-6.12X$

$\Sigma M_@ = 0$

$6.12X = 9.07$

$X = 1.48'$



$e = 2.63 - 1.48' = 1.15'$

$B \times \frac{2}{3} = 5.25(2/3) = 3.5'$

$\frac{3.5'}{2} = 1.75' > 1.15'$ OK ✓

(middle two-thirds)

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)
Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft.
(AASHTO Fig. 10.6.3.4-1)

Applied Horizontal Resultant = Pa, kips/ft.

Again, assume cohesive soil bearing.

From SHT. 5, Let $C = 1.5$ KSF

Factored Resistance, $R_r = \phi_\tau \times S_u = 1.0(1.5) = 1.5$ KSF

1.5 KSF $\times B' = 1.5(\underbrace{4.25+1.0}_{\text{widened}}) = \underline{7.88}$ K/FT.

VS.

Applied Factored Resultant = $P_A \times 1.5$

$= \underbrace{2.62}_{\text{PP. 2 \& 8}}$ K/FT. $(1.5) = \underline{\underline{3.93}}$ K/FT.

7.88 K/FT. > 3.93 K/FT.

OK ✓ w/cohesive backfill

BooNE Co., 6-14.00

PROJECT: N1155079, S-046-2016 Page 9 of

JOB NO. Date 1/17/17 Comp. By CHECKED BY:

Cohesive backfill was checked for std. fdn. width of 4.25'

SHT. 3 found overturning NOT satisfied

SHT 7 " " OK IF Fdn. width increased to 5.25'

SHT. 8 found sliding to be OK @ B = 5.25'

check sliding for B = 4.25'...

$R_r = \phi_r s_u = 1.0(1.5) = 1.5$ KSF... × $B = 1.5(4.25) = 6.38^k$/FT.

vs. Applied Resultant = $P_A(1.5) = 2.62^k$/FT. $(1.5) = 3.93^k$/FT.

↳ SHTS. 2 & 8

6.38^k/FT. > 3.93^k/FT. ⇒ OK ✓

So, if sliding is satisfied for both B = 4.25' & 5.25', but overturning is not satisfied for B = 4.25', repeat overturning analysis assuming heel width is increased 6", making B = 4.75'

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/17/17
Structure No.: S-046-2016

Terracon
Sheet 10

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

Repeat Overturning...

$\beta_{new} = 15.3^\circ$

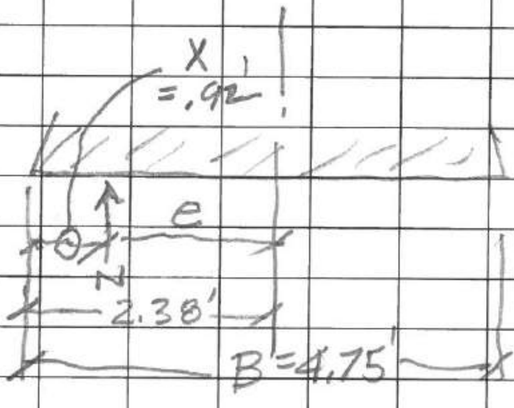
$P_A = 2.62$ K/FT (SHT. 2)

$P_V = P_A \tan\beta = 2.62 \tan(15.3^\circ) = 0.72$ K/FT

AREA	Unfactored Resultant K/FT.	LOAD FACTOR	Factored Load	ARM	Moment About @ (ft-K/FT)
W_{c1}	.91 (sht. 3)	.90	.81 K/FT	.95'	.77
W_{c2}	1.28 (")	.90	1.15	1.92	2.21
W_{c3}	9.90 ft² (.15) = 1.49	.90	1.34	3.20	4.28
W_{s1}	.90 ft² (.125) = .11	1.0	.11	3.97	.44
W_{s2}	9.90 ft² (.125) = 1.24	1.0	1.24	3.97	4.92
P_A	2.62	1.5	3.93	-2.83	-11.12
P_V	.72	1.0	.72	4.75	3.42
$N = \Sigma F_V$			5.37	$-x$	$-5.37x$

$5.37x = 4.92$

$x = .92'$



$e = 2.38' - .92 = 1.46'$

$B \times \frac{2}{3} = 4.75\left(\frac{2}{3}\right) = 3.17'$

$\frac{3.17'}{2} = 1.58' > 1.46'$ OK

SUMMARY: B = 4.25' OK ONLY IF Granular B'fill used
Cohesive B'fill OK only if B ≥ 4.75'

(S-047-2016) Consultant

MEMORANDUM

TO: William McKinney, PE
TEBM
Division of Structural Design

FROM: Bart Asher, PE, LS
Director
Division of Structural Design

BY: Michael Carpenter, PE MC
Geotechnical Branch

DATE: August 11, 2017

SUBJECT: Geotechnical Engineering Structure Foundation Report
Boone County
Reconstruct the Interchange with KY 536 (MT. Zion Road) South of Florence
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall Lt. Sta. 203+92 to 205+77
Item No. 6-14.00
Terracon Project No. N1155079

The geotechnical engineering report for this structure has been completed by Terracon Consulting Engineers and Scientists. We have reviewed and concur with the recommendations as presented in this report.

A copy of the report is attached. If you have any questions, please contact this office at 502-564-2374

cc: J. Van Zee
R. Powell
B. Yeager
R. Franxman
R. Turner
E. Drury
B. Greene
J. Schroeder (Terracon)
C. Callan-Ramler
J. Hager

Attachment

Geotechnical Engineering
Retaining Wall Report
Structure No. S-047-2016

Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
STRUCTURE No. S-047-2016
Boone County, Kentucky

August 3, 2017
Terracon Project Number N1155079

Prepared for:
Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

August 3, 2017

Kentucky Transportation Cabinet
Division of Structural Design-Geotechnical Branch
1236 Wilkinson Blvd.
Frankfort, Kentucky 40601-1200

Attn: Mr. Michael Carpenter, PE
Geotechnical Engineer
P: 502-782-3837
F: 502-564-4839
E: michael.carpenter@ky.gov

Re: Geotechnical Engineering Retaining Wall Report
Structure No. S-047-2016
Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
Boone County, Kentucky
Terracon Project Number: N1155079

Dear Mr. Carpenter:

Terracon Consultants, Inc. (Terracon) is submitting this Geotechnical Engineering Retaining Wall Report for the above referenced structure. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning the retaining wall foundations.

1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/I-71 Interchange with KY 536 (Mt. Zion Road) in Boone County, Kentucky. Stantec is the lead design engineer on the project. Terracon Consultants, Inc. was selected to perform the geotechnical services through our Statewide Engineering Contract. Terracon's services included laboratory testing and engineering services. The field exploration phase was conducted by Thelen Associates, Inc. (now Geotechnology, Inc.) working under a separate Statewide contract with KYTC.

A new “double crossover diamond” interchange is planned with the KY 536 pavement lanes continuing to run beneath the existing I-75 bridge. The project involves reconstruction along KY 536 (Mt. Zion Road), new ramps, a new multi-use path along the northern edge of KY 536, as well as improvements, extensions, and realignments to various side roads that include Biltmore Blvd., Biltmore Drive, Investment Way, Sam Neace Drive, and about 1300 ft. of US 25.

This report addresses the geotechnical-recommendations for one of the proposed retaining walls on the project, namely Structure S-047-2016. The wall location is shown on the attached Project Location Map. As shown, the retaining wall is planned between about STA’s 203+92 and 205+77 along the left side of the mainline. The retaining wall will support a fill slope having a 2H:1V back slope. A proposed shared use path is located at the top of the proposed embankment, but has been determined to be beyond the horizontal proximity to the retaining wall so that any surface surcharge loading from the path can be neglected in the wall overturning, bearing, and sliding analyses.

A gravity retaining wall was evaluated at this location. The proposed total wall height will range from about 5 ft. to 9 ft. and the wall length will be about 185 feet.

2.0 SITE TOPOGRAPHY AND GEOLOGICAL CONDITIONS

The project area lies in a dissected upland of the Outer Bluegrass Region. Ground elevations along the overall project route generally range from about Elev. 870 ft. to about 950 ft. Grades generally rise to the east. At the proposed retaining wall location, existing ground surface elevations generally range from about Elev. 932 ft. to Elev. 942 ft. As mentioned, there will be a 2H:1V embankment slope extending up from the wall to the proposed shared use path and roadway.

Surface drainage in the project vicinity is generally dendritic with most flow towards the South Branch of Gunpowder Creek, which lies west of I-75. The Ohio River lies about 8 miles north of the site and has a normal pool elevation of 455 ft.

Geologic mapping indicates the project area is underlain by limestone and shale of the Bull Fork Formation and Ordovician System. Mapping shows the limestone comprises as much as about 95 percent of the rock mass. No known karst features are mapped in the project area.

The USGS Soil Survey shows that the uppermost soils along the project site comprise mostly of Rossmoyne Silt Loam with lesser amounts of Jessup Silt Loam (a wind-blown loess) and Faywood Silty Clay (residuum).

3.0 SUBSURFACE EXPLORATIONS

An exploration plan was developed by Terracon after a review of the available plans, profiles, and cross-sections provided by Stantec. The draft exploration plan was subsequently reviewed and approved by KYTC Geotechnical Branch. Some borings were relocated during the field program due to access, utility conflicts, etc.

Six test borings were drilled along the alignment of Structure S-047-2016. These borings included three undisturbed sample borings and three rockline soundings. A summary of these six borings is provided below.

Table 3.0: Summary of Test Borings

Boring	Samples	Approx. Top/Weathered Bedrock, ft.	Approx. Top/Weathered Rock Elev., ft.	Approx. Depth to RDZ, ft.
1043	2 UD's	Refusal @ 12.0'	933.6	N/A
1044	None	Refusal @ 13.6'	926.2	N/A
1045	5 UD's and 1 SPT	23.5' w/refusal @ 23.8'	928.0	N/A
1046	None	Refusal @ 11.8'	925.2	N/A
1047	4 UD's and 2 SPT's	27.0' w/ refusal @ 27.3'	924.5	N/A
1048	None	Refusal @ 10.8'	926.7	N/A

UD: Undisturbed (Shelby tube) sample
SPT: Standard Penetration Test sample
RDZ: Rock Disintegration Zone

Refer to the attached Subsurface Data Sheet for the location of the borings, subsurface logs, and soil test results.

4.0 LABORATORY TESTING AND RESULTS

A laboratory testing program was assigned to the thin-walled tubes and approved by the KYTC Geotechnical Branch. The laboratory tests were conducted by Terracon in accordance with the appropriate AASHTO or Kentucky Methods as outlined in the Geotechnical Manual. The results of the laboratory tests are depicted graphically on the Subsurface Data Sheet.

The laboratory testing program on undisturbed samples in the overburden soil zone included classification and compressive strength testing; results are summarized on the following page.

Table 4.0: Summary of Laboratory Test Results

Station	Offset	Hole	Sample	AASHTO	USCS	U.C., psf	Silt+Clay, %
203+97	38 ft. LT	1043	1	A-7-6(20)	CL	2663	79(59+20)
203+97	38 ft. LT	1043	2	A-6(17)	CL	-	97(76+21)
205+04	24 ft. LT	1045	1	A-6(9)	CL	4999	75(67+8)
205+04	24 ft. LT	1045	2	A-7-6(23)	CH	2887	81(53+28)
205+04	24 ft. LT	1045	3	A-6(7)	CL	3239	58(50+6)
205+04	24 ft. LT	1045	4	A-6(8)	CL	-	66(53+13)
205+68	28 ft. LT	1047	1	A-7-6(12)	CL	-	63(48+15)
205+68	28 ft. LT	1047	2	A-6(12)	CL	1601	77(64+13)
205+68	28 ft. LT	1047	3	A-6(11)	CL	2047	78(64+14)
205+68	28 ft. LT	1047	4	A-7-6(29)	CH	2406	87(55+32)
205+68	28 ft. LT	1047	5	A-4(0)	SM	-	42(39+3)

U.C.: Unconfined compressive strength

5.0 ENGINEERING ANALYSES

5.1 General Remarks

The gravity-type retaining wall for Structure S-047-2016 was analyzed at its maximum proposed height of 9 feet and at the design backslope of 2H:1V. Wall analyses included overturning, bearing capacity, and sliding.

Upon review of the cross-sections and collected subsurface data, it is our opinion that slope stability analyses should be performed to verify that a potential slope failure does not undermine the proposed retaining wall. Those analyses are described later.

5.2 Wall Overturning, Bearing, and Sliding Analyses

Due to the 2H:1V proposed finished slope above the wall (26.6 degrees), it is recommended that the wall backfill consist of granular soil. A slope stability analysis was conducted for the granular backfill case. Additionally, the foundation was assumed to bear directly on at least stiff cohesive soil.

A summary of soil parameters used in the analyses is provided below.

Table 5.1: Summary of Assumed Soil Parameters

Item	Moist Unit Weight, pcf	Effective Internal Friction, Φ	Cohesion, psf
Granular Wall Backfill	115	37 degrees	0
Cohesive Soil Foundation	121	0 degrees	1200

Results of the analyses for a gravity wall are summarized below:

Overturning with granular soil wall backfill – satisfied safety criteria of having the resultant fall within the middle 2/3's of the foundation (for soil-bearing conditions). While cohesive soil backfill was also checked for the overturning analysis and found to be satisfactory only if the wall base were increased by 1.5 ft., cohesive soil backfill should not be allowed due to slope stability considerations.

Bearing Capacity – satisfied minimum safety (factored resistance greater than applied factored bearing stress).

Sliding Resistance with granular soil wall backfill – satisfied minimum safety criteria (factored resistance greater than applied factored resultant). Again, cohesive soil wall backfill was evaluated for sliding resistance and showed satisfactory safety when the wall base was widened by 1.5 feet; however, cohesive soil backfill should not be allowed due to slope stability considerations.

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

5.3 Slope Stability Analyses

A representative cross-section is shown on the attached exhibit. This exhibit shows the encountered subsurface conditions from test borings 1045 and 1046 drilled at approximate mainline STA 205+00. The assumed soil parameters are indicated on the exhibit. The embankment fill was assumed to consist entirely of granular soil (wall backfill and formation of the entire embankment). The shear strength parameters for the granular soil were based upon values recommended by KYTC.

The shear strength parameters for the in-situ overburden soil were based on consolidated-undrained triaxial test results from Boring 5A (Ramp A1, STA 11100+45, 59 ft. LT) and is somewhat consistent with other slope stability analyses performed for the proposed roadway cut slopes and embankments reported under separate cover.

A 250 psf surface surcharge was assumed to occur at the locations of the shared use path and roadway at the top of the slope.

The attached exhibits show computed theoretical safety factors against shear failure under both short term and long term conditions. The theoretical safety factors are tabulated on the attachment and indicate acceptable values, per KYTC.

Table 5.3: Slope Stability Analyses Results

Condition	Theoretical Safety Factor
Short-tem (total stress)	1.8
Long-Term (effective stress)	1.75

6.0 RECOMMENDATIONS

6.1 The gravity wall dimensions should meet KYTC's Standard Drawing RGX-002-09 (12-1-15), Case III.

6.2 A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.3 Design the gravity retaining wall to bear directly upon stiff to very stiff undisturbed cohesive soil. In the event that undercutting is required during construction (for example, to remove soft pockets or layers), the undercut should expose suitable stiff to very stiff cohesive soils and be backfilled with class B concrete. Granular Embankment should not be allowed for use as undercut backfill.

6.4 To satisfy global stability, the gravity retaining wall should be backfilled with Granular Embankment. This granular material should continue as required to comprise the entire proposed embankment zone, even if located outside the limits of normal retaining wall backfill. The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches.

6.5 Place a Type IV Geotextile Fabric between the contact points of the soil and Granular Embankment. The Geotextile fabric shall be in accordance with Sections 214 and 843 of the Standard Specifications, current edition.

6.6 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

6.7 Wall construction and backfilling should be completed in accordance with KYTC specifications.

7.0 PLAN NOTES

7.1 Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls" at the appropriate locations in the plans.

8.0 CLOSING

The analysis and conclusions presented in this report are based upon the data obtained from the test borings performed by others at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur away from the borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident over the short term. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If KYTC is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use by KYTC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We appreciate the opportunity to be of service to you on this project. Please contact us with any questions concerning this report.

Respectfully submitted,

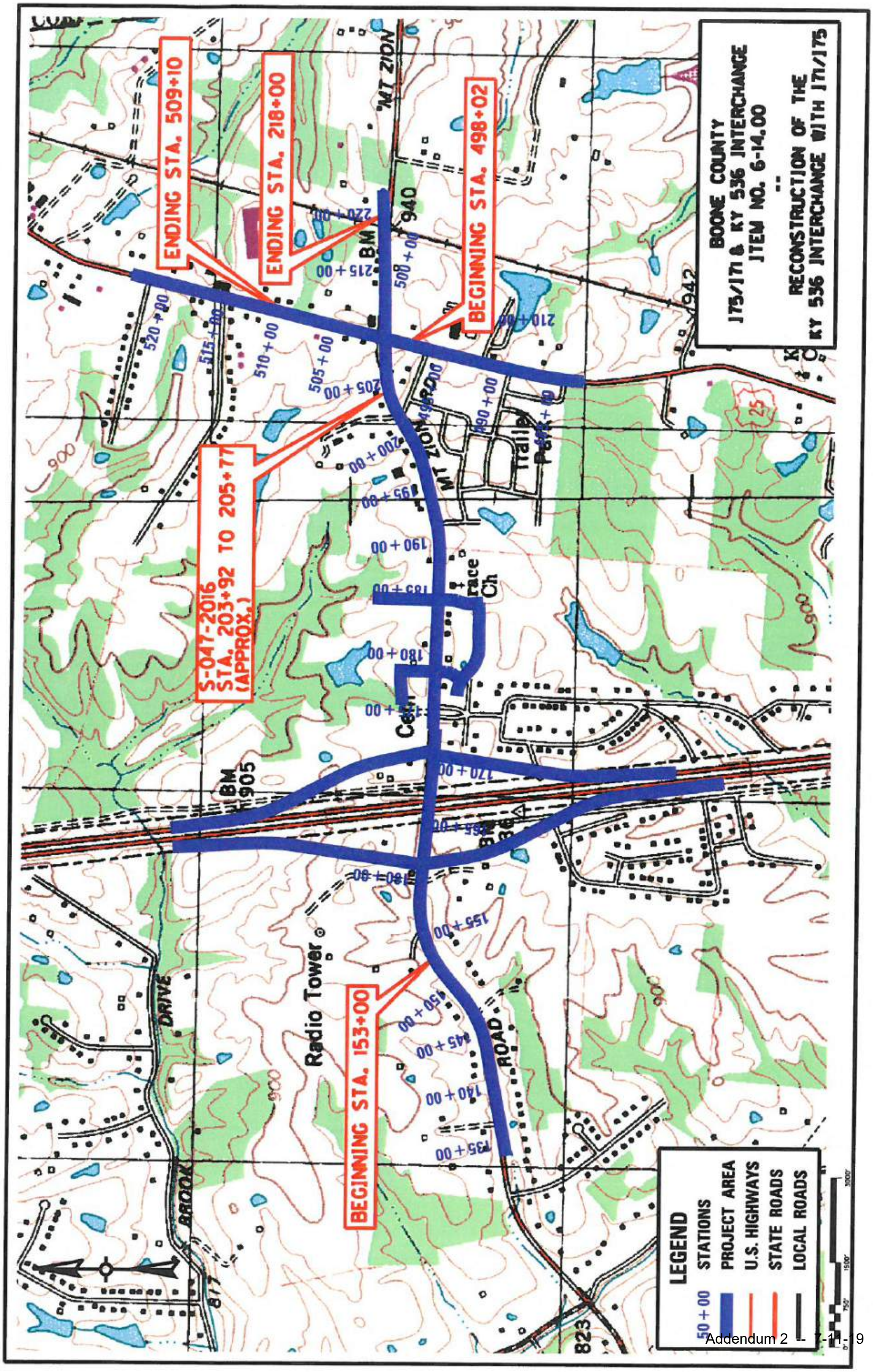
Terracon Consultants, Inc.

for Aaron J. Muck

Jess A. Schroeder, P.E.
Senior Geotechnical Engineer

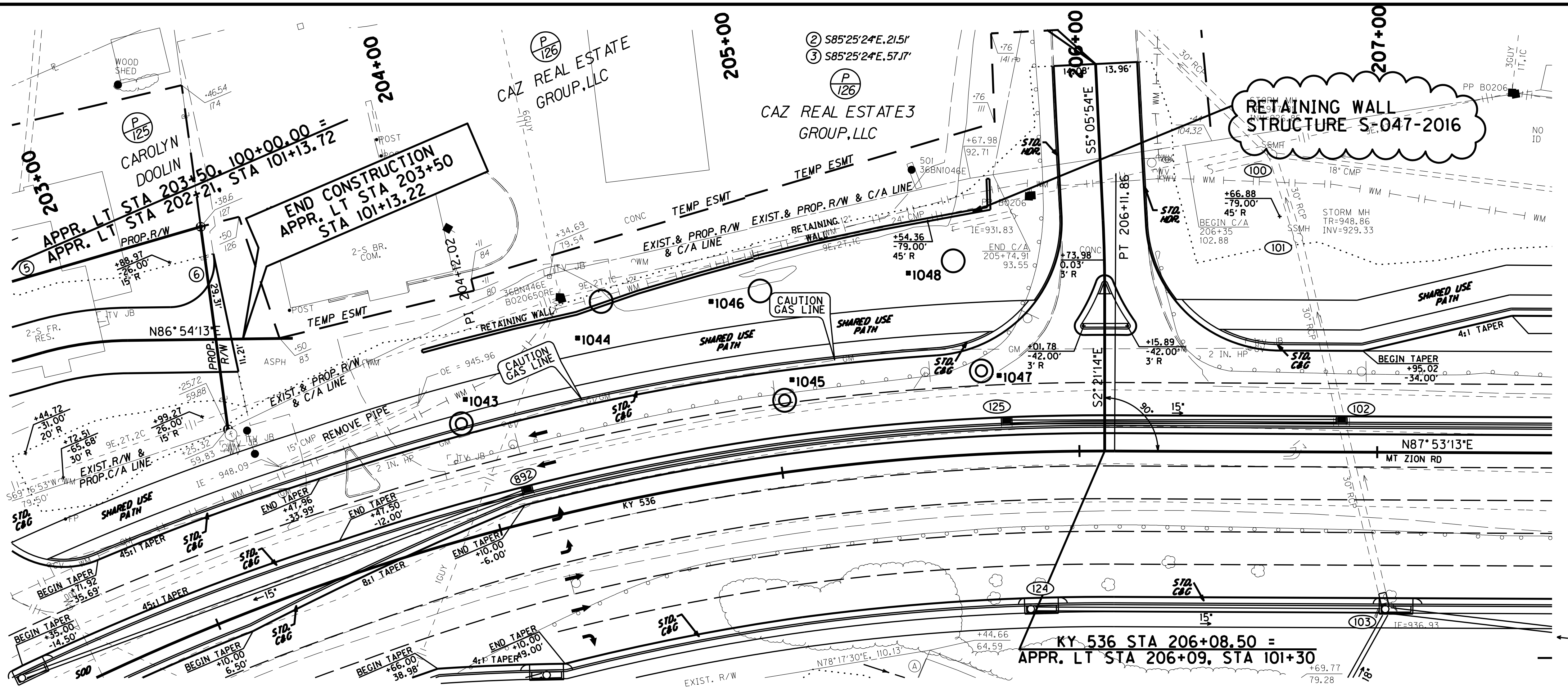
Aaron J. Muck, P.E.
Senior Geotechnical Engineer

Attachments:	Project Location Plan
	Subsurface Data Sheet
	Cross-Section and Slope Stability Analyses
	Geotechnical Notes for Cast-In-Place Non-Reinforced Concrete Gravity Walls
	Coordinate Data Form
	Calculations



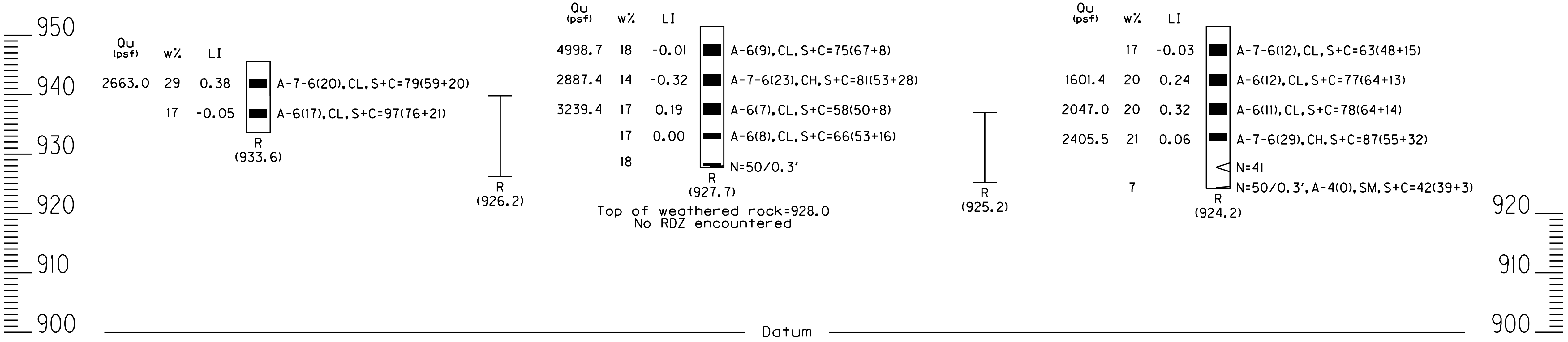
BOONE COUNTY
I75/I71 & KY 536 INTERCHANGE
ITEM NO. 6-14.00
--
RECONSTRUCTION OF THE
KY 536 INTERCHANGE WITH I71/I75

Plan Scale 1" = 20'



Hole No.	#1043	#1044	#1045	#1046	#1047	#1048
Station	203+97	204+50	205+04	205+01	205+68	205+61
Offset	38 FT. LT.	67 FT. LT.	24 FT. LT.	62 FT. LT.	28 FT. LT.	65 FT. LT.
Elev. (Sea level datum)	945.6	939.8	951.5	937.0	951.5	937.5

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale



#1043

Qu (psf)	w%	LI	
2663.0	29	0.38	A-7-6(20), CL, S+C=79(59+20)
	17	-0.05	A-6(17), CL, S+C=97(76+21)

R (933.6)

#1044

R (926.2)

#1045

Qu (psf)	w%	LI	
4998.7	18	-0.01	A-6(9), CL, S+C=75(67+8)
2887.4	14	-0.32	A-7-6(23), CH, S+C=81(53+28)
3239.4	17	0.19	A-6(7), CL, S+C=58(50+8)
	17	0.00	A-6(8), CL, S+C=66(53+16)
	18		N=50/0.3'

R (927.7)

Top of weathered rock=928.0
No RDZ encountered

#1046

R (925.2)

#1047

Qu (psf)	w%	LI	
	17	-0.03	A-7-6(12), CL, S+C=63(48+15)
1601.4	20	0.24	A-6(12), CL, S+C=77(64+13)
2047.0	20	0.32	A-6(11), CL, S+C=78(64+14)
2405.5	21	0.06	A-7-6(29), CH, S+C=87(55+32)
			N=41
	7		N=50/0.3', A-4(0), SM, S+C=42(39+3)

R (924.2)

#1048

R (926.7)

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

𝕮𝖔𝖒𝖒𝖔𝖓𝖜𝖊𝖆𝖑𝖙𝖍 𝖔𝖋 𝕶𝖊𝖓𝖙𝖚𝖈𝖐𝖞
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE: **KY 536**
CROSSING: **RETAINING WALL STA. 203+92 TO STA. 205+77**

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 - 7-11-19

SHEET NO.
DRAWING NO.

S–047–2016

SHEET 1 OF 1

ITEM NUMBER
6–14.00

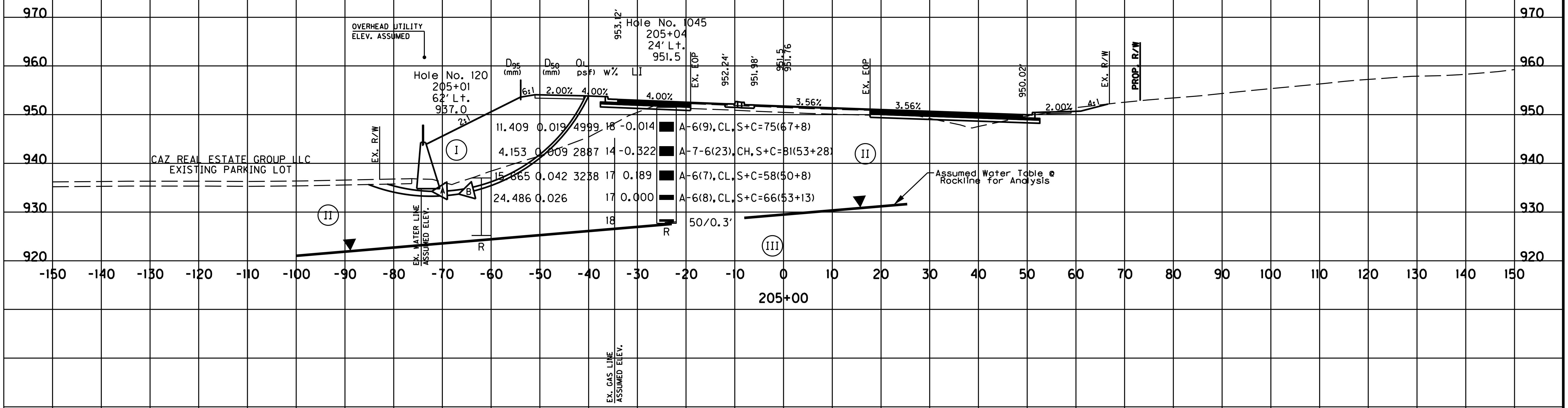
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\1155079\NEW PROJECT FILES\RETAINING WALLS\S-047-2016.DGN
USER: kjmankin
DATE PLOTTED: May 10, 2017
E-SHEET NAME:
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	**6-14.00**	

SUMMARY OF TRIAXIAL TEST DATA	
STATION	RAMP A-1, 11100+45
OFFSET	59′ Lt.
DEPTH	(8-10′)
c	374 psf
ϕ	12°
$\bar{c}$	307 psf
$\bar{\phi}$	18°

ASSUMED SOIL STRENGTH PARAMETERS			
SOIL	I	II	III
SHORT TERM	γ = 115 pcf c = 0 psf ϕ = 37°	γ = 128 pcf c = 374 psf ϕ = 12°	γ = 140 pcf c = 2000 psf ϕ = 40°
LONG TERM	γ = 115 pcf $\bar{c}$ = 0 psf $\bar{\phi}$ = 37°	γ = 128 pcf $\bar{c}$ = 307 psf $\bar{\phi}$ = 18°	γ = 140 pcf $\bar{c}$ = 2000 psf $\bar{\phi}$ = 40°

FACTORS OF SAFETY		
SHORT TERM	A	1.6
LONG TERM	B	1.7



SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

EMBANKMENT STABILITY SECTION
KY 536
STA 205+00

Addendum 2 - 7-11-19

MicroStation v8.11.9.832
E-SHEET NAME:
USER: kjmankin
DATE PLOTTED: July 13, 2017
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\1155079\NEW PROJECT FILES\6-14_KY536-DCD_CROSS-SECTIONS.DGN

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall, except for cases where the wall height (ft.) is over 8 ft. In such a case, the embedment depth shall be 1/4 H, per note 1 of Std. Dwg. RGX-002-09.

Use wall dimensions in accordance with Case III of the Standard Drawing RGX-002.

Backfill this wall with Granular material as outlined on this sheet.

The base of the wall shall be extended to bear on existing stiff to very stiff cohesive soil.

Station Interval	Bearing Surface	Factored Presumptive Bearing Resistance at the Service Limit State
ML 203+92 TO 205+77, LT	Undisturbed Soil	2.3 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Embankment	0	38	110
Foundation Soils Existing	1200	0	121

Where external granular backfill is required, place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible, as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

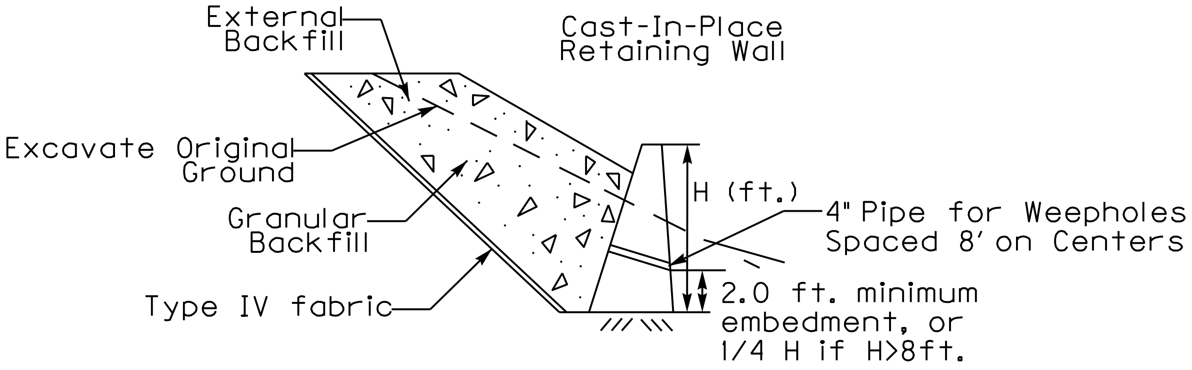
Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

The footing concrete should be placed as soon as possible after the footing excavation is made.

The wall designer shall verify wall stability based on final design dimensions.

If undercutting is required the undercut should expose suitable stiff to very stiff cohesive soils and be backfilled with class B concrete. Granular embankment shall not be allowed for use to backfill the undercut.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\GEOTECHNICAL NOTES S-047-2016.DGN

USER: kjmankin
DATE PLOTTED: August 3, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

S–047–2016

ITEM NUMBER
6–014.00

DATE:
DESIGNED BY:
DETAILED BY: K. MANKIN
CHECKED BY
J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536

CROSSING
RETAINING WALL @ ML STA. 203+92 TO STA. 205+77, LT

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 7-11-19

SHEET NO.

DRAWING NO.

COORDINATE DATA SUBMISSION FORM - PROPOSED RETAING WALL S-047-2016						
KYTC Division of Structural Design - Geotechnical Branch						
County:		**Boone**				
Road Number:		**KY 536 & I-75 (Reconstruct I-75 Interchange with KY 536, Mt. Zion Road**				
Item:		**6-14.00**				
MARS		**8022203D**				
Project #:		**FD52 008 0075 177-179D**				
Hole Number	**Latitude**	**Longitude**	**Station Number**	**Offset**	**Elevation**	**Hole Depth**
1043	38.9575216	-84.6217467	20397	38 LT	945.57	12
1044	38.9576390	-84.6215790	20450	67 LT	939.80	13.6
1045	38.9575640	-84.6213540	20504	24 LT	951.50	23.8
1046	38.9576533	-84.6213872	20501	62 LT	937.04	11.8
1047	38.9575880	-84.6211490	20568	28 LT	951.50	27.3
1048	38.9576862	-84.6211607	20561	65 LT	937.54	10.8

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

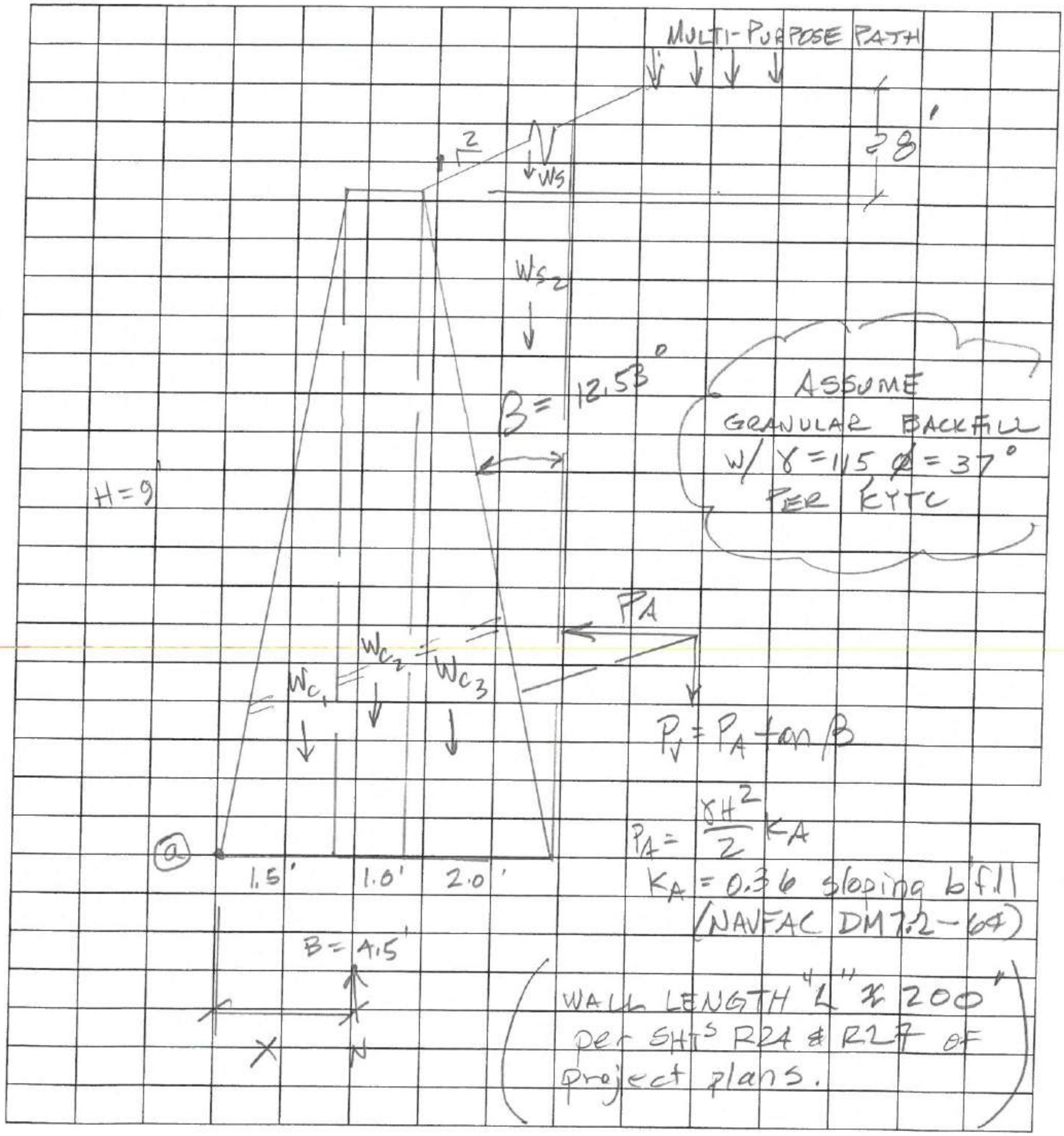
Date: 11/7/16

Structure No.: S-047-2016

Sheet 1

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III



ASSUME GRANULAR BACKFILL w/ $\gamma = 115$ $\phi = 37°$ PER KYTC

$P_V = P_A \tan\beta$

$P_A = \frac{\gamma H^2}{2} K_A$

$K_A = 0.36$ sloping b'fill (NAVFAC DM7.2-64)

(WALL LENGTH "L" ≈ 200' per SHT^S R24 & R27 of project plans.)

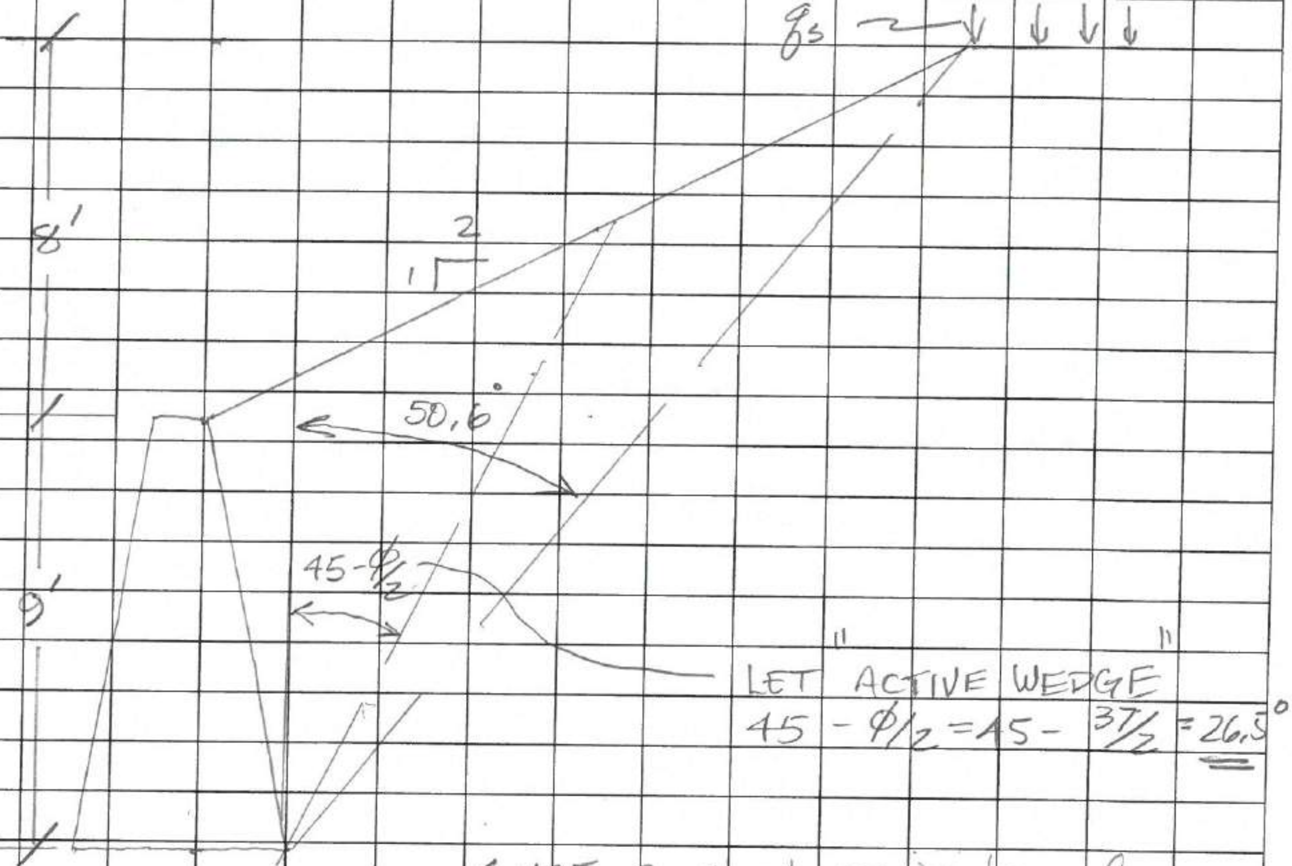
Addendum 2 -- 7-11-19

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 11/7/16
Structure No.: S-047-2016

Terracon
Sheet 2

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III



LET ACTIVE WEDGE
$45 - \phi/2 = 45 - 37/2 = \underline{\underline{26.5^{\circ}}}$

SINCE q_s surcharge is beyond Active wedge, neglect it.

$P_A = \frac{\gamma H^2}{2} K_A = \frac{.115(9)^2}{2}(0.36) = 1.68$ k/FT, UNFACTORED

$P_V = 2.61 \tan\beta = 1.68(\tan 12.53^{\circ}) = 0.37$ k/FT, UNFACTORED

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 11/7/16
Structure No.: S-047-2016

Terracon
Sheet 3

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

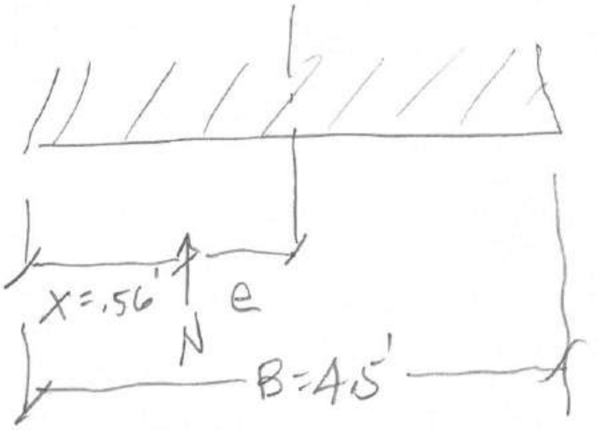
AREA	UNFACTORED RESULTANT, K/FT.	LOAD FACTOR	FACTORED LOAD, K/FT.	ARM	MOMENT ABOUT @
W_{c_1}	6.75 FT²(.15) = 1.01	.9	.91	1.0	.91 FT-K/FT.
W_{c_2}	9(.15) = 1.35	.9	1.22	2.0	2.44
W_{c_3}	9(.15) = 1.35	.9	1.22	3.16	3.86
W_{s_1}	2(.115) = .23	1.0	.23	3.83	.88
W_{s_2}	9(.115) = 1.04	1.0	1.04	3.83	3.98
P_A	1.68	1.5	2.52	-3.0	-7.56
P_V	.37	1.0	.37	4.5	1.67
N^*			4.99	-X	-4.99X

$$\Sigma M_{@} = 0 \Rightarrow -4.99x = 6.18$$

$$x = 1.24$$

* WHERE $N = \Sigma F_V = W_{c_1} + W_{c_2} + W_{c_3} + W_{s_1} + W_{s_2} + P_V$

$= .91 + 1.22 + 1.22 + .23 + 1.04 + .37 = 4.99$ K/FT, FACTORED



$e = \frac{B}{2} - x = 2.25 - 1.24 = 1.01'$

For Soil bearing, e must be within middle 2/3 of base (AASHTO 11.6.3.3).

$4.5 \times \frac{2}{3} = 3.0'; \frac{3.0}{2} = 1.5 > 1.01'$

OK ✓

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 11/7/16
Structure No.: 5-047-2016

Part 3: Check Bearing Capacity

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.35	*Fig. C11.56-2, page 11-11*
Concrete Weight	1.25	
Live Load Surcharge	1.75	*(applied above rear wall batter, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φb):	0.55	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent: Gravity Walls*

Nominal Bearing = qn = c x (Nc) x (1+0.3(B/L)) + (ϒ x D) *Ref.: NAVFAC DM 7.2, p. 131, Fig. 1*
Factored Bearing Resistance = qn x φb, ksf
Applied Bearing = V/B, ksf

LET $C = 1.2$ KSF (Ref.: Lab tests @ Borings 1043, 1045 & 1047 which were below BOT/FTG. Elev... lowest value was Sample #4 @ Boring 1047..., $q_u = 2406$ psf, $\gamma_T = 121$ pcf

$N_c = 5.53$ (Ref.: NAVFAC DM 7.2-131)

Per AASHTO ¶ 10.6.1.3, eccentrically-loading footings should be evaluated for bearing resistance using an effective area, $B' \times L'$, where $B' = B - 2e$ & $L' = L - 2e$.

From SHT 3, $e = 1.01' \Rightarrow B' = 4.5 - 2(1.01) = 2.48'$
$L' = 200 - 2(1.01) = 197.98'$

Let $D = 2'$

Unfactored Bearing Resistance $= q_n = 1.2(5.53)\left(1 + 0.3\left(\frac{2.48}{197.98}\right)\right) + .121(2)$
$= 6.90$ KSF

Factored Bearing Resistance $= q_n \times \phi_b = 6.9(0.55) = \underline{3.8}$ KSF

Factored Applied Bearing Stress $= \left[W_{c_1} + W_{c_2} + W_{c_3} + W_{s_1} + W_{s_2} + P_V\right] \times \frac{\text{LOAD FACTORS}}{B'}$
$= \left[(1.01 + 1.35 + 1.35)(1.25) + (0.23 + 1.04)(1.35) + 0.37(1.35)\right] / B'$
$= \left[6.85\ ^{K}/_{FT}\right] / 2.48' = \underline{\underline{2.8}}$ KSF

3.8 KSF > 2.8 KSF OK ✓

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)

Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft. (AASHTO Fig. 10.6.3.4-1)

Applied Horizontal Resultant = Pa, kips/ft.

$R_r = \phi_\tau \cdot S_u$ governs if bearing directly on cohesive soil. However, if >6" of granular soil is placed below the wall foundation, the lesser of the two formulas shown above applies.

For this case, assume direct cohesive soil bearing.

From sht. 4, Let $s_u = c = 1.6$ ksf.

$R_r = \phi_\tau \cdot s_u = 1.0(1.6\ \text{ksf}) = 1.6\ \text{ksf}$

$1.6\ \text{ksf} \times B = 1.6(4.5\ \text{ft.}) = \underline{\underline{7.2\ ^k/\text{FT}}}$

vs.

Applied Factored Resultant $= P_A \times 1.5 = 1.68\ ^k/\text{FT.}(1.5)$
$= \underline{\underline{2.52\ ^k/\text{FT}}}$

↳ SHT. 2 Granular B'fill

$7.2\ ^k/\text{FT.} > 2.52\ ^k/\text{FT.} \Rightarrow$ OK ✓ for Granular B'fill

Now check to see if cohesive backfill can be used...

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/17/17
Structure No.: 5-047-2016

Terracon
Sheet 6

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

Assume Cohesive Backfill w/ $\gamma = 125$ pcf, $\phi = 24°$ & 2H:1V backslope

Per NAVFAC DM 7.2-64, $K_A = 0.85$

$$P_A = \frac{\gamma H^2}{2} K_A = \frac{.125(9)^2}{2}(.85) = 4.3\ ^K/_{FT.}$$

$$P_V = P_A \tan\beta = 4.3 \tan(12.53°) = .96\ ^K/_{FT.}$$

Area	Unfactored Resultant (K/FT)		Load Factor	Factored Load, K/FT.	Arm	Moment about @, ft-K/Ft.
W_{c1}	1.01	(sht. 3)	.9	.91	1.0	.91
W_{c2}	1.35	(")	.9	1.22	2.0	2.44
W_{c3}	1.35	(")	.9	1.22	3.16	3.86
W_{s1}	.23	(")	1.0	.23	3.83	.88
W_{s2}	1.04	(")	1.0	1.04	3.83	3.98
P_A	4.3		1.5	6.45	-3.0	-19.35
P_V	.96		1.0	.96	4.5	4.32
N	$= \Sigma F_V$			5.58	-x	-5.58x

5.58x = -2.96

⟹ NO GOOD; x = -.53
NEED WIDER BASE

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/17/17
Structure No.: S-047-2016

Terracon

Sheet 7

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case III

TRY INCREASING HEEL by 1.5' making $B_{new} = 6'$

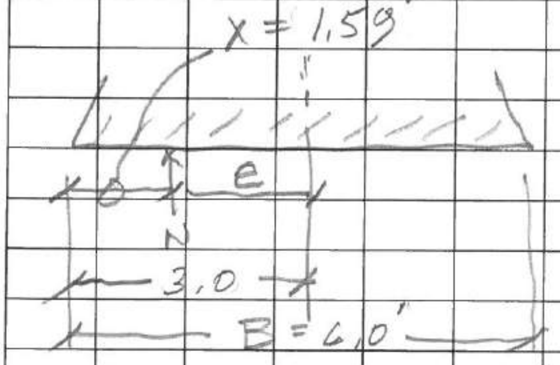
$\beta_{new} = 21.3°$, $P_A = 4.3^k/FT$, (cohesive b'fill)

$P_V = P_A \tan\beta = 1.67\ ^k/FT$

Area	Unfactored Resultant, ft-k	Load Factor	Factored Load, ft-k	Arm	Moment about @, ft-k/ft.
W_{c1}	1.01 (sht. 3	.9	.91	1.0	.91
W_{c2}	1.35 (")	.9	1.22	2.0	2.44
W_{c3}	15.75 ft^2(.15) = 2.36	.9	2.12	3.67	7.77
W_{s1}	3.06 ft^2 (.125) = .38	1.0	.38	4.83	1.84
W_{s2}	15.75(.125) = 1.97	1.0	1.97	4.83	9.52
P_A	4.3	1.5	6.45	-3	-19.35
P_V	1.67	1.0	1.67	6.0	10.02
$N = \Sigma F_V$			8.27	-x	-8.27 x

$8.27x = 13.15$

$x = 1.59'$



$e = 3.0 - 1.59 = 1.41$

$6 \times \frac{2}{3} = 4$

$\frac{4}{2} = 2.0 > 1.41'$ OK ✓

For cohesive b'fill

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/17/17
Structure No.: S-047-2016

Terracon
Sheet 8

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)
Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft.
(AASHTO Fig. 10.6.3.4-1)

Rr = ϕτ x su applies only if bearing directly on cohesive soil. If > 6" granular material is placed below the foundation, then the lesser of the two formulas provided here applies.

Applied Horizontal Resultant = Pa, kips/ft.

For this case, assume direct bearing on cohesive soil.
From sht, 4, Let $C = S_u = 1.6$ KSF.
$R_r = \phi_\tau \cdot S_u = 1.0(1.6) = 1.6$ KSF... $1.6 \times B = 1.6(6')$
$= \underline{9.6}$ k/FT.

VS.

Applied Factored Resultant $= P_A \times 1.5$
$= 4.3$ k/FT $(1.5) = \underline{6.45}$ k/FT.
→ SHT. 6
cohesive b'fill

9.6 k/Ft. > 6.45 k/FT. ⇒ ok

Summary – Granular B'fill ok @ B = 4.5'
Cohesive " ok if B ≥ 6'
(w/ heel increased from 2.0 to 3.5')

(S-048-2016) Consultant

M E M O R A N D U M

TO: William McKinney, PE
TEBM
Division of Structural Design

FROM: Bart Asher, PE, LS
Director
Division of Structural Design

BY: Michael Carpenter, PE MC
Geotechnical Branch

DATE: August 11, 2017

SUBJECT: Geotechnical Engineering Structure Foundation Report
Boone County
Reconstruct the Interchange with KY 536 (MT. Zion Road) South of Florence
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall Biltmore Connector, Rt. Sta. 26+15 to 27+00
Item No. 6-14.00
Terracon Project No. N1155079

The geotechnical engineering report for this structure has been completed by Terracon Consulting Engineers and Scientists. We have reviewed and concur with the recommendations as presented in this report.

A copy of the report is attached. If you have any questions, please contact this office at 502-564-2374

cc: J. Van Zee
R. Powell
B. Yeager
R. Franxman
R. Turner
E. Drury
B. Greene
J. Schroeder (Terracon)
C. Callan-Ramler
J. Hager

Attachment

Geotechnical Engineering Retaining Wall Report Structure No. S-048-2016

Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
STRUCTURE No. S-048-2016
Boone County, Kentucky

August 3, 2017
Terracon Project Number N1155079

Prepared for:
Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

August 3, 2017

Kentucky Transportation Cabinet
Division of Structural Design-Geotechnical Branch
1236 Wilkinson Blvd.
Frankfort, Kentucky 40601-1200

Attn: Mr. Michael Carpenter, PE
Geotechnical Engineer
P: 502-782-3837
F: 502-564-4839
E: michael.carpenter@ky.gov

Re: Geotechnical Engineering Retaining Wall Report
Structure No. S-048-2016
Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
Boone County, Kentucky
Terracon Project Number: N1155079

Dear Mr. Carpenter:

Terracon Consultants, Inc. (Terracon) is submitting this Geotechnical Engineering Retaining Wall Report for the above referenced structure. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning the retaining wall foundations.

1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/I-71 Interchange with KY 536 (Mt. Zion Road) in Boone County, Kentucky. Stantec is the lead design engineer on the project. Terracon Consultants, Inc. was selected to perform the geotechnical services through our Statewide Engineering Contract. Terracon's services included laboratory testing and engineering services. The field exploration phase was conducted by Thelen Associates, Inc. (now Geotechnology, Inc.) working under a separate Statewide contract with KYTC.

A new “double crossover diamond” interchange is planned with the KY 536 pavement lanes continuing to run beneath the existing I-75 bridge. The project involves reconstruction along KY 536 (Mt. Zion Road), new ramps, a new multi-use path along the northern edge of KY 536, as well as improvements, extensions, and realignments to various side roads that include Biltmore Blvd., Biltmore Drive, Investment Way, Sam Neace Drive, and about 1300 ft. of US 25.

This report addresses the geotechnical-recommendations for one of the proposed retaining walls on the project, namely Structure S-048-2016. The wall location is shown on the attached Project Location Map. As shown, the retaining wall is planned on the south edge of the Biltmore Connector, just east of its intersection with Sherwood Lakes Drive. The total wall length will be about 90 feet.

A gravity retaining wall was evaluated at this location. The proposed total wall height will be about 8 ft. There is a 4H:1V design backslope above the wall with no additional surcharge loading at the slope crest.

2.0 SITE TOPOGRAPHY AND GEOLOGICAL CONDITIONS

The project area lies in a dissected upland of the Outer Bluegrass Region. Ground elevations along the overall project route generally range from about Elev. 870 ft. to about 950 ft. Grades generally rise to the east. The existing ground surface elevation at the base of the wall is about 918 ft.

Surface drainage in the project vicinity is generally dendritic with most flow towards the South Branch of Gunpowder Creek, which lies west of I-75. The Ohio River lies about 8 miles north of the site and has a normal pool elevation of 455 ft.

Geologic mapping indicates the project area is underlain by limestone and shale of the Bull Fork Formation and Ordovician System. Mapping shows the limestone comprises as much as about 95 percent of the rock mass. No known karst features are mapped in the project area.

The USGS Soil Survey shows that the uppermost soils along the project site comprise mostly of Rossmoyne Silt Loam with lesser amounts of Jessup Silt Loam (a wind-blown loess) and Faywood Silty Clay (residuum).

3.0 SUBSURFACE EXPLORATIONS

An exploration plan was developed by Terracon after a review of the available plans, profiles, and cross-sections provided by Stantec. The draft exploration plan was subsequently reviewed and approved by KYTC Geotechnical Branch. Some borings were relocated during the field program due to access, utility conflicts, etc.

Three test borings were drilled along the alignment of Structure S-048-2016 as shown on the attached site plan. The borings were offset due to access issues on the existing slope and existing vegetation. These borings included one rock core hole and two rockline soundings. A summary of these three borings is provided below.

Table 3.0: Summary of Test Borings

Boring	Samples	Approx. Top/Weathered Bedrock, ft.	Approx. Top/Weathered Rock Elev., ft.	Approx. Depth to RDZ, ft.
1051	None	Refusal @ 10.3	915.6	N/A
1052	1 UD’s, 1 SPT plus coring	8.0	916.8	9.5
1053	None	Refusal @ 8.1	915.1	N/A

UD: Undisturbed (Shelby tube) sample
SPT: Standard Penetration Test sample
RDZ: Rock Disintegration Zone

Refer to the attached Subsurface Data Sheet for the location of the borings, subsurface logs, and soil test results.

The rock core log (Boring 1052) below the RDZ revealed gray limestone and shale with close fractures and some heavy weathering at the fractures. Kentucky RQD values were 0% and core recoveries ranged from about 96% to 100%.

4.0 LABORATORY TESTING AND RESULTS

A laboratory testing program was assigned to the thin-walled tubes and approved by the KYTC Geotechnical Branch. The laboratory tests were conducted by Terracon in accordance with the appropriate AASHTO or Kentucky Methods as outlined in the Geotechnical Manual. The results of the laboratory tests are depicted graphically on the Subsurface Data Sheet.

The laboratory testing program on undisturbed samples in the overburden soil zone included classification testing; results are summarized on the following page.

Table 4.0: Summary of Laboratory Test Results

Station	Offset	Hole	Sample	AASHTO	USCS	U.C., psf	Silt+Clay, %
26+50	14 ft. RT	1052	1	A-7-6(27)	CL	-	87(58+29)

U.C.: Unconfined compressive strength

5.0 ENGINEERING ANALYSES

The gravity-type retaining wall for Structure S-048-2016 was analyzed at its maximum proposed height of 8 feet and at the design backslope of 4H:1V. Analyses included overturning, bearing capacity, and sliding. Slope stability analyses were not conducted since the embankment height and depth to bedrock were small.

The proposed retaining wall was were evaluated assuming cohesive soil wall backfill. For this case, drainage would still be required in the form of a drainage medium placed on the back face of the wall to prohibit hydrostatic pressures from developing and to allow drainage through weep holes.

For the foundation, bedrock is anticipated to be close to design foundation level (see attached profile illustration). Therefore, it is assumed that the retaining wall will be supported on bedrock or an undercut performed to bedrock and replaced with granular fill. The bearing capacity analysis was based on granular soil bearing conditions.

A summary of soil parameters used in the analyses is provided below.

Table 5.0: Summary of Assumed Soil Parameters

Item	Moist Unit Weight, pcf	Effective Internal Friction, Φ	Cohesion, psf
Cohesive Soil Wall Backfill	125	24 degrees	0
Granular Backfill for Foundation Undercut	115	37 degrees	0

Results of the analyses for a gravity wall are summarized below:

Overturning with cohesive soil wall backfill – satisfied safety criteria of having the resultant fall within the middle 9/10's of the foundation (for rock-bearing conditions).

Bearing Capacity with cohesive soil wall backfill – satisfied minimum safety (factored resistance greater than applied factored bearing stress) for bearing on bedrock or granular embankment after undercutting to bedrock.

Sliding Resistance with cohesive soil wall backfill bearing on granular soil replacement or bedrock– satisfied the minimum safety criteria (factored resistance was greater than applied factored resultant).

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.0 RECOMMENDATIONS

6.1 The gravity wall dimensions should meet KYTC's Standard Drawing RGX-002-09 (12-1-15), Case II.

6.2 A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.3 Design the gravity retaining wall to bear within undisturbed weathered or unweathered shale and limestone bedrock. If bedrock is not present at design bearing elevation, undercut to expose bedrock and replace with "Granular Embankment", non-erodible only, meeting the material requirements of Section 805 of the Standard Specifications for Road and Bridge Construction, current edition.

6.4 The gravity retaining wall can be backfilled with cohesive soil. For this case, a drainage medium is required on the back face of the wall to prohibit hydrostatic pressures from developing and to allow drainage through the specified weep holes. Alternatively, the wall can be backfilled with Granular Embankment. The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches.

6.5 If Granular Embankment is utilized as wall backfill, place a Type IV Geotextile Fabric between the contact points of the soil and Granular Embankment. The Geotextile fabric shall be in accordance with Sections 214 and 843 of the Standard Specifications, current edition.

6.6 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

6.6 The plans should indicate that solid rock excavation will be required to reach footing elevations.

6.6 Wall construction and backfilling should be completed in accordance with KYTC specifications.

7.0 PLAN NOTES

7.1 Add the attached plan sheet, “Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls” at the appropriate locations in the plans.

8.0 CLOSING

The analysis and conclusions presented in this report are based upon the data obtained from the test borings performed by others at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur away from the borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident over the short term. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If KYTC is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use by KYTC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We appreciate the opportunity to be of service to you on this project. Please contact us with any questions concerning this report.

Respectfully submitted,

Terracon Consultants, Inc.

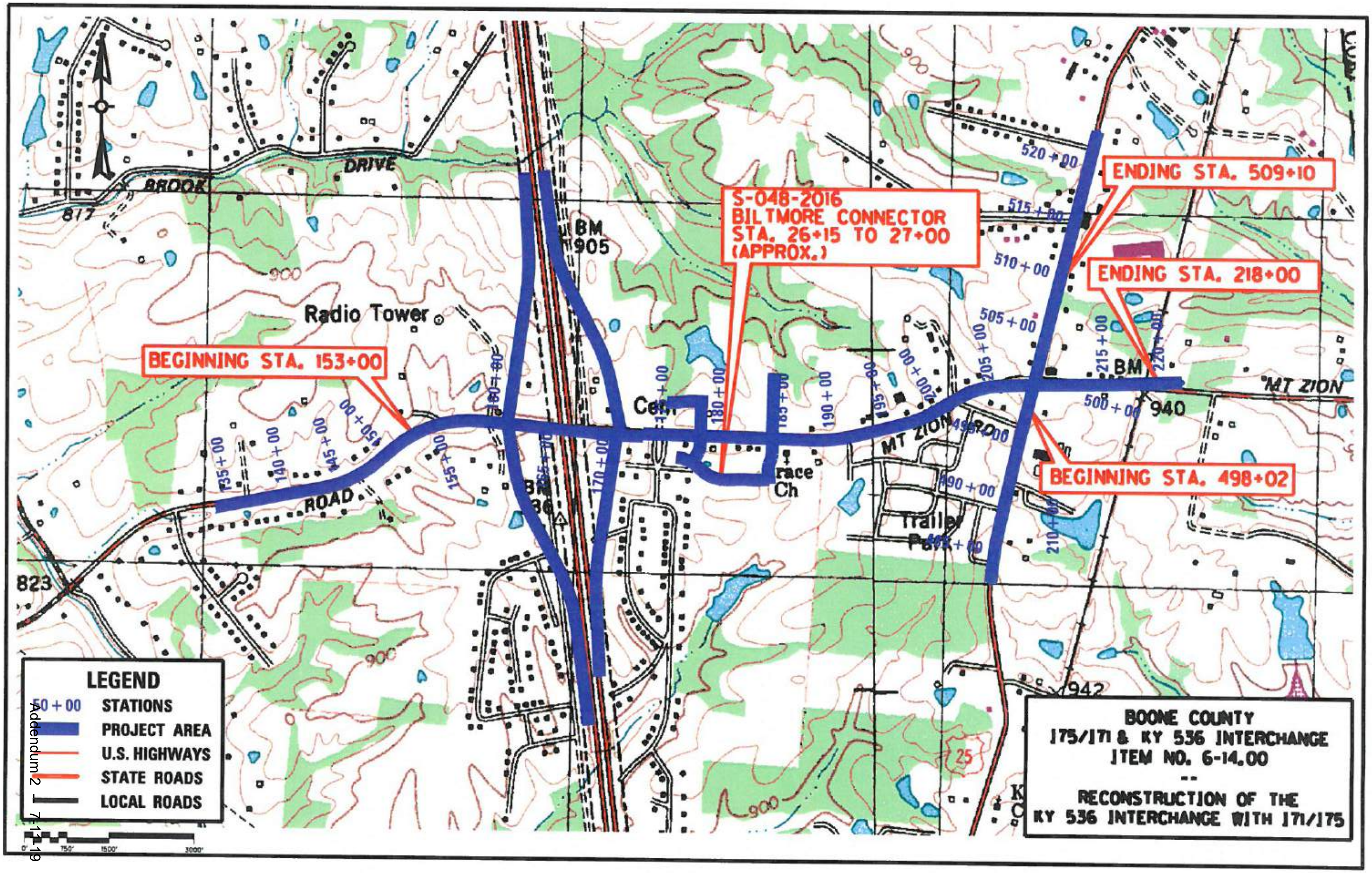
Jess a. Sch

Jess A. Schroeder, P.E.
Senior Geotechnical Engineer

Jess a. Sch
for Aaron J. Muck

Aaron J. Muck, P.E.
Senior Geotechnical Engineer

Attachments:
- Project Location Plan
- Subsurface Data Sheets (2 each)
- Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls
- Coordinate Data Form
- Calculations


BOONE COUNTY
I75/I71 & KY 536 INTERCHANGE
ITEM NO. 6-14.00
--
RECONSTRUCTION OF THE
KY 536 INTERCHANGE WITH I71/I75

BEGINNING STA. 153+00

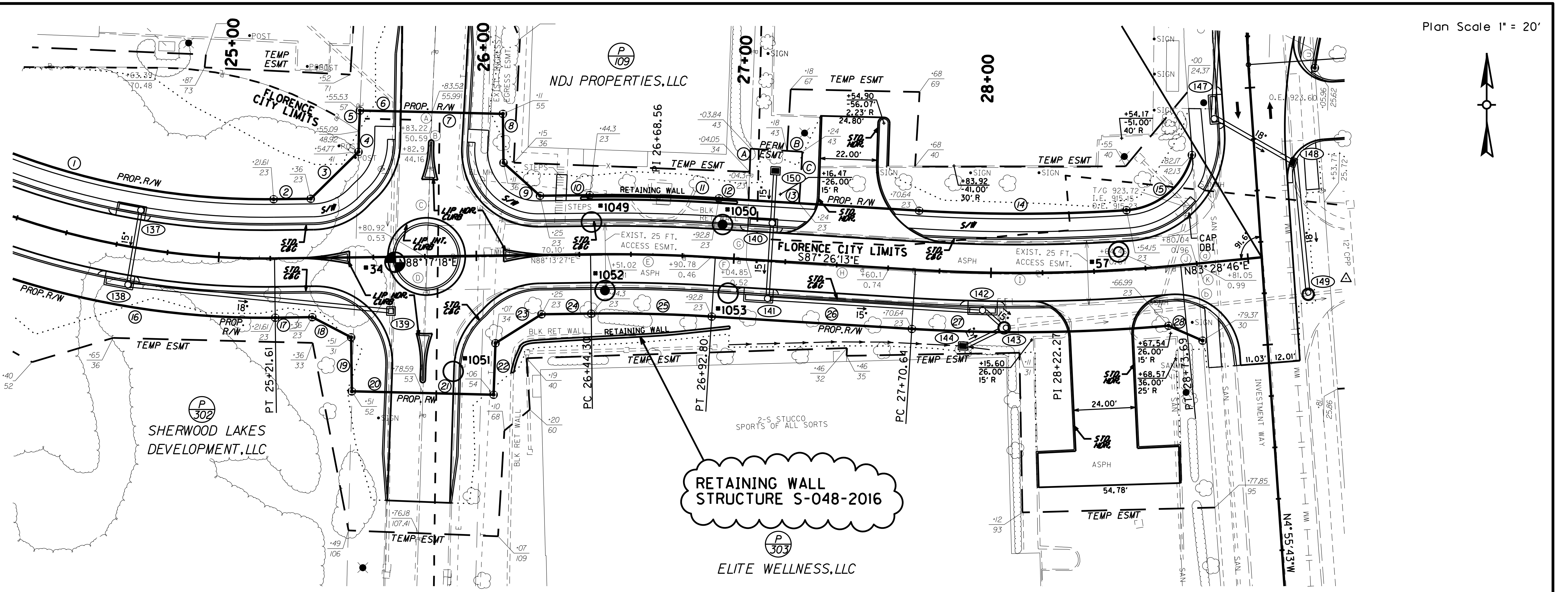
ENDING STA. 509+10

ENDING STA. 218+00

BEGINNING STA. 498+02

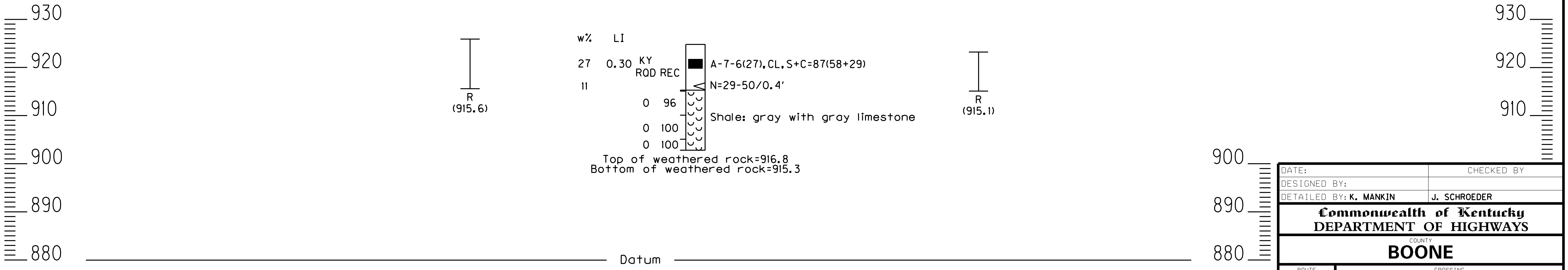
S-048-2016
BILTMORE CONNECTOR
STA. 26+15 TO 27+00
(APPROX.)

Plan Scale 1" = 20'



Hole No. Station Offset Elev. (Sea level datum)	#1051 25+90 45 FT. RT. 925.9	#1052 26+50 14 FT. RT. 924.8	#1053 26+99 27 FT. RT. 923.2

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale



S–048–2016

SHEET 1 OF 1

ITEM NUMBER
6–14.00

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 536	RETAINING WALL STA. 26+15 TO STA. 27+00

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 - 7-11-19

SHEET NO.

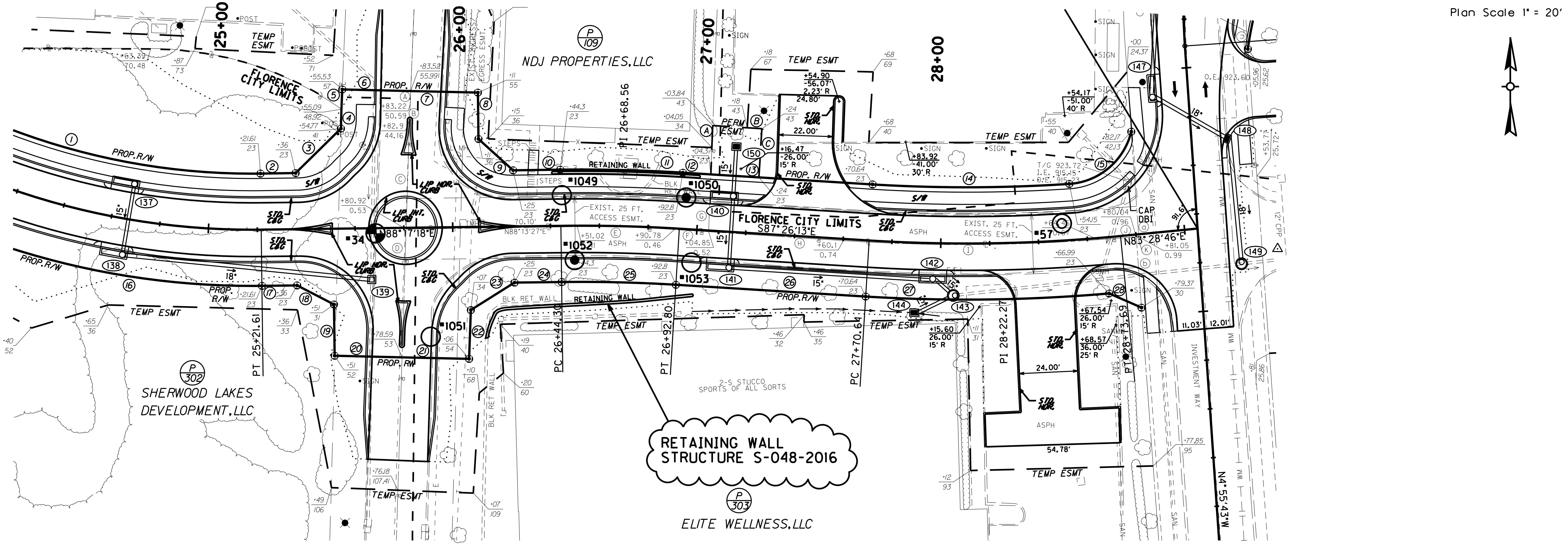
DRAWING NO.

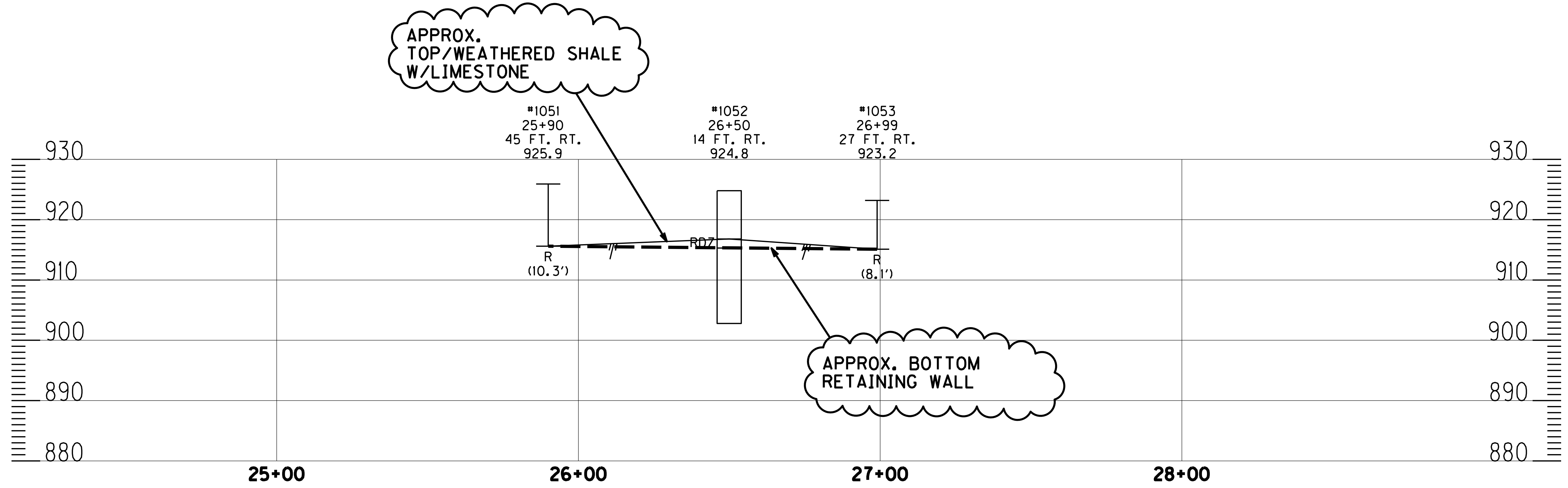
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\S-048-2016.DGN

USER: kjmankin
DATE PLOTTED: May 10, 2017

E-SHEET NAME:

MicroStation v8.11.9.832





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USER: kjmankin
DATE PLOTTED: March 9, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

SHEET 1 OF 1

S–048–2016

ITEM NUMBER
6–14.00

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536

CROSSING
RETAINING WALL STA. 26+15 TO STA. 27+00

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 7-11-19

SHEET NO.

DRAWING NO.

MicroStation v8.11.9.832
E-SHEET NAME:
USER: kjmankin
DATE PLOTTED: August 3, 2017
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\115\115079\NEW PROJECT FILES\RETAINING WALLS\GEOTECHNICAL NOTES S-048-2016.DGN

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Use wall dimensions in accordance with Case II of the Standard Drawing RGX-002 except that the minimum embedment shall be 2 ft. regardless of wall height.

Backfill this wall with Granular material or Cohesive soil as outlined on this sheet.

The base of the wall shall be extended to bear on weathered or unweathered bedrock. If bedrock is not present at design bearing elevation, undercut to expose bedrock and replace with "Granular Embankment", non-erodible only, meeting the material requirements of Section 805 of the Standard Specifications for Road and Bridge Construction, current edition.

Station Interval	Bearing Surface	Factored Presumptive Bearing Resistance at the Service Limit State
Biltmore Connector 26+15 TO 27+00, RT	Weathered or Unweathered Bedrock, or Granular Embankment after undercutting to bedrock	6.8 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Embankment	0	37	115
Cohesive Soil (Alternate)	0	24	125

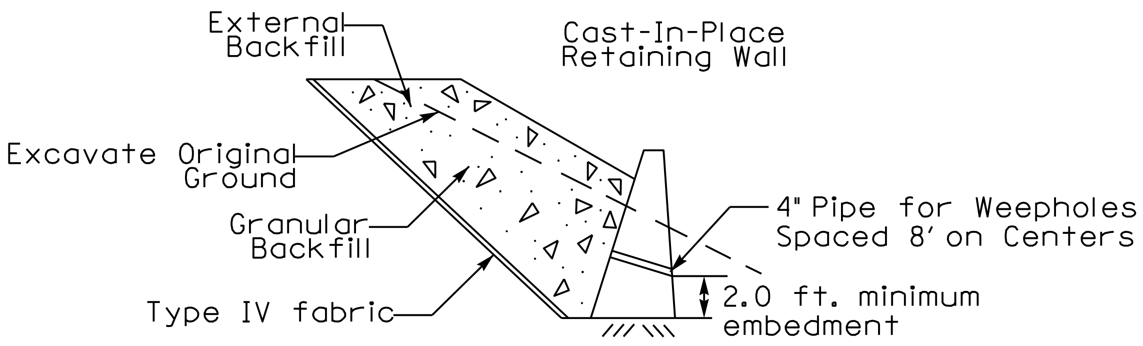
Where external granular backfill is required, place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible, as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

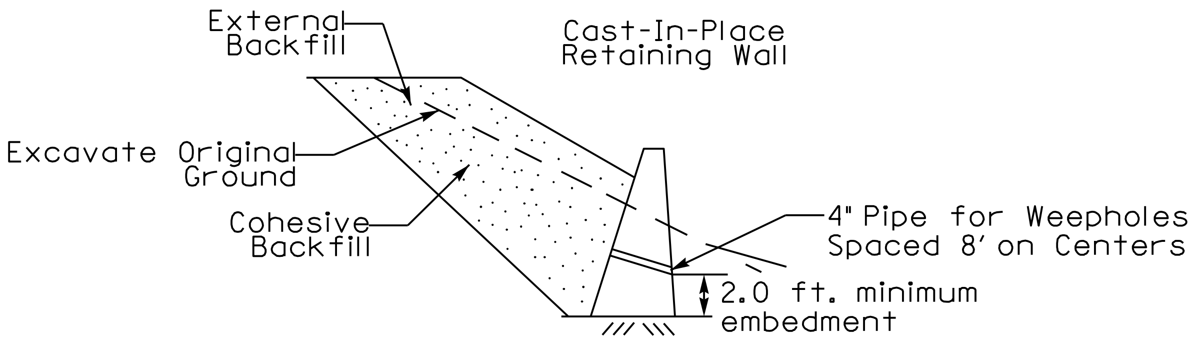
Solid rock excavation will be required for installation of this retaining wall. The footing concrete should be placed as soon as possible after the footing excavation is made. If the bedrock becomes softened at bearing elevation, the softened material shall be undercut to suitable bearing material prior to placing the concrete.

The wall designer shall verify wall stability based on final design dimensions.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



S–048–2016

ITEM NUMBER
6–014.00

DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 536	RETAINING WALL @ STA. 26+15 TO STA. 27+00, RT

SUBSURFACE DATA

PREPARED BY
Terracon
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611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 - 7-11-19

SHEET NO.

DRAWING NO.

COORDINATE DATA SUBMISSION FORM - PROPOSED RETAINING WALL S-048-2016

KYTC Division of Structural Design - Geotechnical Branch

County:		**Boone**				
Road Number:		**KY 536 & I-75 (Reconstruct I-75 Interchange with KY 536, Mt. Zion Road**				
Item:		**6-14.00**				
MARS		**8022203D**				
Project #:		**FD52 008 0075 177-179D**				
Hole Number	**Latitude**	**Longitude**	**Station Number**	**Offset**	**Elevation**	**Hole Depth**
1051	38.9551358	-84.6292998	2590	45 RT	925.90	10.3
1052	38.9552230	-84.6290925	2650	14 RT	924.82	22
1053	38.9552204	-84.6289246	2699	14 RT	923.18	8.1

Gravity Retaining Wall Calculations

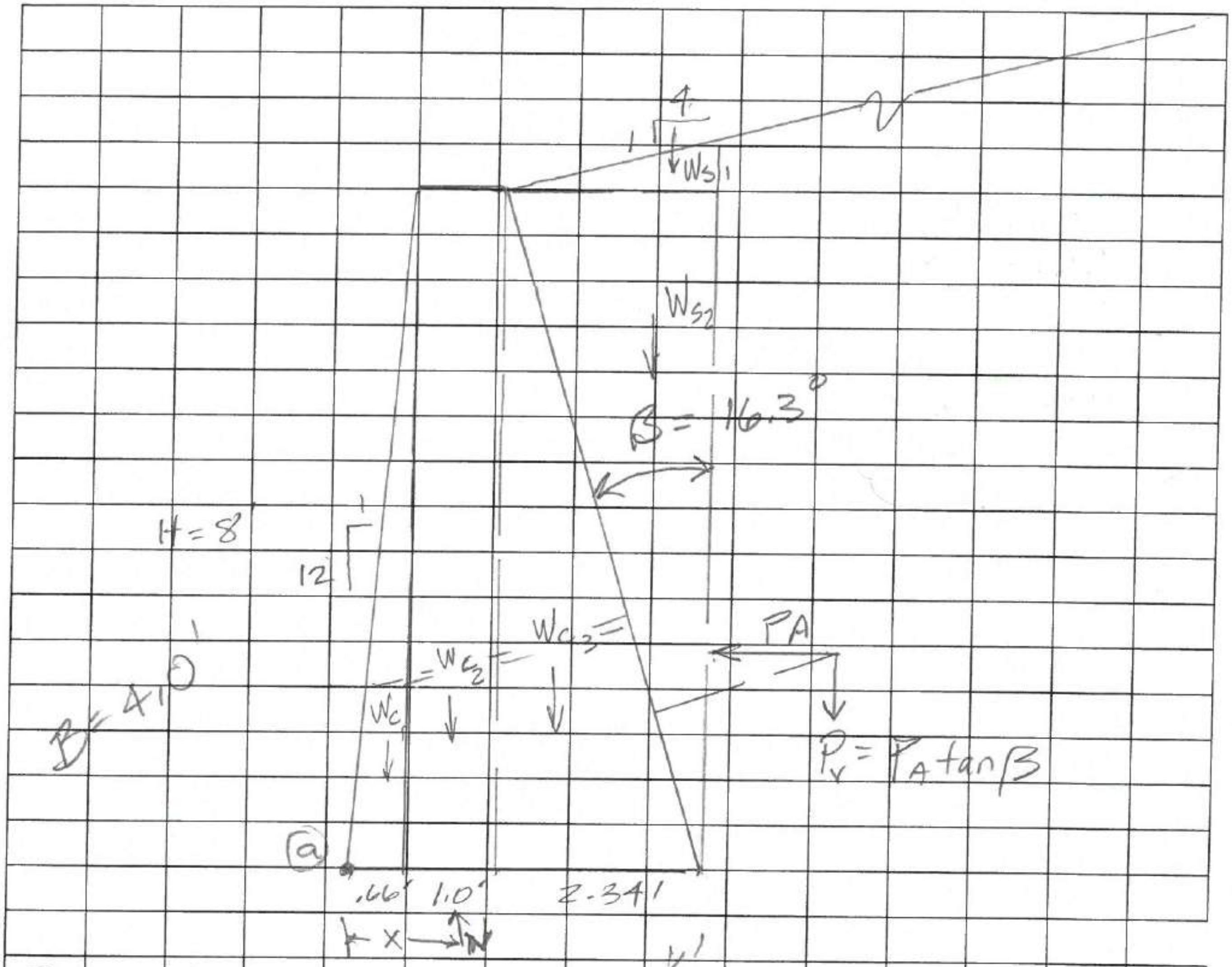
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 11/7/16
Structure No.: S - 048 - 2016

Terracon

Sheet 1

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case II



ROADWAY IS LOCATED ABOUT 16½' BACK FROM WALL HEEL WHICH IS WELL OUTSIDE ACTIVE WEDGE. NEGLECT TRAFFIC SURCHARGE.

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 12/20/16

Structure No.: 5-048-2016

Terracon

Sheet 2

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case II

Assume cohesive soil backfill w/drainage board
(NO hydrostatic pressure)

Let ϕ backfill = 24° (NAVFAC DM 7.2-39)
$\gamma = 125$ pcf for CL/CH soil
K_A (sloping backfill @ 4:1) = .53
∴ NAVFAC DM-7.2-64

$$P_A = \frac{.125}{2}(8)^2(0.53) = 2.12\ ^{K}/_{FT.}$$

$$P_V = P_A \tan \beta = .62\ ^{K}/_{FT}$$

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: S-048-2016

Terracon
Sheet 3

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

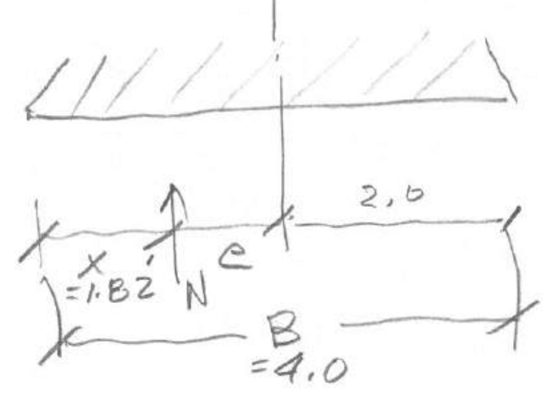
AREA	UNFACTORED RESULTANT (K/FT)	LOAD FACTOR	FACTORED LOAD (K/FT)	ARM	MOMENT ABOUT ⓐ
W_{C_1}	2.64 ft² (.15) = .40	.9	.36	.44	.16 ft-k/FT.
W_{C_2}	8.0 (.15) = 1.20	.9	1.08	1.16	1.25
W_{C_3}	9.36 (.15) = 1.40	.9	1.26	2.43	3.06
W_{S_1}	.68 (.125) = .09	1.0	0.09	3.22	.29
W_{S_2}	9.36 (.125) = 1.17	1.0	1.17	3.22	3.77
P_A	2.12	1.5	3.18	-2.67	-8.49
P_V	0.62	1.0	.62	4.0	2.48
N^*			4.58	-x	-4.58x

$$\Sigma M_a = 0 \Rightarrow 4.58x = 2.52$$

$$x = 1.82$$

$$* \text{ WHERE: } N = \Sigma F_V = W_{C_1} + W_{C_2} + W_{C_3} + W_{S_1} + W_{S_2} + P_V$$

$$= .36 + 1.08 + 1.26 + .09 + 1.17 + .62 = 4.58^k/\text{FT, FACTORED}$$



$$e = \frac{B}{2} - x = \frac{4}{2} - 1.82 = .18'$$

For Rock-bearing, AASHTO 11.6.3.3 states resultant must fall within mid-9/10 of base... $\frac{9}{10}(B) = 3.6'$

$$\frac{3.6}{2} = 1.8' > 0.18', \text{ OK}$$

Part 3: Check Bearing Capacity

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.35	*Fig. C11.56-2, page 11-11*
Concrete Weight	1.25	
Live Load Surcharge	1.75	*(applied above rear wall batter, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φb):	0.55	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent: Gravity Walls*

Nominal Bearing = qn = c x (Nc) x (1+0.3(B/L)) + (ϒ x D) *Ref.: NAVFAC DM 7.2, p. 131, Fig. 1*
Factored Bearing Resistance = qn x φb, ksf
Applied Bearing = V/B, ksf

The foundation will be constructed on bedrock or granular backfill placed after undercutting to bedrock.

Let $\phi = 37°$, $\gamma = 115$ pcf for granular fill (per KYTC)

$D = 2'$

$N_q = 40$ (Ref.: NAVFAC DM 7.2-131)

$N_\gamma = 55$ (")

$B = 4'$... Per AASHTO ¶ 10.6.1.3, eccentrically loaded footings should be evaluated for bearing resistance using an effective area, $B' \times L'$, where $B' = B - 2e$, $L' = L - 2e$. From sht. 2, $e = 0.18'$. $\Rightarrow B' = 4 - 2(.18) = 3.64'$

for granular Material, $q_n = \gamma D N_q + \frac{\gamma B}{2} N_\gamma$ = nominal, unfactored resistance
(Ref.: NAVFAC DM-7.2-131)

$$q_n = .115(2)(40) + \frac{.115(3.64)}{2}(55) = \underline{20.7}\ \text{KSF}$$

$$\text{FACTORED RESISTANCE} = q_n \times \phi_b = 20.7(.55) = \underline{\underline{11.4\ \text{KSF}}}$$

APPLIED FACTORED BEARING STRESS =

$$= \left[(W_{c_1} + W_{c_2} + W_{c_3})(1.25) + (W_{S_1} + W_{S_2} + P_V)(1.35)\right] / B'$$

$$= \left[(.40 + 1.20 + 1.40)(1.25) + (.09 + 1.17 + .62)(1.35)\right] / 3.64$$

$$= \underline{\underline{1.73\ \text{KSF}}}$$

$11.4\ \text{KSF} > 1.73\ \text{KSF}$ OK ✓

Date: 12/20/16
Structure No.: 5-048-2016

Part 4: Check Sliding

LRFD Load Factors:			
	Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
	Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
	Concrete weight	0.9	
	Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):		1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

→ Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)

Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft. (AASHTO Fig. 10.6.3.4-1)

Applied Horizontal Resultant = Pa, kips/ft.

Assume rock-bearing or undercut to rock & replace w/granular fill.

$R_r = \phi_r V \tan\phi$, where $V = \Sigma F_V$, factored

From Sht. 3, $V = 4.58$ k/FT.

Assume granular replacement material is compacted to $N \gtrsim 30 \Rightarrow$ Let $\phi = 36°$ (AASHTO Table 10.4.6.2.4-1)

$R_r = 1.0(4.58)\tan 36° = \underline{3.33}$ k/FT. = Factored Resistance

VS.

Applied Factored Resultant = P_A × Load Factor = 2.12×1.5 = $\underline{3.18}$ k/FT

3.3 k/FT. > 3.2 k/FT. ⇒ OK ✓

- COHESIVE WALL BACKFILL OK
- UNDERCUT FDN. TO ROCK & BACKFILL W/ GRANULAR

(S-049-2016) Consultant

MEMORANDUM

TO: William McKinney, PE
TEBM
Division of Structural Design

FROM: Bart Asher, PE, LS
Director
Division of Structural Design

BY: Michael Carpenter, PE MC
Geotechnical Branch

DATE: August 11, 2017

SUBJECT: Geotechnical Engineering Structure Foundation Report
Boone County
Reconstruct the Interchange with KY 536 (MT. Zion Road) South of Florence
FD52 008 0075 178-180 D; FedNum: 000IM0757130
Mars No. 8022203D
Retaining Wall Biltmore Connector, Lt. Sta. 26+40 to 27+00
Item No. 6-14.00
Terracon Project No. N1155079

The geotechnical engineering report for this structure has been completed by Terracon Consulting Engineers and Scientists. We have reviewed and concur with the recommendations as presented in this report.

A copy of the report is attached. If you have any questions, please contact this office at 502-564-2374

cc: J. Van Zee
R. Powell
B. Yeager
R. Franxman
R. Turner
E. Drury
B. Greene
J. Schroeder (Terracon)
C. Callan-Ramler
J. Hager

Attachment

Geotechnical Engineering Retaining Wall Report Structure No. S-049-2016

Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
STRUCTURE No. S-049-2016
Boone County, Kentucky

August 3, 2017
Terracon Project Number N1155079

Prepared for:
Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio

August 3, 2017

Kentucky Transportation Cabinet
Division of Structural Design-Geotechnical Branch
1236 Wilkinson Blvd.
Frankfort, Kentucky 40601-1200

Attn: Mr. Michael Carpenter, PE
Geotechnical Engineer
P: 502-782-3837
F: 502-564-4839
E: michael.carpenter@ky.gov

Re: Geotechnical Engineering Retaining Wall Report
Structure No. S-049-2016
Reconstruct I-75 Interchange with KY 536
(Mt. Zion Road)
State No. 8022203D
Item No. 6-014.00
Boone County, Kentucky
Terracon Project Number: N1155079

Dear Mr. Carpenter:

Terracon Consultants, Inc. (Terracon) is submitting this Geotechnical Engineering Retaining Wall Report for the above referenced structure. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning the retaining wall foundations.

1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/I-71 Interchange with KY 536 (Mt. Zion Road) in Boone County, Kentucky. Stantec is the lead design engineer on the project. Terracon Consultants, Inc. was selected to perform the geotechnical services through our Statewide Engineering Contract. Terracon's services included laboratory testing and engineering services. The field exploration phase was conducted by Thelen Associates, Inc. (now Geotechnology, Inc.) working under a separate Statewide contract with KYTC.

Terracon Consultants, Inc. 611 Lunken Park Drive Cincinnati, Ohio 45226
P [513] 321 5816 terracon.com

Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

A new “double crossover diamond” interchange is planned with the KY 536 pavement lanes continuing to run beneath the existing I-75 bridge. The project involves reconstruction along KY 536 (Mt. Zion Road), new ramps, a new multi-use path along the northern edge of KY 536, as well as improvements, extensions, and realignments to various side roads that include Biltmore Blvd., Biltmore Drive, Investment Way, Sam Neace Drive, and about 1300 ft. of US 25.

This report addresses the geotechnical-recommendations for one of the proposed retaining walls on the project, namely Structure S-049-2016. The wall location is shown on the attached Project Location Map. As shown, the retaining wall is proposed on the north edge of the Biltmore Connector, just east of its intersection with Sherwood Lakes Drive. The wall will have a total length of about 60 feet and support a cut slope. The proposed total wall height will range from about 5 to 6 ft. and support a cut slope with a backslope of about 4H:1V. No additional surcharge loading has been considered upslope of the wall.

2.0 SITE TOPOGRAPHY AND GEOLOGICAL CONDITIONS

The project area lies in a dissected upland of the Outer Bluegrass Region. Ground elevations along the overall project route generally range from about Elev. 870 ft. to about 950 ft. Grades generally rise to the east. The existing ground surface elevations generally range from about 926 to 929 ft. along the proposed wall alignment.

Surface drainage in the project vicinity is generally dendritic with most flow towards the South Branch of Gunpowder Creek, which lies west of I-75. The Ohio River lies about 8 miles north of the site and has a normal pool elevation of 455 ft.

Geologic mapping indicates the project area is underlain by limestone and shale of the Bull Fork Formation and Ordovician System. Mapping shows the limestone comprises as much as about 95 percent of the rock mass. No known karst features are mapped in the project area.

The USGS Soil Survey shows that the uppermost soils along the project site comprise mostly of Rossmoyne Silt Loam with lesser amounts of Jessup Silt Loam (a wind-blown loess) and Faywood Silty Clay (residuum).

3.0 SUBSURFACE EXPLORATIONS

An exploration plan was developed by Terracon after a review of the available plans, profiles, and cross-sections provided by Stantec. The draft exploration plan was subsequently reviewed and approved by KYTC Geotechnical Branch. Some borings were relocated during the field program due to access, utility conflicts, etc.

Two test borings were drilled near the alignment of Structure S-049-2016 and were offset due to access issues. These borings included one rock core boring and one rockline sounding. A summary of the borings is provided below.

Table 3.0: Summary of Test Borings

Boring	Samples	Approx. Top/Weathered Bedrock, ft.	Approx. Top/Weathered Rock Elev., ft.	Approx. Depth to RDZ, ft.
1049	None	Refusal @ 11.9	913.9	N/A
1050	2 UD's, 1 SPT plus rock core	8.0'	916.2	8.5'

UD: Undisturbed (Shelby tube) sample
SPT: Standard Penetration Test sample
RDZ: Rock Disintegration Zone

The rock core log for Boring 1050 below the RDZ revealed gray limestone and shale with close fractures and some heavy weathering at the fractures. Kentucky RQD values were 0 % and the core recovery was about 100%.

Refer to the attached Subsurface Data Sheet for the location of the borings, subsurface logs, and soil test results.

4.0 LABORATORY TESTING AND RESULTS

A laboratory testing program was assigned to the thin-walled tubes and approved by the KYTC Geotechnical Branch. The laboratory tests were conducted by Terracon in accordance with the appropriate AASHTO or Kentucky Methods as outlined in the Geotechnical Manual. The results of the laboratory tests are depicted graphically on the Subsurface Data Sheet.

The laboratory testing program on undisturbed samples in the overburden soil zone included classification and compressive strength testing; results are summarized below.

Table 4.0: Summary of Laboratory Test Results

Station	Offset	Hole	Sample	AASHTO	USCS	U.C., psf	Silt+Clay, %
26+96	13 ft. LT	1050	1	A-7-6(30)	CL	4262	94(57+37)

5.0 ENGINEERING ANALYSES

The gravity-type retaining wall for Structure S-049-206 was analyzed at its maximum proposed height of 6 feet with a 4H:1V back slope. Analyses included overturning, bearing capacity, and sliding. Slope stability analyses were not conducted due to the low slope height.

Two backfilling conditions were evaluated: granular wall backfill and cohesive soil wall backfill. Additionally, the foundation was assumed to bear directly on cohesive soil.

A summary of soil parameters used in the analyses is provided below.

Table 5.0: Summary of Assumed Soil Parameters

Item	Unit Weight, pcf	Effective Internal Friction, Φ	Cohesion, psf
Granular Wall Backfill	115	37 degrees	0
Cohesive Soil Wall Backfill	125	24 degrees	0
Cohesive Foundation Soil	125	0 degrees	2130

Results of the gravity wall analyses are summarized below:

Overturning with granular wall backfill **–** satisfied safety criteria of having the resultant fall within the middle 2/3's of the foundation (for soil-bearing conditions). The case where cohesive soil wall backfill was assumed did not satisfy overturning requirements unless the foundation width was increased beneath the "heel" portion by 6 inches.

Bearing Capacity – satisfied minimum safety (factored resistance greater than applied factored bearing stress).

Sliding Resistance – with granular soil wall backfill satisfied minimum safety criteria (factored resistance was greater than applied factored resultant). When the wall base was widened by 6 inches (per overturning analysis results), the cohesive soil wall backfill case satisfied the minimum safety criteria.

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.0 RECOMMENDATIONS

6.1 The gravity wall dimensions should meet KYTC's Standard Drawing RGX-002-09 (12-1-15), Case II, with the possible exception stated in Paragraph 6.3 below.

6.2 A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternate.

6.3 Design the gravity retaining wall to bear directly upon stiff to very stiff undisturbed cohesive soil. In the event that undercutting is required during construction (for example, to remove soft pockets or layers), the undercut should expose suitable stiff to very stiff cohesive soils and be backfilled with class B concrete. Granular Embankment should not be allowed for use to backfill the undercut.

6.4 The backfill behind the wall shall consist of "Granular Embankment" extending on a 1H:1V slope from the base of the wall. The Granular Embankment shall be non-erodible only, meeting the material requirements of Section 805 in the Standard Specifications for Road and Bridge Construction, current edition. Contrary to the Standard Specifications, the maximum size limit for Granular Embankment is 4 inches. Alternatively, cohesive soil backfill can be used provided the foundation width shown on KYTC Std. Dwg. RGX-002-09 (12-1-15), Case II is increased by 0.5 feet in its heel section.

6.5 Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment. The Geotextile fabric shall be in accordance with Sections 214 and 843 of the Standard Specifications, current edition.

6.6 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

6.7 If cohesive soil is used as wall backfill, a drainage medium is required on the back face of the wall to prohibit hydrostatic pressures from developing and to allow drainage through the specified weep holes.

6.6 Wall construction and backfilling should be completed in accordance with KYTC specifications.

7.0 PLAN NOTES

7.1 Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls" at the appropriate locations in the plans.

8.0 CLOSING

The analysis and conclusions presented in this report are based upon the data obtained from the test borings performed by others at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur away from the borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident over the short term. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If KYTC is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use by KYTC for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We appreciate the opportunity to be of service to you on this project. Please contact us with any questions concerning this report.

Respectfully submitted,

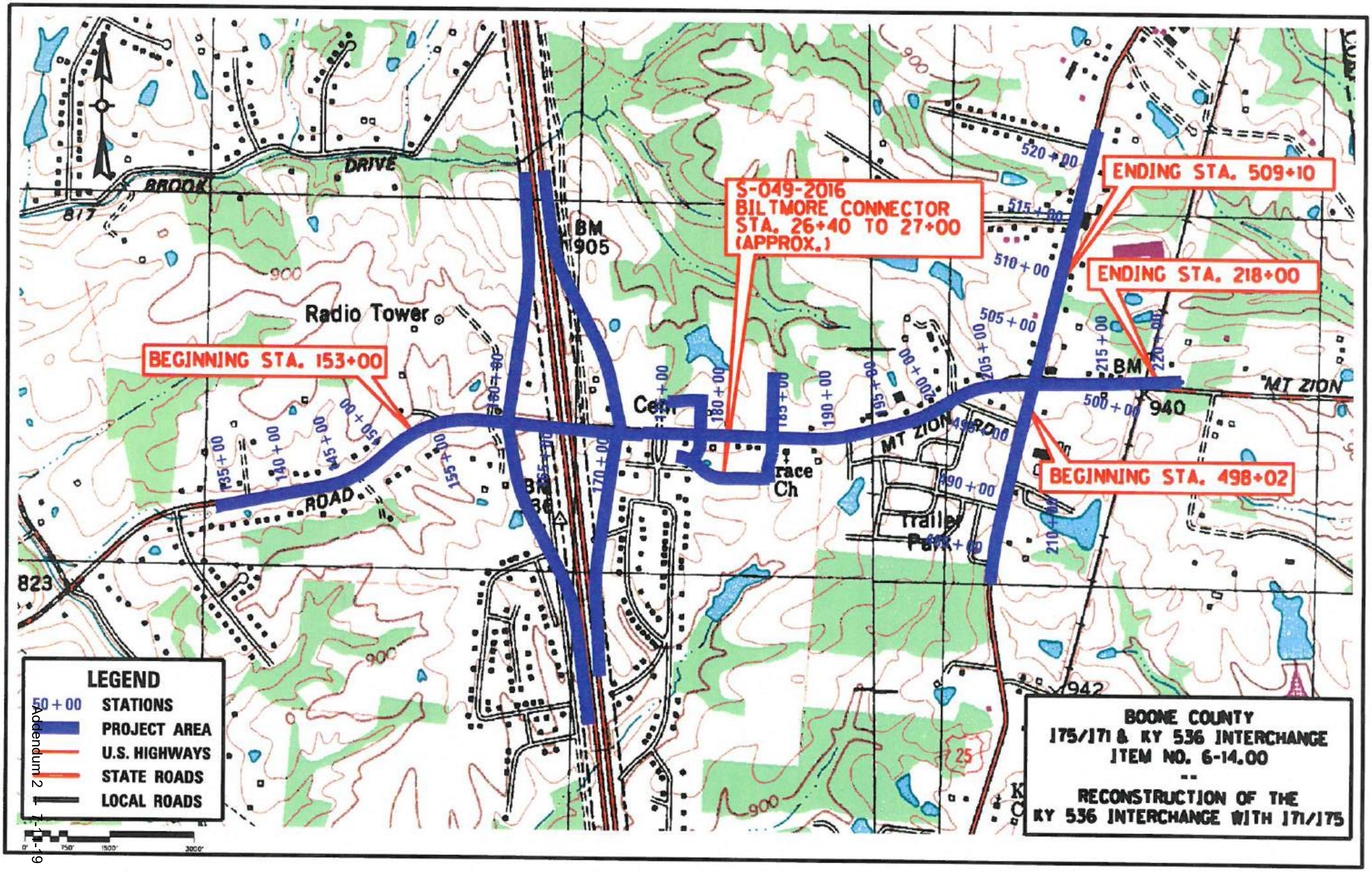
Terracon Consultants, Inc.

Jess A. Schroeder, P.E.
Senior Geotechnical Engineer

for Aaron J. Muck

Aaron J. Muck, P.E.
Senior Geotechnical Engineer

Attachments:
- Project Location Plan
- Subsurface Data Sheet
- Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls
- Coordinate Data Form
- Calculations



BOONE COUNTY
I75/I71 & KY 536 INTERCHANGE
ITEM NO. 6-14.00
--
RECONSTRUCTION OF THE
KY 536 INTERCHANGE WITH I71/I75

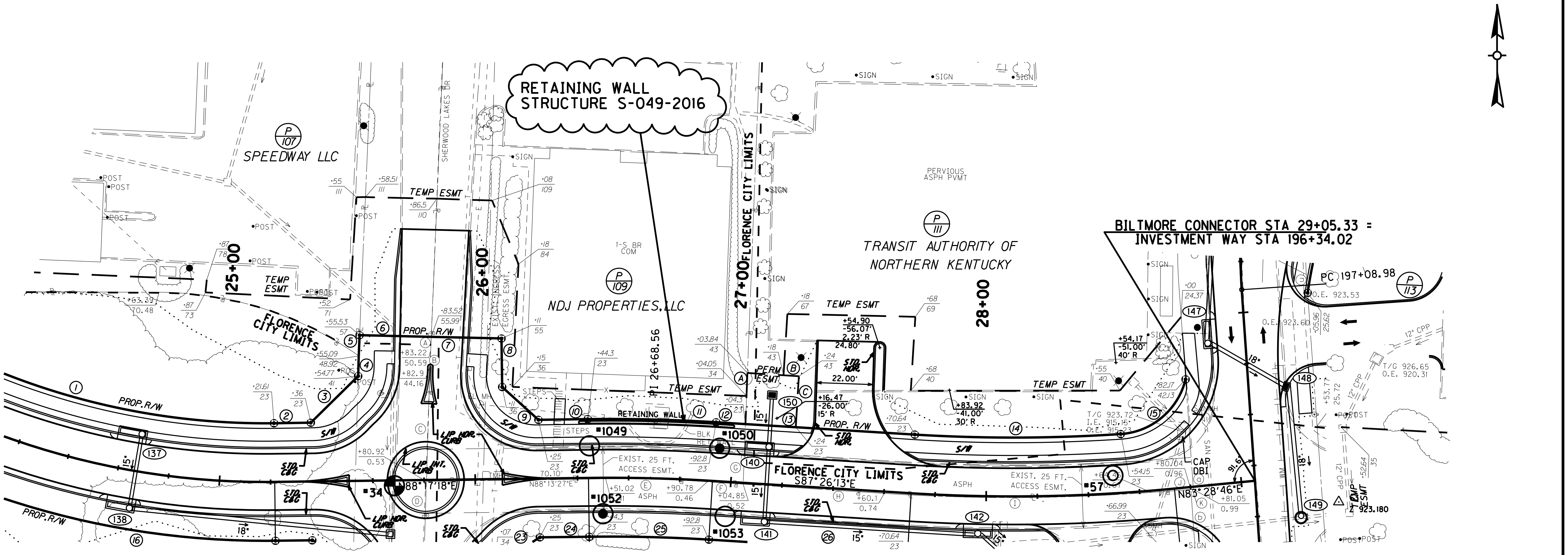
FILE NAME: N:\HCN PROJECTS\AUTOCAD\2015\1155079\NEW PROJECT FILES\RETAINING WALLS\S-049-2016.DGN

USER: kjmankin
DATE PLOTTED: July 13, 2017

E-SHEET NAME:

MicroStation v8.11.9.832

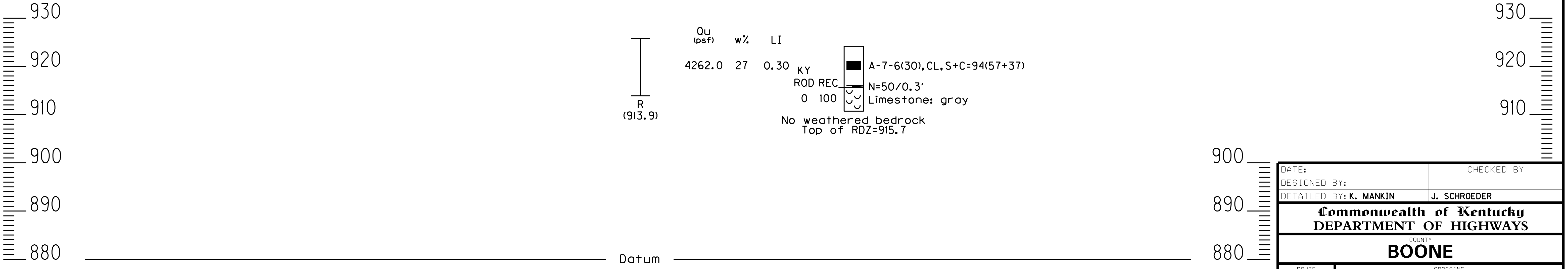
Plan Scale 1" = 20'



Hole No.
Station
Offset
Elev.
(Sea level datum)

	#1049	#1050
Station	26+45	26+96
Offset	12.5 FT. LT.	13 FT. LT.
Elev.	925.8	924.2

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale



DATE:	CHECKED BY
DESIGNED BY:	
DETAILED BY: K. MANKIN	J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 536	RETAINING WALL STA. 26+40 TO STA. 27+00

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers & Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 - 7-11-19

SHEET NO.

DRAWING NO.

S-049-2016

SHEET 1 OF 1

ITEM NUMBER
6-14.00

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Use wall dimensions in accordance with Case II of the Standard Drawing RGX-002-09.

Backfill this wall with Granular material as outlined on this sheet. Alternatively cohesive soil backfill can be used provided the foundation width shown on Standard Drawing RGX-002-09 (2-1-15) Case II is increased by 0.5 ft. in its heel section.

The base of the wall shall be extended to bear on existing very stiff cohesive soil.

Station Interval	Bearing Surface	Factored Presumptive Bearing Resistance at the Service Limit State
Biltmore Connector 26+40 TO 27+00, LT	Undisturbed Soil	4.0 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Embankment	0	37	115
Cohesive Soil (Alternate)	0	24	125
Foundation Soils Existing	2130	0	128

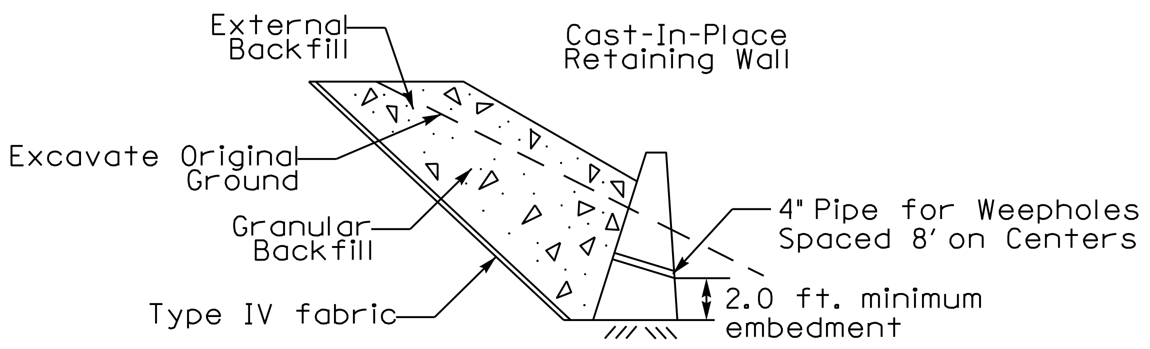
Where external granular backfill is required, place granular material as shown below. Use granular material meeting the requirements of "granular embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible, as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric in accordance with Sections 214 and 843 of the Standard Specifications, current edition, as shown below.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

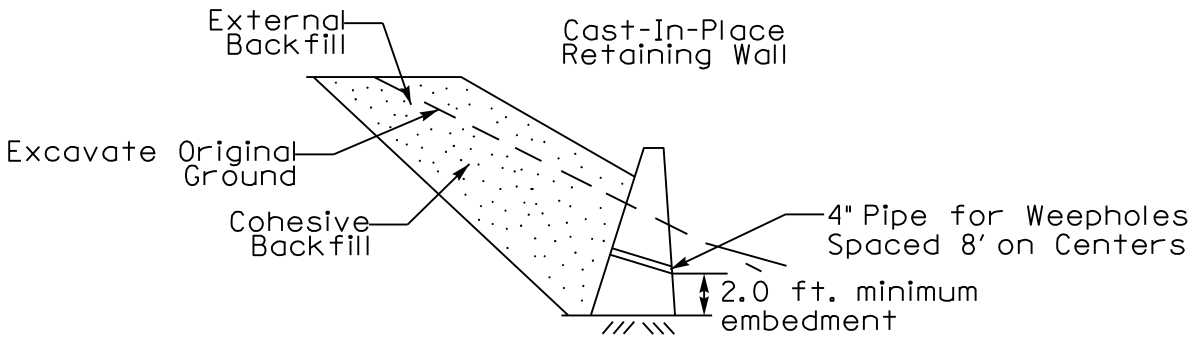
The footing concrete should be placed as soon as possible after the footing excavation is made.

The wall designer shall verify wall stability based on final design dimensions.

EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



EXTERNAL EXCAVATION AND BACKFILL REPLACEMENT



S-049-2016

ITEM NUMBER
6-014.00

DATE:
CHECKED BY
DESIGNED BY:
DETAILED BY: K. MANKIN
J. SCHROEDER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 536

CROSSING
RETAINING WALL @ STA. 26+40 TO STA. 27+00, LT

SUBSURFACE DATA

PREPARED BY
Terracon
Consulting Engineers and Scientists
611 LUNKEN PARK DRIVE CINCINNATI, OHIO 45226
PH. (513) 321-5816 FAX. (513) 321-4540

Addendum 2 7-11-19

SHEET NO.
DRAWING NO.

COORDINATE DATA SUBMISSION FORM - PROPOSEDRETAINING WALL S-049-2016						
KYTC Division of Structural Design - Geotechnical Branch						
County:		**Boone**				
Road Number:		**KY 536 & I-75 (Reconstruct I-75 Interchange with KY 536, Mt. Zion Road**				
Item:		**6-14.00**				
MARS		**8022203D**				
Project #:		**FD52 008 0075 177-179D**				
Hole Number	**Latitude**	**Longitude**	**Station Number**	**Offset**	**Elevation**	**Hole Depth**
1049	38.9552951	-84.6291117	2645	13 LT	925.80	11.9
1050	38.9552932	-84.6289327	2696	13 LT	924.17	13.5

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)

Terracon Project N1155079

Date: 12/20/16

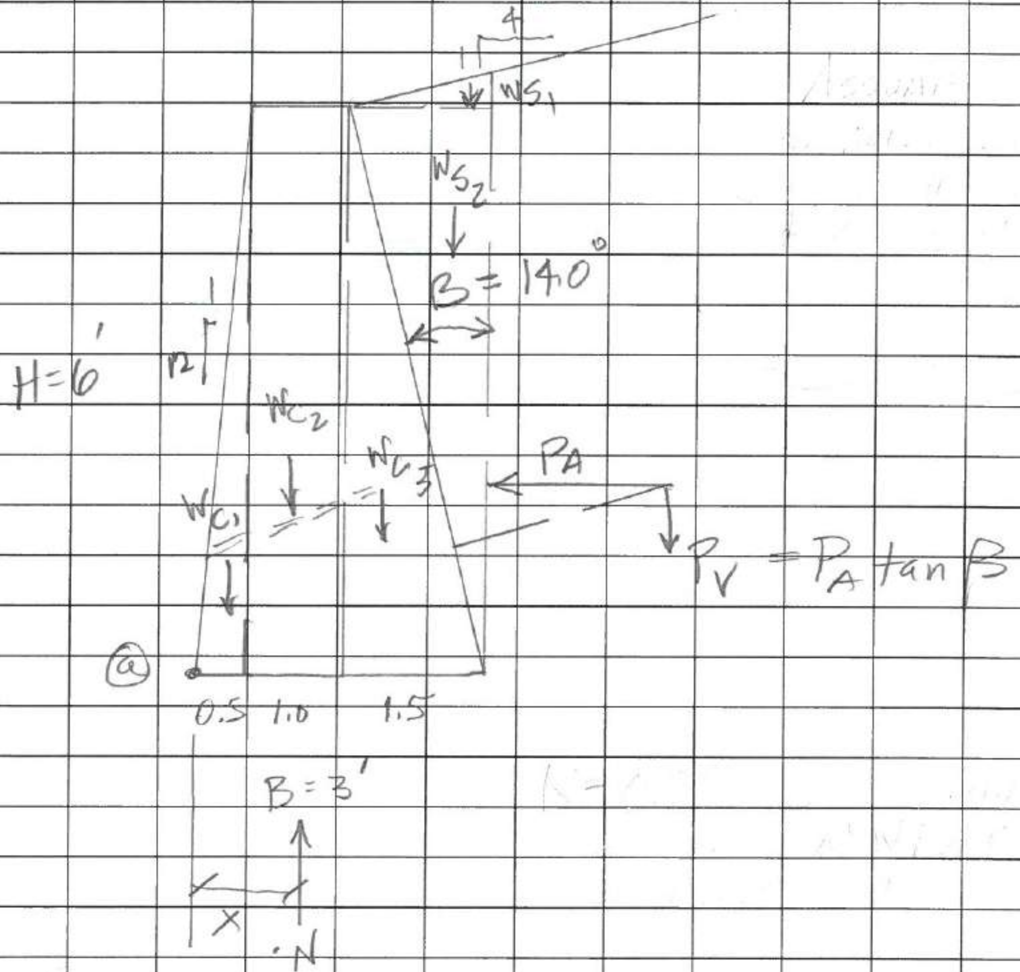
Structure No.: S-049-2016

Terracon

Sheet 1

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case II



Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: S-049-2016

Terracon

Sheet 2

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case II

Assume cohesive soil backfill with drainage board (NO hydrostatic pressure)

Let ϕ backfill = 24° (NAVFAC DM-7.2-39 for CL/OH soil)

$\gamma = 125$ pcf

KA (sloping backfill @ 4:1) = .53 ∴ NAVFAC DM-7.2-64

$P_A = \frac{.125(6)^2}{2}(.53) = 1.19$ K/FT.

$P_V = P_A \tan\beta = .30$ K/FT.

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/20/16
Structure No.: S-049-2016

Terracon
Sheet 3

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

AREA	UNFACTORED RESULTANT (K/FT.)	LOAD FACTOR	FACTORED LOAD (K/FT.)	ARM	MOMENT ABOUT ⓐ
W_{c1}	$1.5 ft^2 \times .15 = .23$	.9	.20	.33	.07 ft-k/ft
W_{c2}	$6 ft^2 \times .15 = .90$	.9	.81	1.0	.81
W_{c3}	$4.5 ft^2 \times .15 = .68$	.9	.61	2.0	1.22
W_{s1}	$.28 ft^2 \times .125 = .04$	1.0	.04	2.5	.10
W_{s2}	$4.5 ft^2 \times .125 = .56$	1.0	.56	2.5	1.40
P_A	1.19	1.5	1.79	−2.0	−3.58
P_V	.30	1.0	.30	3	.90
N^*				−x	−2.52x

$$\Sigma M_{ⓐ} = 0 \Rightarrow 2.52x = .92$$

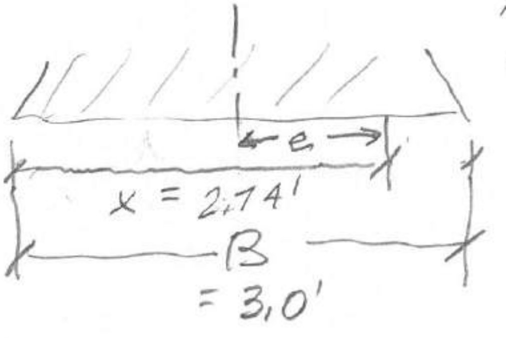
$$x = 2.74'$$

$$^{*}\text{WHERE: } N = \Sigma F_V = W_{c1} + W_{c2} + W_{c3} + W_{s1} + W_{s2} + P_V =$$

$$= .20 + .81 + .61 + .04 + .56 + .30 = 2.52 \text{ k/ft, factored}$$

$$e = 1.24'$$

AASHTO 11.6.3.3 states e must be within mid 2/3 of base for soil bearing



$$B \times \frac{2}{3} = 2.0'$$

$$\frac{2}{2} = 1.0' \ngtr 1.24' \Rightarrow \text{NO GOOD}$$

Either widen base or use granular backfill. Try granular b'fill.

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 12/12/16
Structure No.: S-049-2016

Terracon
Sheet 4

Part 2: Check Overturning

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*

Check overturning w/granular backfill having $\phi = 37°$, $\gamma = 115$ pcf (per KYTC)

$K_A = .29$ (NAVFAC DM 7.2-64 for sloping b'fill @ 4:1)

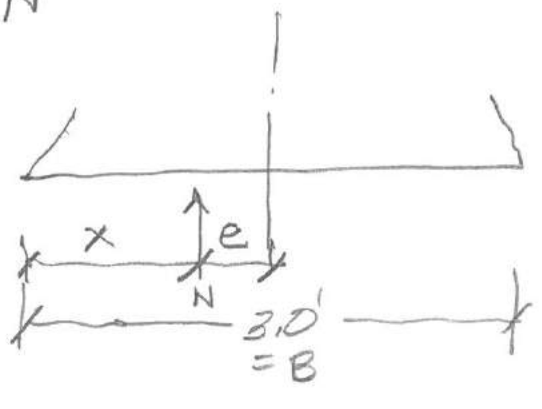
$P_A = .115 \frac{(6)^2}{2}(.29) = .60$ k/FT.

$P_V = P_A \tan\beta = .15$ k/FT.

AREA	Unfactored Load	Load Factor	Factored Load	Arm	Moment About @ ft-k/ft.
W_{c1}	.23 k/ft.	.9	.20 k/ft.	.33'	.07
W_{c2}	.90	.9	.81	1.0	.81
W_{c3}	.68	.9	.61	2.0	1.22
W_{g1}	.28 ft²(.115) = .03	1.0	.03	2.5	.08
W_{g2}	4.5 ft²(.115) = .52	1.0	.52	2.5	1.30
P_A	.60	1.5	.90	-2.0	-1.80
P_V	.15	1.0	.15	3	.45
N			2.32	-x	-2.32x

$\Sigma M_@ = 0 \Rightarrow 2.32x = 2.13$

$x = 0.92'$



$e = \frac{B}{2} - x = 1.5 - .92 = .58'$

Mid 2/3 of base $= B \times \frac{2}{3} = 2.0$

$\frac{2}{2} = 1.0 > .92 \Rightarrow$ OK✓

Addendum 2 -- 7-11-19

Part 3: Check Bearing Capacity

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.35	*Fig. C11.56-2, page 11-11*
Concrete Weight	1.25	
Live Load Surcharge	1.75	*(applied above rear wall batter, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φb):	0.55	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent: Gravity Walls*

Nominal Bearing = qn = c x (Nc) x (1+0.3(B/L)) + (Υ x D) *Ref.: NAVFAC DM 7.2, p. 131, Fig. 1*
Factored Bearing Resistance = qn x φb, ksf
Applied Bearing = V/B, ksf

Let $c = 2.13$ KSF (lab test, Boring 1050, 3-5'); $\gamma = .128$ KCF
$N_c = 5.53$ (Ref.: NAVFAC DM 7.2 - 131)

$D = 2'$
$L \cong 60'$ (Ref.: Project Dwgs, SHT. R43)

Per AASHTO ¶ 10.6.1.3, eccentrically-loaded footings should be evaluated for bearing resistance using an effective area: $B' \times L'$, where: $B' = B - 2e$, $L' = L - 2e$.
From SHT. 4, $e = 1.09' \Rightarrow B' = 3 - 2(1.09) = 0.82'$,
$L' = 60 - 2(1.09) = 57.8'$

q_n = UNFACTORED Resistance $= 2.13 \cdot (5.53)\left(1 + 0.3\left(\frac{.82}{57.8'}\right)\right) + 2(.128)$
$= 12.1$ KSF

FACTORED RESISTANCE $= q_n \cdot \phi_b = 12.1\,(0.55) = 6.6$ KSF

APPLIED FACTORED BEARING STRESS =
$\left[(W_{C_1} + W_{C2} + W_{C3})(1.25) + (W_{S_1} + W_{S2} + P_V)(1.35)\right] / B'$
$= \left[(.23 + .90 + .68)(1.25) + (.03 + .52 + .15)(1.35)\right] / .82$
$= \underline{3.91}$ KSF

6.6 KSF > 3.91 KSF OK ✓

Gravity Retaining Wall Calculations
Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/9/17
Structure No.: S-049-2016

Terracon
Sheet 6

Part 1: Wall Configuration

Note: Front wall face batter per KYTC Std. Dwg. RGX-002-09 (12/1/15), Case II

Repeat analysis w/cohesive b'Fill but arbitrarily increase heel from 1.5' to 2.0' (all other dimensions remain the same).

$\beta_{new} = 18.4^\circ$

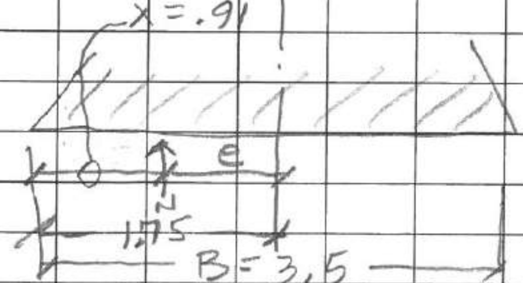
$P_A = 1.19\ ^k/_{FT.}$ (sht, 2)

$P_V = P_A \tan\beta = 1.19 \tan 18.4^\circ) = .40\ ^k/_{ft.}$

Check overturning...

Area	Unfactored Resultant, K/Ft.	Load Factor	Factored Load, K/Ft	Arm (Ft.)	Moment about @ (Ft-K/Ft)
W_{c1}	.23 (sht.3)	.9	.20	.33	.07
W_{c2}	.90 (sht.3)	.9	.81	1.0	.81
W_{c3}	6.0 ft^2 (.15) = 0.90	.9	.81	2.17	1.76
W_{s1}	.50 ft^2 (.125) = .06	1.0	.06	2.83	.17
W_{s2}	6.0 ft^2 (.125) = .75	1.0	.75	2.83	2.13
P_A	1.19	1.5	1.79	-2	-3.58
P_V	.40	1.0	.40	3.5	1.40
N = ΣF_V			3.03	-x	-3.03x

3.03x = 2.76
x = .91'



e = 1.75 - .91 = .84'

$B \times \frac{2}{3} = 3.5(2/3) = 2.33'$

$\frac{2.33}{2} = 1.17' > 0.84' \Rightarrow$ OK ✓
(within mid 2/3's)

Gravity Retaining Wall Calculations

Boone County, 6-0014.0 (K536/Mt. Zion Road Interchange Reconstruction @ I-75)
Terracon Project N1155079
Date: 1/17/17
Structure No.: S-049-2016

Terracon
Sheet 7

Part 4: Check Sliding

LRFD Load Factors:

Horiz. Soil Pressures	1.5	*Ref.: AASHTO LRFD Bridge design Speciifcations, 7th Ed., 2015*
Vert. Soil Pressures	1.0	*Fig. C11.56-2, page 11-11*
Concrete weight	0.9	
Live Load Surcharge	1.75	*(applied outside heel only, per Fig. C11.5.6-3 (a))*
LRFD Resistance Factor (φτ):	1.0	*Ref.: AASHTO, Table 11.5.7-1 for "Permanent" Gravity Walls*

Factored Sliding Resistance, Granular Soils........Rr = φτ x V x tanΦ, kips/ft. (AASHTO eqn. 10.6.3.4-2)

Factored Sliding Resistance, Cohesive Soils........Rr = φτ x su or φτ x (0.5 x σ'v), whichever is less, kips/sq. ft. (AASHTO Fig. 10.6.3.4-1)

Rr = ϕτ x su applies only if bearing directly on cohesive soil. If > 6" granular material is placed below the foundation, then the lesser of the two formulas provided here applies.

Applied Horizontal Resultant = Pa, kips/ft.

Assume wall bears directly on cohesive soil.

From SHT. 5, let $s_u = c = 4.26$ ksF

$R_r = \phi_\tau \cdot s_u = 1.0 (4.26) = 4.26$ KSF

4.26 ksf × B = 4.26 (3) = 12.78 k/FT

VS.

Applied Factored Resultant = $P_A \times 1.5 = 0.6$ k/Ft. (1.5) =
= 0.9 k/FT.

↳ sht. 4
★ granular b'fill

12.78 k/FT. > 0.9 k/FT

OK ✓ for granular b'fill

Repeat for ★cohesive backfill & increased Fdn. width to 3.5'

$R_r = \phi_\tau \cdot s_u = 4.26$ ksf ⟹ 4.26 × 4' = 17.0 k/FT.

VS.

$P_A \times 1.5$ = 1.19 k/FT. × 1.5 = 1.8 k/FT.

↳ SHT. 7

17.0 k/FT. > 1.8 k/FT. ⟹ OK ✓ for cohesive b'fill & widened ftg. to 3.5'

M E M O R A N D U M **S-087-2018**

TO: Bart Asher, P.E.
Director
Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM
Geotechnical Branch

BY: Clayton S. Cook, P.E.
Geotechnical Branch

DATE: January 25, 2019

cc: J. Van Zee
C. Van Zee
M. Bezold (D-6)
R. Franxman (D-6)
E. Drury
R. Turner
B. Yeager
C. Callan-Ramler (D-6)
W. Hagerman (HDR)
K. Sperry (HMB)
D. Woods (Stantec)

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 178-179; IM 075-7130
MARS No. 8022203D
Reconstruct I-75/KY 536 Interchange South of Florence;
Noise Wall Along 1-75/I-71, Stationing 00+00 to 24+15.76
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed sound wall will run along the west side of the on ramp of KY 536 to southbound I-71/I-75. This wall will be approximately 2416 feet long. The structure is located in the Union Quadrangle (GQ-779). The geologic mapping indicates that the bedrock at the side consists of the Bull Fork Formation. The Bull Fork Formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

2.0 FIELD INVESTIGATION

The drilling for this structure was performed by a KYTC drill crew. A total of nine sample and core holes and seventeen soundings were drilled. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples.

3.0 SUBSURFACE CONDITIONS

The soil samples were designated as CL, CH, and GC USCS, and A-6, A-7-6, A-2-6, and A-7-5 by the AASHTO classification system. Top of rock elevations ranged greatly along the centerline of the sound wall. With depths of nine feet in the shallower sections and maximum depth of thirty one feet in and around fill embankments of I-75/I-71. Four unconfined compression tests were conducted on soil samples which yielded an average value of 5382 psf.

The bedrock along the sound wall consists of shale with limestone. The core recovered percentages were generally above the 90's. KY Rock Quality Designations (RQD) values were almost all below twenty and SDI values were between twenty and eighty six indicating that the bedrock in this location is all non-durable interbedded shale and limestone. See the estimated rockline in the attachments for rockline elevation estimates along the sound wall centerline.

4.0 ENGINEERING ANALYSIS

Drilled shafts are proposed for the noise barrier wall foundations. The Idealized Soil and Bedrock Profile Sheet and the Drilled Shaft Axial Resistance Tables are attached. Because of the structure type and pre-existing site conditions, embankment and settlement analyses were not required.

5.0 FOUNDATION RECOMMENDATIONS

Use drilled shafts with a minimum socket length of 15 feet or minimum tip embedment of 3 feet in sound bedrock. Lower tip elevations may be necessary in order to satisfy lateral capacity or other structural requirements. For shafts not anticipated to tip into bedrock allowable axial capacities may be evaluated using the table below. Otherwise, evaluate the allowable axial capacities using the attached Drilled Shaft Axial Resistance Tables provided at the end of the report. Axial capacities obtained through soil may not be combined with capacities through bedrock. Refer to General Recommendation 6.1 and Plan Note 7.3 below for a discussion of variability in the rockline and its impact on shaft design and construction.

Summary of Capacities in Soil for 15' Drilled Shafts Plus Incremental Nominal Side Resistance per Additional Foot of Embedment

Shaft Diameter	End Bearing	Side Resistance	Factored End Bearing	Factored Side Resistance	Total Factored Uplift Resistance	Additional Factored Side Resistance Per Foot of Additional Embedment	
						Side	Uplift
(ft)	(kips)	(kips)	(kips)	(kips)	(kips)	(kips)	(kips)
1.5	42.94	70.21	17.18	31.60	24.58	3.16	2.46
2	76.34	93.62	30.54	42.13	32.77	4.21	3.28
2.5	119.28	117.02	47.71	52.66	40.96	5.27	4.10
3	171.77	140.43	68.71	63.19	49.15	6.32	4.92
Calculation Notes: Top 5 (feet) are neglected. Capacities through soil must be neglected if rock socket is utilized Resistance Factors: Side = 0.45; End = 0.40; Uplift = 0.35							

6.0 GENERAL RECOMMENDATIONS

6.1 The rocklines along the portions of the proposed wall were found to be variable. It is possible that interpolated rock depths during design may not be encountered in the field. The potential for an unexpectedly high or low rockline should be addressed in the wall plans. The designer may choose to establish minimum embedment depths for lateral support. Criteria for axial capacity can be addressed in the plans based on the following:

Soil Supported Shafts:
If the shaft is to be supported in soil and bedrock is encountered above the anticipated tip elevation, the contractor shall provide a 2 foot rock socket. In these cases the design axial capacities of the shafts can be conservatively assumed to be met. Lateral support conditions should still be verified and approved by the wall design consultant.

Bedrock Supported Shafts:
If the shaft is to be supported in bedrock and bedrock is below the anticipated tip elevation the contractor must extend the shaft to bedrock in order to provide the required socket length unless the wall design consultant considers and approves the corresponding reduction in axial and lateral capacity.

6.2 The drilled shafts shall be constructed in accordance with the Special Note for Drilled Shafts, current edition, except that subsurface exploration borings in accordance with Section 3.5 of the Special Note is not required.

6.3 The top 5 feet of the soils shall be neglected for lateral support or axial resistance of the drilled shafts

6.4 Perform lateral analyses using the geotechnical parameters provided in the attached Idealized Soil and Bedrock Profile. These parameters may be used to perform analyses using LPILE Plus or similar software. Some of the parameters may not be required to be input, depending on the version of the program being used.

6.5 At the designer's discretion the overburden soils maybe utilized for lateral support; however, for shafts embedded less than 15 feet a minimum rock socket depth of 2 feet is required for axial support.

6.6 Noise Walls should not be subjected to differential earth loading. Reinforced panels may shift or crack and the entire wall could potentially have an overturning failure if it is subjected to earth loads. Special pane and foundation designs are required in order to safely construct a hybrid Retaining/Noise Wall. In walls constructed in newly placed fill areas it should not be assumed that construction will be phased in a manner to avoid imposing earth loads. The walls should either be designed to withstand the maximum potential earth load or construction phasing must be specified to prevent differential loading conditions. Wall design loads should be determined using Soil Type 3 of Exhibit 413 in the Division of Structural Design Guidance Manual.

7.0 PLAN NOTES

7.1 Permanent casing is not required. The contractor may elect to use temporary casing in deeper soil areas. Temporary casing may be omitted if the contractor can demonstrate the ability to maintain an open excavation without collapse of the side walls, fall back material into the excavation, or fall back into and contamination of the freshly placed concrete. In shall overburden, unsupported excavation or some other shoring method maybe utilized at the contractor's discretion.

7.2 Except as permitted by special design Noise Walls shall not be subjected to differential earth loading. Temporary or permanent soil loads placed on the sound barrier walls are only permitted as noted in the sound barrier wall plans.

7.3 Due to variability in the rockline the potential for field adjustment in shaft lengths shall be addressed in the following manner:

Soil Supported Shafts:
If the shaft is to be supported in soil and bedrock is encountered above the anticipated tip elevation, the contractor shall provide a 2 foot rock socket. In these cases the design axial capacities of the shafts can be conservatively assumed to be met. Lateral support conditions should still be verified and approved by the wall design consultant.

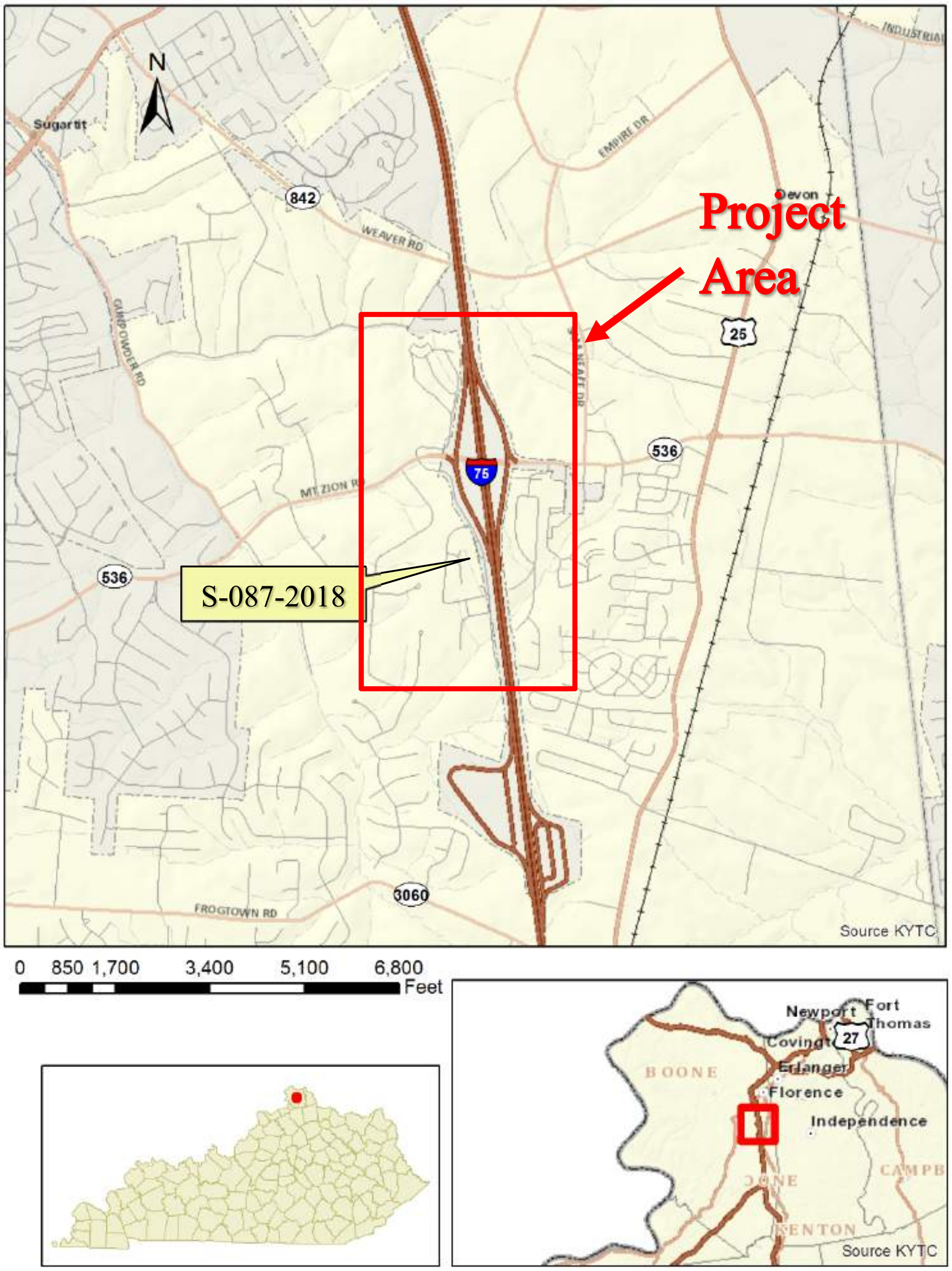
Bedrock Supported Shafts:
If the shaft is to be supported in bedrock and bedrock is below the anticipated tip elevation the contractor must extend the shaft to bedrock in order to provide the required socket length unless the wall design consultant considers and approves the corresponding reduction in axial and lateral capacity.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **S-087-2018 Idealized Soil Profile**
- **S-087-2018 Drilled Shaft Profile Capacity Tables**
- **Estimated Rockline Along Sound Wall Centerline**
- **Coordinate Data Sheet**
- **Sound Wall Profile Sheet**

Project Location Map



SUBSURFACE DATA

Plan Scale 1" = 10'

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Boring 1002:

A-7-6(29), CH, S+C=82(34+48)
N=R/0.40'

Shale: (51%) dark gray, silty, calcareous, disseminated fossil fragments, interbedded w/Limestone (49%), light gray and gray, medium and coarse grained, even and irregularly bedded, fossiliferous.

Top of Rock elev. = 925.9
Base of weathered rock elev. = 924.4

Boring 1005:

N=11, A-7-5(40), CH, S+C=81(26+55)
N=R/0.20'

Shale: (51%) dark gray, silty, calcareous, disseminated fossil fragments, interbedded w/Limestone (49%), light gray and gray, medium and coarse grained, even and irregularly bedded, fossiliferous.

Top of Rock elev. = 921.7
Base of weathered rock elev. = 917.4

DATE: 23-JANUARY-2019	CHECKED BY
DESIGNED BY:	
DETAILED BY: C. Cook	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I-75

CROSSING

S-087-18

ITEM NUMBER
6-14.00

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:
FILE NAME: $$$$design$file$$$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 10'

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

1008
6+50.00
CL
927.6

D50 (mm)	w%	LI	
0.007	18	-0.13	N=24, A-6(15), CL, S+C=85(52+33)
0.023	22	0.08	N=21, A-7-6(11), CL, S+C=59(27+32)
0.023	22	0.08	N=50/0.30', A-7-6(11), CL, S+C=59(27+32)

SDI(JS)

KYRQD	REC	
0	100	82(4)
0	100	
17	98	70(3)

Shale: (64%) dark gray, silty, calcareous, disseminated fossil fragments, interbedded w/Limestone (36%), light gray and gray, medium and coarse grained, even and irregularly bedded, fossiliferous.

Shale: (82%) dark gray, silty, calcareous, interbedded w/Limestone (18%), gray, medium grained, even bedded.

Top of Rock elev. = 911.5
Base of weathered rock elev. = 911.5

1009
7+50.00
1.0' Rt.
924.8
R
(913.2')

1010
8+50.00
5.0' Rt.
922.2
R
(912.6')

1011
9+49.82
11.2' Rt.
917.4

D50 (mm)	w%	LI	
0.704	9	-0.48	N=63, A-2-6(1), GC, S+C=34(22+13)
0.704	9	-0.48	N=50/0.40', A-2-6(1), GC, S+C=34(22+13)

SDI(JS)

KYRQD	REC	
18	90	69(3)
9	96	
16	100	89(4)

Shale: (73%) dark gray, silty, dessiminated fossil fragments, calcareous, interbedded w/Limestone (27%), gray, medium grained, even bedded.

Top of Rock elev. = 906.1
Base of weathered rock elev. = 904.1

1012
10+48.74
15.3' Rt.
912.3
R
(903.1')

1013
11+50.00
CL
913.8
R
(897.0')

1014
12+50.00
CL
917.6

QU(psf)	D50 (mm)	w%	LI	
5434	0.012	10	-0.75	A-6(8), CL, S+C=77(55+22)
	0.005	21	0.11	N=32, A-6(14), CL, S+C=82(44+38)

SDI(JS)

KYRQD	REC	
0	91	34(2)
8	100	
0	100	20(2)

Shale: (72%) dark gray, silty, calcareous, interbedded w/Limestone (28%), gray, medium grained, even bedded.

Top of Rock elev. = 904.7
Base of weathered rock elev. = 902.4

870
860
850
Datum

DATE: 23-JANUARY-2019	CHECKED BY
DESIGNED BY:	
DETAILED BY: C. Cook	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I-75
CROSSING

S-087-18

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Division of Structural Design
GEOTECHNICAL BRANCH

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Addendum 2 -- 7-11-19

SHEET LOCATION:
FILE NAME: $$$$design$file$$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

SHEET LOCATION:

FILE NAME: $$$$design$file$$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 10'

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

1017

D50 (mm)	w%	LI	
0.020	17	−0.22	N=4, A−6(10), CL, S+C=64(37+26)
0.020	17	−0.22	N=21, A−6(10), CL, S+C=64(37+26)
0.025	23	0.09	N=11, A−7−6(12), CL, S+C=59(29+30)
0.025	23	0.09	N=44, A−7−6(12), CL, S+C=59(29+30)

KYRQD	REC	SDI(JS)
		67(2)
0	100	
8	98	84(3)
18	90	82(3)

Shale: (72%), dark gray, silty, calcareous, interbedded w/Limestone (28%), light gray, coarse grained, even bedded, fossiliferous.

Top of Rock elev. = 881.0
Base of weathered rock elev. = 880.8

1020

D50 (mm)	w%	LI	
0.015	25	0.14	N=5, A−7−6(14), CL, S+C=66(36+30)
0.015	25	0.14	N=7, A−7−6(14), CL, S+C=66(36+30)
0.006	19	−0.05	N=21, A−6(13), CL, S+C=76(38+38)

KYRQD	REC	SDI(JS)
0	80	32(1)
0	84	
0	100	70(3)

Shale: (72%), dark gray, silty, calcareous, interbedded w/Limestone (28%), light gray, coarse grained, even bedded, fossiliferous.

Top of Rock elev. = 881.6
Base of weathered rock elev. = 877.6

DATE: 23-JANUARY-2019
CHECKED BY
DESIGNED BY:
DETAILED BY: C. Cook

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–75
CROSSING

S–087–18

SUBSURFACE DATA

ITEM NUMBER
6–14.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.
DRAWING NO.
00000

Addendum 2 -- 7-11-19

SUBSURFACE DATA

Plan Scale 1" = 10'

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

DATE: 23-JANUARY-2019	CHECKED BY
DESIGNED BY:	
DETAILED BY: C. Cook	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I-75

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S-087-18

SUBSURFACE DATA

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SHEET NO.

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00000

SHEET LOCATION:
FILE NAME: $$$$design$file$$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

IDEALIZED SOIL AND BEDROCK PROFILE

Boone Co., Item No. 6-14.00, S-087-2018
Noise Wall Along I-75/I-71, Station 0+00.00 to 24+15.76

CSC 1/10/2019

Elev. (ft.)	Strata	Parameters for Lateral Load Analyses	Top of Shaft
	Overburden - Neglect top 5 feet for lateral or axial support		
	Fill Materials / Overburden / Stiff Clay No Free Water		
	Effective Unit Weight,	γ_e (lb/ft^3) =	120
	Cohesion	c (psf) =	2700
		k static (lb/in^3) =	1,000
		k cyclic (lb/in^3) =	400
	e50	=	0.005
*			
	Shale with Limestone	**Weak Rock**	
	Effective Unit Weight,	γ_e (lb/ft^3) =	130
	Uniaxial Compressive Strength,	q_u (psi) =	1000
	Initial Modulus of Rock Mass,	E_r (psi) =	69,750
	Strain Factor	(k rm) =	0.0005
	RQD	=	50
*			

* **Elevations vary and estimates are given in attachments**

ADDITIONAL DATA FOR GEOTECHNICAL CALCULATIONS ONLY:

min. f'_c (psi) = 3500

p_a (psi) = 14.7

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Boone Co., Item No. 6-14.00, S-087-2018
Noise Wall Along I-75/I-71, Station 0+00.00 to 24+15.76

Rock Socket Diameter = 1.5 feet
Rock Socket Diameter = 18 inches

CSC 1/10/2019

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	4.7	48	22	85	11	42	53	9
>>> 2.0	4.7	48	44	85	22	42	64	18
3.0	4.7	48	66	85	33	42	75	26
4.0	4.7	48	88	85	44	42	87	35
5.0	4.7	48	110	85	55	42	98	44
6.0	4.7	48	132	85	66	42	109	53
7.0	4.7	48	154	85	77	42	120	62
8.0	4.7	48	176	85	88	42	131	71
9.0	4.7	48	198	85	99	42	142	79
10.0	4.7	48	221	85	110	42	153	88
11.0	4.7	48	243	85	121	42	164	97
12.0	4.7	48	265	85	132	42	175	106
13.0	4.7	48	287	85	143	42	186	115
14.0	4.7	48	309	85	154	42	197	124
15.0	4.7	48	331	85	165	42	208	132
16.0	4.7	48	353	85	176	42	219	141
17.0	4.7	48	375	85	187	42	230	150
18.0	4.7	48	397	85	198	42	241	159
19.0	4.7	48	419	85	210	42	252	168
20.0	4.7	48	441	85	221	42	263	176
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	1.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Boone Co., Item No. 6-14.00, S-087-2018
Noise Wall Along I-75/I-71, Station 0+00.00 to 24+15.76

Rock Socket Diameter = 2.0 feet
Rock Socket Diameter = 24 inches

CSC 1/10/2019

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance $\phi\ R_{sr}$ (kips)	Factored End Bearing Resistance $\phi\ R_{eb}$ (kips)	Total Factored Axial Resistance $\phi\ R_t$ (kips)	Total Factored Uplift Resistance $\phi\ R_{tu}$ (kips)
0.0								
1.0	4.7	48	29	151	15	75	90	12
>>> 2.0	4.7	48	59	151	29	75	105	24
3.0	4.7	48	88	151	44	75	120	35
4.0	4.7	48	118	151	59	75	134	47
5.0	4.7	48	147	151	74	75	149	59
6.0	4.7	48	176	151	88	75	164	71
7.0	4.7	48	206	151	103	75	178	82
8.0	4.7	48	235	151	118	75	193	94
9.0	4.7	48	265	151	132	75	208	106
10.0	4.7	48	294	151	147	75	222	118
11.0	4.7	48	323	151	162	75	237	129
12.0	4.7	48	353	151	176	75	252	141
13.0	4.7	48	382	151	191	75	267	153
14.0	4.7	48	412	151	206	75	281	165
15.0	4.7	48	441	151	221	75	296	176
16.0	4.7	48	470	151	235	75	311	188
17.0	4.7	48	500	151	250	75	325	200
18.0	4.7	48	529	151	265	75	340	212
19.0	4.7	48	559	151	279	75	355	223
20.0	4.7	48	588	151	294	75	369	235
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40

D (ft.) = 2.0

>>> = Min. Socket Length

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Boone Co., Item No. 6-14.00, S-087-2018

Noise Wall Along I-75/I-71, Station 0+00.00 to 24+15.76

Rock Socket Diameter = 2.5 feet
Rock Socket Diameter = 30 inches

CSC 1/10/2019

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance $\phi\ R_{sr}$ (kips)	Factored End Bearing Resistance $\phi\ R_{eb}$ (kips)	Total Factored Axial Resistance $\phi\ R_t$ (kips)	Total Factored Uplift Resistance $\phi\ R_{tu}$ (kips)
0.0								
1.0	4.7	48	37	236	18	118	136	15
>>> 2.0	4.7	48	74	236	37	118	155	29
3.0	4.7	48	110	236	55	118	173	44
4.0	4.7	48	147	236	74	118	191	59
5.0	4.7	48	184	236	92	118	210	74
6.0	4.7	48	221	236	110	118	228	88
7.0	4.7	48	257	236	129	118	246	103
8.0	4.7	48	294	236	147	118	265	118
9.0	4.7	48	331	236	165	118	283	132
10.0	4.7	48	368	236	184	118	302	147
11.0	4.7	48	404	236	202	118	320	162
12.0	4.7	48	441	236	221	118	338	176
13.0	4.7	48	478	236	239	118	357	191
14.0	4.7	48	515	236	257	118	375	206
15.0	4.7	48	551	236	276	118	393	221
16.0	4.7	48	588	236	294	118	412	235
17.0	4.7	48	625	236	312	118	430	250
18.0	4.7	48	662	236	331	118	449	265
19.0	4.7	48	698	236	349	118	467	279
20.0	4.7	48	735	236	368	118	485	294
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	2.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Boone Co., Item No. 6-14.00, S-087-2018
Noise Wall Along I-75/I-71, Station 0+00.00 to 24+15.76

Rock Socket Diameter = 3.0 feet
Rock Socket Diameter = 36 inches

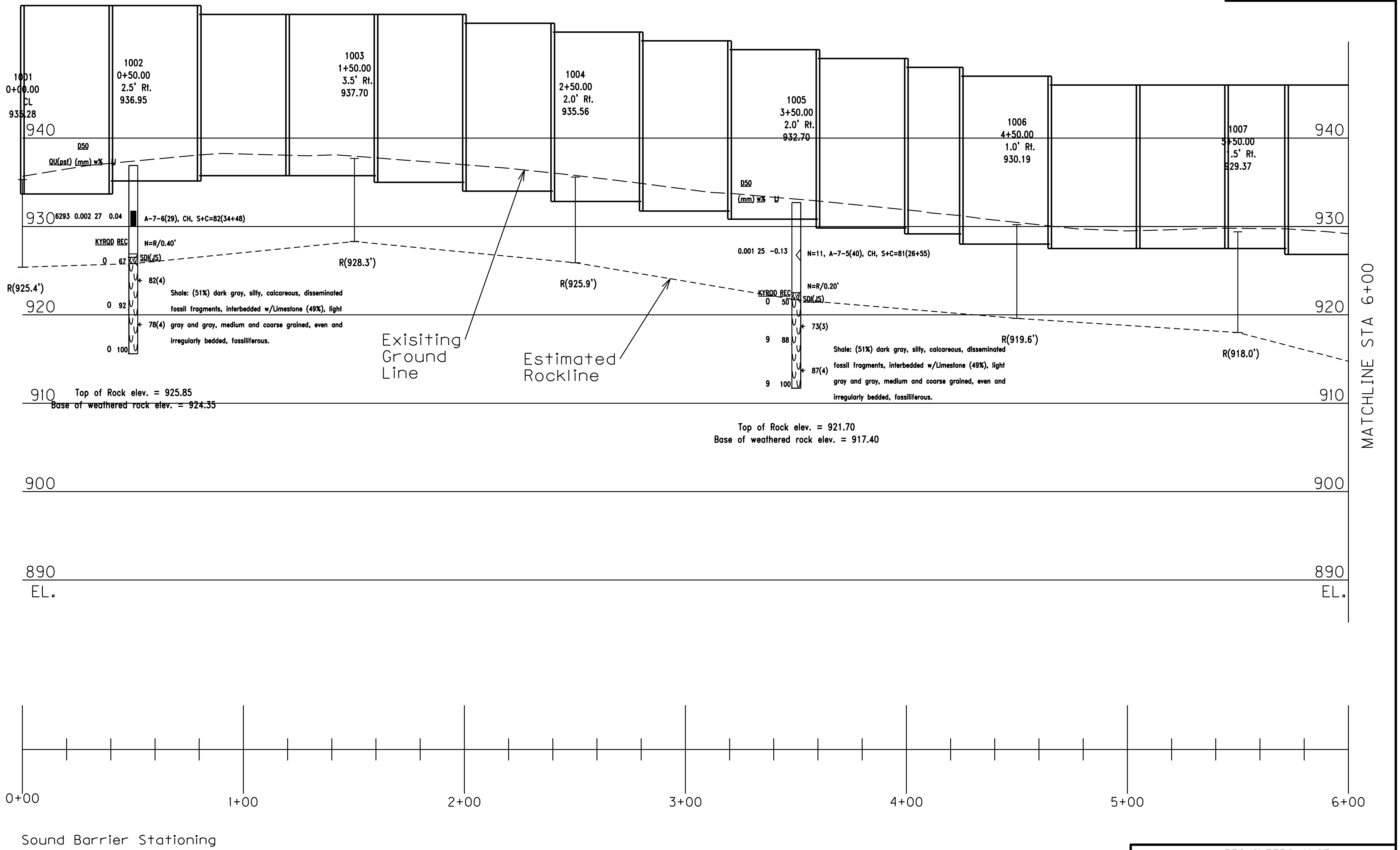
CSC 1/10/2019

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	4.7	48	44	339	22	170	192	18
>>> 2.0	4.7	48	88	339	44	170	214	35
3.0	4.7	48	132	339	66	170	236	53
4.0	4.7	48	176	339	88	170	258	71
5.0	4.7	48	221	339	110	170	280	88
6.0	4.7	48	265	339	132	170	302	106
7.0	4.7	48	309	339	154	170	324	124
8.0	4.7	48	353	339	176	170	346	141
9.0	4.7	48	397	339	198	170	368	159
10.0	4.7	48	441	339	221	170	390	176
11.0	4.7	48	485	339	243	170	412	194
12.0	4.7	48	529	339	265	170	434	212
13.0	4.7	48	573	339	287	170	456	229
14.0	4.7	48	618	339	309	170	478	247
15.0	4.7	48	662	339	331	170	500	265
16.0	4.7	48	706	339	353	170	523	282
17.0	4.7	48	750	339	375	170	545	300
18.0	4.7	48	794	339	397	170	567	318
19.0	4.7	48	838	339	419	170	589	335
20.0	4.7	48	882	339	441	170	611	353
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40

>>> = Min. Socket Length

D (ft.) = 3.0

COUNTY OF	ITEM NO.	SHEET NO.
Boone	6-14.00	1



FILE NAME: U:\DOCUMENTS\PROJ FOLD\D6\BOONE\ITEM NO. 6-14.00\DGN FILES\S-087-2018 ROCKLINE ESTIMATE\S-087-2018 ROCKLINE ESTIMATE 6+00 TO 12+00

USER: clayton.cook
DATE PLOTTED: September 4, 2018

E-SHEET NAME:

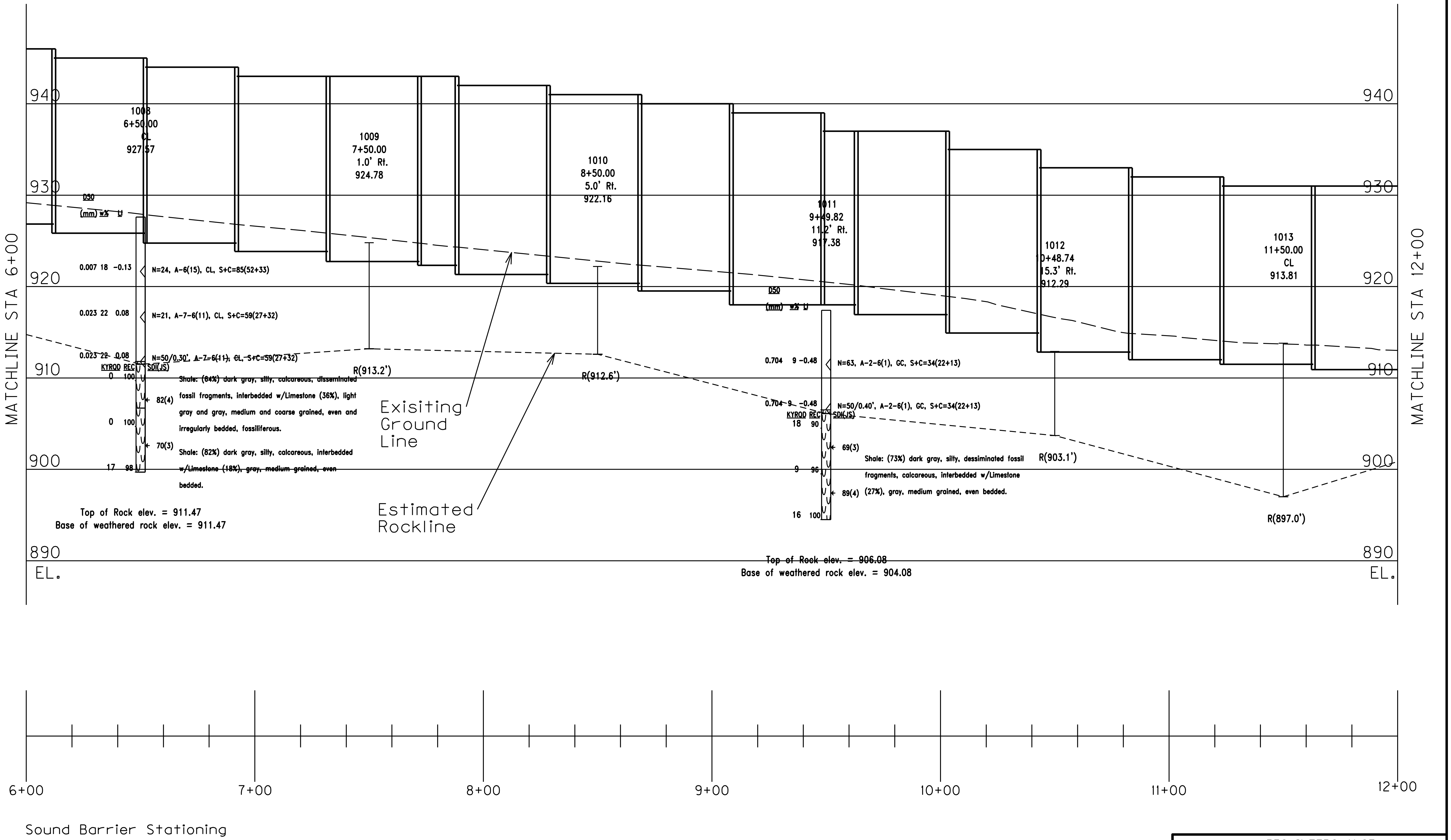
MicroStation v8.11.9.832

VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 400'

KY 536 INTERCHANGE
ESTIMATED ROCKLINE
STA 0+00 TO 6+00

Addendum 2 – 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
Boone	6-14.00	2



VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 400'

KY 536 INTERCHANGE
ESTIMATED ROCKLINE
STA 6+00 TO 12+00

Addendum 2 -- 7-11-19

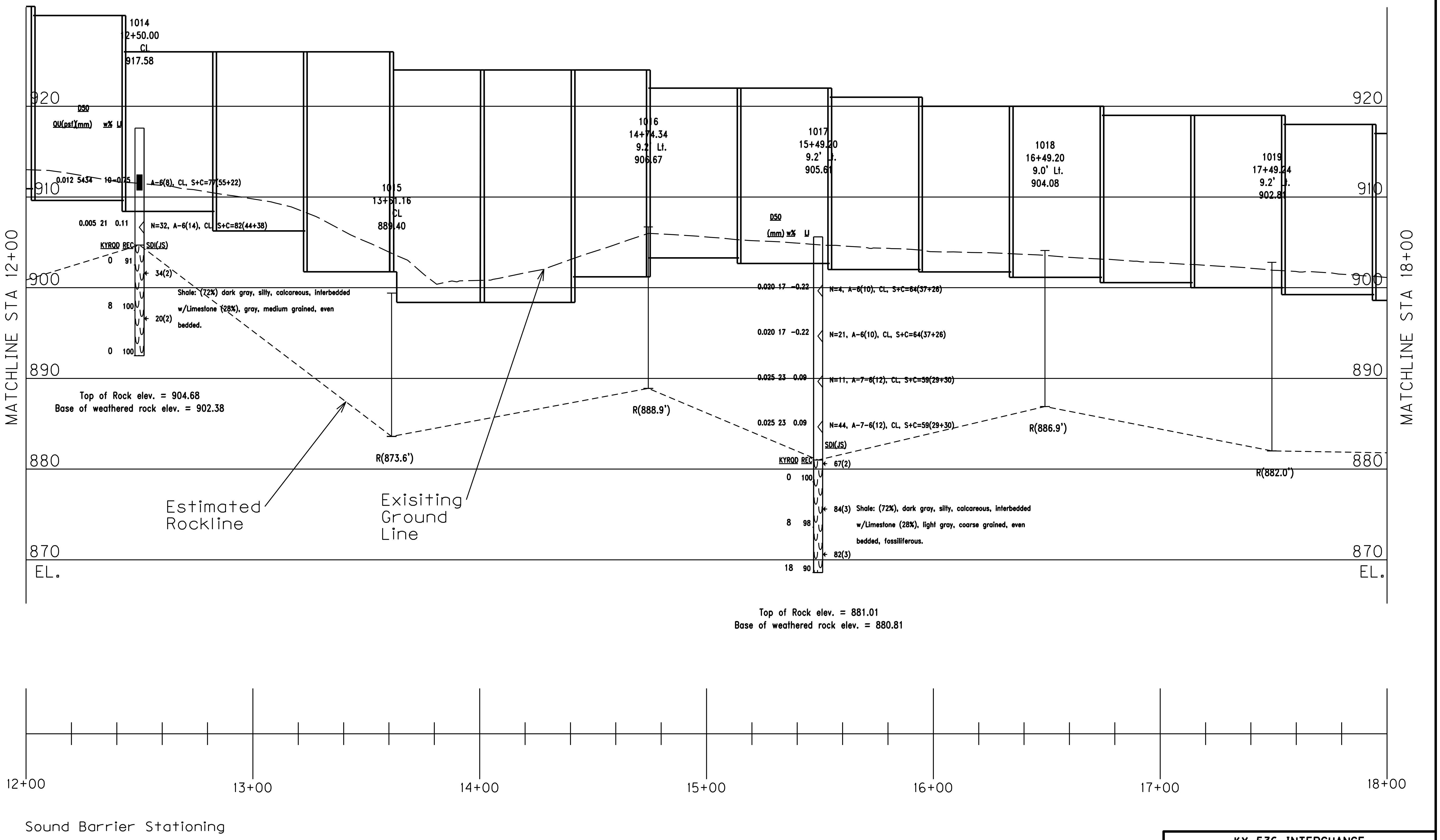
FILE NAME: U:\DOCUMENTS\PROJ FOLD\D6\BOONE\ITEM NO. 6-14.00\DGN FILES\S-087-2018 ROCKLINE ESTIMATE\S-087-2018 ROCKLINE ESTIMATE 6+00 TO 12+00

USER: clayton.cook
DATE PLOTTED: September 4, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
Boone	6-14.00	3



VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 400'

KY 536 INTERCHANGE
ESTIMATED ROCKLINE
STA 12+00 TO 18+00

Addendum 2 -- 2-11-19

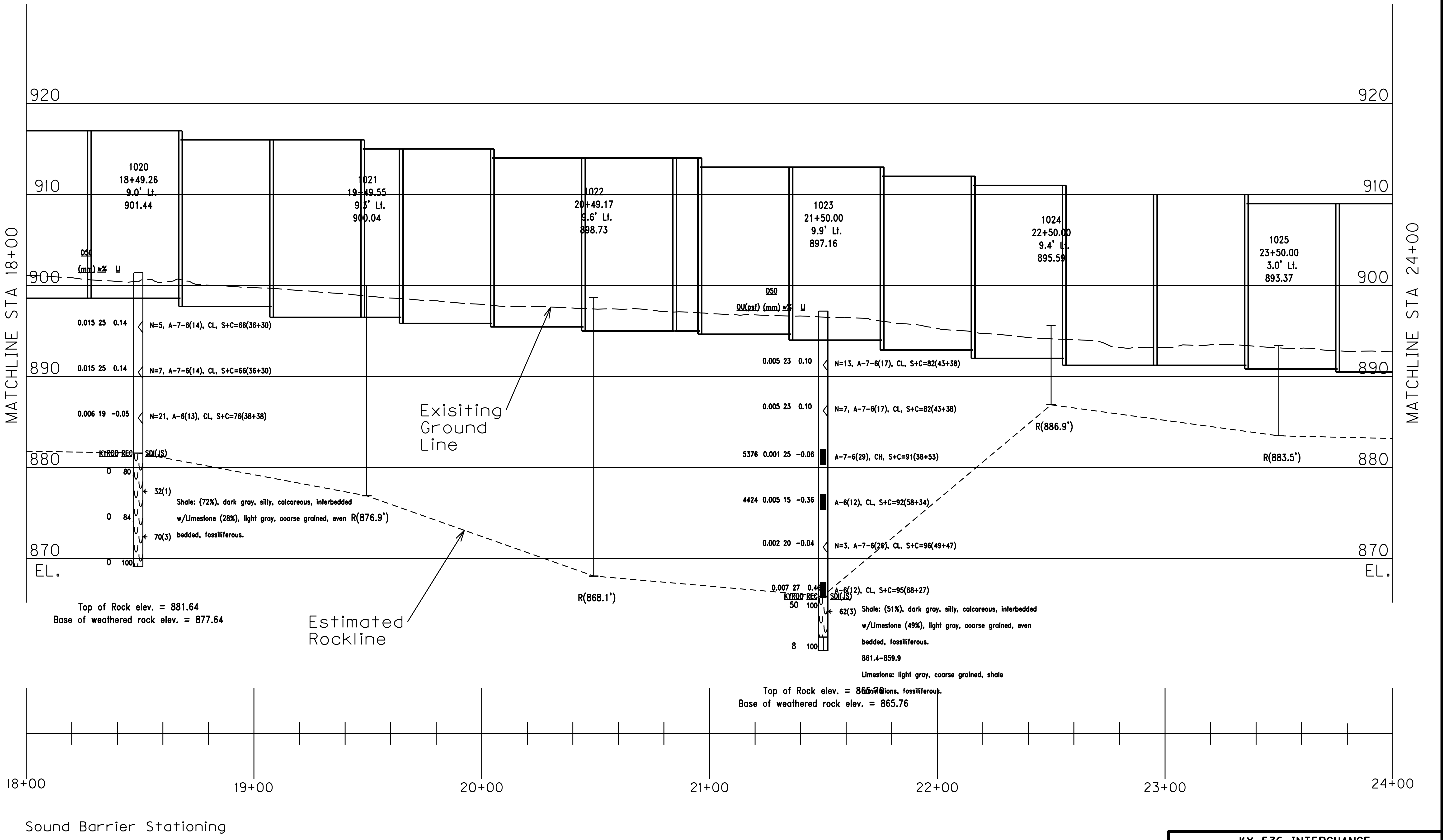
FILE NAME: U:\DOCUMENTS\PROJ FOLD\D6\BOONE\ITEM NO. 6-14.00\DGN FILES\S-087-2018 ROCKLINE ESTIMATE\S-087-2018 ROCKLINE ESTIMATE 6+00 TO 12+00

USER: clayton.cook
DATE PLOTTED: September 4, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
Boone	6-14.00	4



VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 400'

KY 536 INTERCHANGE
ESTIMATED ROCKLINE
STA 18+00 TO 24+00

Addendum 2 -- 7-11-19

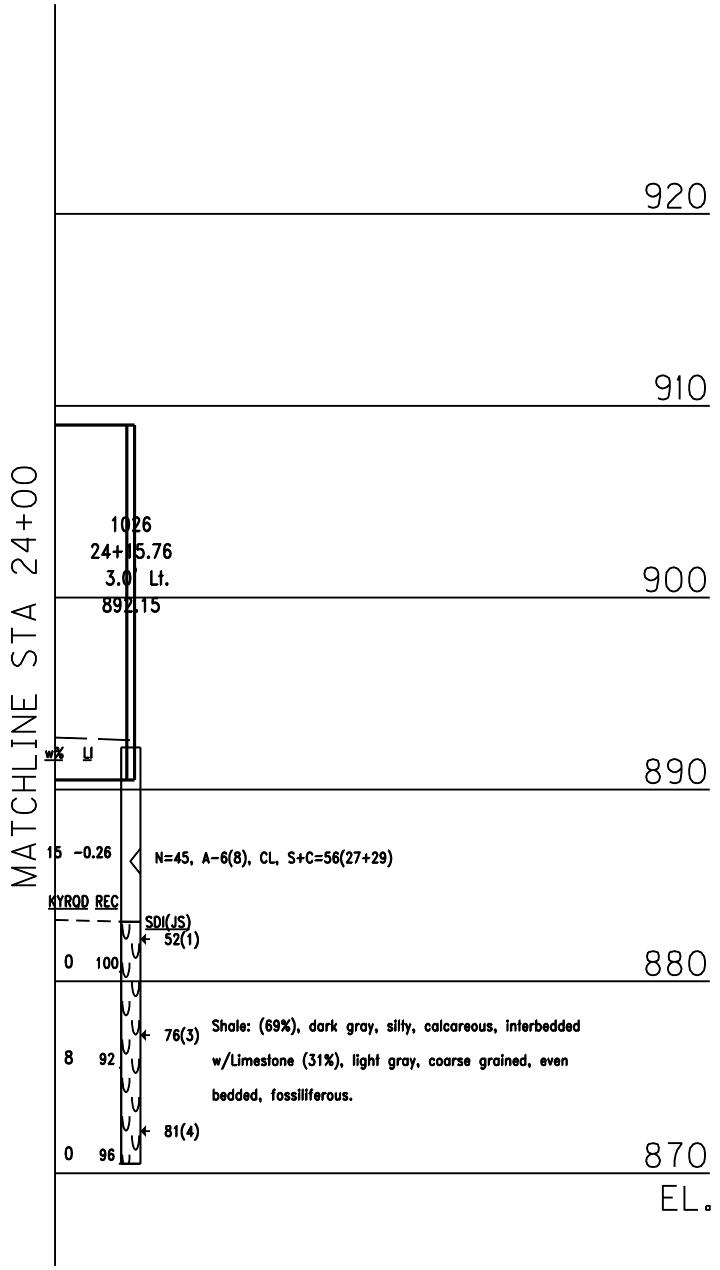
FILE NAME: U:\DOCUMENTS\PROJ FOLD\D6\BOONE\ITEM NO. 6-14.00\DGN FILES\S-087-2018 ROCKLINE ESTIMATE\S-087-2018 ROCKLINE ESTIMATE 6+00 TO 12+00

USER: clayton.cook
DATE PLOTTED: September 4, 2018

E-SHEET NAME:

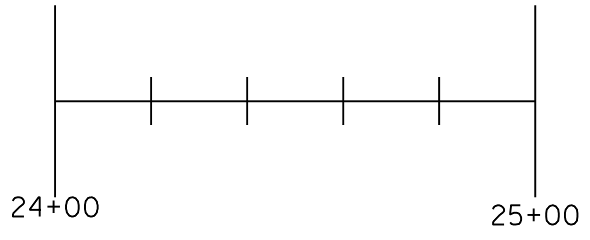
MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
Boone	**6-14.00**	**5**



Shale: (69%), dark gray, silty, calcareous, interbedded w/Limestone (31%), light gray, coarse grained, even bedded, fossiliferous.

Top of Rock elev. = 883.05
Base of weathered rock elev. = 878.75



Sound Barrier Stationing

VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 400'

KY 536 INTERCHANGE
ESTIMATED ROCKLINE
STA 24+00 TO 25+00

Addendum 2 --- 7-11-19

FILE NAME: U:\DOCUMENTS\PROJ FOLD\D6\BOONE\ITEM NO. 6-14.00\DGN FILES\S-087-2018 ROCKLINE ESTIMATE\S-087-2018 ROCKLINE ESTIMATE 6+00 TO 12+0

USER: clayton.cook
DATE PLOTTED: September 4, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

COORDINATE DATA SUBMISSION FORM

KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone **Date**

Road Number I 71-75

Survey Crew / Consultant

Contact Person

Item # 6-14.00

Mars # 8022203D

Project # S-087-2018

Notes:
Station in reference to noise wall stationing.

(circle one)

Elevation Datum NAVD88 Assumed

HOLE NUMBER	NORTHING KY 1 ZONE	EASTING KY 1 ZONE	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-087-2018						
1001	4236978.1178	5238187.8249	1001	00+00.00	CL	935.28
1002	4236934.8675	5238212.9130	1002	00+50.00	CL	936.95
1003	4236848.3669	5238263.0892	1003	01+50.00	CL	937.7
1004	4236761.8663	5238313.2653	1004	02+50.00	CL	935.56
1005	4236675.3657	5238363.4415	1005	03+50.00	CL	932.70
1006	4236587.6766	5238411.2996	1006	04+50.00	CL	930.19
1007	4236496.4467	5238452.2521	1007	05+50.00	CL	929.37
1008	4236401.5220	5238483.1894	1008	06+50.00	CL	927.57
1009	4236305.5536	5238511.2972	1009	07+50.00	CL	924.78
1010	4236208.0019	5238532.5806	1010	08+50.00	CL	922.16
1011	4236107.739	5238538.547	1011	9+49.82	11.2' RT	917.38
1012	4236009.628	5238548.456	1012	10+48.74	15.3' RT	912.29
1013	4235911.4155	5238577.4448	1013	11+50.00	CL	913.81
1014	4235812.3593	5238591.1511	1014	12+50.00	CL	917.58
1015	4235702.2434	5238606.3877	1015	13+61.16	CL	889.40
1016	4235606.899	5238672.895	1016		9.2' LT	906.67
1017	4235531.714	5238682.706	1017	15+49.14	9.2' LT	905.61
1018	4235432.439	5238695.186	1018	16+49.20	9.0 LT	904.08
1019	4235333.266	5238708.305	1019	17+49.24	9.2' LT	902.81
1020	4235234.426	5238721.676	1020	18+49.26	9.0' LT	901.44
1021	4235135.46	5238737.892	1021	19+49.55	9.3' LT	900.04
1022	4235037.31	5238754.586	1022	20+49.17	9.6' LT	898.73
1023	4234937.126	5238769.331	1023	21+50.02	9.9' LT	897.16
1024	4234837.755	5238781.007	1024	22+50.08	9.4' LT	895.59
1025	4234737.4292	5238783.8491	1025	23+50.00	CL	893.37
1026	4234672.1581	5238791.8625	1026	24+15.76	CL	892.15

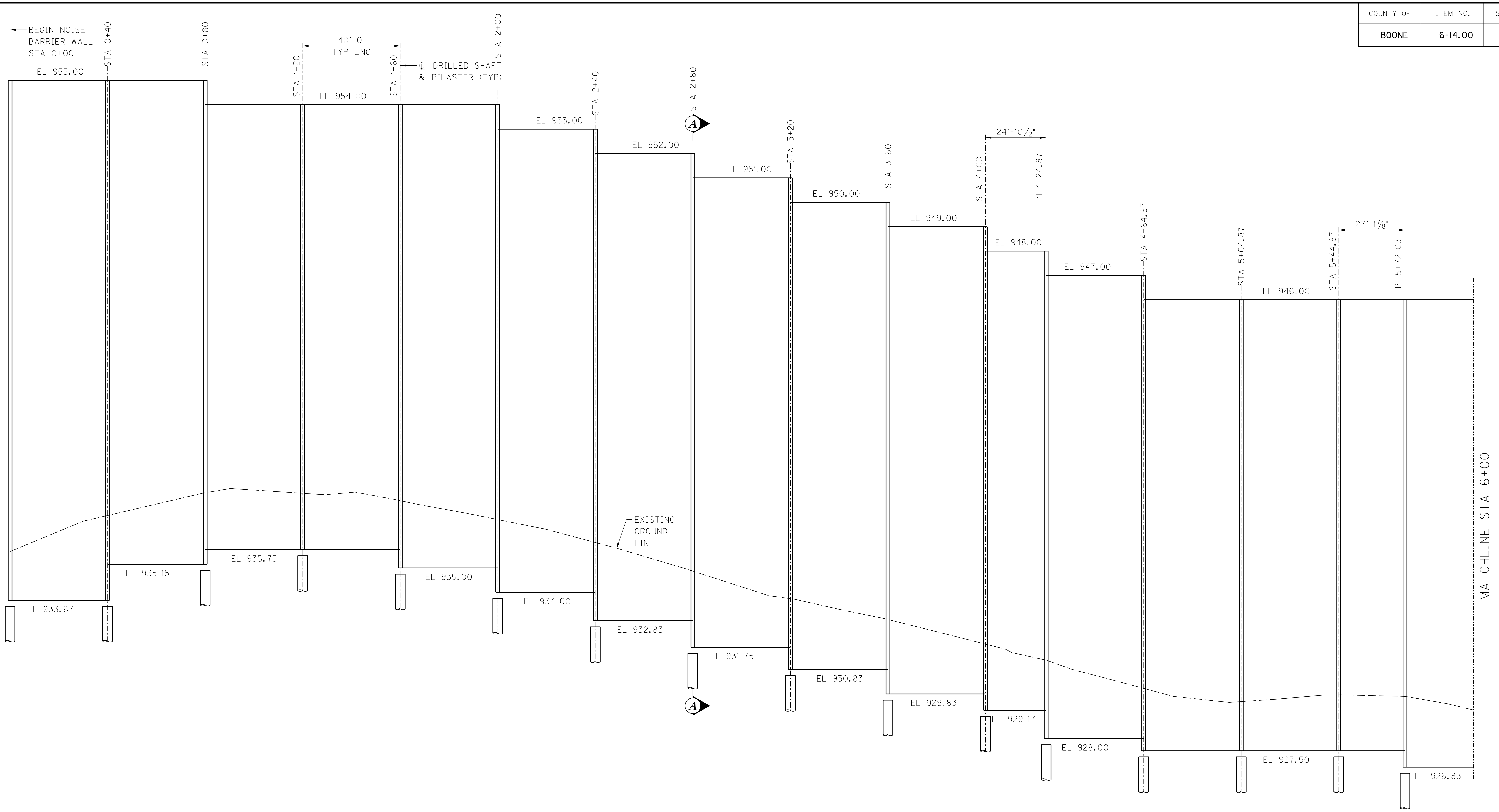
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	5

FILE NAME: V:\1785\ACTIVE\178560012\STRUCTURES\NOISE_WALL_PF1.DGN

USER: srparsons
DATE PLOTTED: August 21, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

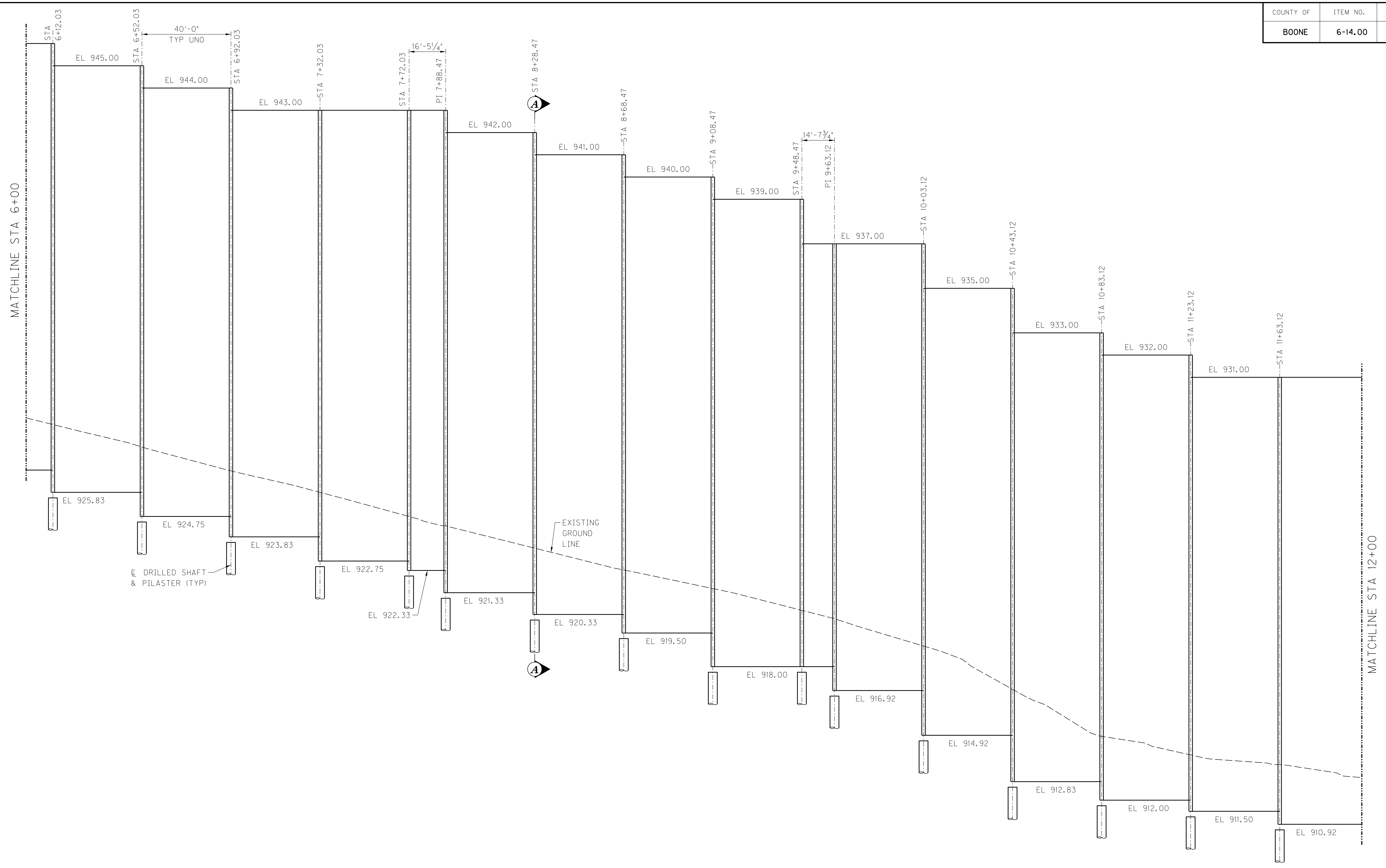


SCALE: 1"=20'

KY 536 INTERCHANGE
ELEVATION NOISE WALL
STA 0+00 TO STA 6+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	6



SCALE: 1"=20'

KY 536 INTERCHANGE
ELEVATION NOISE WALL
STA 6+00 TO STA 12+00

MicroStation v8.11.9.832

E-SHEET NAME:

USER: srparsons
DATE PLOTTED: August 27, 2018

FILE NAME: V:\1785\ACTIVE\178560012\STRUCTURES\NOISE_WALL_PF2.DGN

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	7

SCALE: 1"= 20'

KY536 INTERCHANGE
ELEVATION NOISE WALL
STA 12+00 TO STA 18+00

Addendum 2 -- 7-11-19

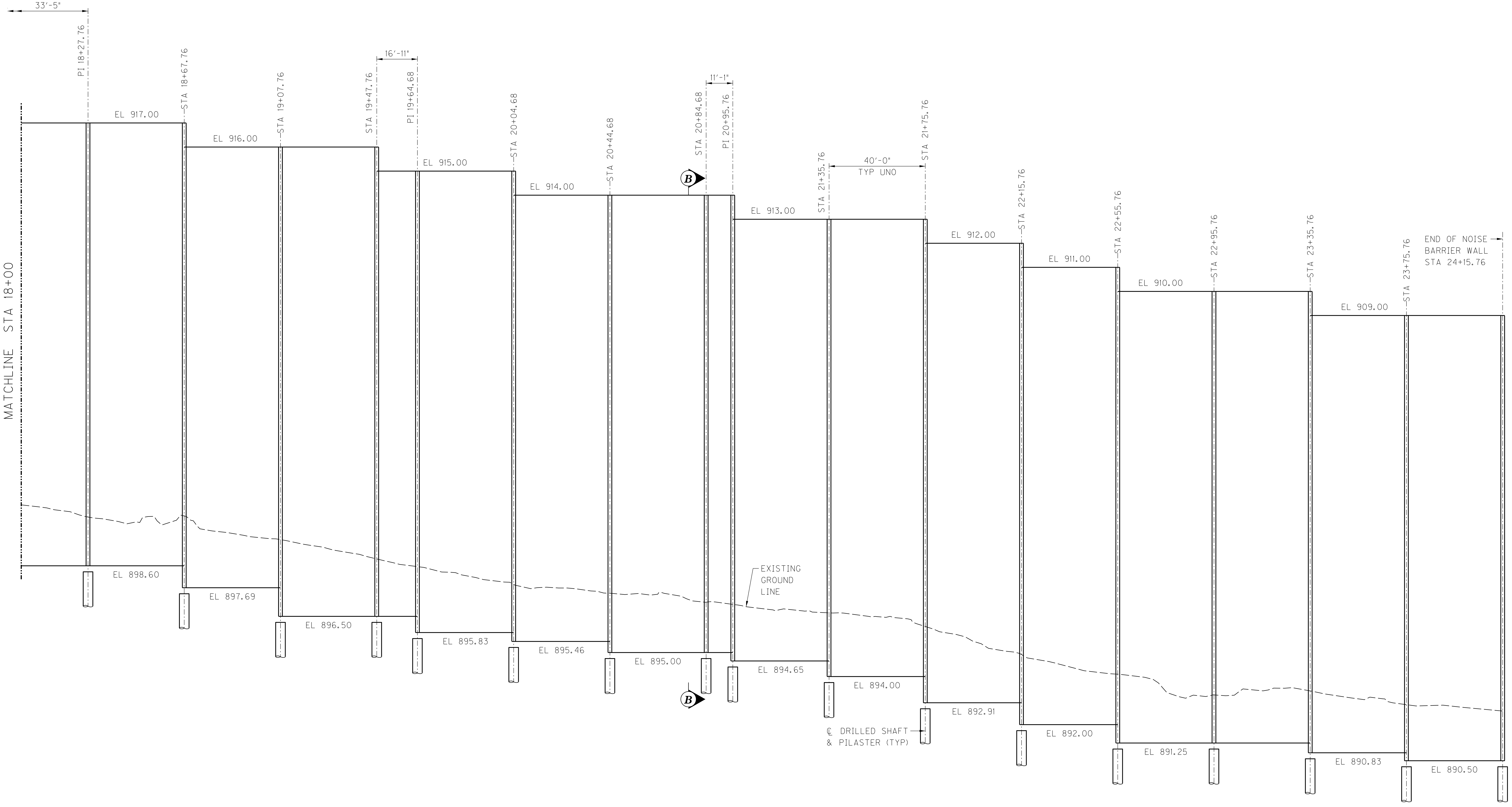
FILE NAME: V:\1785\ACTIVE\178560012\STRUCTURES\NOISE_WALL_PF3.DGN

USER: srparsons
DATE PLOTTED: August 21, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-14.00	8



MicroStation v8.11.9.832

E-SHEET NAME:

USER: srparsons
DATE PLOTTED: August 21, 2018

FILE NAME: V:\1785\ACTIVE\178560012\STRUCTURES\NOISE_WALL_PF4.DGN

SCALE: 1"= 20'

KY536 INTERCHANGE
ELEVATION NOISE WALL
STA 18+00 TO STA 24+16

Addendum 2 -- 7-11-19

Appendix H3 -- KY 338 (Item No. 6-18) Geotechnical Reports (Roadway)

For Reference Only

6-18 Geotechnical Reports for Roadway + Structures Summary

Last Update: 6-7-19, v.3

Structure Type	Number	Structure	Alignment	Begin	End	Length	Offset	Average Height Approx.	Wall Type	Structure Number	Report Date	Company	Page #
Bridges	1	US25 over KY 338 Bridge over - SPUI	US 25	46+66.40	49+71.84	305				S-065-2018	01-02-19	HDR	
	2	Norfolk Southern Railway Bridge over KY 338	Rail	19+73.82	20+96.82	123				S-066-2018	12-04-18	HDR	
		Addendum								SA-002-2019	04-03-19	HDR	
Box Culverts / Culverts	1	4' x 4' RCBC Extension	US 25	32+06.40	NA					S-080-2018	11-21-18	HDR	R77
	2	8' x 5' RCBC Extension at Outlet	I-75 / I-71	435+53.90	NA					S-081-2018	11-21-18	HDR	R29
	3	72" Pipe Culvert Extension	Triple Crown Blvd.	119+45	EB 106+45~					RA-002-2019		Parsons	R113
Retaining Walls	1	Retaining Wall #1, KY 338 at Triple Crown Blvd	KY 338	103+88	106+60	225	LT	9	Gravity	S-074-2018	12-12-18	Parsons	R3A, R5
		Addendum: Wall 1								SA-003-2019	03-15-19		
		Addendum: Wall 1A								S-045-2019	03-20-19		
	2	Retaining Wall #2	KY 338	113+80	114+70	150	LT	6	Gravity	Std. Dwg.	N/A		R7, R9
	3	Retaining Wall #3, I-75/I-71 Ramp A to WB KY 338	WB KY 338	201+14	202+77	160	LT	10	Gravity	S-075-2018	03-20-19	Parsons	R13
	4	~~Retaining Wall #4, Best Pal Drive~~	~~Best Pal Drive~~	~~23+00~~	~~25+10~~	~~238~~	~~RT~~		~~Gravity~~	~~S-078-2018~~	~~12-26-18~~	~~HDR~~	~~R123~~
	5	~~Retaining Wall #5, Best Pal Drive~~	~~Best Pal Drive~~	~~27+18~~	~~27+86~~		~~RT~~		~~Gravity~~	~~eliminated?~~		~~HDR~~	~~R125~~
	7	Retaining Wall #7, KY 338 to SB US 25 Ramp G	US 25	42+00	46+75	475	LT	12	MSE wall	S-067-2018	01-07-19	HDR	R81, R83
	8	Retaining Wall #8, SB US 25 to KY 338 Ramp E	US 25	49+55	55+50	595	LT	12	MSE wall	S-070-2018	01-09-19	HDR	R83, R85
	9	Retaining Wall #9, NB US 25 to KY 338 Ramp A	US 25	41+50	46+70	520	RT	12	MSE wall	S-068-2018	01-09-19	HDR	R81, R83
	10	Retaining Wall #10, KY 338 to NB US 25 Ramp C	US 25	49+55	55+25	570	RT	12	MSE wall	S-071-2018	01-09-19	HDR	R83, R85
	11	Retaining Wall #11, US 25 North to KY 338 East	Ramp A	13+45	17+60	405	RT	10	Non-MSE	S-069-2018	12-11-19	HDR	R95, R97
	12	Retaining Wall #12, NS Bridge Wingwall on Ramp C	Ramp C	30+46	31+50	700	RT	10	Non-MSE	S-072-2018	12-11-18	HDR	R99
	13	Retaining Wall #13	I-75 / I-71	489+85	490+25	40	RT	5	Gravity	Std. Dwg.	N/A		R35, R37
	14	Retaining Wall #14, EB KY 338 under I-75/I-71	EB KY 338	107+85	109+58	165	LT	13	Soil-nail	S-077-2018	03-26-18	Parsons	R15
		Addendum							Soil-nail	SA-008-2019	04-15-19	Parsons	R15
	15	Retaining Wall #15, WB KY 338 under I-75/I-71	WB KY 338	207+80	209+45	175	RT	13	Soil-nail	S-076-2018	01-10-19	Parsons	R15
Noise Wall	1	Sound Wall Along I-75/I-71	I-75 / I-71	421+50	442+50	2100		14		S-073-2018	01-09-19	Parsons	R27, R29

Roadway Reports	Number	Facility (ies) / Report Contents	Alignment	Begin	End	Length	Offset	Average Height	Wall Type	Report Number	Report Date	Company	Page #
Roadway Report	N/A	KY 338, US 25, I-75	KY 338 US 25 I-75 I-75 Mile Points	99+00 5+84 419+04 175.217	392+44 77+00 506+18 175.622		N/A	N/A	N/A	R-049-2015	10-26-16		Overall Plans
Addendum	N/A	Norfolk Southern Rail Track Improvements (non-structural)	NS Track				N/A	N/A	N/A	RA-010-2018	03-27-19		
Roadway Addendum	N/A	Best Pal, Pilot "East" Entrance, Changes to Retaining Walls, Pipes > 54", Lightweight fill requirements for (2) box culverts, Geotechnical Notes & Special Notes					N/A	N/A	N/A	RA-002-2019	04-04-19		
Roadway Addendum	N/A	Geotechnical Note 7.24 for Retaining Walls, added soil profile for Best Pal Dr.					N/A	N/A	N/A	RA-004-2019	05-09-19		

(R-049-2015) Consultant

MEMORANDUM

TO: **Randy Turner, PE**
Project Management Coordinator
Division of Highway Design

FROM: **Bart Asher, PE, PLS**
Geotechnical Branch Manager
Division of Structural Design

BY: **Erik Scott, PE**
Geotechnical Branch

DATE: **October 26, 2016**

Subject: **Geotechnical Engineering Roadway Report**
Boone County
I-75 / KY-338 (Richwood Road) Interchange
FD52 008 0075 175-176
I-75 Milepost 175.217 to 175.622
Mars No. 8433801D
Item No. 6-18.00

The geotechnical engineering roadway report for the subject project has been completed by Stantec Consulting Services, Inc. The drilling and sampling was also performed by Stantec, but under a separate statewide contract for drilling services. The electronic data files will be provided via email to the Design Consultant, HDR, Inc., for incorporation into the roadway plans. The electronic files will also be made available on ProjectWise.

If you have any questions or need additional information, please contact the Geotechnical Branch at 502-564-2374.

cc: **Division of Design (Plan Processing Section)**
Division of Construction
TEBM for Pavement Design
TEBM for Project Delivery & Preservation (District)
TEBM for Project Development (District)
Project Manager (District)
HDR, Inc.
Stantec Consulting Services, Inc.

Attachment

Report of Geotechnical Exploration

I-75/71 and KY 338 Interchange
Boone County, Kentucky
Item No. 6-18.00
R-049-2015

Prepared for:
Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:
Stantec Consulting Services Inc.
Lexington, Kentucky

October 12, 2016

Addendum 2 -- 7-11-19

Stantec Consulting Services Inc.
3052 Beaumont Centre Circle, Lexington KY 40513-1703

October 12, 2016
File: rpt_001_175565314

Attention: Mr. Bart Asher, PE
Kentucky Transportation Cabinet
Division of Structural Design – Geotechnical Branch
1236 Wilkinson Boulevard
Frankfort, Kentucky 40601-1200

Reference: Report of Geotechnical Exploration
I-75/71 and KY 338 Interchange
Boone County, Kentucky
Item No. 6-18.00
R-049-2015

Dear Mr. Asher,

Our geotechnical engineering report for the referenced roadway project is being submitted with this letter. The exploration was conducted by Stantec Consulting Services Inc. (Stantec) under a separate contract in late 2015.

Results of the field borings, laboratory testing program, and recommendations for design and construction of the roadway are presented in this report. A legend sheet, geotechnical notes, soil profile sheets, and cut and embankment stability sections are included as half-scale reproductions.

We have enjoyed working with your staff again in support of the design of this project. If we can be of further assistance, please call our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Derek Gerdeman, PE	Adam Crace, PE
Project Engineer	Senior Associate
Phone: (859) 422-3086	Phone: (859) 422-3084
Fax: (859) 422-3100	Fax: (859) 422-3100
Derek.Gerdeman@stantec.com	Adam.Crace@stantec.com

/rnm

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LIST OF APPENDICES

1.0 LOCATION AND DESCRIPTION

The Kentucky Transportation Cabinet (KYTC) is planning to reconstruct the I-75/71 and KY 338 (Richwood Road) Interchange in Boone County, Kentucky. HDR, Inc. (HDR) is the lead designer for this interchange. Stantec Consulting Services Inc. (Stantec) was selected to provide geotechnical services through the Statewide Engineering Contract.

The project is located along the existing KY 338 and I-75/71 alignments in Boone County, Kentucky. Project plans provided by HDR indicate the project is positioned from approximate mileposts 175.2 to 175.6 along the I-75/71 alignment. US 25, which basically runs parallel to I-75/71 in this area, is also being improved with interchange modifications where it crosses KY 338. The project consists of a DCD interchange, SPUI interchange, roundabout, culvert extensions, 15 retaining walls, 2 new bridges, and a railroad detour. This report addresses the geotechnical exploration and recommendations relating to the roadway portions of the project. The structures will be addressed under separate covers. The proposed alignment is illustrated on portions of the Union and Independence, Kentucky USGS 7.5 minute topographic quadrangles in Appendix A.

2.0 TOPOGRAPHY AND DRAINAGE

The project area is located in the Outer Bluegrass Physiographic Region. This region consists of deep valleys with little flat land due to erosion of the underlying interbedded limestones and shales. The maximum vertical relief along the proposed finished grade of KY 338 is approximately 87 feet with the lowest point at approximate Station 99+00 (elevation ±822 feet) and the highest point being at approximate (KY 338 East) Station 73+80 (elevation ±909 feet).

Surface drainage in the area generally follows a dendritic pattern. Drainage flows towards the southwest through several named and unnamed tributaries of Mud Lick Creek. The watershed eventually drains into the Ohio River.

3.0 GEOLOGY

Available geologic mapping (USGS Geologic Maps of the Union and Independence Quadrangles) indicates that the project area is underlain by bedrock of the Bullfork Formation, Bellevue Tongue of Grant Lake Limestone, and Fairview Formation, representing the Upper Ordovician Geologic Period. The Bullfork Formation consists primarily of 50 to 60 percent limestone interbedded with shale. The limestone is primarily described as fossil-fragmental limestone, medium gray in color, even to irregularly bedded, beds are 1 to 8 inches thick, weathers light gray to yellowish gray, and consists of whole and broken fossils cemented with micrograined to sparry calcite. The shale is described as medium-gray in color, calcareous, poor to good fissility, and sparsely to moderately fossiliferous. The Bellevue Tongue of Grant Lake Limestone is described as rubbly weathering, medium-gray in color, thin irregular beds and discontinuous. The Fairview Formation consists of 50 to 60 percent limestone interbedded with shale. The limestone is described as medium-gray in color, weathers light gray, thin to medium bedded, fine grained, argillaceous, and silty. The shale is described as medium gray in color, weathers light gray, commonly occurs in beds 1 to 8 inches thick, and is more abundant in the lower part of the unit.

Structural contours (drawn on the base of the Bellevue Tongue of Grant Lake Limestone on the Union Quadrangle) show the regional dip to be nearly zero in the project vicinity. No known faults or other geologic features are mapped in the project vicinity.

4.0 DRILLING AND SAMPLING

4.1 GENERAL

Stantec executed the drilling and sampling operations in late 2015. These activities included rock core borings, soil profile/disturbed sample borings, undisturbed soil sampling, rockline soundings, and observation well installations. A boring plan was developed by Stantec personnel for the proposed project alignment after a review of the available plans, profiles, and cross-sections provided by HDR. The draft boring plan was subsequently reviewed and approved by the KYTC Geotechnical Branch. The final boring plan was provided to KYTC District 6 personnel for field staking. Some boring locations were adjusted in the field during the subsurface exploration as site conditions warranted.

4.2 ROCK CORE BORINGS

Selected critical cut sections along the alignments contained rock core borings. Stantec utilized these borings to evaluate cut slope geometries applicable for this roadway project. Upon completion of the drilling operations, the rock cores were transported to Stantec's office and logged by the project geologist. The geologist determined the depth of the rock disintegration zone (RDZ) for each boring, and also determined the percent recovery and rock quality designation (RQD) for each core run. As previously noted, the predominant rock types in the project area are limestone and shale. Appendix B contains cut stability sections with detailed rock core descriptions.

4.3 DISTURBED SAMPLE BORINGS

Soil profile borings were drilled along the proposed roadway alignment to provide information concerning the types and thicknesses of the existing soils. Soil profile borings were typically extended to the cut-off depths presented in the final boring plan, unless auger refusal was encountered before reaching the proposed cut-off depth. Soil cuttings were logged by Stantec personnel as they were conveyed to the surface during the augering process. Particular attention was given to the texture, color, moisture content, and consistency of the materials encountered. Soil cuttings (jar samples) were collected from each boring at depth intervals of approximately five feet to provide samples for subsequent natural moisture content testing. Bag samples of the predominant soil types were collected per 1,000-foot intervals per soil horizon to provide specimens for engineering classification, moisture-density, and California Bearing Ratio (CBR) testing, as applicable.

4.4 UNDISTURBED SAMPLE BORINGS

Several embankment stability sections included sample borings which were performed to collect subsurface data for the proposed embankments. Undisturbed thin-walled (Shelby) tube samples were generally collected at five-foot intervals of depth, or less, to provide specimens for subsequent shear-strength testing. Where granular soils were encountered, or where gravel and rock fragments resulted in poor Shelby tube recoveries, standard penetration tests (SPT) were performed in the sample borings. Selected Shelby tube specimens extruded by laboratory personnel of Stantec were subjected to consolidated-undrained triaxial strength, unconfined compressive strength, and engineering classification testing. Appendix B contains graphical results on the appropriate stability sections.

4.5 ROCKLINE SOUNDINGS

Rockline soundings were drilled along the project alignment at locations within selected cut intervals, or where additional top of rock data was necessary to assist in developing slope recommendations. The rockline data is presented on the appropriate stability sections in Appendix B.

4.6 OBSERVATION WELLS

Selected boring locations included observation wells to estimate the position of subsurface ground water. Stantec installed traditional KYTC type observation wells where the overburden depths in the sample borings exceeded 5 feet, as outlined in the KYTC Geotechnical Manual. Water level readings were obtained from the observation wells a minimum of seven days following the completion of the borings. The observed water levels indicated on the embankment stability sections in Appendix B are as recorded 7 days after installation of the well. These water levels may vary considerably, with time, according to the prevailing climate, rainfall, or other factors. Table 1 includes a summary of ground water measurements.

Table 1. Observation Well Measurements

Hole Number	Ground Elevation (ft)	Water Level Elevation (ft)
1A	865.0	853.9
2A	864.5	856.9
15A	924.9	Dry
167	886.8	853.2
168	858.1	Dry
169	863.4	830.1
171	859.5	830.5
173	878.0	874.3
174	876.9	871.6

5.0 LABORATORY TESTING AND RESULTS

5.1 GENERAL

All laboratory tests were performed by Stantec in accordance with applicable AASHTO or Kentucky Methods of soil and rock testing specifications. The results of the laboratory tests are depicted graphically on the appropriate soil profile sheets and stability sections presented in Appendix B. The test results were used to estimate material properties that would be utilized in subsequent engineering analyses to evaluate slope stability and pavement subgrade support.

5.2 DISTURBED SOIL DRILLING AND TESTING RESULTS

Soil classification tests, including particle size analyses, Atterberg limits, and specific gravities were performed on disturbed bag samples representing the soils encountered within fill sections. In addition to soil classification testing, standard Proctor moisture-density relationships and California Bearing Ratios (CBR) were determined for bag samples representing the predominant soils encountered within cut intervals.

Based upon the information obtained from the borings performed along the alignment, soil thickness varies from less than 2 feet to over 20 feet. The topsoil measured in the test borings for the project varied from areas with no topsoil to approximately 0.5 feet. The soils classify as CH (49%), CL (43%), SC (6%) and GC (2%) according to the Unified Soils Classification System (USCS), and as A-7-6 (82%), A-6 (16%), and A-2-4 (2%) according to the AASHTO classification system. A summary of laboratory testing of disturbed soil samples can be found in Appendix C.

CBR test results for the bag samples ranged from a low value of 0.9 at I-75/71 Ramp C to KY 338 Station 309+00, which classified as a CH material, to a high value of 9.0 at US 25 Ramp E Station 55+00, which classified as a CL material. A CBR design value of 2 is estimated for this project, using Yoder's 90th percentile method. Because of the low design CBR value, and the estimate that sufficient quantities of durable rock will not be available for roadbed construction, lime modification, or mechanical treatment of subgrade soils will be recommended to improve subgrade support during construction and to increase the life of the pavement. Recommendations for such subgrade treatment are provided in Section 8 of this report.

Natural moisture contents were determined for grab samples of soils obtained from disturbed soil borings. Generally, these test results indicate that the soils can be categorized as moist to wet, based on a range of dry, damp, moist, wet, and saturated moisture conditions. In general, the moisture contents of the soil materials encountered were above or near the soil's corresponding plastic limit.

5.3 UNDISTURBED SOIL TESTING

Undisturbed (Shelby) tube samples were obtained from selected critical cut and embankment stability locations. Soil samples were extruded from the tubes, trimmed into six-inch specimens, and described visually. Unit weights (wet and dry) and natural moisture contents were determined for each six-inch specimen. Unconfined compressive strength testing was also performed on select samples. The results of these tests are presented on the appropriate stability sections in Appendix B.

5.4 RESULTS OF FIELD AND LABORATORY TESTING OF SPT SAMPLES

Standard penetration tests (SPT) were performed in sample borings where non-cohesive materials were encountered. The SPT N-values varied from 0 to 14 blows per foot. Recovered SPT samples were subjected to natural moisture content, grain-size sieve analysis (silt plus clay determination), and standard engineering classification testing. The SPT samples tested classify as GC and CL according to USCS, and primarily as A-2-6 and A-7-6 with lesser occurrences of A-6 based on the AASHTO classification system. The results of the standard penetration testing and associated laboratory testing are presented on the appropriate stability sections presented in Appendix B.

5.5 SLAKE DURABILITY INDEX (SDI) AND JAR SLAKE (JS) TESTING

The SDI and Jar Slake tests provide indications of the effects that weathering processes will have on the bedrock when exposed in open cut faces. Both of these tests are performed on rock comprised primarily of shale. The Kentucky Transportation Cabinet separates shale into four categories for design purposes, depending upon SDI and Jar Slake values, as indicated in Table 2.

Table 2. KYTC Shale Classification

Classification	SDI (%)	Typical Jar Slake Category
Durable	95 to 100	6
Non-Durable, Class I	80 to 94	4 or 5
Non-Durable, Class II	50 to 79	3 or 4
Non-Durable, Class III	0 to 49	1 or 2

A review of SDI and Jar Slake indicated none of the samples tested classify as durable shale; 24% classify as non-durable, Class I; 58% classify as non-durable, Class II; and 18% classify as non-durable, Class III. The specific sample locations with corresponding SDI and JS values are depicted on the graphical core logs shown on the cut stability sections in Appendix B.

6.0 SLOPE STABILITY ANALYSES

6.1 CUT SECTIONS

6.1.1 Rock Cuts

Bedrock encountered in the rock core borings drilled along the project corridor correlates well with the referenced geologic mapping. The cores obtained consist of limestone and shale. The limestones are light gray to gray, argillaceous, thin wavy bedding, and slightly weathered and fractured along joints. The shales are gray to dark gray, fissile, calcareous, medium thick laminations, and slightly weathered in zones.

Cut slope recommendations were based upon a review of the rock cores obtained at selected critical cut sections, thicknesses of soil materials at cut stability boring locations, regional and local lithology and, Stantec’s experiences gained from past design of cut slopes in similar rock formations. Due to the overall poor quality of the bedrock and shallow nature of the cuts, all cut slopes on the project are shown at a 2:1(H:V) slope. The cut slopes were submitted to KYTC for review and all comments from KYTC were addressed and corrected. No formal rock core meeting was conducted. Final cut slope recommendations are presented in Appendix B.

6.1.2 Soil Cut Stability

Slope recommendations for soil cuts were based upon reviews of the borings drilled at critical cut sections, soil thicknesses at these locations, associated laboratory testing, and slope stability analyses. Final cut slope recommendations are presented in Appendix B.

Selected critical soil cut sections were evaluated for intermediate-term and long-term slope stability. Stantec evaluated the global stability of the cut slopes utilizing the SLOPE/W software, a slope stability program distributed by GEO-SLOPE International, LTD., of Calgary, Alberta, Canada. SLOPE/W is a special-purpose computer program designed to analyze the stability of earth slopes using two-dimensional limit equilibrium methods. Intermediate-term analyses, using effective-stress shear-strength parameters for residual materials, simulate conditions after the cut has been completed and the groundwater table is positioned at its maximum anticipated height within the cut. Long-term analyses, using effective-stress shear-strength parameters with reduced cohesion, simulate conditions that will exist long after the cut is constructed and the groundwater table has been lowered due to the presence of the cut. Target factors of safety for roadway cut and embankment situations as defined by the current KYTC Geotechnical Manual are presented in Table 3.

Table 3. Target Factors of Safety for Slope Stability Analyses

	Short-Term	Intermediate-Term	Long-Term
Roadway Embankments	1.1 – 1.3	---	1.4 – 1.6
Bridge/Culvert Approach Slopes	1.2 – 1.4	---	1.6 – 1.8
Cut Slopes in Soil	1.2 – 1.4	1.2 – 1.4	1.4 – 1.6

Based on a review of the soil types and thicknesses encountered within cut intervals, it is apparent that the majority of cuts will be made in cohesive soils (sandy, silty, clays). Shear-strength parameters for the residual materials were derived from soil classification data discussed in Section 5 of this report. Table 4 provides a summary of the cut stability analyses.

Table 4. Summary of Cut Stability Analyses

US 25 Ramp C Station		Slope Geometry (H:V)	Approximate Cut Depth (ft)	Factor of Safety	
				Intermediate-Term	Long-Term
30+00	Right	2:1	25	2.5	1.5

One cut stability analysis was performed for this project. Factors of safety presented in Table 4 meet or exceed the minimum target values outlined in the KYTC Geotechnical Manual. It should be noted that the cut section above at Station 30+00 is within 30 feet of a proposed retaining wall. Additional stability analyses will be required for the wall and a factor of safety of 1.6 will be required.

6.2 EMBANKMENT STABILITY ANALYSES

Selected embankment sections were evaluated for short and long term slope stability. Stantec evaluated the global stability of the embankment slopes utilizing the SLOPE/W software. Short-term analyses, using total-stress shear-strength parameters for foundations and embankment materials, simulate conditions that will exist immediately following completion of the embankments. Long-term analyses, using effective-stress shear-strength parameters, simulate conditions that will exist long after the embankment is constructed and excess pore pressures within the foundation materials have dissipated.

Based on the proposed construction limits, it is estimated that the majority of the roadway embankments will be constructed from the residual overburden soil and limestone/shale mixtures that will be available from project excavations. Shear-strength parameters for the soil embankment materials were estimated from correlations for published data for recompacted clays and laboratory testing of samples encountered in the borings performed along the project alignment. The shear-strength parameters for the foundation soils were derived from soil classifications and associated published correlations of such data.

Shear-strength parameters used for the embankment and foundation materials are shown on the embankment stability sections in Appendix B. Table 5 summarizes the shear-strength parameters modeled for the embankment materials.

Table 5. Embankment Shear-Strength Parameters

Soil Fill Material						
Total Stress				Effective Stress		
c	=	1,400 psf		$\bar{c}$	=	270 psf
ϕ	=	0°		$\bar{\phi}$	=	28°
γ	=	125 pcf		γ	=	125 pcf

Results of slope stability analyses, including predicted minimum factors of safety, predicted failure surfaces, and modeled groundwater table positions are presented graphically on the appropriate stability sections in Appendix B. A summary of the results of the embankment stability analyses is provided in Table 6.

Table 6. Summary of Embankment Stability Analysis

Station	Slope Geometry (H:V)	Approximate Embankment Height (ft)	Factor of Safety		
			Short-Term	Long-Term	Rapid Drawdown
425+00, SB I-71/75 Aux. Entrance Lane	2:1	28	1.2	1.5	1.4
435+50, SB I-71/75 Aux. Entrance Lane	2.5:1*	33	1.4	1.7	1.7
326+50, Ramp C**	2.5:1*	--	--	--	--
51+00, Triple Crown Blvd	2:1	19	4.0	1.9	1.5
32+50, US 25	2:1	23	1.6	1.6	1.3

* The 2.5:1 (H:V) slope configuration is required to meet KYTC minimum target factors of safety as outlined in the Geotechnical Manual for culvert approach slopes.

** Refer to Station 435+50, SB 1-71/75 Aux. Entrance Lane for stability analysis information for this section.

The embankment stability sections at SB I-71/75 Aux. Entrance Lane Station 435+50 and Ramp C Station 326+50 are in the vicinity of proposed box culverts. In order to meet the minimum target factor of safety values, these embankments shall have a minimum slope of 2.5:1 (H:V). Stantec performed analysis of these areas with durable rock as the new embankment and 2:1 (H:V) embankment slopes and they did not meet minimum factor of safety requirements. It should be noted that the projects limits for Ramp C have been adjusted and Ramp C Station 326+50 is now outside of those limits, but is still shown here for completeness. Refer to SB 1-71/75 Aux. Entrance Lane Station 435+50 for stability analysis information that is also applicable to Ramp C Station 326+50, as these are essentially the same section. The factors of safety presented in Table 6 meet or exceed the minimum target values outlined in the KYTC Geotechnical Manual and indicate the 2:1 (H:V) embankment configurations should exhibit adequate stability as proposed for all other embankment locations.

7.0 GEOTECHNICAL NOTES

7.1 Clearing and grubbing of embankment areas shall be completed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.2 Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.3 Procedures shall be performed as required to control erosion and water pollution in accordance with Sections 212 and 213 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.4 All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.5 All catch basins and manholes shall be filled and capped and all septic tanks shall be filled in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.6 All channel changes and special ditches shall be constructed prior to placement of any embankment materials adjacent to them in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Materials excavated from these areas may be utilized in construction of the embankments, but may require aeration to the proper moisture contents prior to compaction operations. No extra payment shall be permitted for re-handling, hauling, stockpiling, and/or manipulating these materials.

7.7 In accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, the moisture content of embankment and subgrade materials shall not vary from the optimum moisture content, as determined by KM 64-511, by more than ±2%. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

7.8 All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for re-handling, hauling, stockpiling, and/or manipulating soils.

7.9 The Contractor shall conduct grading operations in such a manner that limestone obtained from roadway excavation shall be stockpiled separately or otherwise manipulated so that ample quantities are available for those areas requiring said material. No direct payment will be allowed for such necessary manipulating as stockpiling and/or double handling the material. Limestone shall not be wasted unless prior approval is obtained from the Engineer.

7.10 The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be incidental to the earthwork.

7.11 Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas as directed by the Engineer shall be drained and stabilized using non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. An estimated 3-foot working platform shall be constructed in such areas.

7.12 As directed by the Engineer, a three-foot thickness of non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction shall be utilized to fill full-width and stabilize the existing drainage swales or stream channels located within the limits of the roadway embankment. The granular embankment shall also be placed over all adjacent areas that may be soft and saturated. Positive drainage of these abandoned stream channels shall be maintained to reduce the possibility of trapping water within the roadway embankments.

7.13 The Contractor shall construct embankment foundation benches and transverse benches as indicated on the plans or as directed by the Engineer, prior to placement of embankments in areas requiring such benches.

7.14 Embankment foundation benches/slope serrations and perforated pipe underdrains shall be constructed at the following approximate locations in accordance with current Kentucky Department of Highways Standard Drawings RGX-010 and RDP-006, project cross-sections and as directed by the Engineer. The benches shall be constructed one at a time beginning with the lowest bench. Each bench shall be backfilled prior to excavation of the next bench. This procedure should be followed to help maintain stability of the existing slopes in these areas.

Approximate Station Limits

KY 338
88+75 to 89+25, Right
99+50 to 106+50, Left
107+75 to 108+25, Left

SB I-71/I-75 Aux. Entrance Lane
422+50 to 426+75, Left
432+75 to 437+75, Left

SB I-71/I-75 Aux. Exit Lane
478+50 to 482+50, Left

NB I-71/I-75 Aux. Entrance Lane
478+25 to 480+50, Left

Ramp B
256+25 to 264+00, Right

US 25
18+50 to 21+00, Right
19+25 to 21+75, Left
30+00 to 33+25, Right
31+25 to 33+50, Left

Triple Crown Blvd
50+75 to 51+25, Left and Right

7.15 Conventional transverse benches shall be constructed and perforated pipe underdrains installed at the following approximate locations in accordance with Kentucky Department of Highways Standard Drawings RDP-005 and RDP-006, project cross-sections (as applicable), and as directed by the Engineer. Contrary to Standard Drawing RDP-006, transverse benches and perforated pipe underdrains shall be installed in both uphill and downhill transition areas between cuts and fills. Existing perforated pipe underdrains should be extended.

Approximate Station Limits

Ramp A1
155+40
157+20

Ramp B
252+20

Ramp B1
201+75

7.16 Perforated pipes for subgrade drainage shall be installed at vertical sags and at the upgrade ends of structures, in accordance with Kentucky Department of Highways Standard Drawing RDP-005 and/or as directed by the Engineer. These drainage features shall be installed at the following approximate locations:

Approximate Station Limits

KY 338
100+25
108+60
113+40

KY 338 East
87+48

Ramp A1
156+90

Ramp B1
202+45

Approximate Station Limits

Ramp C1

352+60

Ramp D

415+90

US 25

9+97	32+63
22+43	54+10

US 25 Ramp A

17+49

US 25 Ramp D

42+05

US 25 Ramp E

59+22

US 25 Ramp G

71+25

Grand National Blvd

98+90

Grand National Access Drive

50+20
55+75

Triple Crown Blvd

51+80

Best Pal Drive

26+28

Old Lexington Pike

5+65

Paddock Drive

200+85

Frogtown Connector Road

600+70

7.17 The Contractor shall conduct grading operations in such a manner that soil (free of rock larger than 4 inches) from roadway excavation be stockpiled separately or otherwise manipulated so that ample quantities are available for a chemically stabilized roadbed meeting the requirements of Section 208 of the current Standard Specifications for Road and Bridge Construction. No direct payment will be allowed for such necessary manipulating as stockpiling, hauling and/or handling the material.

7.18 Construct a chemically modified soil subgrade with a CBR value of 2 for the underlying soil. Where soft and/or wet subgrade is encountered during construction, the thickness of the chemically modified soil may need to be adjusted (increased up to 16" max) to also serve as a working platform for subgrade stabilization. These adjustments shall be as directed by the Engineer, and may depend on the seasonal fluctuations in the water table.

7.19 In areas where the chemical stabilization is not feasible (such as cross-overs, tie-ins, narrow widenings, etc.) the top one foot of the roadbed shall be constructed with KY Course Aggregate No. 2, 3, or 23 in accordance with Section 805 of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, current edition. The aggregate shall be wrapped with Geotextile Fabric Type IV in accordance with Sections 214 and 843 of the current Standard Specifications. The platform shall daylight horizontally to the edge of the embankment in fills and to the ditchline in the cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction.

7.20 Where shale (or limestone) bedrock is encountered at the top of subgrade in the cuts, the roadbed shall be undercut one foot below the proposed grade and the limits of the roadbed excavation shall be extended to the ditchlines. The refill shall consist of soil and shall be constructed as specified in Section 204 of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, current edition. Shale cannot be used in the top one foot of the subgrade. For Roadway Excavation projects, the placement of soil refill shall be incidental. For Embankment-in-Place projects, the placement of soil refill shall be paid at the unit bid price for Embankment-in-Place and the excavation of the bedrock material shall be incidental. For either case, no compensation shall be made for the incidental portions of this work.

7.21 Pile cores shall be constructed at the bridge approach embankments in accordance with Kentucky Standard Drawings RGX-100 and RGX-105, meeting the material requirements of the current edition of Special Provision 69. If dissimilar materials are used, a Geotextile fabric, Type IV, separator will be required between the pile core and embankment, in accordance with Sections 214 and 843 of the current Standard Specifications.

7.22 As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and backfilled with suitable subgrade material in accordance with Section 207 of the current Standard Specifications.

Approximate Station Limits

KY 338
99+00 to 108+00
111+00 to 124+00

EB KY 338
100+00 to 105+00
112+00 to 116+00

WB KY 338
205+00 to 216+22

KY 338 East
87+00 to 92+45

SB I-71/I-75 Aux. Entrance Lane
419+04 to 433+50

SB I-71/I-75 Aux. Exit Lane
474+86 to 492+86

NB I-71/I-75 Aux. Entrance Lane
473+00 to 506+17

Ramp A
87+60 to 101+00

Ramp B
253+00 to 265+40

Ramp C
304+00 to 311+50
324+00 to 326+96

Approximate Station Limits

Ramp D
400+00 to 405+00
408+00 to 416+00

US 25
5+94 to 22+90
27+60 to 30+80
34+00 to 77+00

Triple Crown Blvd
50+00 to 53+14

Best Pal Drive
24+25 to 28+25
29+75 to 33+00

Paddock Drive
201+00 to 203+85

7.23 As directed by the Engineer, existing bituminous concrete at the following approximate locations that is positioned within the limits of new roadway embankments and positioned at a distance greater than three feet below proposed subgrade elevation, shall be scarified or broken until all cleavage planes are destroyed, or the pavement shall be removed entirely as conditions demand in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Subgrade materials remaining after removal of pavements may need to be stabilized prior to placement of new pavement sections, as directed by the Engineer.

Approximate Station Limits

US 25
30+80 to 34+00

7.24 The retaining walls at the following locations will affect the cut slope and embankment construction. For these areas, please refer to the structural plans for specific instructions for cut slope and embankment construction.

Approximate Station Limits

KY 338
103+90 to 106+60, Left
113+70 to 115+25, Left

Approximate Station Limits

EB KY 338

100+90 to 102+70, Left
107+90 to 109+60, Left
113+70 to 114+90, Right

WB KY 338

200+90 to 202+50, Left
207+80 to 209+50, Left

Ramp B1

200+10 to 201+00, Right

US 25

42+00 to 47+00, Left
41+50 to 47+00, Right
49+10 to 55+50, Left
49+40 to 55+20, Right

US 25 Ramp A

12+80 to 17+40, Right

US 25 Ramp B

20+00 to 21+29.78

US 25 Ramp C

30+50 to 36+50, Right

7.25 Embankment slopes at the following location will need to be flatter than a 2:1 (H:V) to maintain minimum factor of safety requirements for slope stability. The fill limits and required sections show the flattened slopes and results of the stability analysis.

Approximate Limits	**Steepest Allowable Slope**
SB I-71/I-75 Aux. Entrance Lane Station 434+80 to 436+20	2.5:1 (H:V)

7.26 All embankment construction using non-durable shale will be in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction, “Embankment Principally of Non-Durable Shale”.

7.27 Some areas of the project may contain silts or sands at subgrade. Lime may not be effective in stabilizing these materials. If such soils are encountered, the Stabilization Contractor shall adjust the stabilization techniques, as directed by the Engineer. Based on boring information, these soils may be encountered at the following locations. Geotechnical Branch personnel are available to assist in identifying these soil types and providing alternative treatment recommendations, if needed.

Approximate Station Limits

Ramp B
260+50 to 265+40

Old Lexington Pike
5+00 to 10+00

8.0 DESIGN RECOMMENDATIONS

8.1 The project shall be designed for a soil subgrade utilizing a CBR value of 2.

8.2 Stantec understands that sufficient quantities of durable rock may not be available to construct a rock subgrade for a pavement section. Therefore, a soil subgrade is recommended to support the pavement section for the majority of this project. Because of the consistently low CBR values, chemical or mechanical improvement of the subgrade will need to be implemented for stabilization purposes during construction and to extend pavement life. It is recommended that chemical modification of the top eight inches of subgrade material be performed for soil stabilization purposes. Stantec's experience gained from similar roadway projects indicate lime may be used to treat soil types that were encountered at the project site. It is suggested that six percent by weight (using an average dry density of 106 pounds per cubic foot) be utilized to determine plan quantities.

The lime shall be applied in accordance with Section 208 – "Chemically Stabilized Roadbed" of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. In roadway areas where there will be cross-overs and property entrances, lime stabilization of the roadbed may not be very practical. For such areas only, mechanical improvement of the subgrade should be considered. Mechanical stabilization may be accomplished using 12 inches (minimum) of coarse aggregate (2s, 3s, or 23s) wrapped with a Type IV geotextile fabric. For quantity estimating purposes 3,000 linear feet of roadway should be included.

8.3 An average soil shrinkage value of 3% is recommended for soil to be excavated on this project. This value is to be used in calculating an "apparent" shrinkage value in accordance with Section 61-03.0400 of the Kentucky Transportation Cabinet Division of Design Guidance Manual. This shrinkage value should be applied only to soil positioned above the top of rock. A shrink/swell value of zero (0) should be applied to Rock Disintegration Zone (RDZ) material.

8.4 The recommended rock swell factor is 10% for material excavated below the RDZ.

8.5 Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas directed by the Engineer shall be drained and stabilized, as specified in Geotechnical Note 7.11 of this report. For quantity estimating purposes only, the following areas shall be considered for this treatment.

Approximate Station Limits

EB KY 338
110+50 to 116+00, Left

SB I-71/I-75 Aux. Entrance Lane
422+50 to 438+75, Left

Approximate Station Limits

US 25

32+00 to 33+00, Left
60+00 to 62+00, Right

8.6 As directed by the Engineer, existing drainage swales or stream channels shall be filled and stabilized with non-erodible Granular Embankment, as specified in Geotechnical Note 7.12 of this report. For quantity estimating purposes only, the following intervals shall be considered.

Approximate Station Limits

KY 338

107+75 to 108+25, Left

WB KY 338

214+00 to 216+00, Left

SB I-71/I-75 Aux. Entrance Lane

433+00 to 434+25, Left

NB I-71/I-75 Aux. Entrance Lane

479+50 to 480+25, Right
482+00 to 484+00, Right

Ramp A

94+00 to 95+50, Right

Ramp B

251+50 to 252+25, Right

Ramp B1

200+00 to 201+50, Left and Right

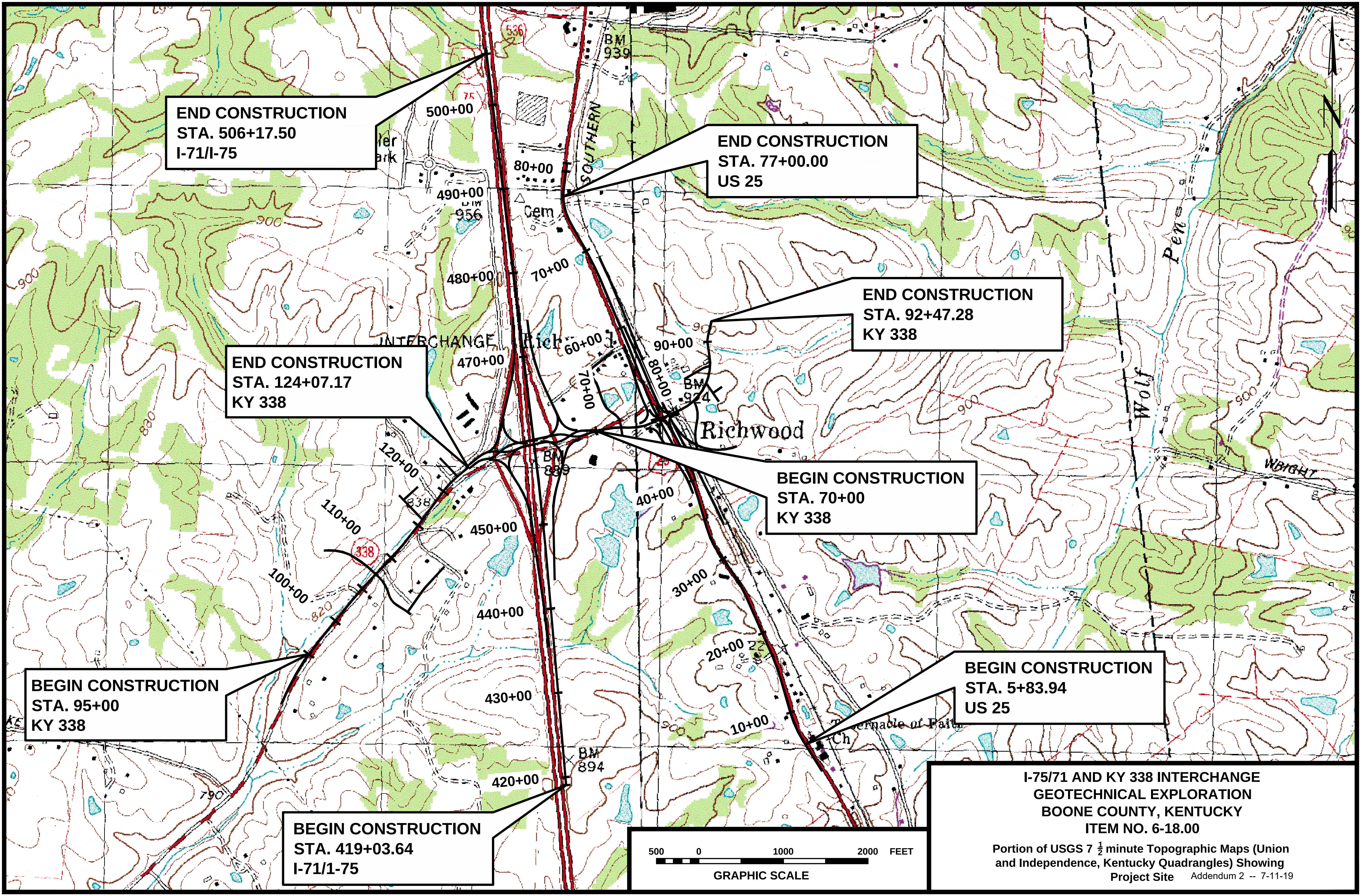
9.0 CLOSING

9.1 General soil and rock descriptions and indicated boundaries are based on an engineering interpretation of all available subsurface information and may not necessarily reflect the actual variation in subsurface conditions between borings and samples. Collected data and filed interpretation of conditions encountered in individual borings are shown on the Geotechnical Drawings.

9.2 The observed water levels and/or conditions indicated on the boring logs are as recorded at the time of exploration. These water levels and/or conditions may vary considerably, with time, according to the prevailing climate, rainfall, or other factors and are otherwise dependent on the duration of and methods used in the exploration program.

9.3 Sound engineering judgment was exercised in preparing the subsurface information presented herein. This information was prepared and is intended for design and estimating purposes. Its presentation on the plans or elsewhere is for the purpose of providing intended users with access to the same information available to the KYTC. This subsurface information interpretation is presented in good faith and is not intended as a substitute for personal investigations, independent interpretations, or judgments of the Contractor.

APPENDIX A
LOCATION MAP



END CONSTRUCTION
STA. 506+17.50
I-71/I-75

END CONSTRUCTION
STA. 77+00.00
US 25

END CONSTRUCTION
STA. 92+47.28
KY 338

END CONSTRUCTION
STA. 124+07.17
KY 338

BEGIN CONSTRUCTION
STA. 70+00
KY 338

BEGIN CONSTRUCTION
STA. 95+00
KY 338

BEGIN CONSTRUCTION
STA. 5+83.94
US 25

BEGIN CONSTRUCTION
STA. 419+03.64
I-71/1-75

I-75/71 AND KY 338 INTERCHANGE
GEOTECHNICAL EXPLORATION
BOONE COUNTY, KENTUCKY
ITEM NO. 6-18.00

Portion of USGS 7 $\frac{1}{2}$ minute Topographic Maps (Union and Independence, Kentucky Quadrangles) Showing Project Site Addendum 2 -- 7-11-19

PLOT DATE: 02/26/2016 USER: FLYNN, RENEE
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APPENDIX B
DRAWINGS

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

GEOTECHNICAL SYMBOLS

AASHTO Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35% or less passing 0.075 mm)							Silt-Clay Materials (More than 35% passing 0.075 mm)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, Percent Passing											
2.00 mm (No. 10)	50 max	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
0.425 mm (No. 40)	30 max	50 max	51 min	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of Fraction Passing 0.425 mm (No. 40)											
Liquid Limit	- - -		- - -	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min

Unified Soil Classifications

MAJOR DIVISIONS		SYMBOL	NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well graded sands or gravelly sands, little or no fines.
		SP	Poorly graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS LL IS LESS THAN 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays.
	SILTS AND CLAYS LL IS GREATER THAN 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
UNCLASSIFIED MATERIAL		NONE	Non-classified material(i.e. overburden, pavement, slag, etc.) Include visual description.

AI	Activity Index
LI	Liquidity Index
S+C	Silt + Clay (% finer than No.200 Sieve)
○	Rockline Soundings
◐	Disturbed Sample Boring
◎	Undisturbed Sample Boring
⊙	Undisturbed Sample Boring & Rock Core
●	Rock Core
⌖	Slope Inclinometer Installation typical applications: ⌖ ◐ ◎ ⊙ ●
OW	Observation Well
➡	Approximate Footing Elevation
▼ (Date)	Water Elevation
VS (psf)	Field Vane Shear Strength
▮	Thin-walled Tube Sample
<	Standard Penetration Test Sample
N	Penetration Resistance
Qu (psf)	Unconfined Compressive Strength
UU (psf)	Unconsolidated Undrained Triaxial Strength
w%	Moisture Content
KY RQD	Rock Quality Designation (Kentucky Method)
STD RQD	Rock Quality Designation (Standard Method)
SDI(JS)	Slake Durability Index (Jar Slake Test)
REC	Core Recovery
$\emptyset$	Angle of Internal Friction (Total Stress)
$\overline{\emptyset}$	Angle of Internal Friction (Effective Stress)
c (psf)	Cohesion (Total Stress)
$\overline{c}$ (psf)	Cohesion (Effective Stress)
γ (pcf)	Total Unit Weight
RDZ	Rock Disintegration Zone
OB	Overburden Bench
IB	Intermediate Bench
R	Refusal
NR	Refusal Not Encountered

LIMESTONE

SANDSTONE

DURABLE SHALE (SDI ≥ 95)

NONDURABLE SHALE (SDI < 95)

■ COAL

TALUS, MINE WASTE, FILL MATERIAL, BOULDERS, & ETC.

GRANULAR EMBANKMENT

STRUCTURE GRANULAR BACKFILL

SLOPE PROTECTION

GEOTECHNICAL SYMBOL SHEET

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\175565314_legend.dgn

USER: rflynn
DATE 10/6/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

GEOTECHNICAL NOTES

1. Clearing and grubbing of embankment areas shall be completed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

2. Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

3. Procedures shall be performed as required to control erosion and water pollution in accordance with Sections 212 and 213 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

4. All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

5. All catch basins and manholes shall be filled and capped and all septic tanks shall be filled in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

6. All channel changes and special ditches shall be constructed prior to placement of any embankment materials adjacent to them in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Materials excavated from these areas may be utilized in construction of the embankments, but may require aeration to the proper moisture contents prior to compaction operations. No extra payment shall be permitted for re-handling, hauling, stockpiling, and/or manipulating these materials.

7. In accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, the moisture content of embankment and subgrade materials shall not vary from the optimum moisture content, as determined by KM 64-511, by more than +/- 2%. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

8. All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for re-handling, hauling, stockpiling, and/or manipulating soils.

9. The Contractor shall conduct grading operations in such a manner that limestone obtained from roadway excavation shall be stockpiled separately or otherwise manipulated so that ample quantities are available for those areas requiring said material. No direct payment will be allowed for such necessary manipulating as stockpiling and/or double handling the material. Limestone shall not be wasted unless prior approval is obtained from the Engineer.

10. The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be incidental to the earthwork.

11. Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas as directed by the Engineer shall be drained and stabilized using non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.
An estimated 3-foot working platform shall be constructed in such areas.

12. As directed by the Engineer, a three-foot thickness of non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction shall be utilized to fill full-width and stabilize the existing drainage swales or stream channels located within the limits of the roadway embankment. The granular embankment shall also be placed over all adjacent areas that may be soft and saturated. Positive drainage of these abandoned stream channels shall be maintained to reduce the possibility of trapping water within the roadway embankments.

13. The Contractor shall construct embankment foundation benches and transverse benches as indicated on the plans or as directed by the Engineer, prior to placement of embankments in areas requiring such benches.

14. Embankment foundation benches/slope serrations and perforated pipe underdrains shall be constructed at the following approximate locations in accordance with current Kentucky Department of Highways Standard Drawings RGX-010 and RDP-006, project cross-sections and as directed by the Engineer. The benches shall be constructed one at a time beginning with the lowest bench. Each bench shall be backfilled prior to excavation of the next bench. This procedure should be followed to help maintain stability of the existing slopes in these areas.

Approximate Station Limits
KY 338
88+75 to 89+25, Right
99+50 to 106+50, Left
107+75 to 108+25, Left

SB I-71/I-75 AUX. ENTRANCE LANE
422+50 to 426+75, Left
432+75 to 437+75, Left

SB I-71/I-75 AUX. EXIT LANE
478+50 to 482+50, Left

NB I-71/I-75 AUX. ENTRANCE LANE
478+25 to 480+50, Left

Ramp A
94+00 to 95+50, Right

Ramp B
256+25 to 264+00, Right

US 25
18+50 to 21+00, Right
19+25 to 21+75, Left
30+00 to 33+25, Right
31+25 to 33+50, Left

Triple Crown Blvd
50+75 to 51+25, Left and Right

15. Conventional transverse benches shall be constructed and perforated pipe underdrains installed at the following approximate locations in accordance with Kentucky Department of Highways Standard Drawings RDP-005 and RDP-006, project cross-sections (as applicable), and as directed by the Engineer. Contrary to Standard Drawing RDP-006, transverse benches and perforated pipe underdrains shall be installed in both uphill and downhill transition areas between cuts and fills. Existing perforated pipe underdrains should be extended.

Approximate Station Limits
Ramp A1
155+40
157+20

Ramp B
252+20

Ramp B1
201+75

16. Perforated pipes for subgrade drainage shall be installed at vertical sags and at the upgrade ends of structures, in accordance with Kentucky Department of Highways Standard Drawing RDP-005 and/or as directed by the Engineer. These drainage features shall be installed at the following approximate locations:

Approximate Station Limits
KY 338
100+25
108+60
113+40

KY 338 East
87+48

Ramp A1
156+90

Ramp B1
202+45

Ramp C1
352+60

Ramp D
415+90

US 25
9+97
22+43
32+63
54+10

US 25 Ramp A
17+49

US 25 Ramp D
42+05

US 25 Ramp E
59+22

US 25 Ramp G
71+25

Grand National Blvd
98+90

Grand National Access Drive
50+20
55+75

Triple Crown Blvd
51+80

Best Pal Drive
26+28

Old Lexington Pike
5+65

Paddock Drive
200+85

Frogtown Connector Road
600+70

17. The Contractor shall conduct grading operations in such a manner that soil (free of rock larger than 4 inches) from roadway excavation be stockpiled separately or otherwise manipulated so that ample quantities are available for a chemically stabilized roadbed meeting the requirements of Section 208 of the current Standard Specifications for Road and Bridge Construction. No direct payment will be allowed for such necessary manipulating as stockpiling, hauling and/or handling the material.

18. Construct a chemically modified soil subgrade with a CBR value of 2 for the underlying soil. Where soft and/or wet subgrade is encountered during construction, the thickness of the chemically modified soil may need to be adjusted (increased up to 16" max.) to also serve as a working platform for subgrade stabilization. These adjustments shall be as directed by the Engineer, and may depend on the seasonal fluctuations in the water table.

19. In areas where the chemical stabilization is not feasible (such as cross-overs, tie-ins, narrow widenings, etc.) the top one foot of the roadbed shall be constructed with KY Course Aggregate No. 2, 3, or 23 in accordance with Section 805 of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, current edition. The aggregate shall be wrapped with Geotextile Fabric Type IV in accordance with Sections 214 and 843 of the current Standard Specifications. The platform shall daylight horizontally to the edge of the embankment in fills and to the ditchline in the cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction.

DESIGNED BY:
DATE SUBMITTED:

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS: FD52 008 0075 175-176

GEOTECHNICAL NOTES
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\17565314\geotechnical\drawing\sheet_files\roadway\profiles\17565314_gnts-1.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

GEOTECHNICAL NOTES

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

20\. Where shale (or limestone) bedrock is encountered at the top of subgrade in the cuts, the roadbed shall be undercut one foot below the proposed grade and the limits of the roadbed excavation shall be extended to the ditchlines. The refill shall consist of soil and shall be constructed as specified in Section 204 of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, current edition. Shale cannot be used in the top one foot of the subgrade. For Roadway Excavation projects, the placement of soil refill shall be incidental. For Embankment-in-Place projects, the placement of soil refill shall be paid at the unit bid price for Embankment-in-Place and the excavation of the bedrock material shall be incidental. For either case, no compensation shall be made for the incidental portions of this work.

21\. Pile cores shall be constructed at the bridge approach embankments in accordance with Kentucky Standard Drawings RGX-100 and RGX-105, meeting the material requirements of the current edition of Special Provision 69.

22\. As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and backfilled with suitable subgrade material in accordance with Section 207 of the current Standard Specifications.

Approximate Station Limits

KY 338
99+00 to 108+00
111+00 to 124+00

EB KY 338
100+00 to 105+00
112+00 to 116+00

WB KY 338
205+00 to 216+22

KY 338 East
87+00 to 92+45

SB I-71/I-75 AUX. ENTRANCE RAMP
419+04 to 433+50

SB I-71/I-75 AUX. EXIT LANE
474+86 to 492+86

NB I-71/I-75 AUX. ENTRANCE LANE
473+00 to 506+17

Ramp A
87+60 to 101+00

Ramp B
253+00 to 265+40

Ramp C
304+00 to 311+50
324+00 to 318+61

Ramp D
400+00 to 416+00

US 25
5+94 to 22+90
27+60 to 30+80
34+00 to 77+00

Triple Crown Blvd
50+00 to 53+14

Paddock Drive
201+00 to 203+85

Best Pal Drive
24+25 to 28+25
29+75 to 33+00

23\. As directed by the Engineer, existing bituminous concrete at the following approximate locations that is positioned within the limits of new roadway embankments and positioned at a distance greater than three feet below proposed subgrade elevation, shall be scarified or broken until all cleavage planes are destroyed, or the pavement shall be removed entirely as conditions demand in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Subgrade materials remaining after removal of pavements may need to be stabilized prior to placement of new pavement sections, as directed by the Engineer.

Approximate Station Limits
US 25
30+80 to 34+00

24\. The retaining walls at the following locations will affect the cut slope and embankment construction. For these areas, please refer to the structural plans for specific instructions for cut slope and embankment construction.

Approximate Station Limits

KY 338
103+90 to 106+60, Left
113+70 to 115+25, Left

EB KY 338
100+90 to 102+70, Left
107+90 to 109+60, Left
113+70 to 114+90, Right

WB KY 338
200+90 to 202+50, Left
207+80 to 209+50, Left

Ramp B1
200+10 to 201+00, Right

US 25
42+00 to 47+00, Left
41+50 to 47+00, Right
49+10 to 55+50, Left
49+40 to 55+20, Right

US 25 Ramp A
12+80 to 17+40, Right

US 25 Ramp B
20+50 to 21+29.78

US 25 Ramp C
30+50 to 36+50, Right

25\. Embankment slopes at the following locations will need to be flatter than a 2:1(H:V) to maintain minumum factor of safety requirements for slope stablity. The fill limits and required slopes are below. The Geotechnical Embankment Stability Sections show the flattened slopes and results of the stability analyses.

Approximate Station Limits	Steepest Allowable Slope
SB I-71/75 Acceleration Lane Station 434+80 to Station 436+20	2.5:1 (H:V)

26\. All embankment construction using non-durable shale will be in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction, "Embankments Principally of Non-Durable Shale".

27\. Some areas of the project may contain silts or sands at subgrade. Lime may not be effective in stabilizing these materials. If such soils are encountered, the Stabilization Contractor shall adjust the stabilization techniques, as directed by the Engineer. Based on boring information, these soils may be encountered at the following locations. Geotechnical Branch Personnel are available to assist in identifying these soil types and providing alternative treatment recommendations, if needed.

Approximate Station Limits

RAMP B
260+50 to 265+40

OLD LEXINGTON PIKE
5+00 to 10+00

DESIGNED BY:
DATE SUBMITTED:

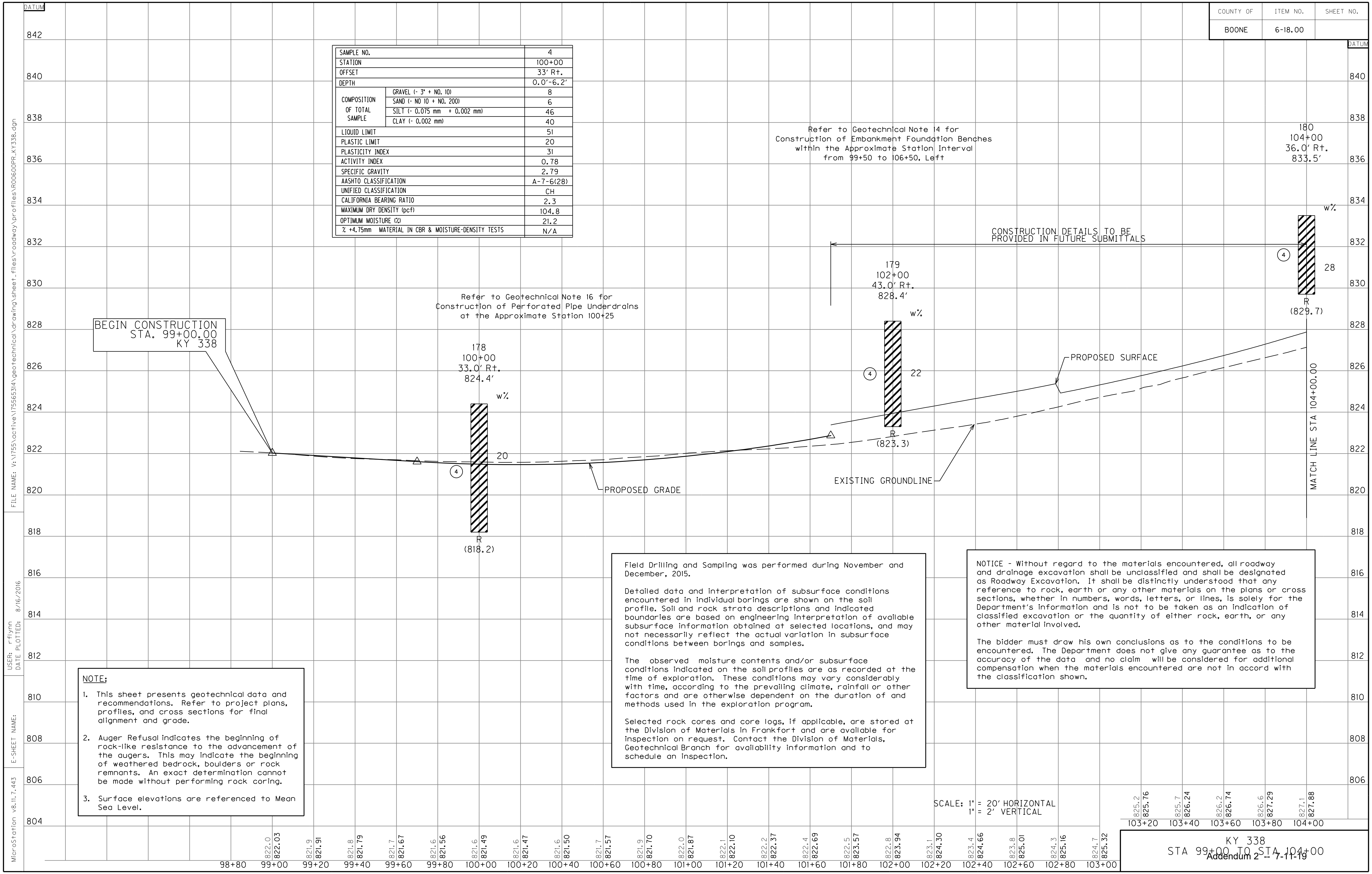
Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS: FD52 008 0075 175-176

GEOTECHNICAL NOTES
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\175565314_gnts-2.dgn
USER: dellison
DATE PLOTTED: 10/11/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		4
STATION		100+00
OFFSET		33' Rt.
DEPTH		0.0'-6.2'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	8
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		20
PLASTICITY INDEX		31
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(28)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.3
MAXIMUM DRY DENSITY (pcf)		104.8
OPTIMUM MOISTURE (%)		21.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

Field Drilling and Sampling was performed during November and December, 2015.

Detailed data and interpretation of subsurface conditions encountered in individual borings are shown on the soil profile. Soil and rock strata descriptions and indicated boundaries are based on engineering interpretation of available subsurface information obtained at selected locations, and may not necessarily reflect the actual variation in subsurface conditions between borings and samples.

The observed moisture contents and/or subsurface conditions indicated on the soil profiles are as recorded at the time of exploration. These conditions may vary considerably with time, according to the prevailing climate, rainfall or other factors and are otherwise dependent on the duration of and methods used in the exploration program.

Selected rock cores and core logs, if applicable, are stored at the Division of Materials in Frankfort and are available for inspection on request. Contact the Division of Materials, Geotechnical Branch for availability information and to schedule an inspection.

NOTICE - Without regard to the materials encountered, all roadway and drainage excavation shall be unclassified and shall be designated as Roadway Excavation. It shall be distinctly understood that any reference to rock, earth or any other materials on the plans or cross sections, whether in numbers, words, letters, or lines, is solely for the Department's information and is not to be taken as an indication of classified excavation or the quantity of either rock, earth, or any other material involved.

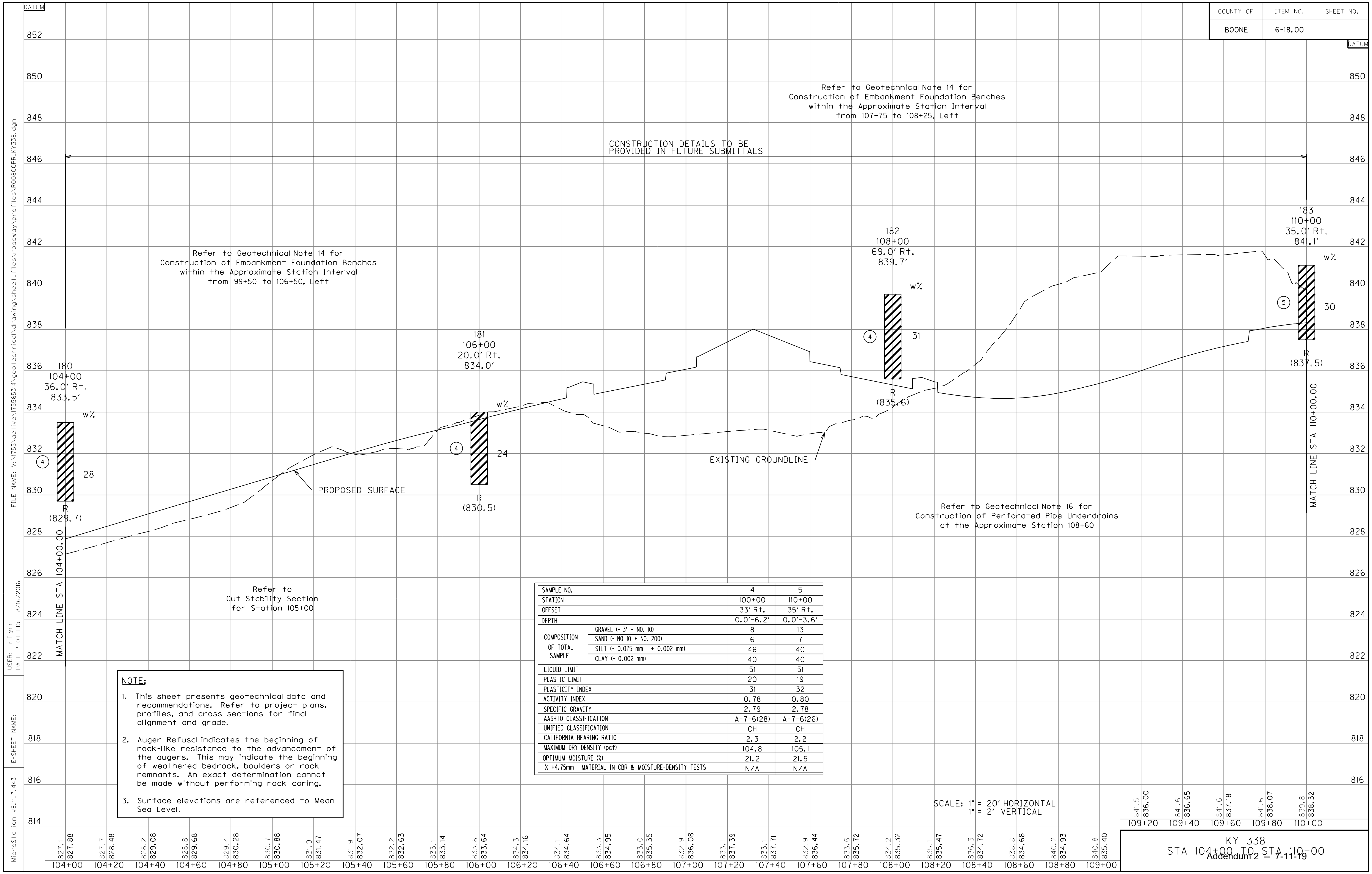
The bidder must draw his own conclusions as to the conditions to be encountered. The Department does not give any guarantee as to the accuracy of the data and no claim will be considered for additional compensation when the materials encountered are not in accord with the classification shown.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 338
STA 99+00 TO STA 104+00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R00600PR_KY338.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



827.1	827.7	828.2	828.8	829.4	830.7	831.9	831.9	832.2	833.1	833.8	834.3	834.1	833.3	833.0	832.9	833.1	833.1	832.9	833.6	834.2	835.1	836.3	838.8	840.2	840.8	841.5	841.6	841.6	841.6	839.8
827.88	828.48	829.08	829.68	830.28	830.88	831.47	832.07	832.63	833.14	833.64	834.16	834.64	834.95	835.35	836.08	837.39	837.71	836.44	835.72	835.32	835.47	834.72	834.68	834.93	835.40	836.00	836.65	837.18	838.07	838.32
104+00	104+20	104+40	104+60	104+80	105+00	105+20	105+40	105+60	105+80	106+00	106+20	106+40	106+60	106+80	107+00	107+20	107+40	107+60	107+80	108+00	108+20	108+40	108+60	108+80	109+00	109+20	109+40	109+60	109+80	110+00

SAMPLE NO.		4	5
STATION		100+00	110+00
OFFSET		33' Rt.	35' Rt.
DEPTH		0.0'-6.2'	0.0'-3.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	8	13
	SAND (- NO 10 + NO. 200)	6	7
	SILT (- 0.075 mm + 0.002 mm)	46	40
	CLAY (- 0.002 mm)	40	40
LIQUID LIMIT		51	51
PLASTIC LIMIT		20	19
PLASTICITY INDEX		31	32
ACTIVITY INDEX		0.78	0.80
SPECIFIC GRAVITY		2.79	2.78
AASHTO CLASSIFICATION		A-7-6(28)	A-7-6(26)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		2.3	2.2
MAXIMUM DRY DENSITY (pcf)		104.8	105.1
OPTIMUM MOISTURE (%)		21.2	21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R00800PR_KY338.dgn

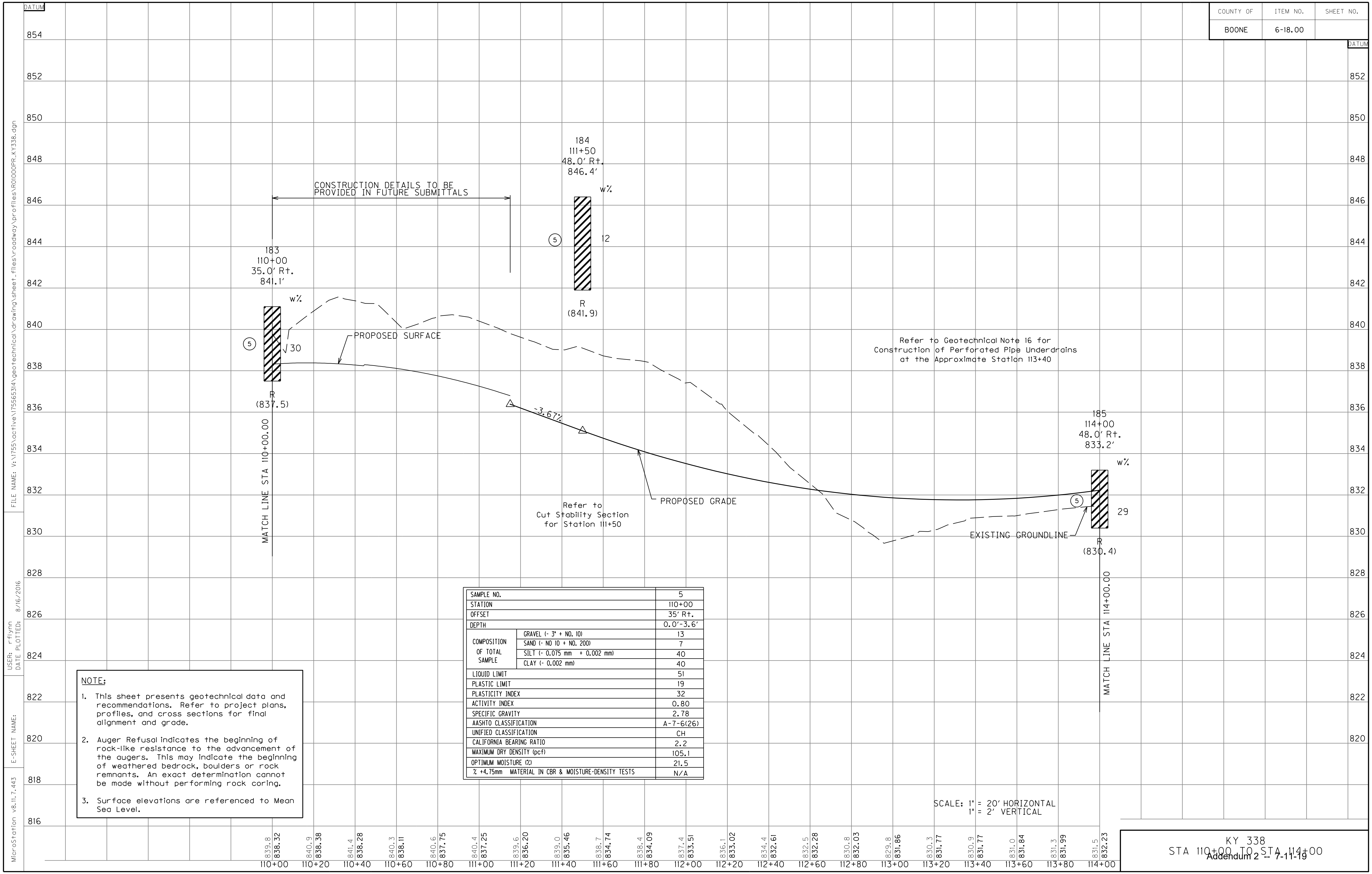
USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

KY 338
STA 104+00 TO STA 110+00
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



110+00	839.8	838.32
110+20	840.9	838.38
110+40	841.4	838.28
110+60	840.3	838.11
110+80	840.6	837.75
111+00	840.4	837.25
111+20	839.6	836.20
111+40	839.0	835.46
111+60	838.7	834.74
111+80	838.4	834.09
112+00	837.4	833.51
112+20	836.1	833.02
112+40	834.4	832.61
112+60	832.5	832.28
112+80	830.8	832.03
113+00	829.8	831.86
113+20	830.3	831.77
113+40	830.9	831.77
113+60	831.0	831.84
113+80	831.3	831.99
114+00	831.5	832.23

SAMPLE NO.		5
STATION		110+00
OFFSET		35′ Rt.
DEPTH		0.0′-3.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA 110+00 TO STA 114+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R01000PR_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

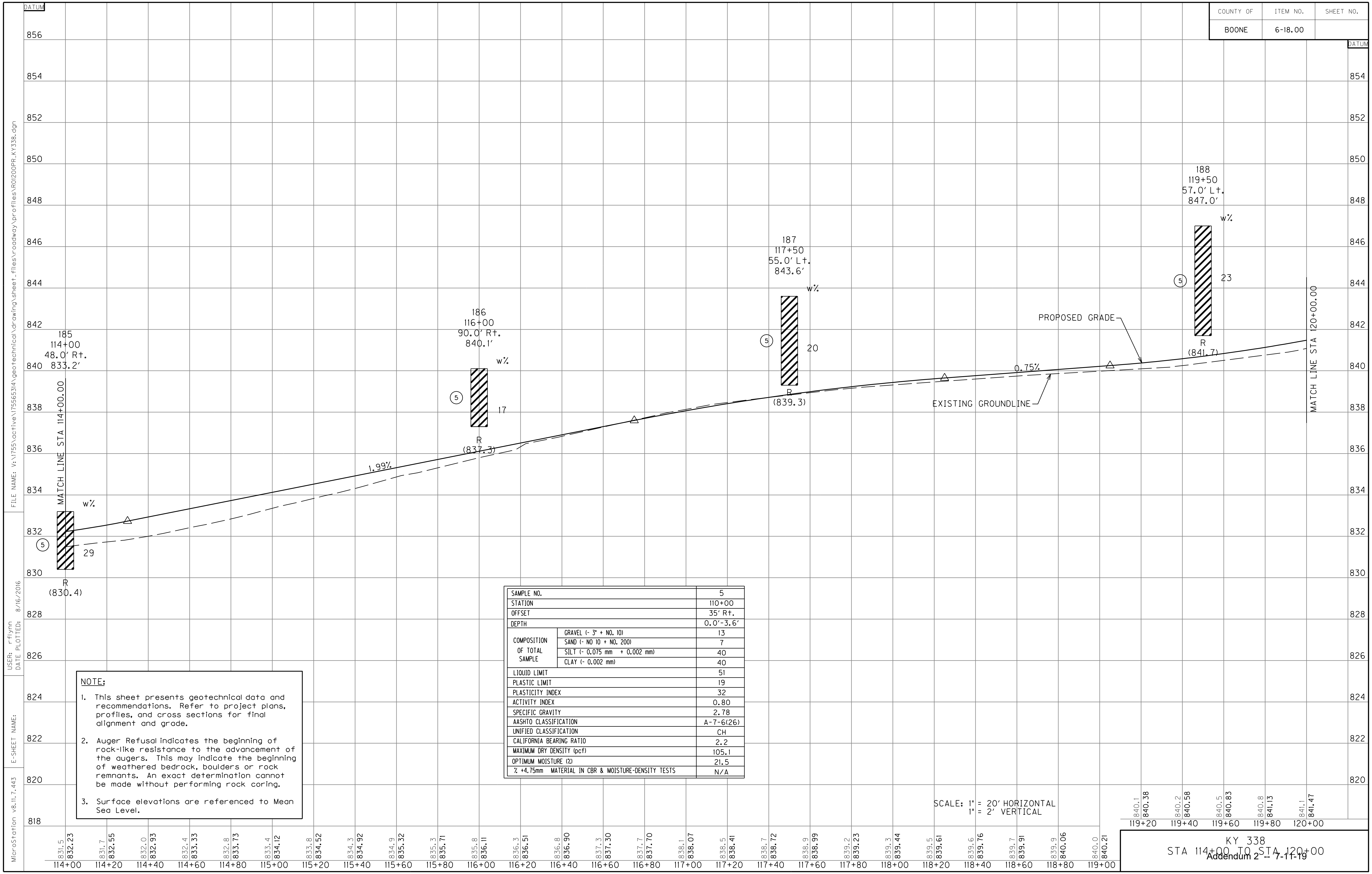
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R01200PR_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

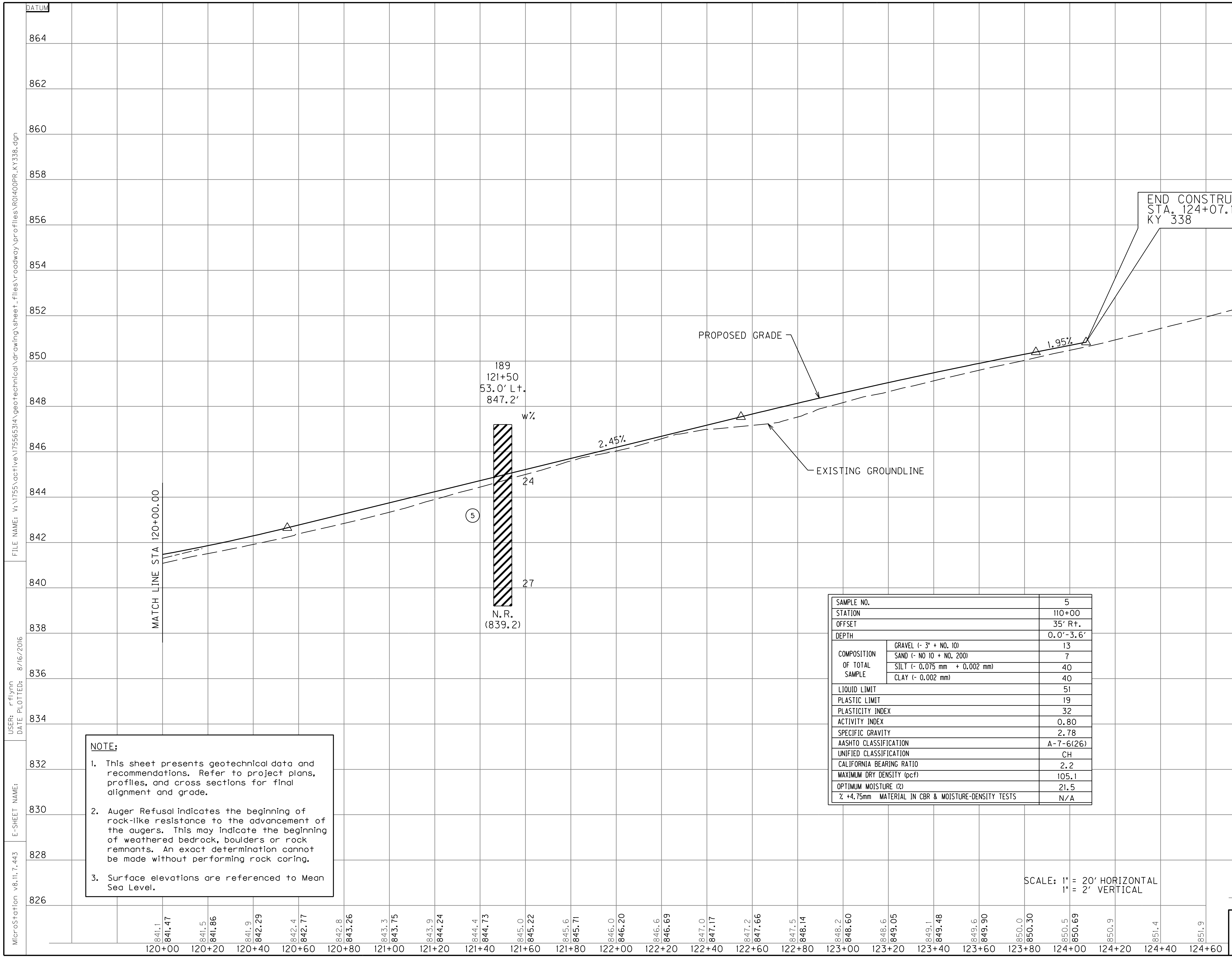
SAMPLE NO.		5
STATION		110+00
OFFSET		35′ Rt.
DEPTH		0.0′-3.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA 114+00 TO STA 120+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		5
STATION		110+00
OFFSET		35' Rt.
DEPTH		0.0'-3.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 338
STA 120+00 TO STA 124+07.17
Addendum 2 -- 7-11-19

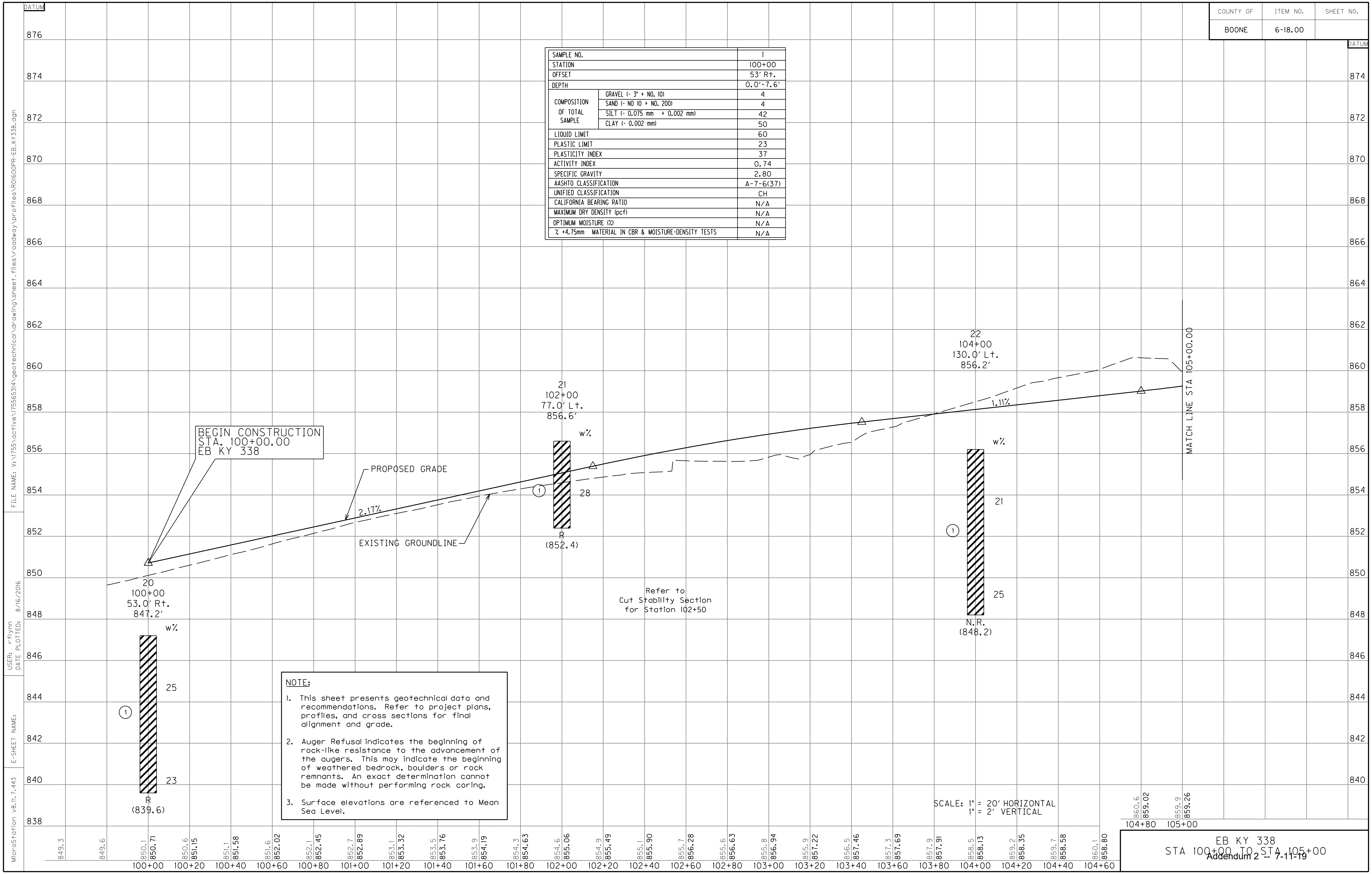
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R01400PR_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		1
STATION		100+00
OFFSET		53' Rt.
DEPTH		0.0'-7.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	42
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		60
PLASTIC LIMIT		23
PLASTICITY INDEX		37
ACTIVITY INDEX		0.74
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(37)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

EB KY 338
STA 100+00 TO STA 105+00

Addendum 2 -- 7-11-19

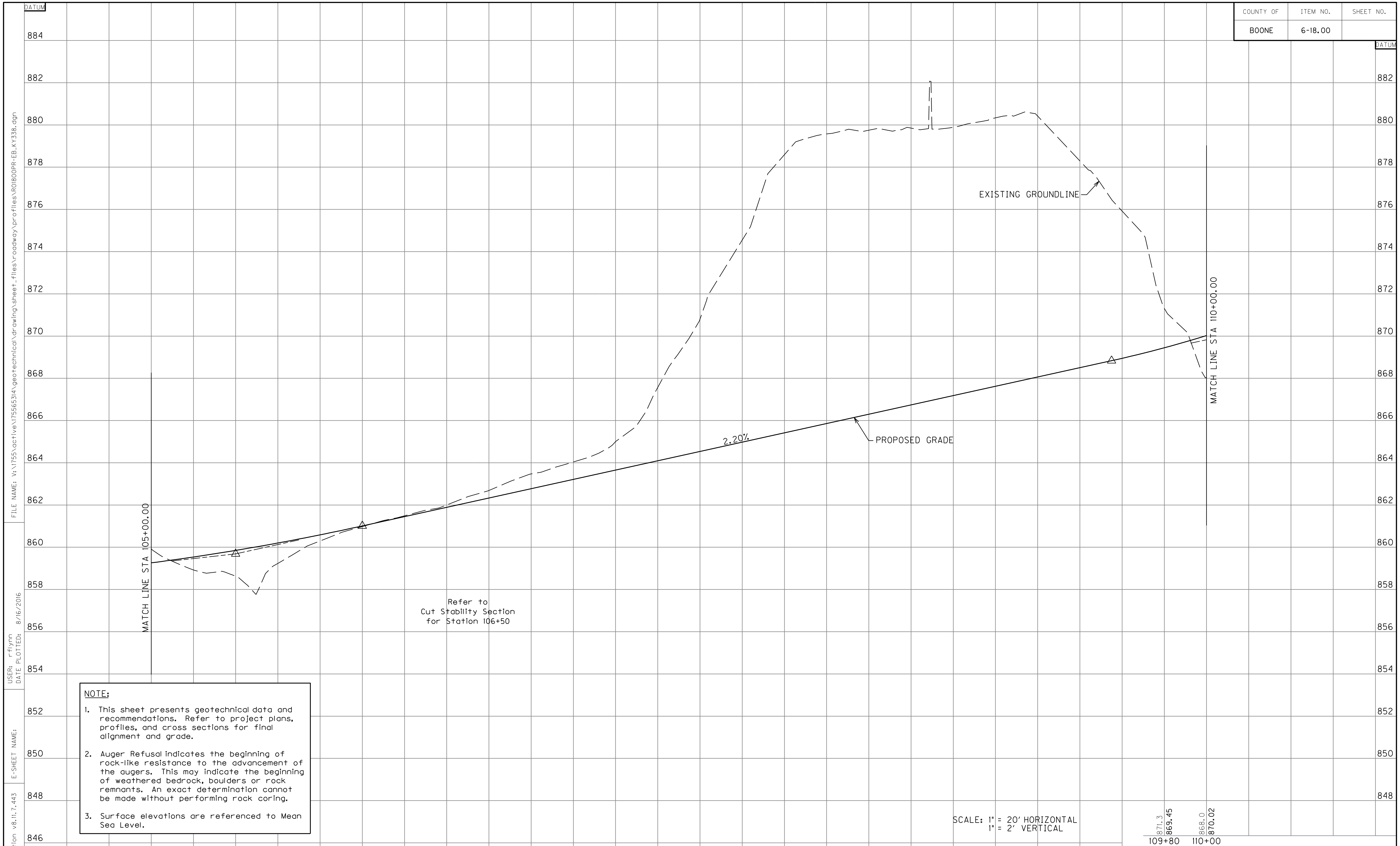
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R01600PR-EB_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

859.9	859.26	105+00
858.9	859.54	105+20
858.6	859.85	105+40
859.2	860.20	105+60
860.3	860.59	105+80
861.0	861.01	106+00
861.5	861.45	106+20
862.0	861.89	106+40
862.7	862.33	106+60
863.5	862.77	106+80
864.0	863.21	107+00
865.0	863.65	107+20
867.6	864.10	107+40
870.8	864.54	107+60
874.6	864.98	107+80
878.6	865.42	108+00
879.6	865.86	108+20
879.7	866.30	108+40
879.8	866.74	108+60
879.9	867.18	108+80
880.3	867.62	109+00
880.4	868.06	109+20
878.3	868.50	109+40
875.9	868.95	109+60
871.3	869.45	109+80
868.0	870.02	110+00

EB KY 338
STA 105+00 TO STA 110+00

Addendum 2 -- 7-11-19

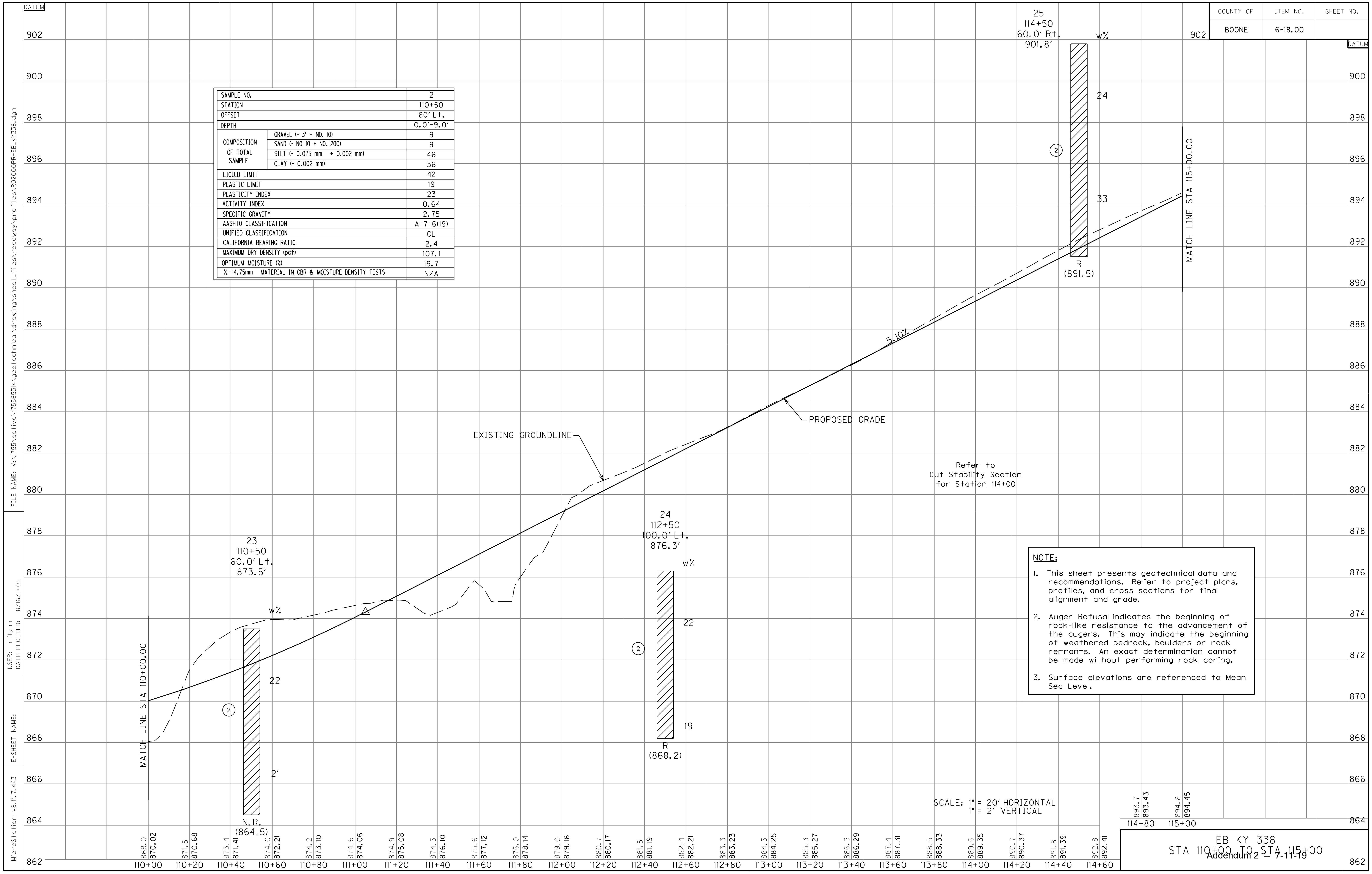
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R01800PR-EB_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		2
STATION		110+50
OFFSET		60' Lt.
DEPTH		0.0'-9.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	9
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	36
LIQUID LIMIT		42
PLASTIC LIMIT		19
PLASTICITY INDEX		23
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.75
AASHTO CLASSIFICATION		A-7-6(19)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.4
MAXIMUM DRY DENSITY (pcf)		107.1
OPTIMUM MOISTURE (%)		19.7
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Refer to
Cut Stability Section
for Station 114+00

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

EB KY 338
STA 110+00 TO STA 115+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R02000PR-EB_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

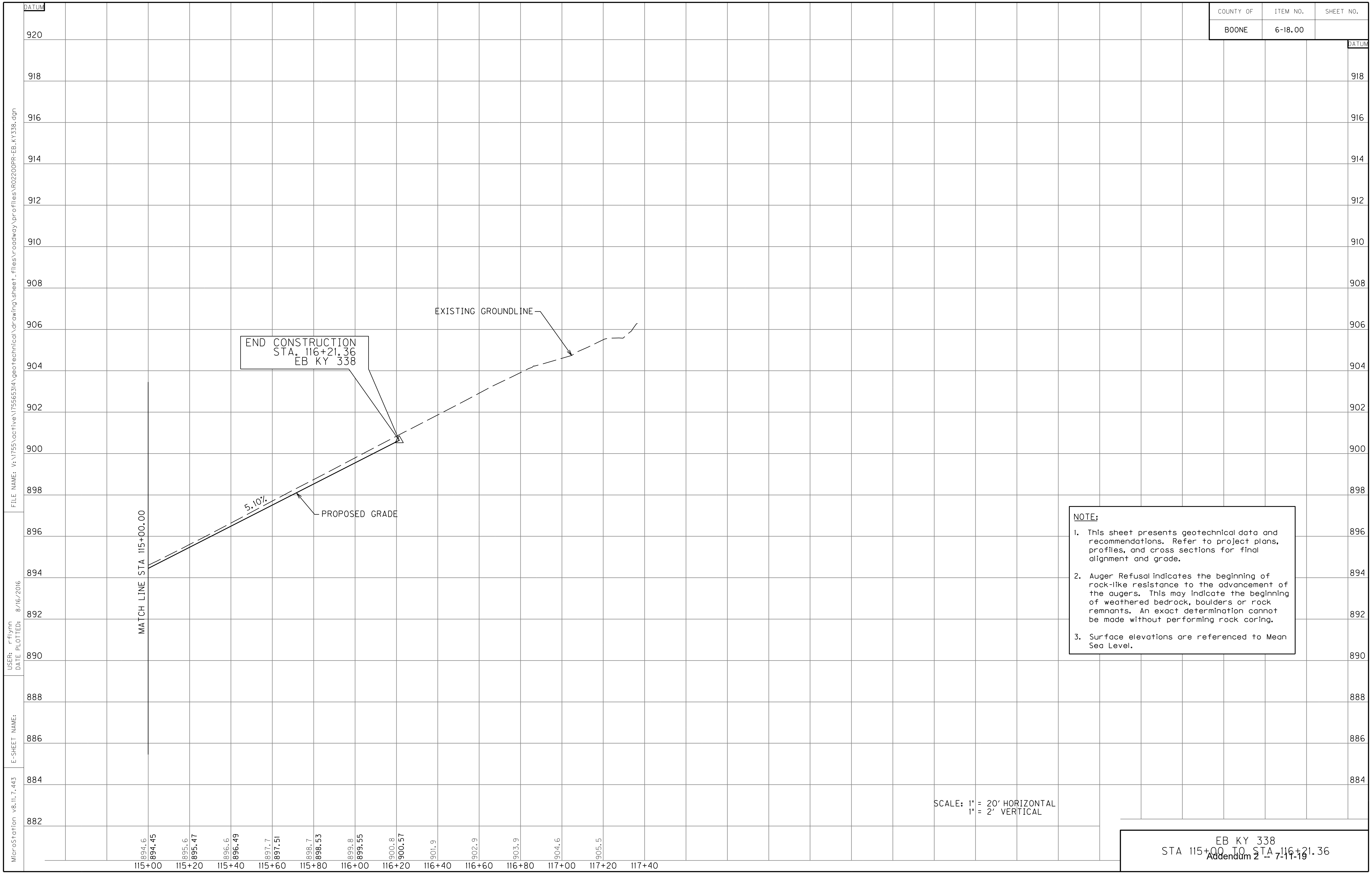
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R02200PR-EB_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443



NOTE:

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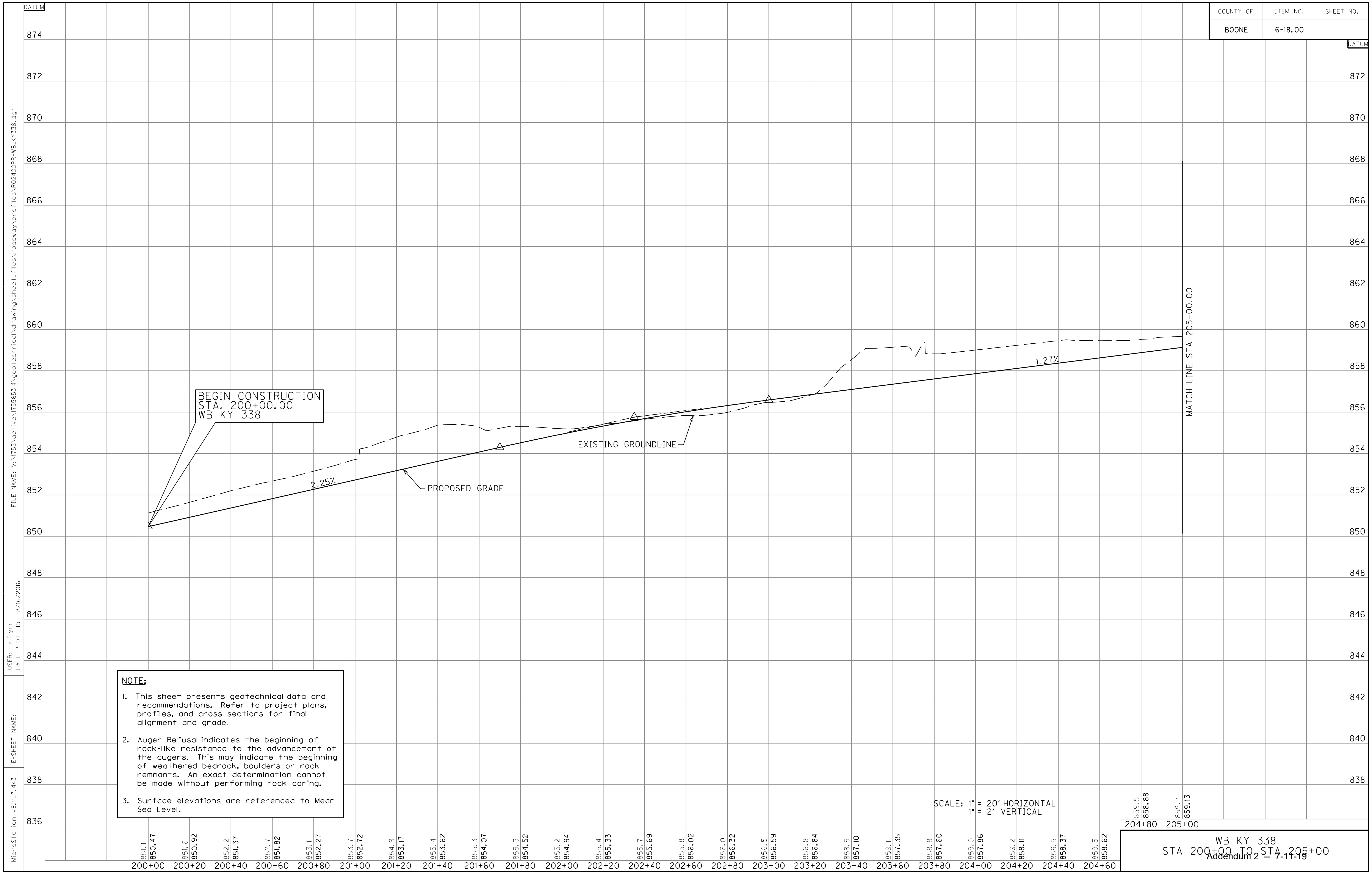
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

EB KY 338
STA 115+00 TO STA 116+21.36

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

WB KY 338
STA 200+00 TO STA 205+00

Addendum 2 -- 7-11-19

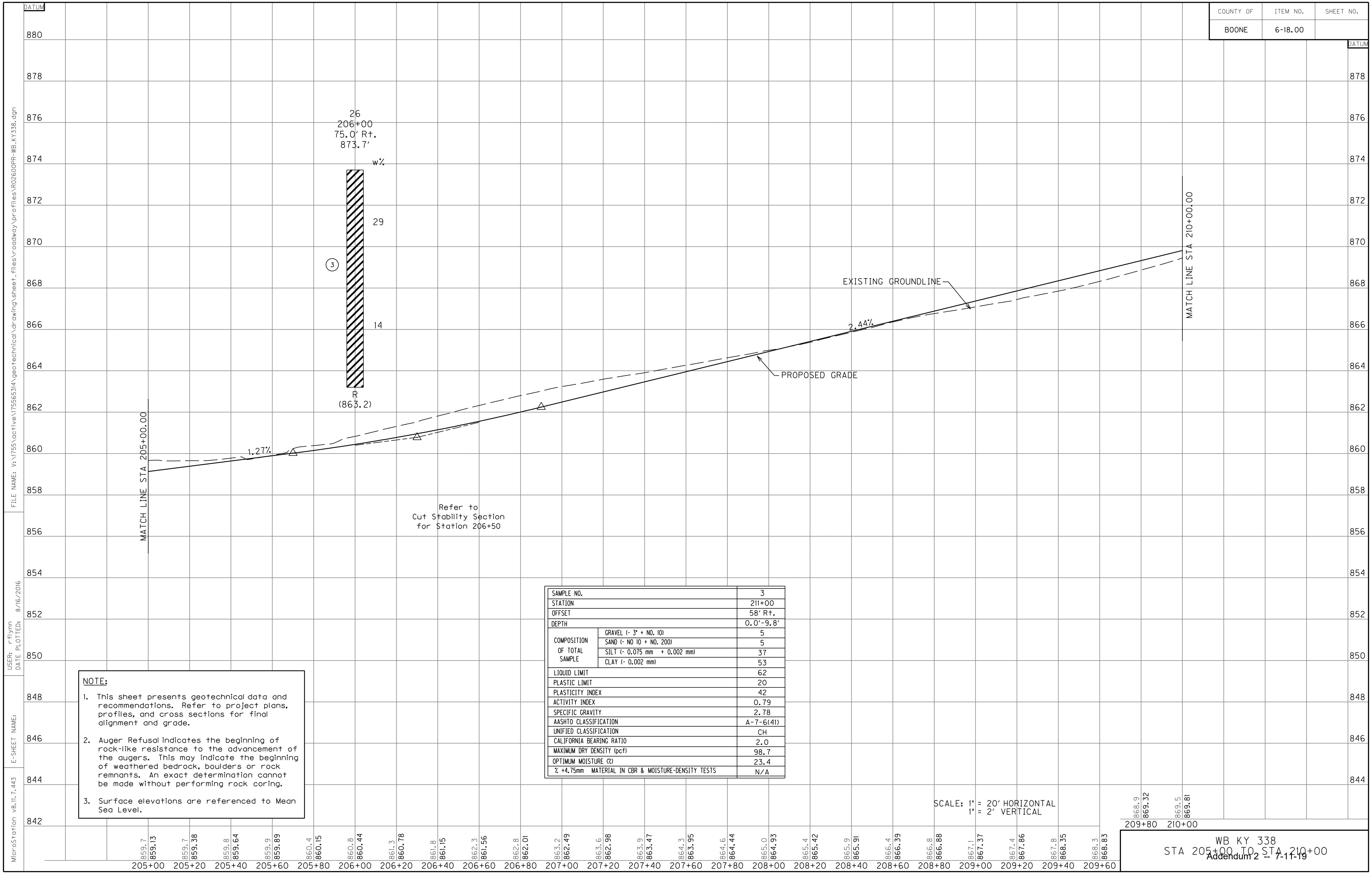
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R02400PR-WB_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		3
STATION		211+00
OFFSET		58′ Rt.
DEPTH		0.0′-9.8′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

WB KY 338
STA 205+00 TO STA 210+00

Addendum 2 -- 7-11-19

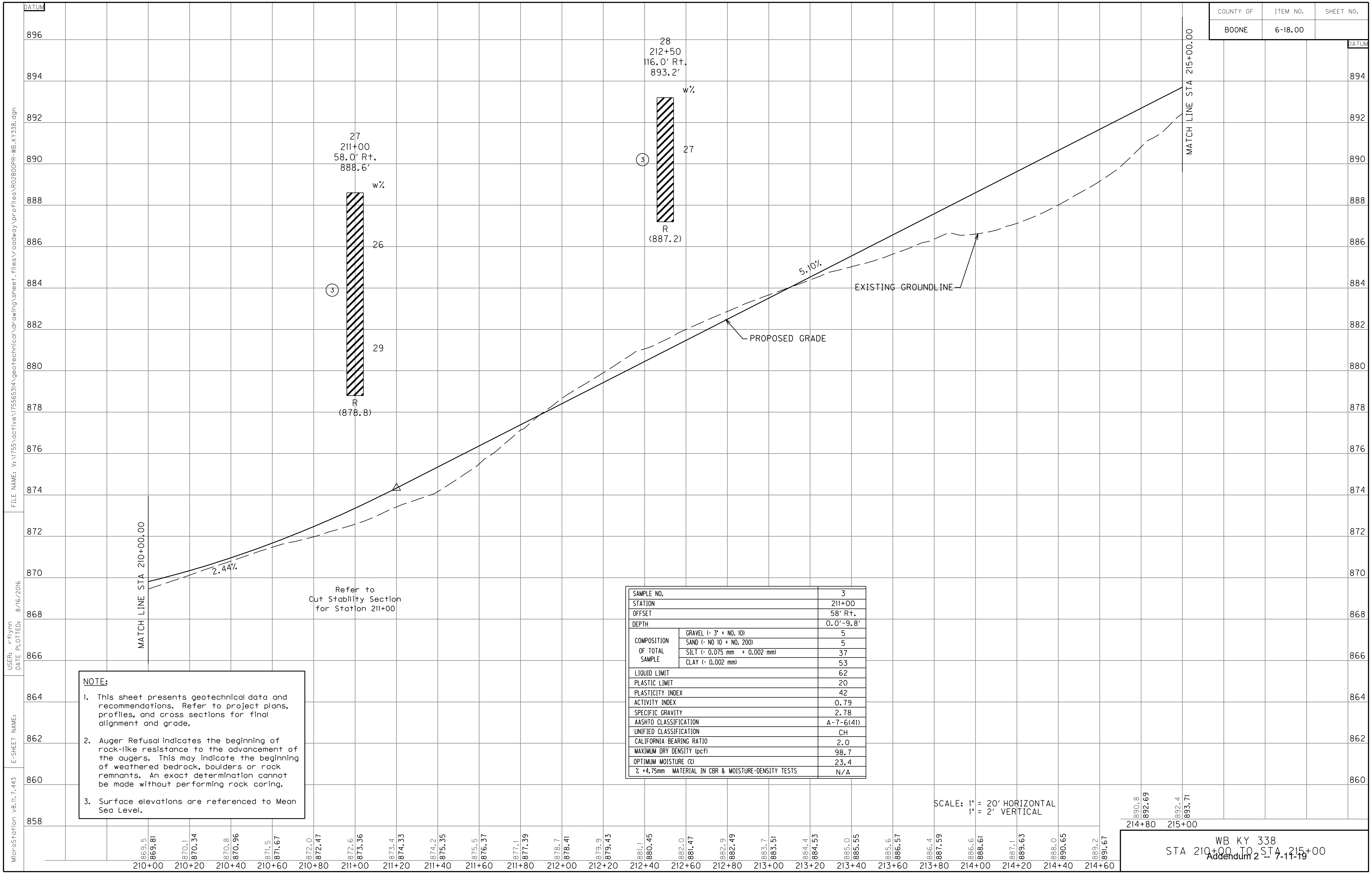
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R02600PR-WB_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

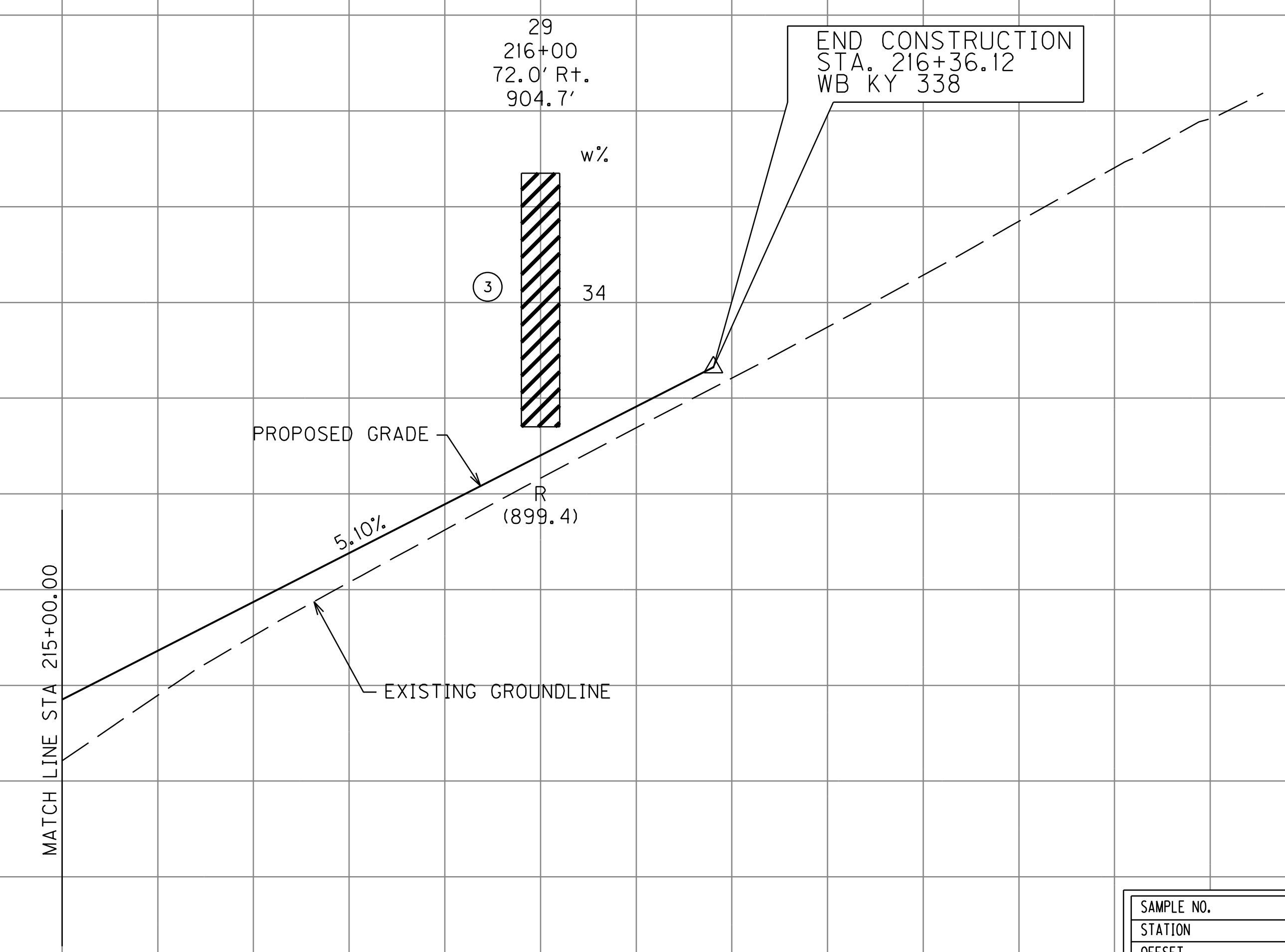
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		3
STATION		211+00
OFFSET		58′ Rt.
DEPTH		0.0′-9.8′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

WB KY 338
STA 210+00 TO STA 215+00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R02800PR-WB_KY338.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		3
STATION		211+00
OFFSET		58' Rt.
DEPTH		0.0'-9.8'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

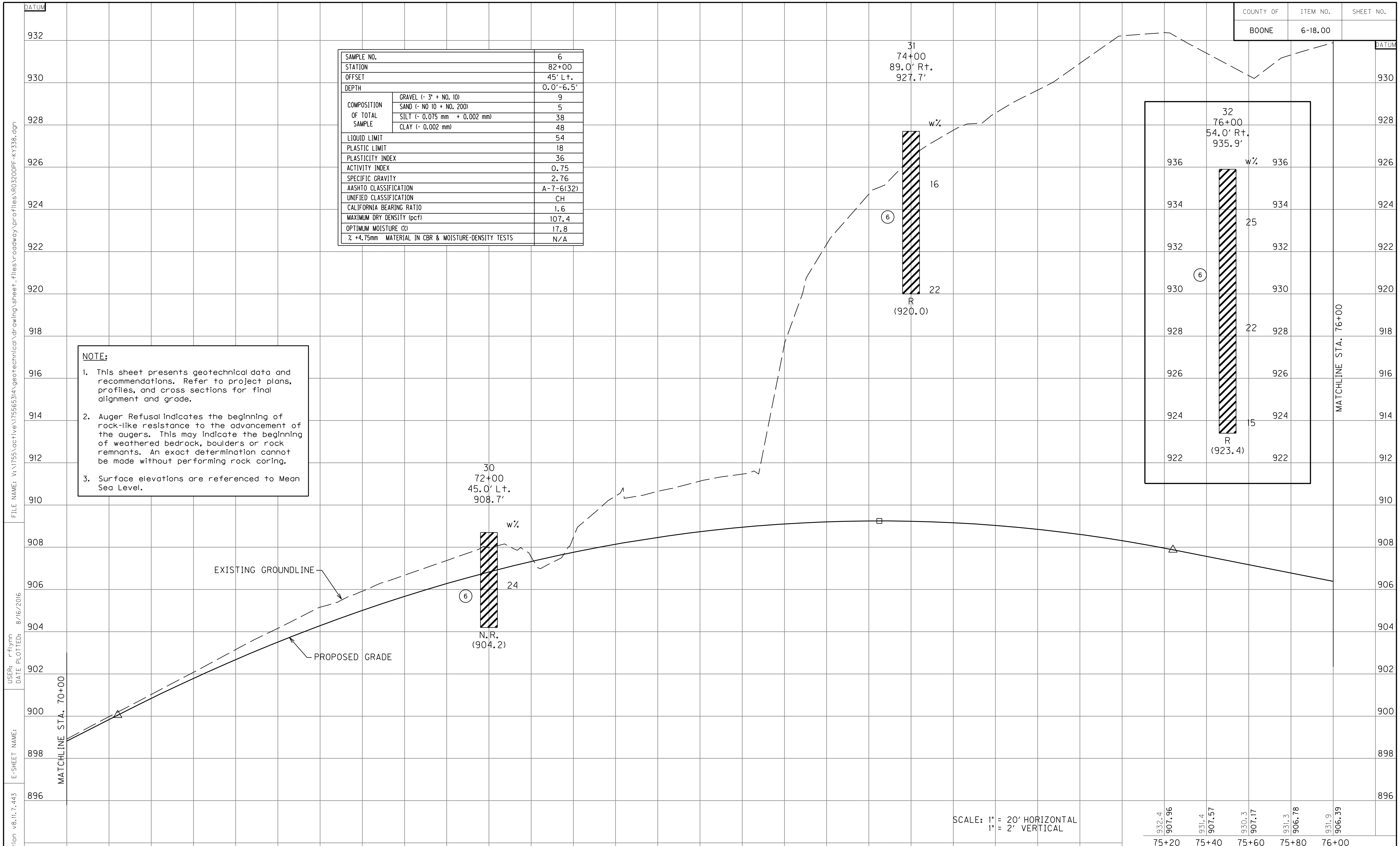
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

WB KY 338
STA 215+00 TO STA 216+36.12

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R03000PR-WB_KY338.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		6
STATION		82+00
OFFSET		45′ Lt.
DEPTH		0.0′-6.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		54
PLASTIC LIMIT		18
PLASTICITY INDEX		36
ACTIVITY INDEX		0.75
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(32)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		107.4
OPTIMUM MOISTURE (%)		17.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
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70+00	898.9	898.82
70+20	900.0	899.84
70+40	901.0	900.84
70+60	902.1	901.79
70+80	903.2	902.68
71+00	904.2	903.51
71+20	905.2	904.29
71+40	905.9	905.01
71+60	906.7	905.67
71+80	907.4	906.28
72+00	908.0	906.83
72+20	907.5	907.32
72+40	908.5	907.76
72+60	910.4	908.14
72+80	910.6	908.47
73+00	911.1	908.74
73+20	911.5	908.95
73+40	917.6	909.10
73+60	922.4	909.20
73+80	924.7	909.24
74+00	926.4	909.23
74+20	927.7	909.16
74+40	928.6	909.03
74+60	929.7	908.85
74+80	930.9	908.61
75+00	932.2	908.31
75+20	932.4	907.96
75+40	931.4	907.57
75+60	930.3	907.17
75+80	931.3	906.78
76+00	931.9	906.39

KY 338

Addendum 2 -- 7-11-19

STA. 70+00 TO STA. 76+00

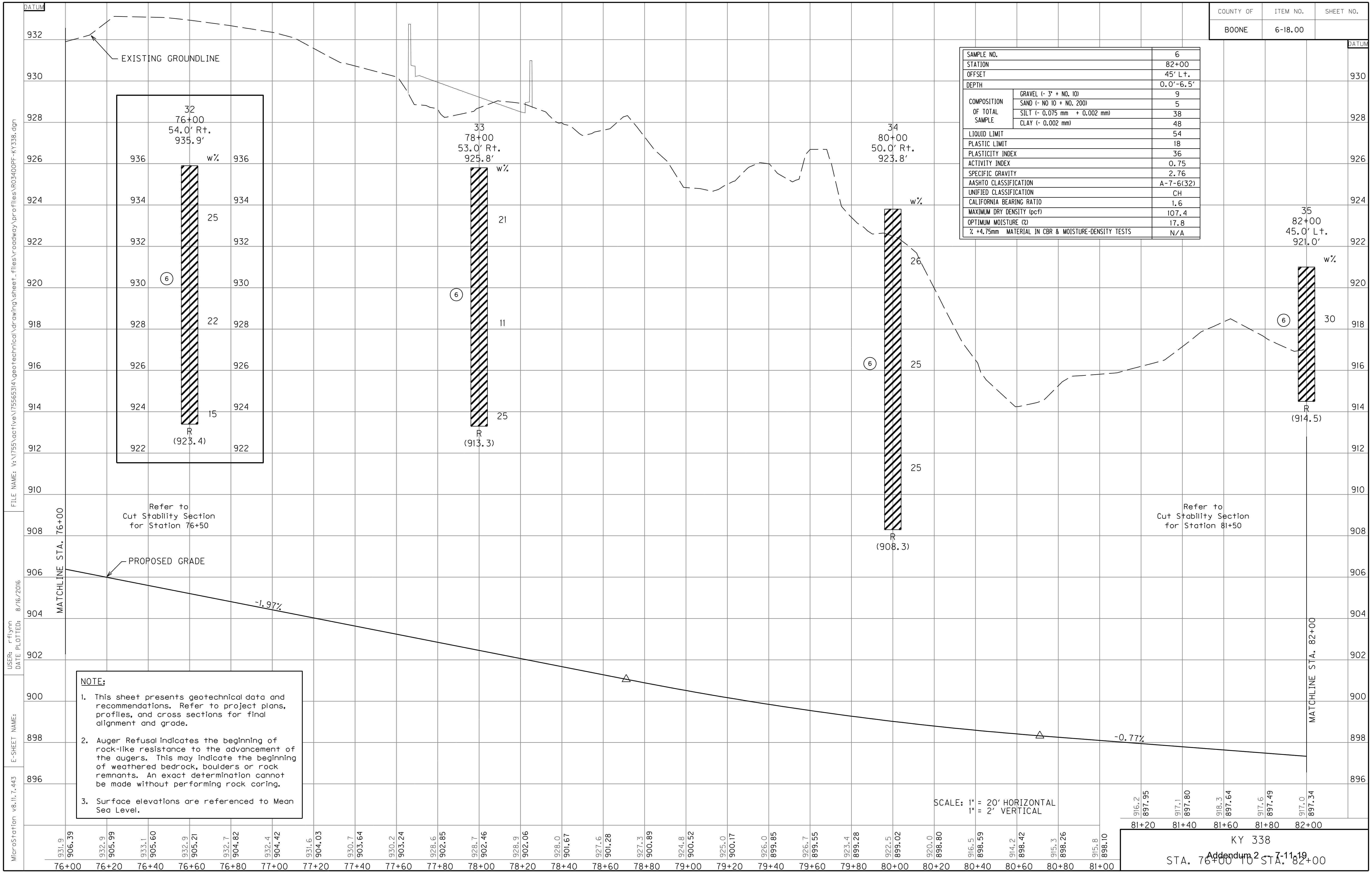
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R03200PF-KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		6
STATION		82+00
OFFSET		45′ Lt.
DEPTH		0.0′-6.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		54
PLASTIC LIMIT		18
PLASTICITY INDEX		36
ACTIVITY INDEX		0.75
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(32)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		107.4
OPTIMUM MOISTURE (%)		17.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

KY 338

STA. 76+00 TO STA. 82+00

Addendum 2 -- 7-11-19

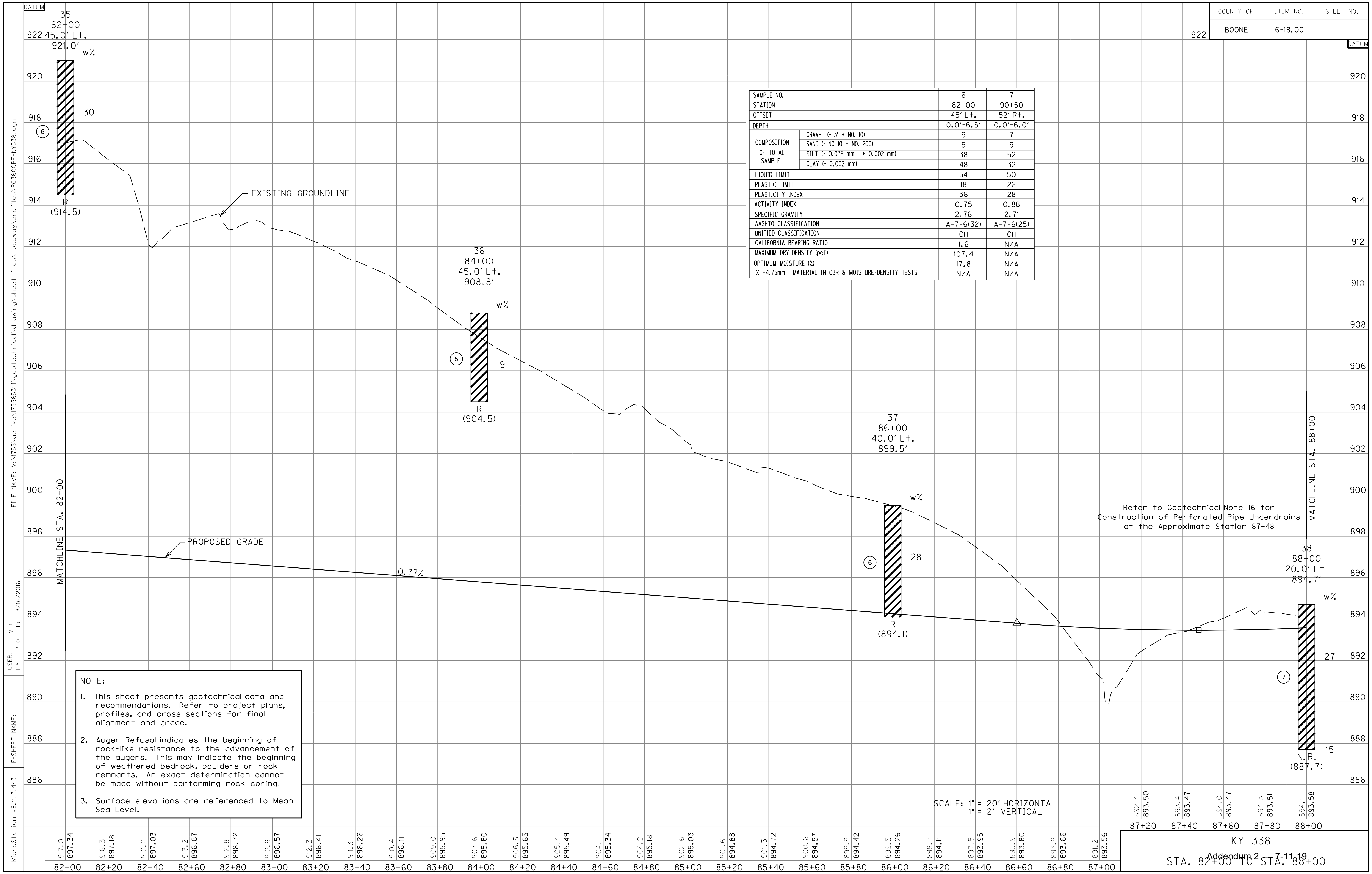
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R03400PF-KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		6	7
STATION		82+00	90+50
OFFSET		45′ Lt.	52′ Rt.
DEPTH		0.0′-6.5′	0.0′-6.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9	7
	SAND (- NO 10 + NO. 200)	5	9
	SILT (- 0.075 mm + 0.002 mm)	38	52
	CLAY (- 0.002 mm)	48	32
LIQUID LIMIT		54	50
PLASTIC LIMIT		18	22
PLASTICITY INDEX		36	28
ACTIVITY INDEX		0.75	0.88
SPECIFIC GRAVITY		2.76	2.71
AASHTO CLASSIFICATION		A-7-6(32)	A-7-6(25)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		1.6	N/A
MAXIMUM DRY DENSITY (pcf)		107.4	N/A
OPTIMUM MOISTURE (%)		17.8	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R03600PF-KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

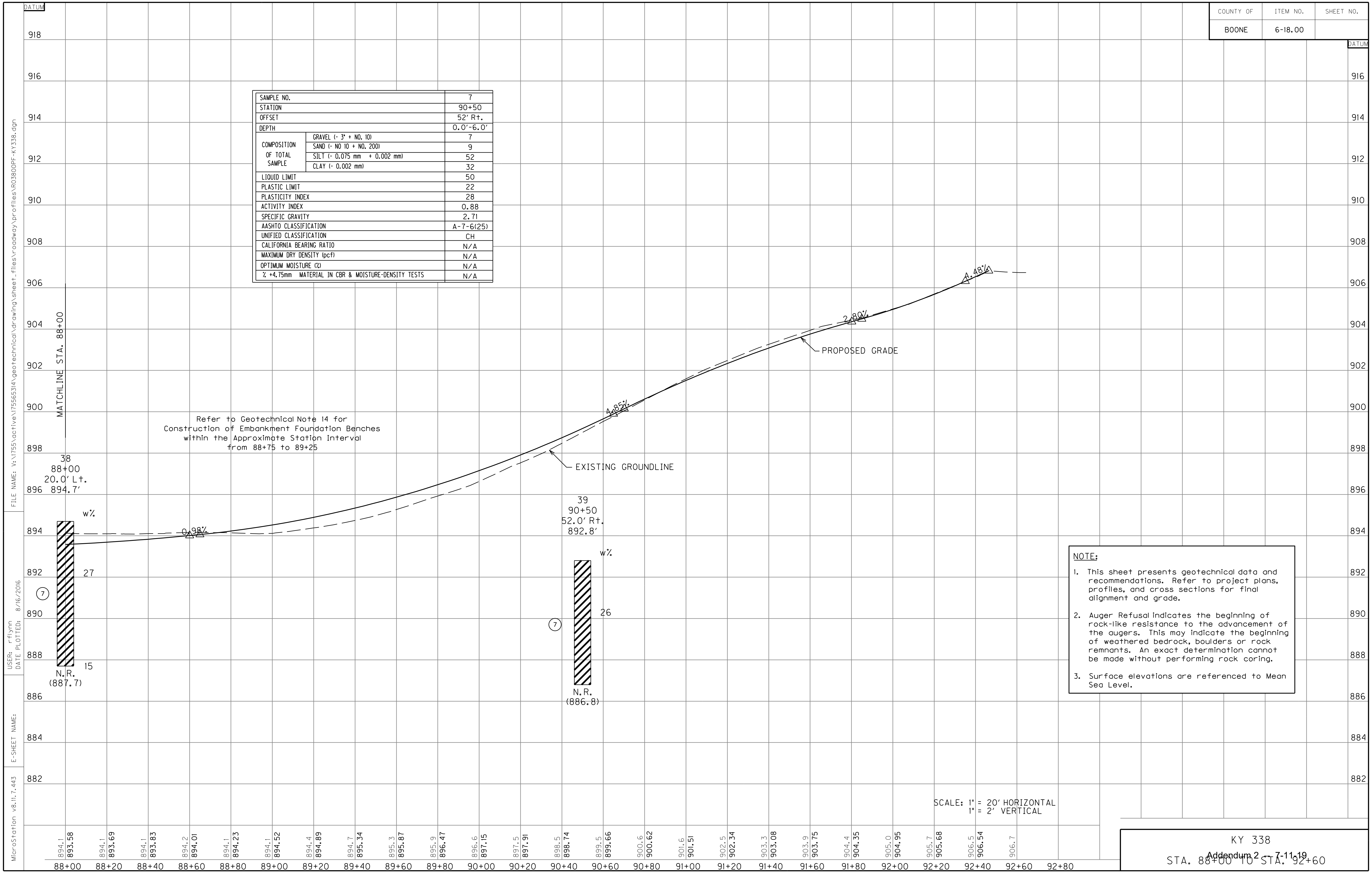
E-SHEET NAME:

MicroStation v8.11.7.443

KY 338
STA. 82+00 TO STA. 88+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



88+00	894.1	893.58
88+20	894.1	893.69
88+40	894.1	893.83
88+60	894.2	894.01
88+80	894.1	894.23
89+00	894.1	894.52
89+20	894.4	894.89
89+40	894.7	895.34
89+60	895.3	895.87
89+80	895.9	896.47
90+00	896.6	897.15
90+20	897.5	897.91
90+40	898.5	898.74
90+60	899.5	899.66
90+80	900.6	900.62
91+00	901.6	901.51
91+20	902.5	902.34
91+40	903.3	903.08
91+60	903.9	903.75
91+80	904.4	904.35
92+00	905.0	904.95
92+20	905.7	905.68
92+40	906.5	906.54
92+60	906.7	
92+80		

SAMPLE NO.		7
STATION		90+50
OFFSET		52' Rt.
DEPTH		0.0'-6.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7
	SAND (- NO 10 + NO. 200)	9
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	32
LIQUID LIMIT		50
PLASTIC LIMIT		22
PLASTICITY INDEX		28
ACTIVITY INDEX		0.88
SPECIFIC GRAVITY		2.71
AASHTO CLASSIFICATION		A-7-6(25)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R03800PF-KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

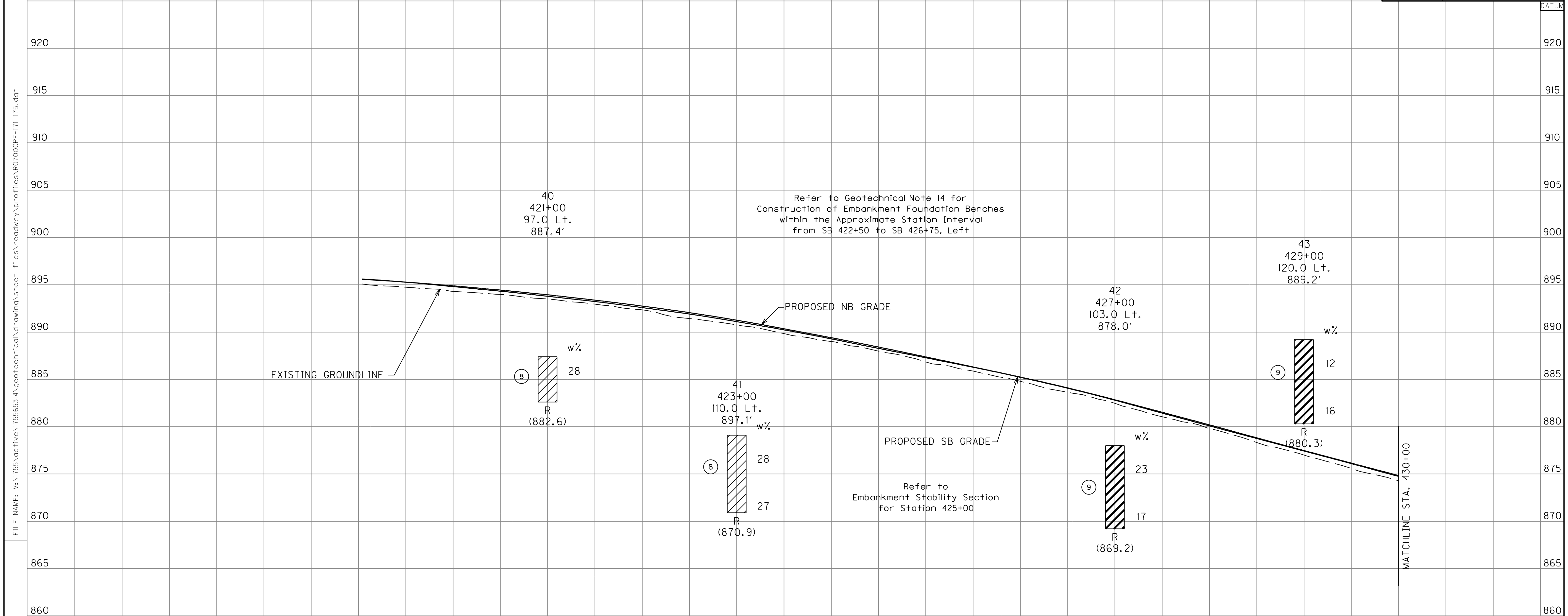
E-SHEET NAME:

MicroStation v8.11.7.443

KY 338
STA. 88+00 TO STA. 92+60

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		8	9
STATION		421+00	429+00
OFFSET		97′ Lt.	120′ Lt.
DEPTH		0.0′-4.8′	0.0′-8.9′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5	11
	SAND (- NO 10 + NO. 200)	10	7
	SILT (- 0.075 mm + 0.002 mm)	48	30
	CLAY (- 0.002 mm)	37	52
LIQUID LIMIT		49	63
PLASTIC LIMIT		20	21
PLASTICITY INDEX		29	42
ACTIVITY INDEX		0.78	0.81
SPECIFIC GRAVITY		2.76	2.79
AASHTO CLASSIFICATION		A-7-6(26)	A-7-6(36)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		N/A	1.7
MAXIMUM DRY DENSITY (pcf)		N/A	100.3
OPTIMUM MOISTURE (%)		N/A	24.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

	LEFT EP GP	RIGHT EP GP
419+00		
419+50	895.28	894.7 895.28
420+00	894.81	894.3 894.89
420+50	894.32	894.0 894.44
421+00	893.78	893.5 893.94
421+50	893.23	893.0 893.37
422+00	892.59	892.3 892.75
422+50	891.90	891.4 892.05
423+00	891.10	890.7 891.26
423+50	890.23	889.8 890.35
424+00	889.28	889.0 889.40
424+50	888.27	888.0 888.42
425+00	887.28	886.8 887.37
425+50	886.28	885.9 886.31
426+00	885.22	884.8 885.24
426+50	884.06	883.6 884.10
427+00	882.79	882.5 882.84
427+50	881.43	881.0 881.52
428+00	880.08	879.8 880.19
428+50	878.75	878.3 878.82
429+00	877.42	877.0 877.47
429+50	876.09	875.6 876.15
430+00	874.75	874.3 874.83

I-71/I-75
STA. 419+00 TO STA. 430+00

Addendum 2 -- 7-11-19

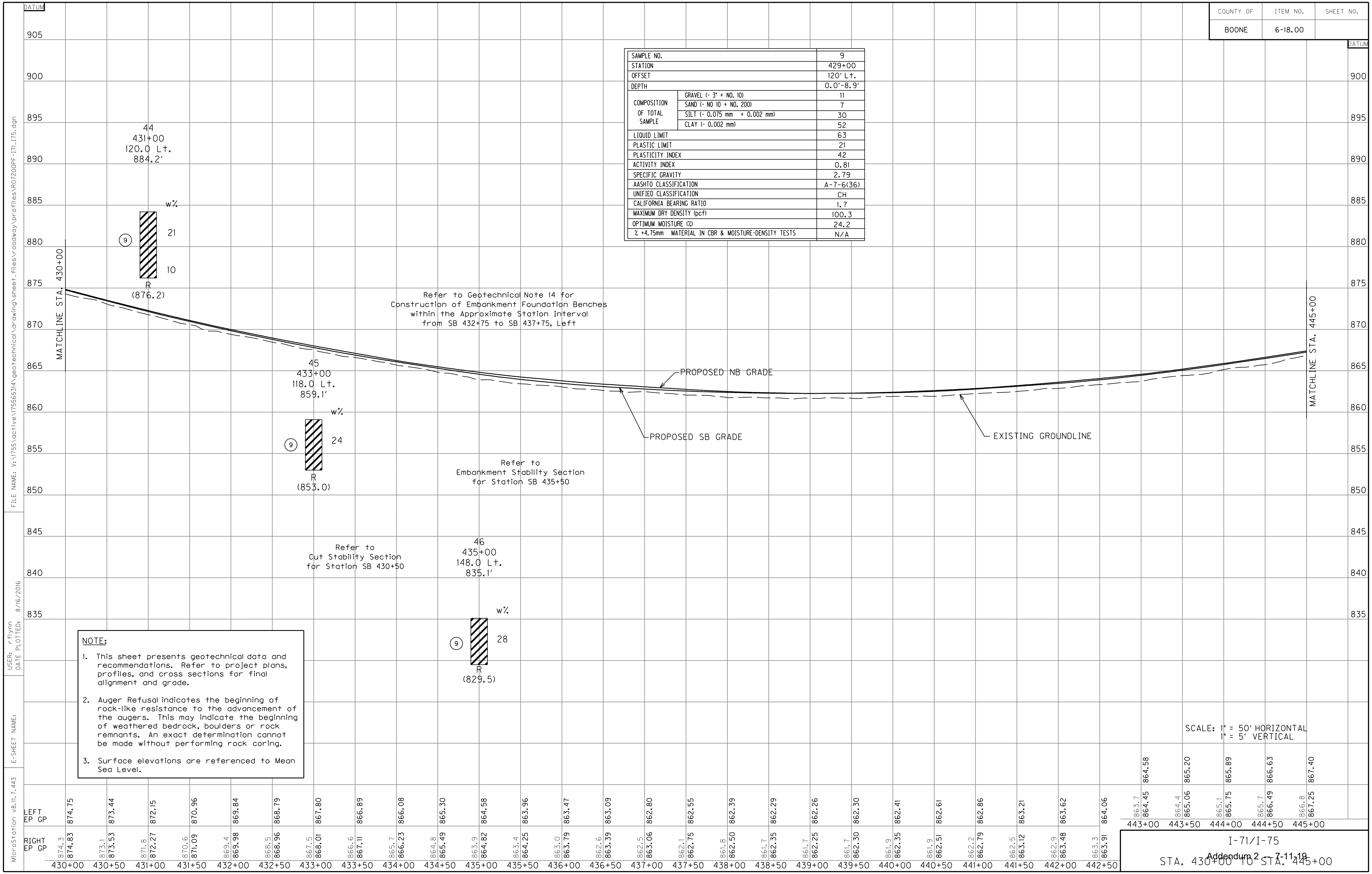
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R07000PF-I71_I75.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		9
STATION		429+00
OFFSET		120′ Lt.
DEPTH		0.0′-8.9′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	11
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	30
	CLAY (- 0.002 mm)	52
LIQUID LIMIT		63
PLASTIC LIMIT		21
PLASTICITY INDEX		42
ACTIVITY INDEX		0.81
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(36)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		100.3
OPTIMUM MOISTURE (%)		24.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

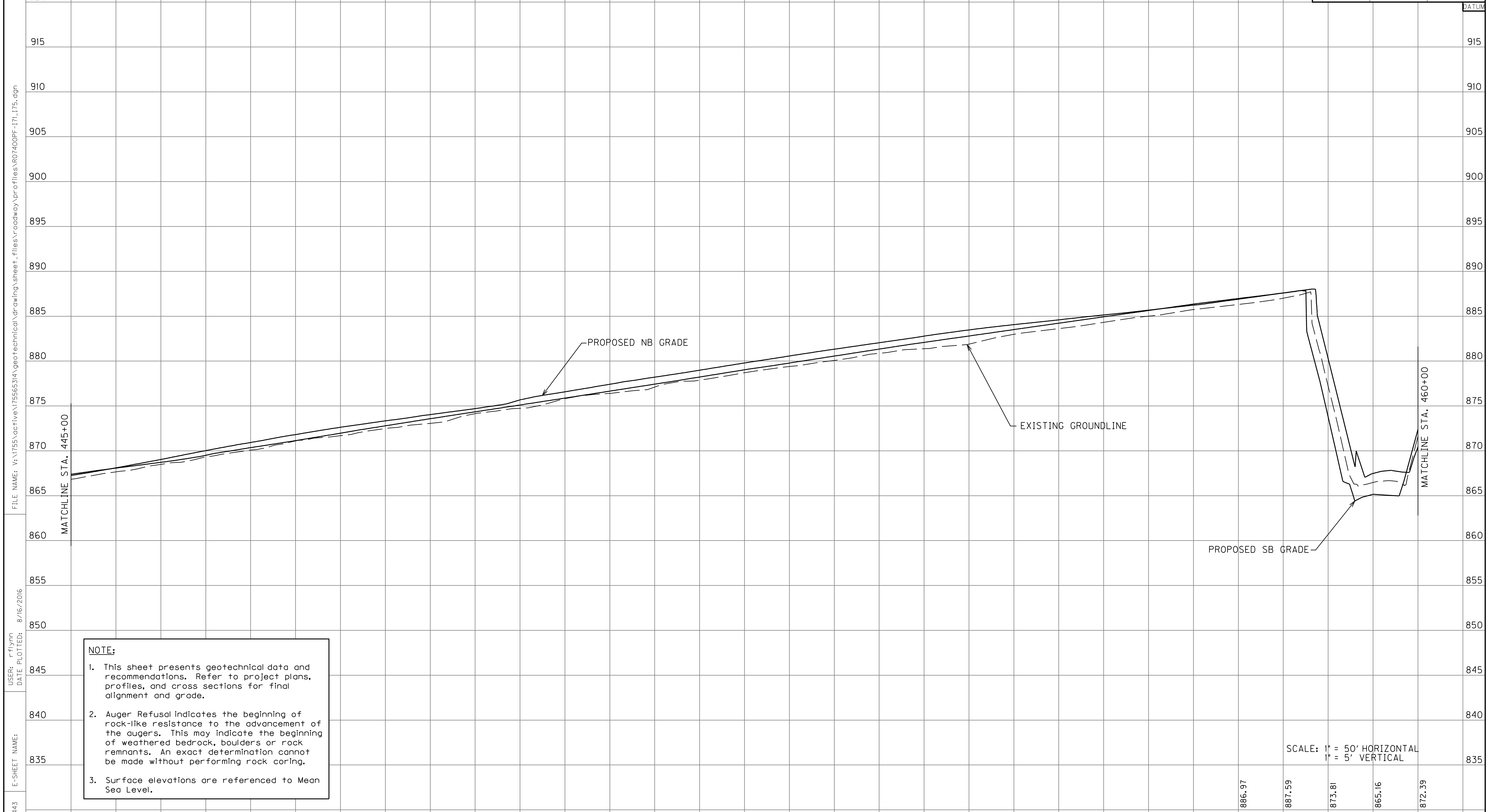
SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

I-71/I-75
STA. 430+00 TO STA. 445+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R07200PF-I71_I75.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

	LEFT EP GP		RIGHT EP GP
445+00	867.40	866.8	867.25
445+50	868.08	867.7	868.11
446+00	868.72	868.5	869.04
446+50	869.50	869.3	870.03
447+00	870.36	870.1	870.93
447+50	871.14	871.1	871.82
448+00	871.97	871.7	872.63
448+50	872.79	872.5	873.34
449+00	873.58	873.1	874.04
449+50	874.35	874.1	874.71
450+00	875.11	874.7	875.67
450+50	875.87	875.8	876.58
451+00	876.65	876.4	877.42
451+50	877.43	877.1	878.21
452+00	878.23	877.9	878.98
452+50	879.03	878.7	879.79
453+00	879.78	879.4	880.57
453+50	880.56	880.1	881.32
454+00	881.34	880.9	882.05
454+50	882.09	881.4	882.78
455+00	882.80	881.9	883.47
455+50	883.51	883.0	884.06
456+00	884.22	883.6	884.60
456+50	884.93	884.3	885.14
457+00	885.64	885.0	885.68
457+50	886.35	885.7	886.23

458+00	886.97	886.3	886.89
458+50	887.59	887.0	887.59
459+00	873.81	877.2	880.29
459+50	865.16	866.5	867.48
460+00	872.39	871.6	870.43

I-71/I-75

Addendum 2 -- 7-11-19

STA. 445+00 TO STA. 460+00

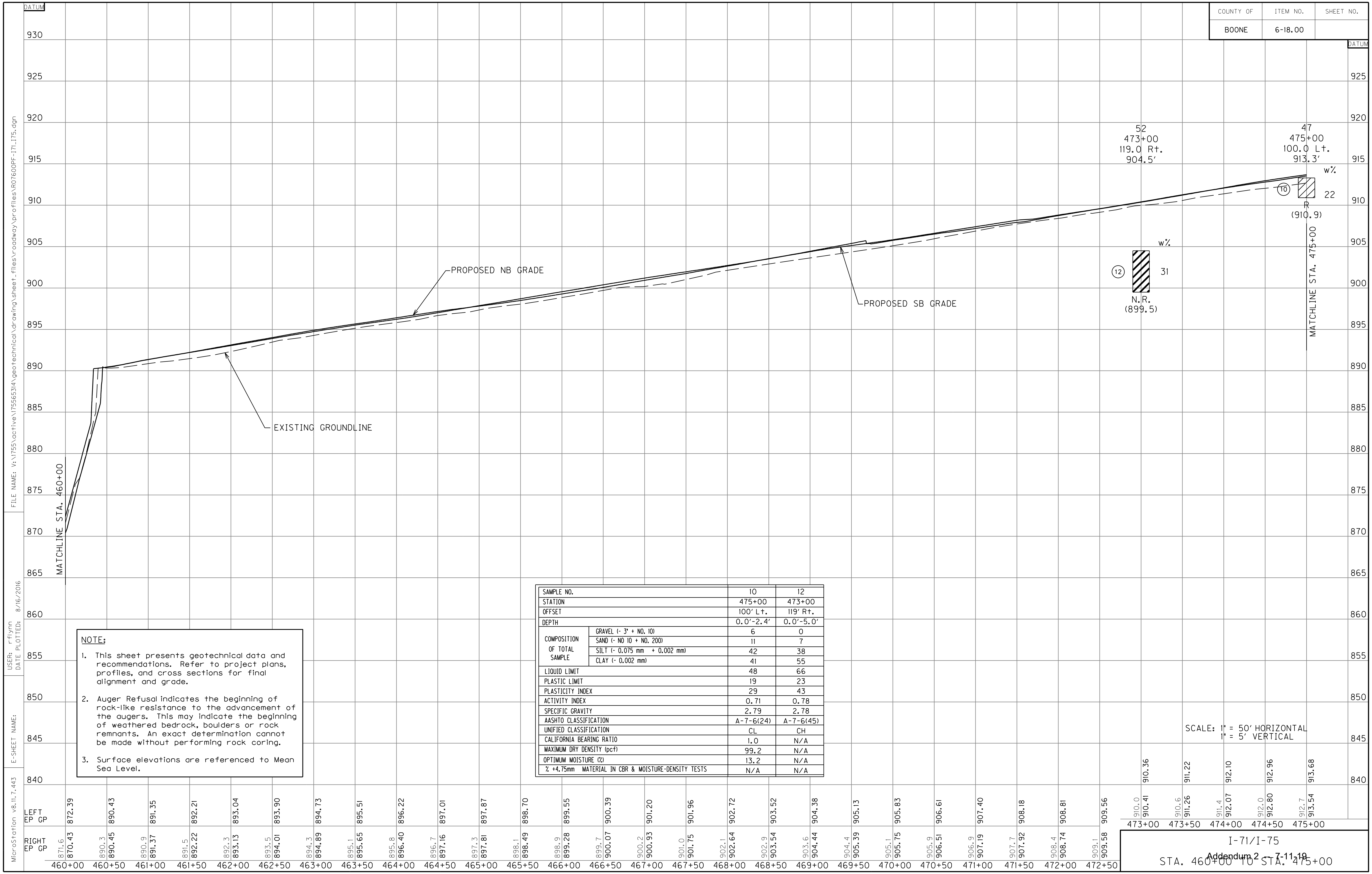
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R07400PF-I71_I75.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R07600PF-171_175.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

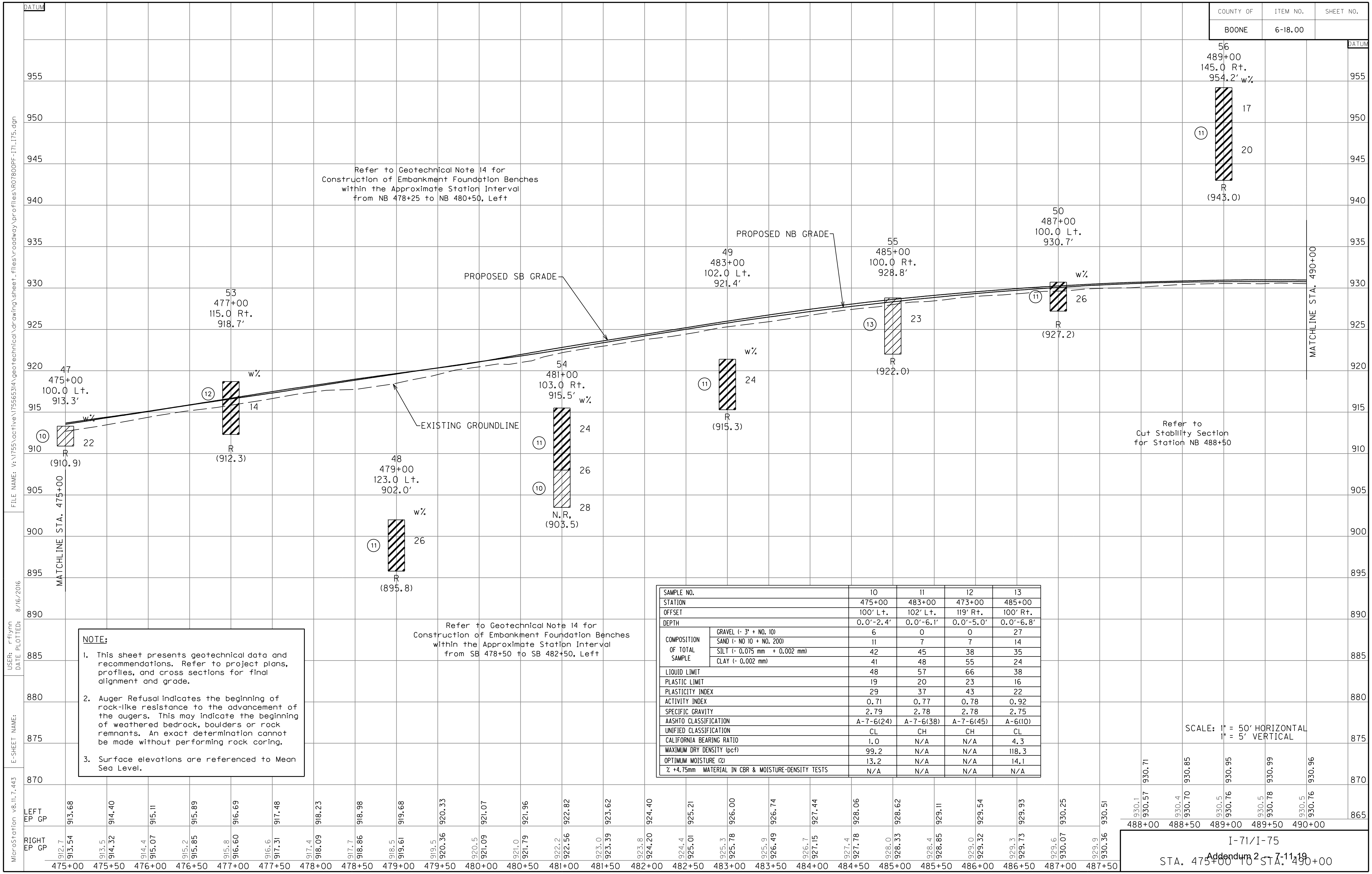
SAMPLE NO.		10	12
STATION		475+00	473+00
OFFSET		100' Lt.	119' Rt.
DEPTH		0.0'-2.4'	0.0'-5.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	0
	SAND (- NO 10 + NO. 200)	11	7
	SILT (- 0.075 mm + 0.002 mm)	42	38
	CLAY (- 0.002 mm)	41	55
LIQUID LIMIT		48	66
PLASTIC LIMIT		19	23
PLASTICITY INDEX		29	43
ACTIVITY INDEX		0.71	0.78
SPECIFIC GRAVITY		2.79	2.78
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(45)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		1.0	N/A
MAXIMUM DRY DENSITY (pcf)		99.2	N/A
OPTIMUM MOISTURE (%)		13.2	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

I-71/I-75
STA. 460+00 TO STA. 475+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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SAMPLE NO.		10	11	12	13
STATION		475+00	483+00	473+00	485+00
OFFSET		100′ Lt.	102′ Lt.	119′ Rt.	100′ Rt.
DEPTH		0.0′-2.4′	0.0′-6.1′	0.0′-5.0′	0.0′-6.8′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	0	0	27
	SAND (- NO 10 + NO. 200)	11	7	7	14
	SILT (- 0.075 mm + 0.002 mm)	42	45	38	35
	CLAY (- 0.002 mm)	41	48	55	24
LIQUID LIMIT		48	57	66	38
PLASTIC LIMIT		19	20	23	16
PLASTICITY INDEX		29	37	43	22
ACTIVITY INDEX		0.71	0.77	0.78	0.92
SPECIFIC GRAVITY		2.79	2.78	2.78	2.75
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(38)	A-7-6(45)	A-6(10)
UNIFIED CLASSIFICATION		CL	CH	CH	CL
CALIFORNIA BEARING RATIO		1.0	N/A	N/A	4.3
MAXIMUM DRY DENSITY (pcf)		99.2	N/A	N/A	118.3
OPTIMUM MOISTURE (%)		13.2	N/A	N/A	14.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A	N/A	N/A

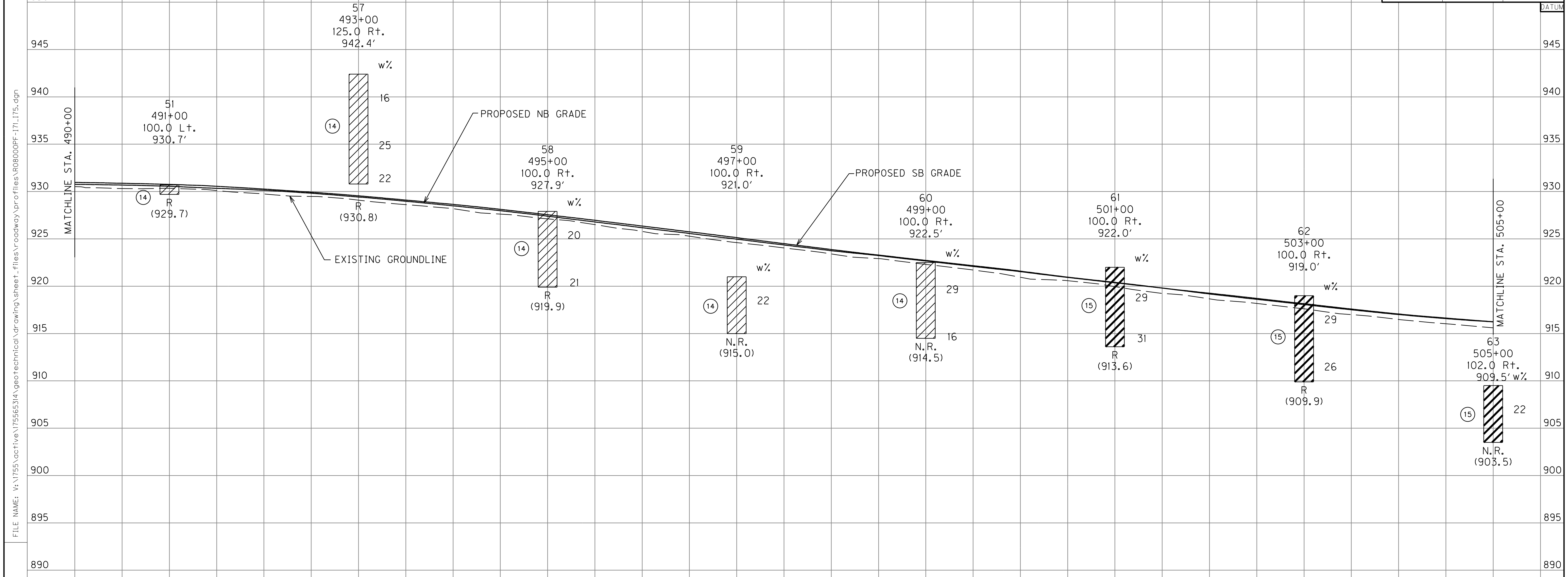
SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

I-71/I-75
STA. 475+00 TO STA. 490+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R07800PF-I71_I75.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		14	15
STATION		495+00	505+00
OFFSET		100′ Rt.	102′ Rt.
DEPTH		0.0′-8.0′	0.0′-6.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1	0
	SAND (- NO 10 + NO. 200)	8	6
	SILT (- 0.075 mm + 0.002 mm)	57	45
	CLAY (- 0.002 mm)	34	49
LIQUID LIMIT		44	55
PLASTIC LIMIT		16	19
PLASTICITY INDEX		28	36
ACTIVITY INDEX		0.82	0.73
SPECIFIC GRAVITY		2.73	2.78
AASHTO CLASSIFICATION		A-7-6(26)	A-7-6(36)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		3.8	N/A
MAXIMUM DRY DENSITY (pcf)		107.6	N/A
OPTIMUM MOISTURE (%)		18.6	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

880
875
870
865

SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

	LEFT EP GP	RIGHT EP GP
490+00	930.96	930.5 930.76
490+50	930.87	930.3 930.69
491+00	930.75	930.3 930.55
491+50	930.55	930.1 930.34
492+00	930.26	929.7 930.13
492+50	929.93	929.5 929.82
493+00	929.55	929.1 929.42
493+50	929.10	928.6 928.98
494+00	928.64	928.2 928.49
494+50	928.12	927.6 927.97
495+00	927.55	927.1 927.40
495+50	926.96	926.5 926.79
496+00	926.36	925.8 926.18
496+50	925.75	925.3 925.57
497+00	925.13	924.6 924.97
497+50	924.50	924.0 924.36
498+00	923.88	923.4 923.75
498+50	923.29	922.9 923.24
499+00	922.72	922.3 922.66
499+50	922.17	921.7 922.09
500+00	921.59	920.9 921.54
500+50	920.96	920.6 920.93
501+00	920.40	920.0 920.36
501+50	919.80	919.2 919.81
502+00	919.18	918.7 919.26
502+50	918.61	918.2 918.71
503+00	918.06	917.6 918.15
503+50	917.51	917.0 917.59
504+00	917.01	916.5 917.07
504+50	916.58	916.0 916.63
505+00	916.24	915.6 916.25

I-71/I-75
STA. 490+00 TO STA. 505+00

Addendum 2 -- 7-11-19

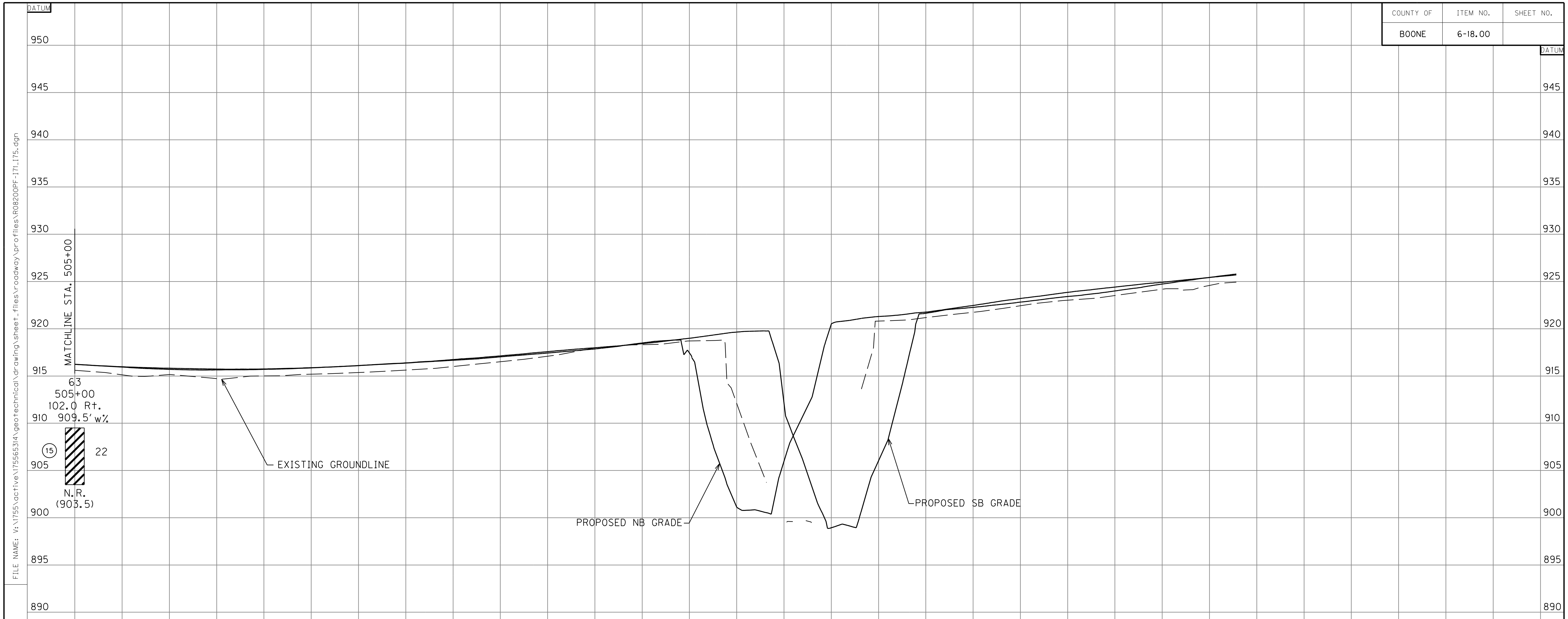
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R0800PF-171_175.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		15
STATION		505+00
OFFSET		102' Rt.
DEPTH		0.0'-6.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	45
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		55
PLASTIC LIMIT		19
PLASTICITY INDEX		36
ACTIVITY INDEX		0.73
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(36)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

880
875
870
865

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

	LEFT EP GP		RIGHT EP GP
505+00	916.24	915.6	916.25
505+50	915.98	915.1	915.95
506+00	915.82	915.2	915.71
506+50	915.73	914.7	915.65
507+00	915.75	915.0	915.70
507+50	915.88	915.2	915.86
508+00	916.11	915.4	916.10
508+50	916.39	915.6	916.37
509+00	916.74	916.0	916.67
509+50	917.12	916.5	917.02
510+00	917.58	917.1	917.43
510+50	917.99	918.0	917.87
511+00	918.42	918.3	918.50
511+50	919.00	918.7	917.43
512+00	919.65	912.1	901.14
512+50	912.15		905.97
513+00	898.94		920.49
513+50	906.03	920.8	921.30
514+00	921.64	921.2	921.76
514+50	922.26	921.7	922.47
515+00	922.82	922.4	923.20
515+50	923.42	923.0	923.85
516+00	924.00	923.5	924.41
516+50	924.73	924.2	924.91
517+00	925.43	924.6	925.43

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R08200PF-I71_I75.dgn

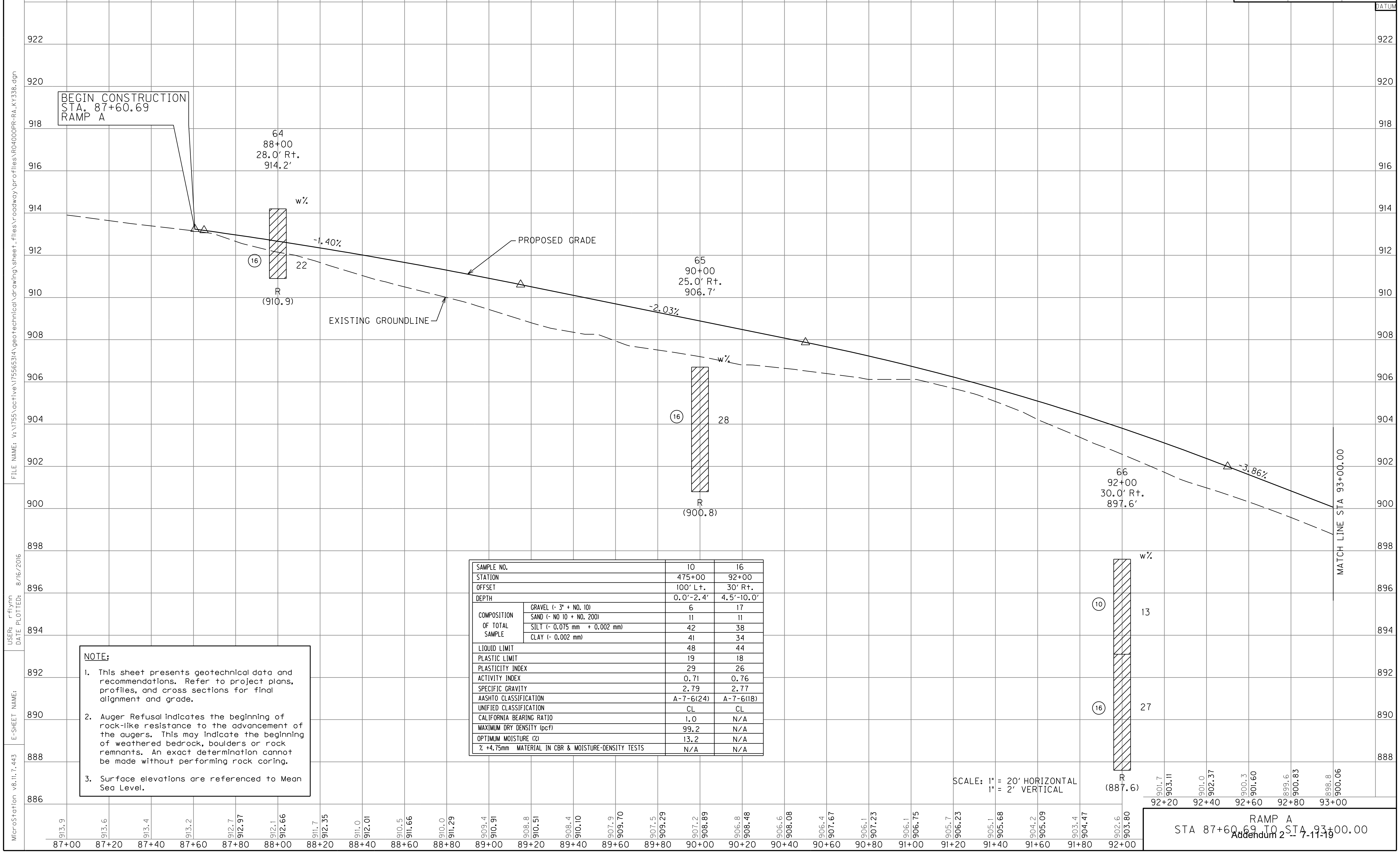
USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

I-71/I-75
STA. 505+00 TO END CONSTRUCTION
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		10	16
STATION		475+00	92+00
OFFSET		100′ Lt.	30′ Rt.
DEPTH		0.0′-2.4′	4.5′-10.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	17
	SAND (- NO 10 + NO. 200)	11	11
	SILT (- 0.075 mm + 0.002 mm)	42	38
	CLAY (- 0.002 mm)	41	34
LIQUID LIMIT		48	44
PLASTIC LIMIT		19	18
PLASTICITY INDEX		29	26
ACTIVITY INDEX		0.71	0.76
SPECIFIC GRAVITY		2.79	2.77
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(18)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	N/A
MAXIMUM DRY DENSITY (pcf)		99.2	N/A
OPTIMUM MOISTURE (%)		13.2	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP A
STA 87+60.69 TO STA 93+00.00

Addendum 2 -- 7-11-19

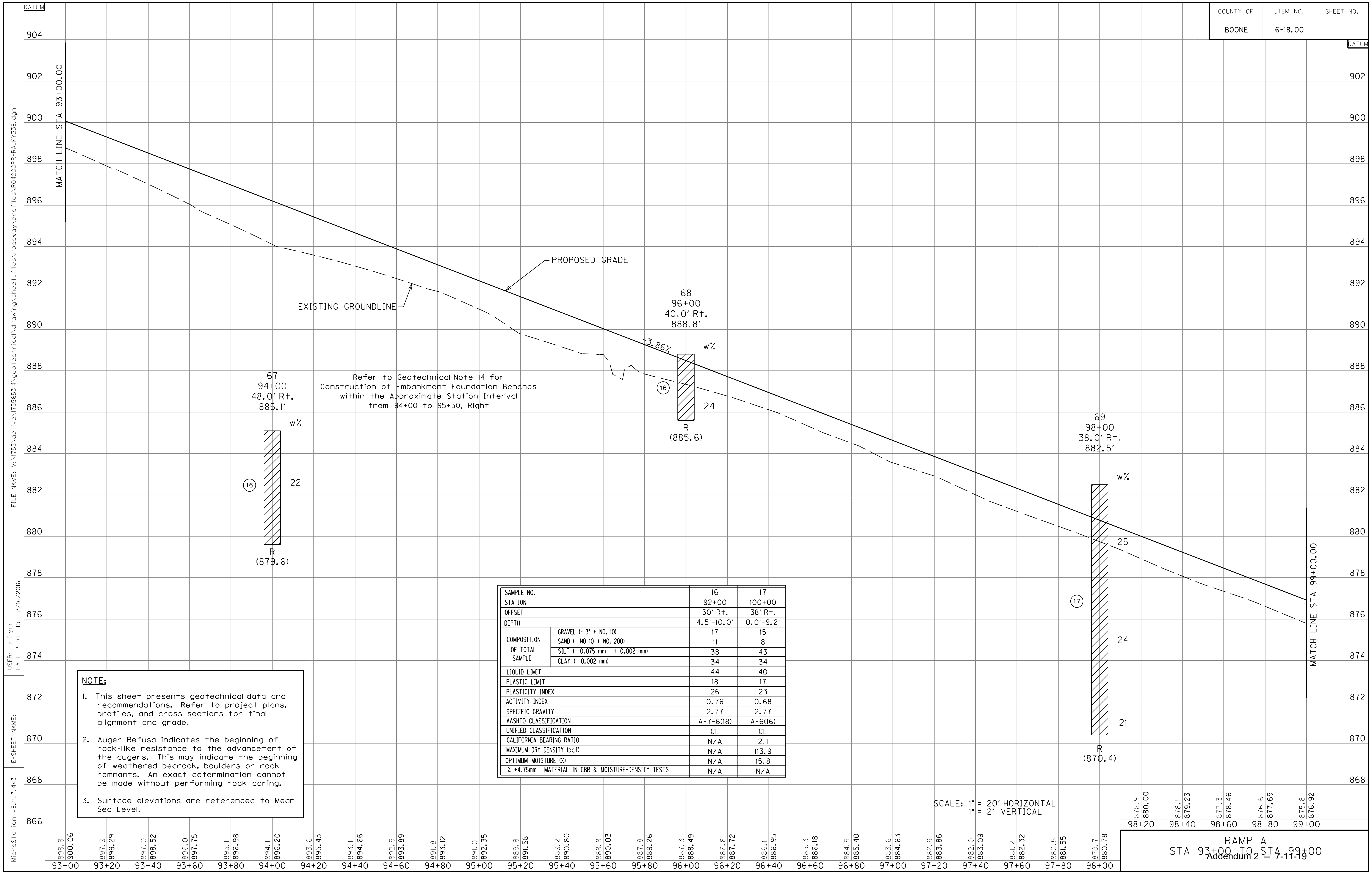
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R04000PR-RA_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



93+00	898.8	900.06
93+20	897.9	899.29
93+40	897.0	898.52
93+60	896.0	897.75
93+80	895.1	896.98
94+00	894.1	896.20
94+20	893.6	895.43
94+40	893.1	894.66
94+60	892.5	893.89
94+80	891.8	893.12
95+00	891.0	892.35
95+20	889.8	891.58
95+40	889.2	890.80
95+60	888.8	890.03
95+80	887.8	889.26
96+00	887.3	888.49
96+20	886.8	887.72
96+40	886.1	886.95
96+60	885.3	886.18
96+80	884.5	885.40
97+00	883.6	884.63
97+20	882.9	883.86
97+40	882.0	883.09
97+60	881.2	882.32
97+80	880.5	881.55
98+00	879.7	880.78
98+20	878.9	880.00
98+40	878.1	879.23
98+60	877.3	878.46
98+80	876.6	877.69
99+00	875.8	876.92

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SAMPLE NO.		16	17
STATION		92+00	100+00
OFFSET		30′ Rt.	38′ Rt.
DEPTH		4.5′-10.0′	0.0′-9.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	17	15
	SAND (- NO 10 + NO. 200)	11	8
	SILT (- 0.075 mm + 0.002 mm)	38	43
	CLAY (- 0.002 mm)	34	34
LIQUID LIMIT		44	40
PLASTIC LIMIT		18	17
PLASTICITY INDEX		26	23
ACTIVITY INDEX		0.76	0.68
SPECIFIC GRAVITY		2.77	2.77
AASHTO CLASSIFICATION		A-7-6(18)	A-6(16)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		N/A	2.1
MAXIMUM DRY DENSITY (pcf)		N/A	113.9
OPTIMUM MOISTURE (%)		N/A	15.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP A
STA 93+00 TO STA 99+00

Addendum 2 -- 7-11-19

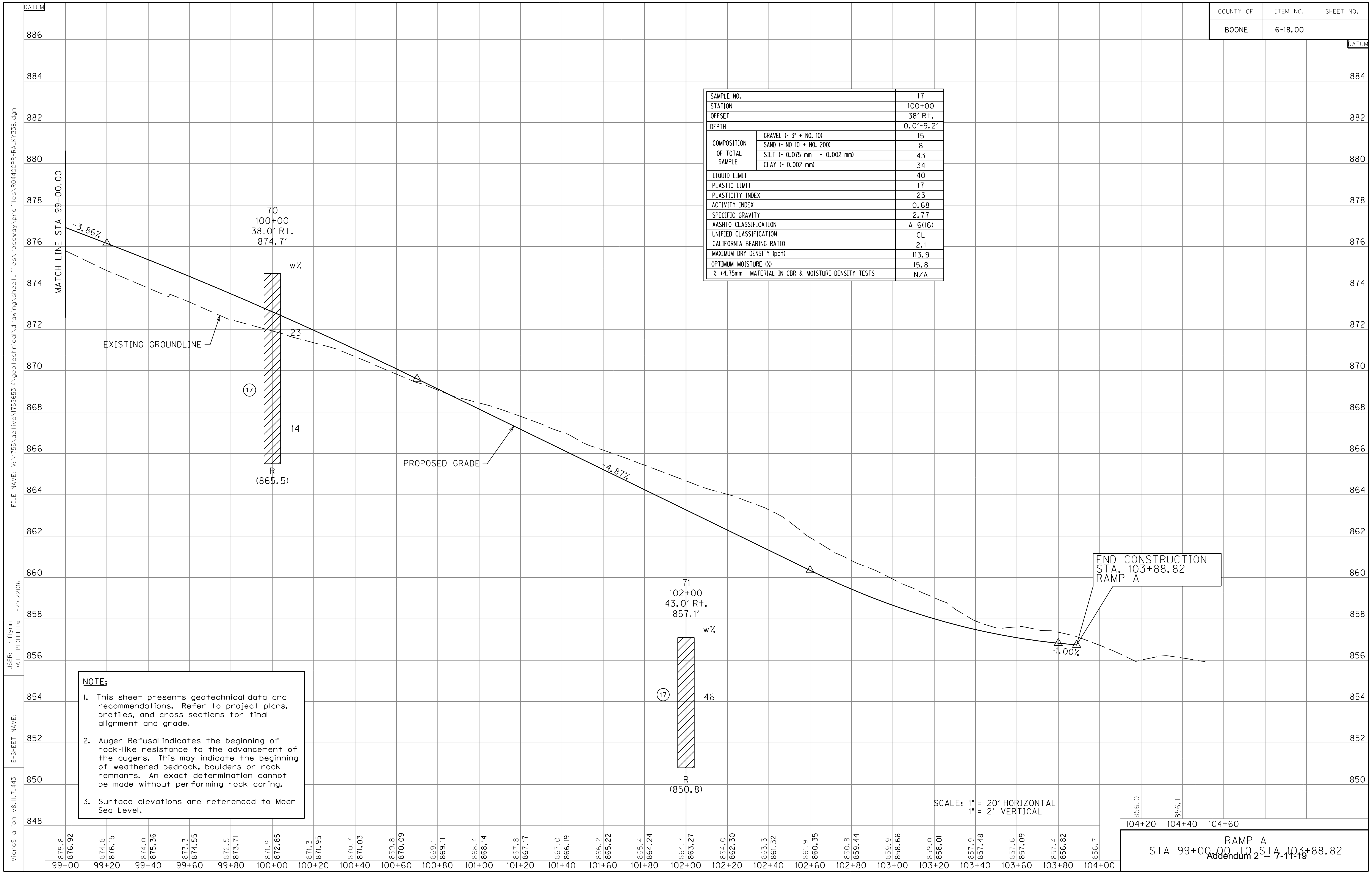
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R04200PR-RA_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		17
STATION		100+00
OFFSET		38' Rt.
DEPTH		0.0'-9.2'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	15
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	43
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		40
PLASTIC LIMIT		17
PLASTICITY INDEX		23
ACTIVITY INDEX		0.68
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-6(16)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.1
MAXIMUM DRY DENSITY (pcf)		113.9
OPTIMUM MOISTURE (%)		15.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

99+00	875.8	876.92
99+20	874.8	876.15
99+40	874.0	875.36
99+60	873.3	874.55
99+80	872.5	873.71
100+00	871.9	872.85
100+20	871.3	871.95
100+40	870.7	871.03
100+60	869.8	870.09
100+80	869.1	869.11
101+00	868.4	868.14
101+20	867.8	867.17
101+40	867.0	866.19
101+60	866.2	865.22
101+80	865.4	864.24
102+00	864.7	863.27
102+20	864.0	862.30
102+40	863.3	861.32
102+60	861.9	860.35
102+80	860.8	859.44
103+00	859.9	858.66
103+20	859.0	858.01
103+40	857.9	857.48
103+60	857.6	857.09
103+80	857.4	856.82
104+00	856.7	

RAMP A
STA 99+00.00 TO STA 103+88.82

Addendum 2 -- 7-11-19

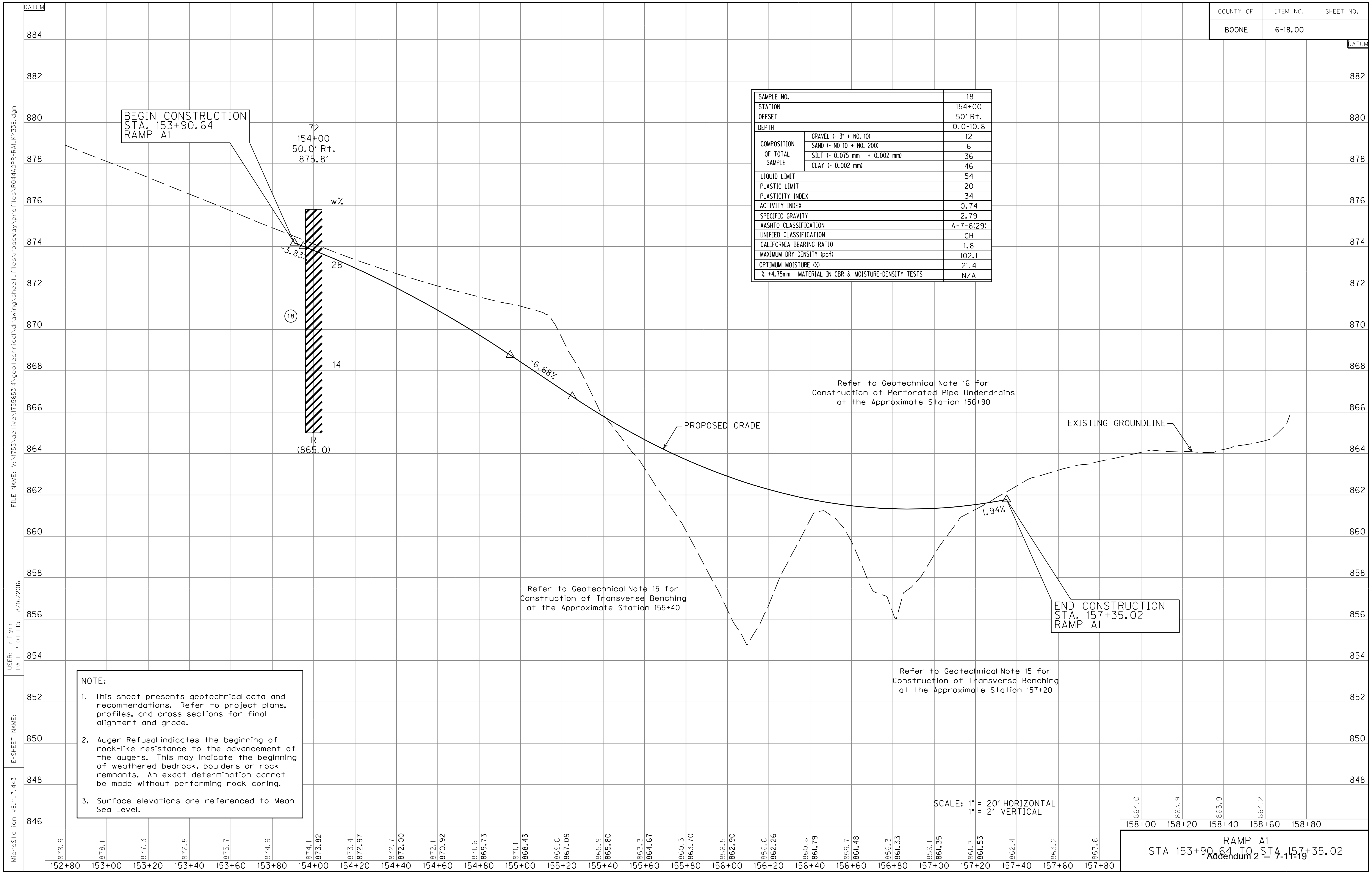
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R04400PR-RA_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		18
STATION		154+00
OFFSET		50' Rt.
DEPTH		0.0-10.8
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	12
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	36
	CLAY (- 0.002 mm)	46
LIQUID LIMIT		54
PLASTIC LIMIT		20
PLASTICITY INDEX		34
ACTIVITY INDEX		0.74
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(29)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.8
MAXIMUM DRY DENSITY (pcf)		102.1
OPTIMUM MOISTURE (%)		21.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 156+90

Refer to Geotechnical Note 15 for Construction of Transverse Benching at the Approximate Station 155+40

Refer to Geotechnical Note 15 for Construction of Transverse Benching at the Approximate Station 157+20

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP A1
STA 153+90.64 TO STA 157+35.02

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R044AOPR-RA1_KY338.dgn

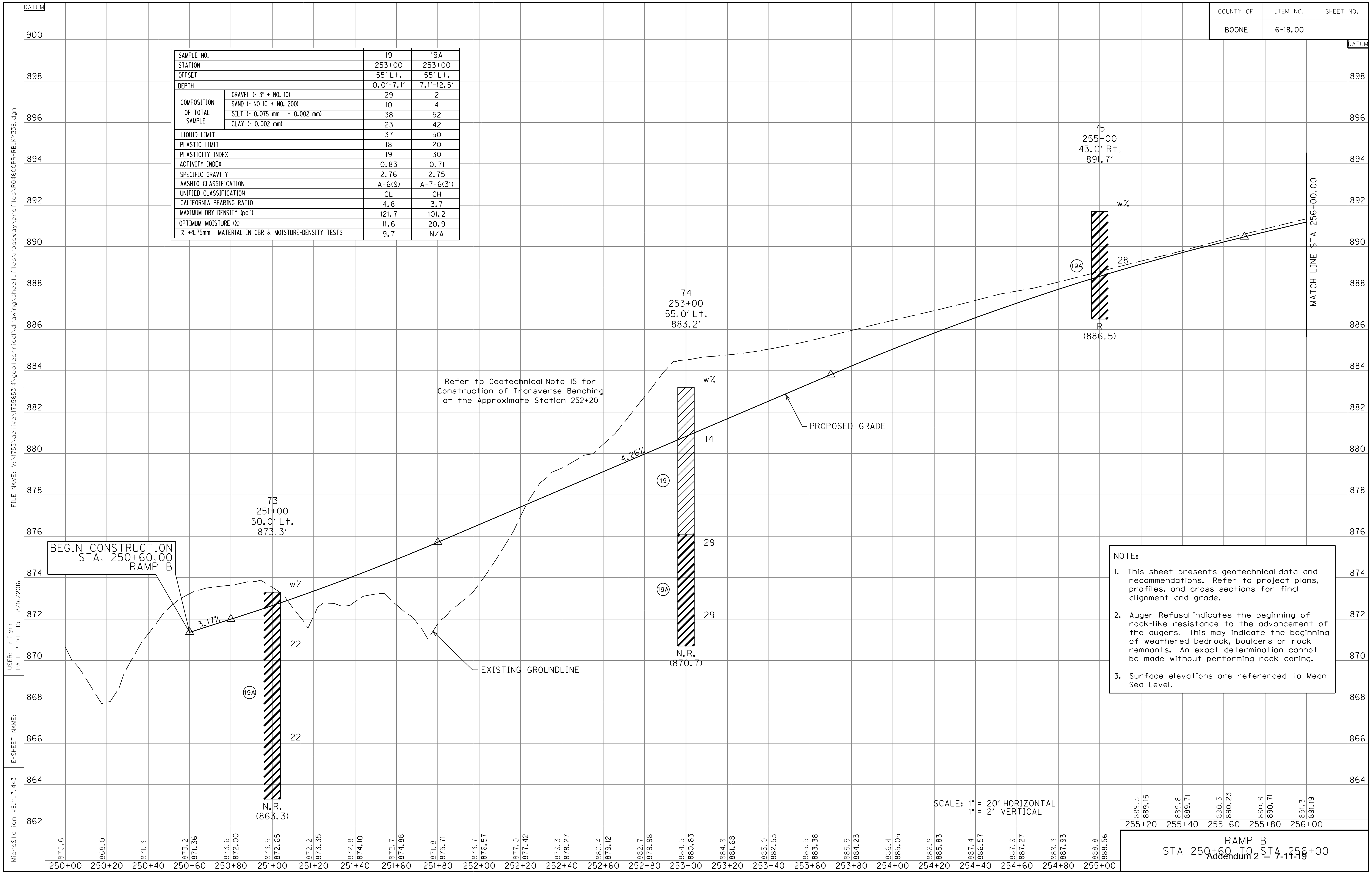
USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		19	19A
STATION		253+00	253+00
OFFSET		55′ Lt.	55′ Lt.
DEPTH		0.0′-7.1′	7.1′-12.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	29	2
	SAND (- NO 10 + NO. 200)	10	4
	SILT (- 0.075 mm + 0.002 mm)	38	52
	CLAY (- 0.002 mm)	23	42
LIQUID LIMIT		37	50
PLASTIC LIMIT		18	20
PLASTICITY INDEX		19	30
ACTIVITY INDEX		0.83	0.71
SPECIFIC GRAVITY		2.76	2.75
AASHTO CLASSIFICATION		A-6(9)	A-7-6(31)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		4.8	3.7
MAXIMUM DRY DENSITY (pcf)		121.7	101.2
OPTIMUM MOISTURE (%)		11.6	20.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		9.7	N/A



Refer to Geotechnical Note 15 for Construction of Transverse Benching at the Approximate Station 252+20

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

RAMP B
STA 250+60 TO STA 256+00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R04600PR-RB_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

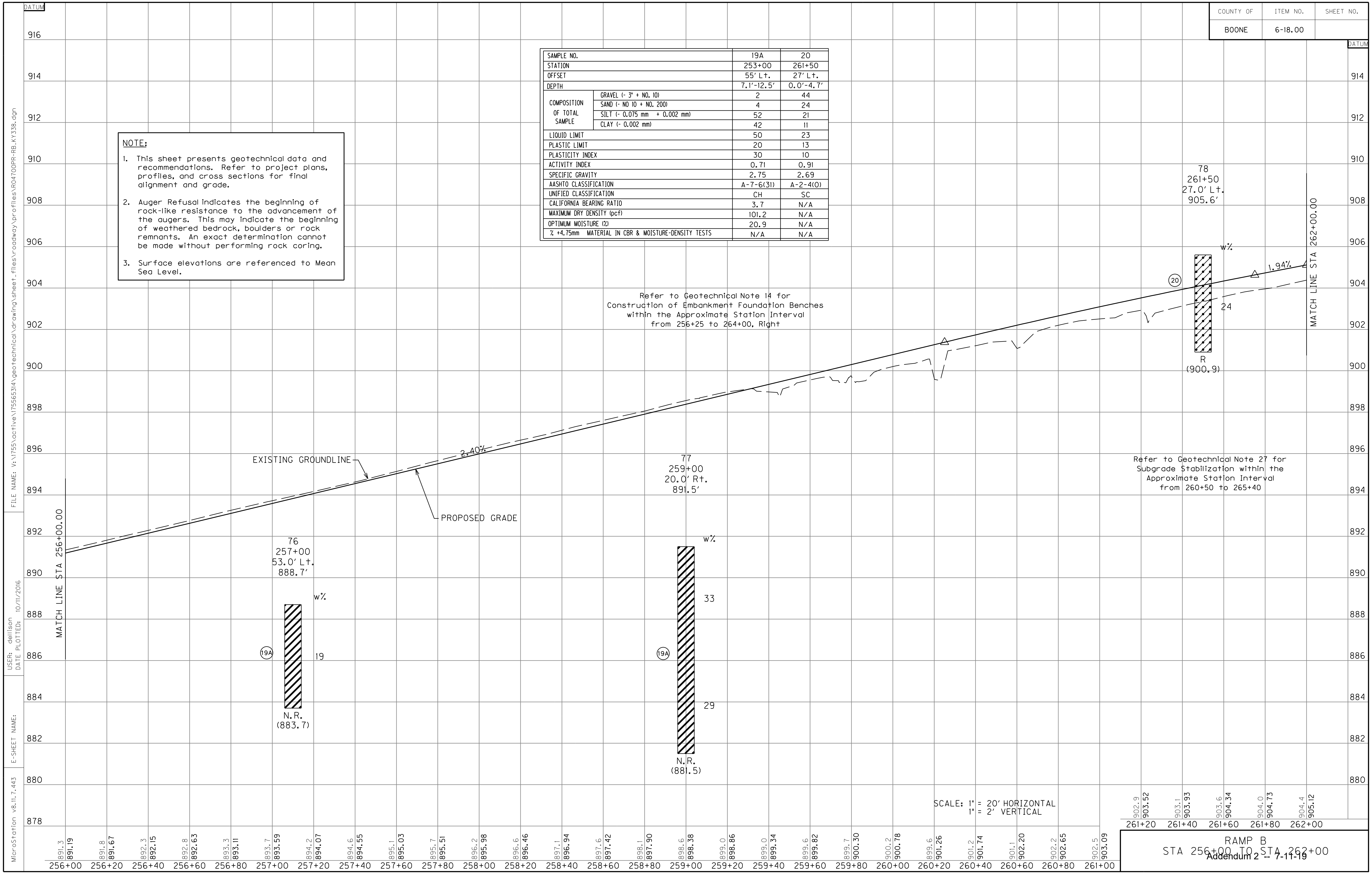
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		19A	20
STATION		253+00	261+50
OFFSET		55′ Lt.	27′ Lt.
DEPTH		7.1′-12.5′	0.0′-4.7′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2	44
	SAND (- NO 10 + NO. 200)	4	24
	SILT (- 0.075 mm + 0.002 mm)	52	21
	CLAY (- 0.002 mm)	42	11
LIQUID LIMIT		50	23
PLASTIC LIMIT		20	13
PLASTICITY INDEX		30	10
ACTIVITY INDEX		0.71	0.91
SPECIFIC GRAVITY		2.75	2.69
AASHTO CLASSIFICATION		A-7-6(31)	A-2-4(0)
UNIFIED CLASSIFICATION		CH	SC
CALIFORNIA BEARING RATIO		3.7	N/A
MAXIMUM DRY DENSITY (pcf)		101.2	N/A
OPTIMUM MOISTURE (%)		20.9	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 256+25 to 264+00, Right

Refer to Geotechnical Note 27 for Subgrade Stabilization within the Approximate Station Interval from 260+50 to 265+40

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

256+00	891.3	891.19
256+20	891.8	891.67
256+40	892.3	892.15
256+60	892.8	892.63
256+80	893.3	893.11
257+00	893.7	893.59
257+20	894.2	894.07
257+40	894.6	894.55
257+60	895.1	895.03
257+80	895.7	895.51
258+00	896.2	895.98
258+20	896.6	896.46
258+40	897.1	896.94
258+60	897.6	897.42
258+80	898.1	897.90
259+00	898.6	898.38
259+20	899.0	898.86
259+40	899.0	899.34
259+60	899.6	899.82
259+80	899.7	900.30
260+00	900.2	900.78
260+20	899.6	901.26
260+40	901.2	901.74
260+60	901.1	902.20
260+80	902.2	902.65
261+00	902.5	903.09
261+20	902.9	903.52
261+40	903.1	903.93
261+60	903.6	904.34
261+80	904.0	904.73
262+00	904.4	905.12

RAMP B
STA 256+00 TO STA 262+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R04700PR-RB_KY338.dgn

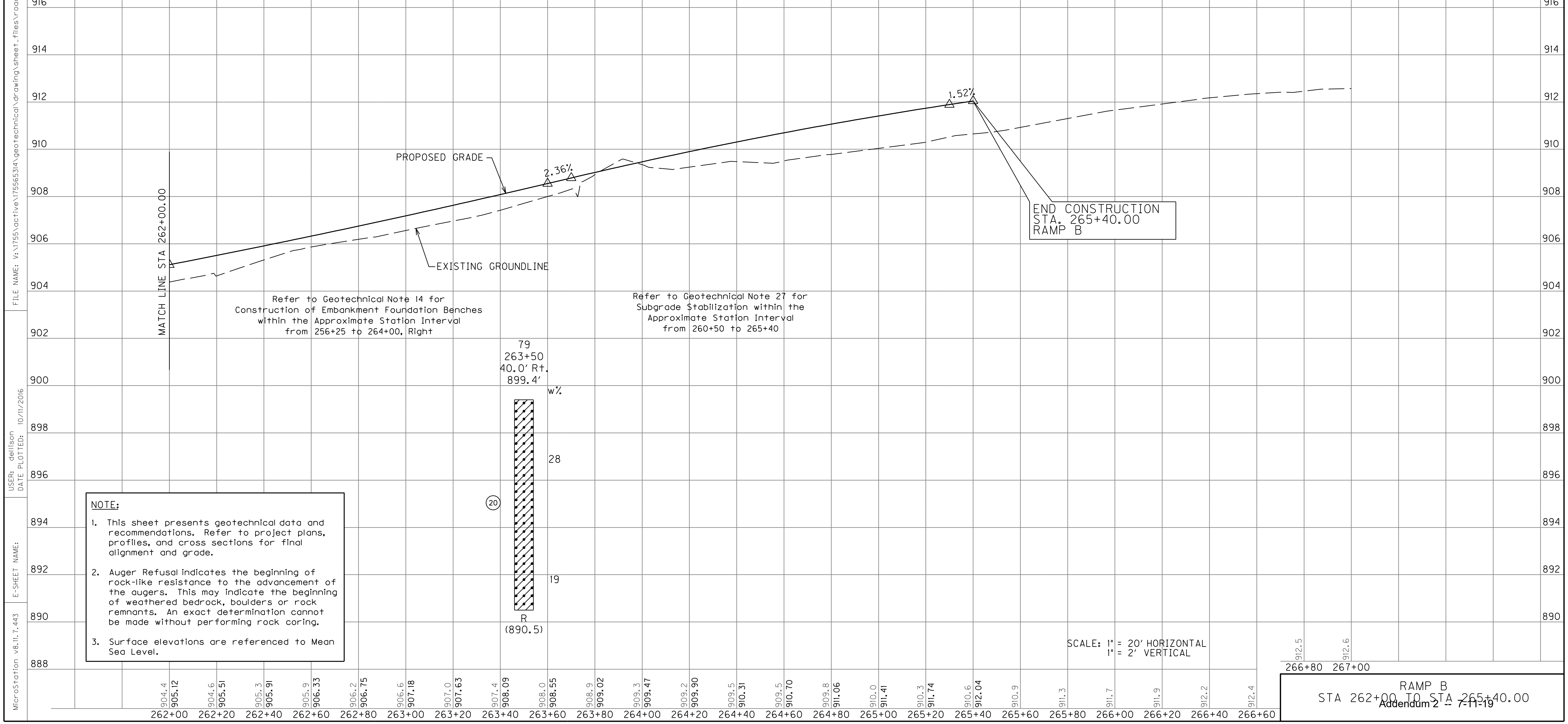
USER: dellison
DATE PLOTTED: 10/11/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		20
STATION		261+50
OFFSET		27′ Lt.
DEPTH		0.0′-4.7′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	44
	SAND (- NO 10 + NO. 200)	24
	SILT (- 0.075 mm + 0.002 mm)	21
	CLAY (- 0.002 mm)	11
LIQUID LIMIT		23
PLASTIC LIMIT		13
PLASTICITY INDEX		10
ACTIVITY INDEX		0.91
SPECIFIC GRAVITY		2.69
AASHTO CLASSIFICATION		A-2-4(0)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 256+25 to 264+00, Right

Refer to Geotechnical Note 27 for Subgrade Stabilization within the Approximate Station Interval from 260+50 to 265+40

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP B
STA 262+00 TO STA 265+40.00

Addendum 2 -- 7-11-19

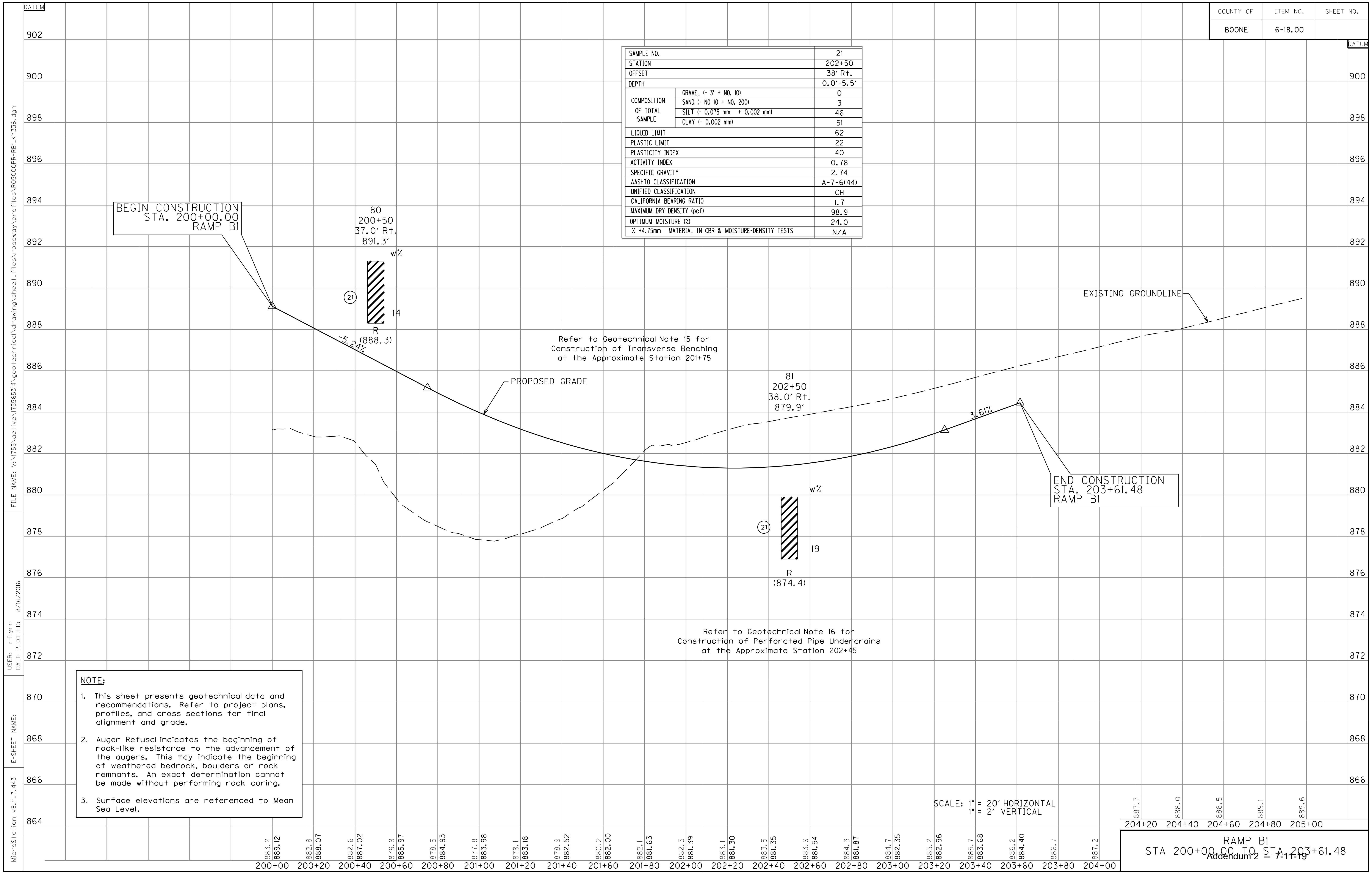
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R04900PR-RB_KY338.dgn

USER: dellison
DATE PLOTTED: 10/11/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		21
STATION		202+50
OFFSET		38′ Rt.
DEPTH		0.0′-5.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	51
LIQUID LIMIT		62
PLASTIC LIMIT		22
PLASTICITY INDEX		40
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(44)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		98.9
OPTIMUM MOISTURE (%)		24.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

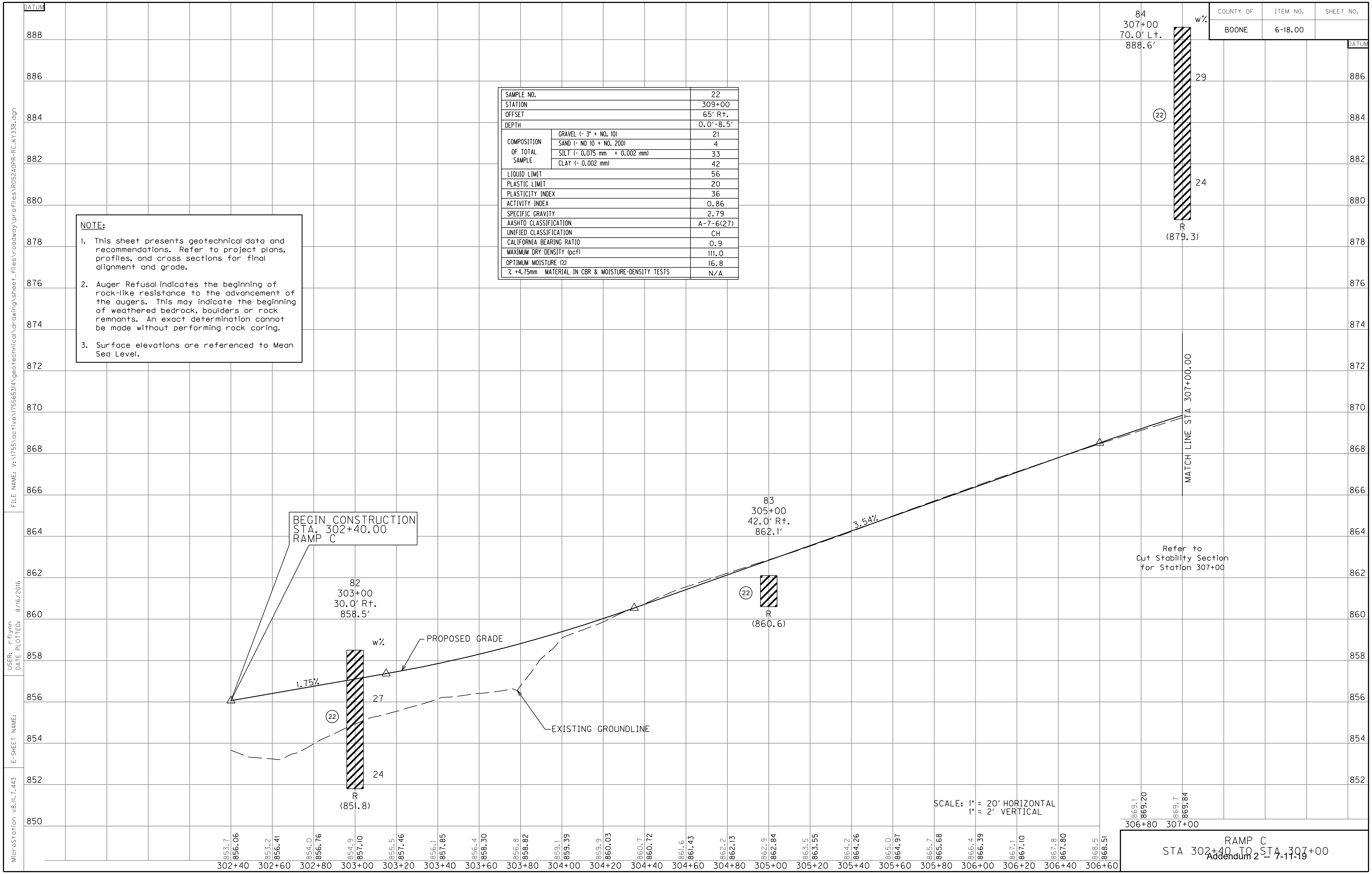
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP B1
STA 200+00.00 TO STA 203+61.48

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		22
STATION		309+00
OFFSET		65′ Rt.
DEPTH		0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	33
	CLAY (- 0.002 mm)	42
LIQUID LIMIT		56
PLASTIC LIMIT		20
PLASTICITY INDEX		36
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		0.9
MAXIMUM DRY DENSITY (pcf)		111.0
OPTIMUM MOISTURE (%)		16.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

RAMP C
STA 302+40 TO STA 307+00

Addendum 2 -- 7-11-19

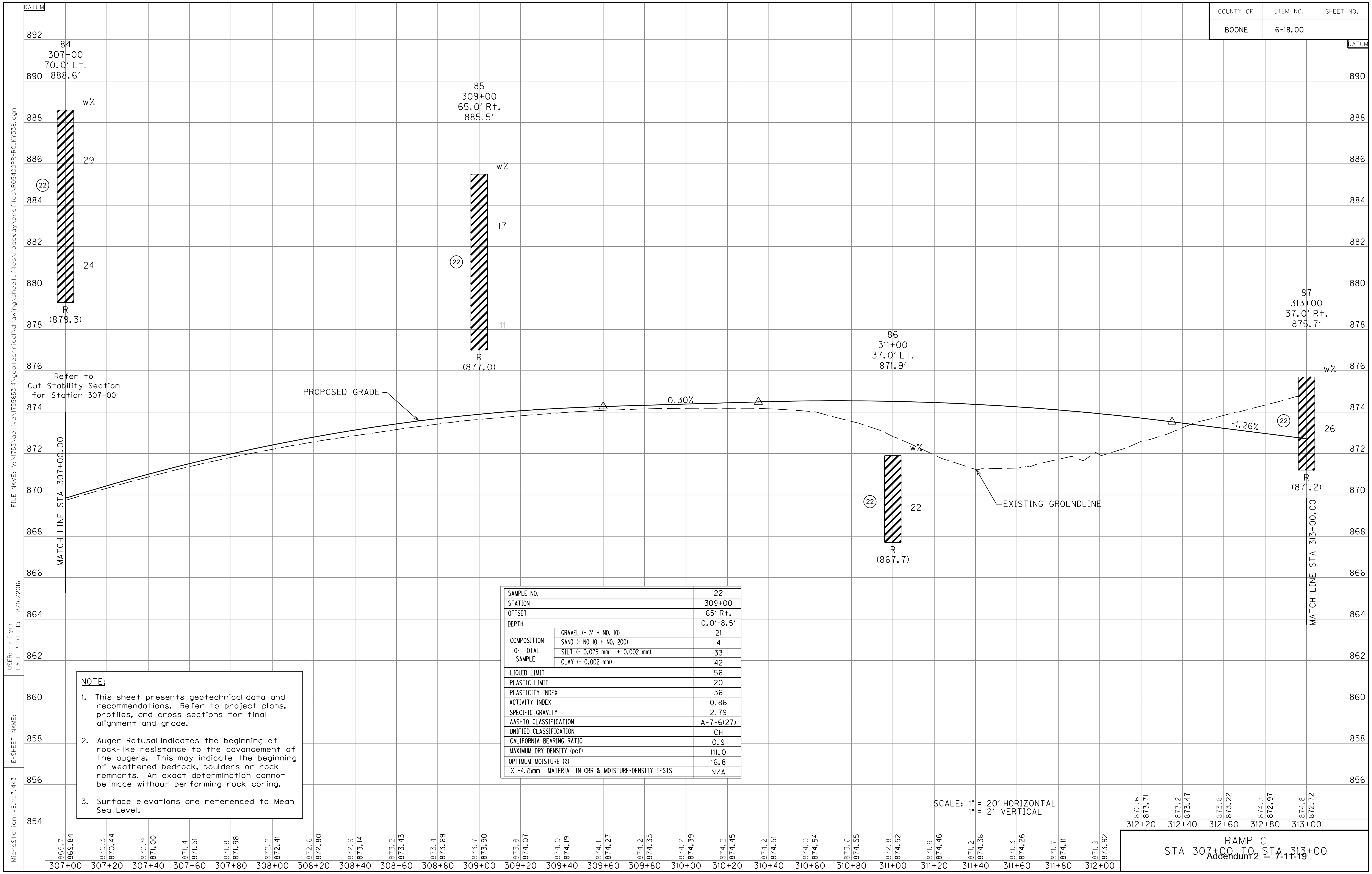
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R052A0PR-RC_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



307+00	869.7	869.84
307+20	870.3	870.44
307+40	870.9	871.00
307+60	871.4	871.51
307+80	871.8	871.98
308+00	872.2	872.41
308+20	872.6	872.80
308+40	872.9	873.14
308+60	873.2	873.43
308+80	873.4	873.69
309+00	873.7	873.90
309+20	873.8	874.07
309+40	874.0	874.19
309+60	874.1	874.27
309+80	874.2	874.33
310+00	874.2	874.39
310+20	874.2	874.45
310+40	874.2	874.51
310+60	874.0	874.54
310+80	873.6	874.55
311+00	872.8	874.52
311+20	871.9	874.46
311+40	871.2	874.38
311+60	871.3	874.26
311+80	871.7	874.11
312+00	871.9	873.92
312+20	872.6	873.71
312+40	873.2	873.47
312+60	873.8	873.22
312+80	874.3	872.97
313+00	874.8	872.72

NOTE:

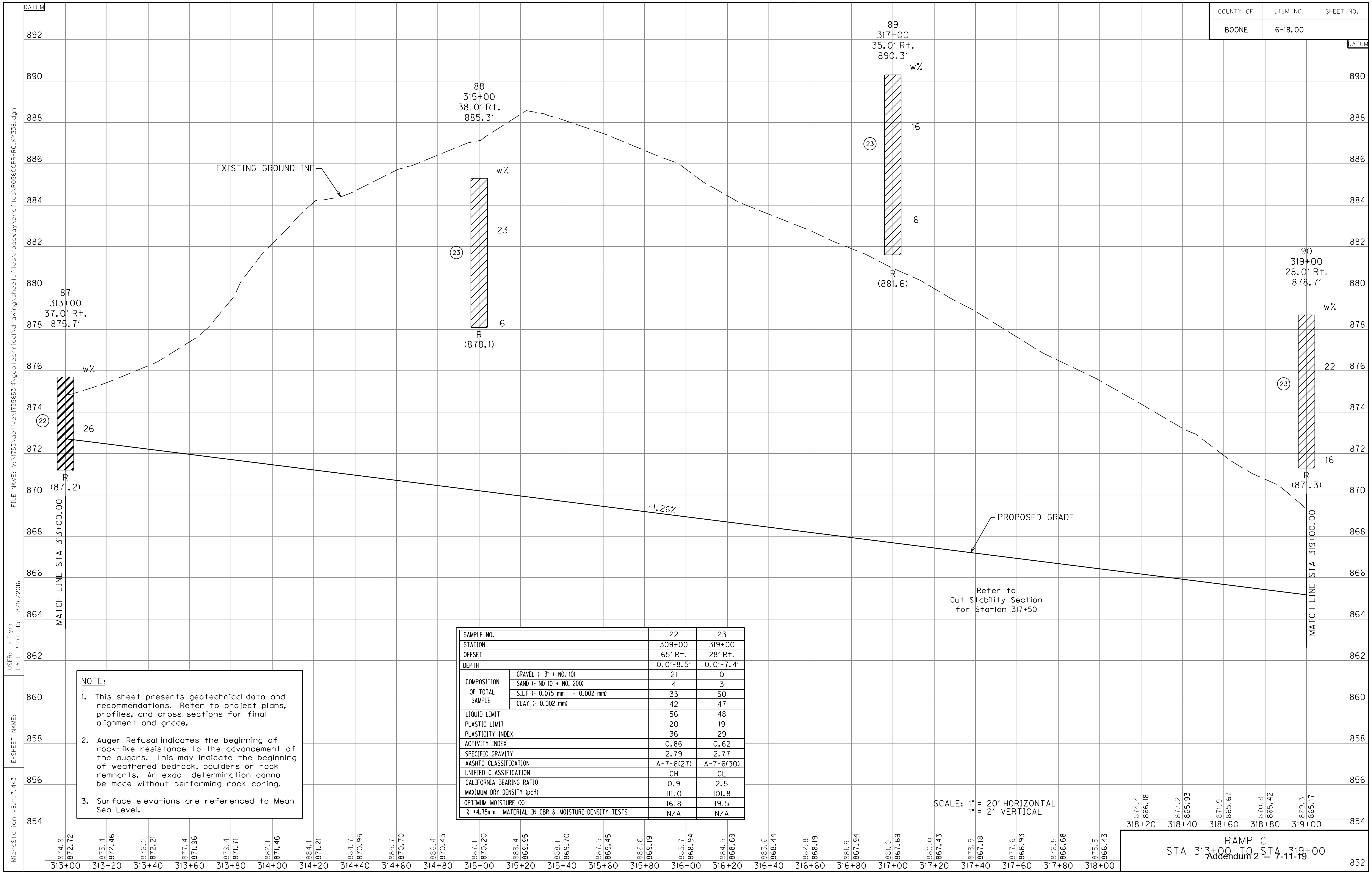
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		22
STATION		309+00
OFFSET		65′ Rt.
DEPTH		0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	33
	CLAY (- 0.002 mm)	42
LIQUID LIMIT		56
PLASTIC LIMIT		20
PLASTICITY INDEX		36
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		0.9
MAXIMUM DRY DENSITY (pcf)		111.0
OPTIMUM MOISTURE (%)		16.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

RAMP C
STA 307+00 TO STA 313+00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R05400PR-RC_KY338.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

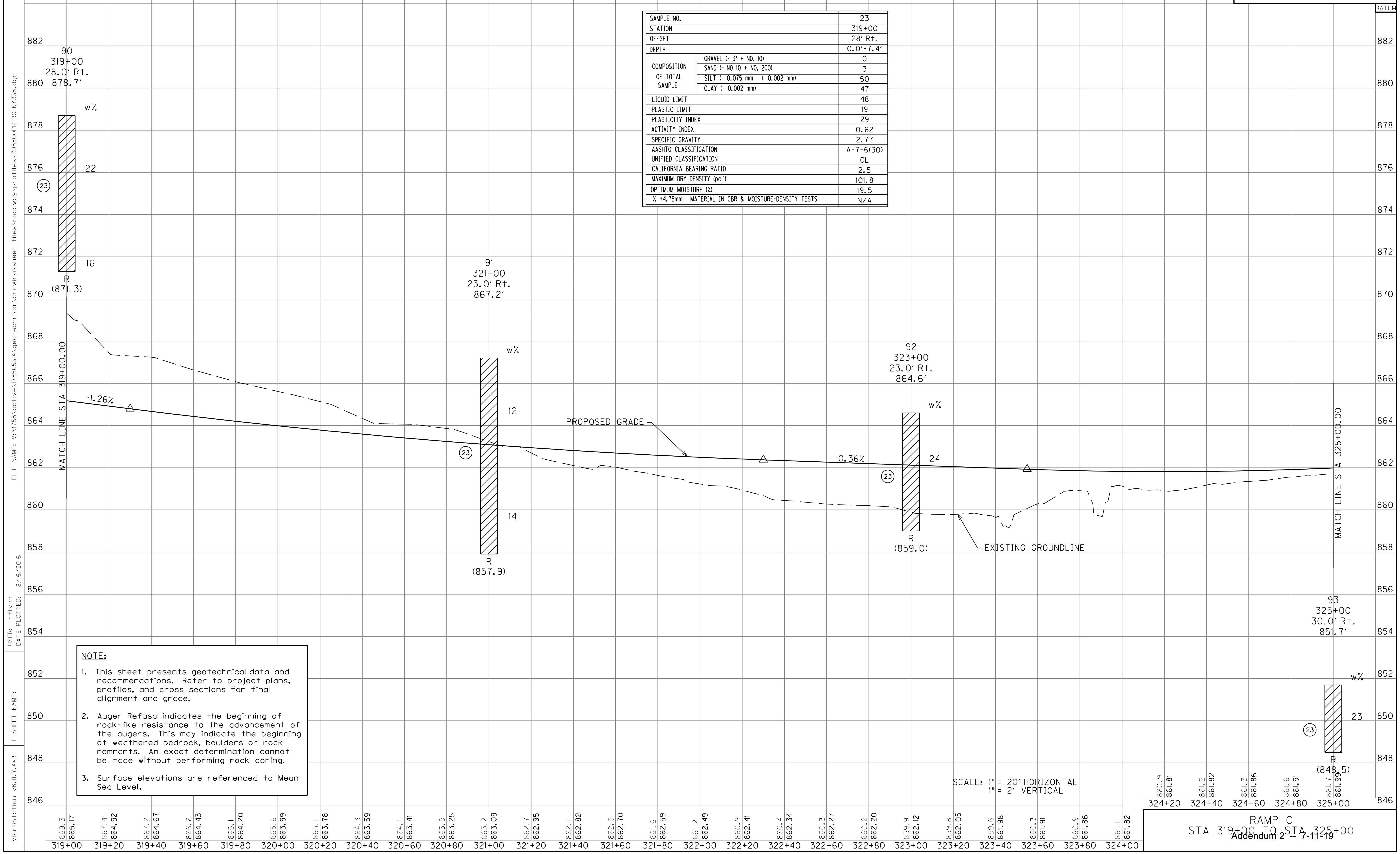
SAMPLE NO.		22	23
STATION		309+00	319+00
OFFSET		65′ Rt.	28′ Rt.
DEPTH		0.0′-8.5′	0.0′-7.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21	0
	SAND (- NO 10 + NO. 200)	4	3
	SILT (- 0.075 mm + 0.002 mm)	33	50
	CLAY (- 0.002 mm)	42	47
LIQUID LIMIT		56	48
PLASTIC LIMIT		20	19
PLASTICITY INDEX		36	29
ACTIVITY INDEX		0.86	0.62
SPECIFIC GRAVITY		2.79	2.77
AASHTO CLASSIFICATION		A-7-6(27)	A-7-6(30)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		0.9	2.5
MAXIMUM DRY DENSITY (pcf)		111.0	101.8
OPTIMUM MOISTURE (%)		16.8	19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP C
STA 313+00 TO STA 319+00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R05600PR-RC_KY338.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



319+00	869.3	865.17
319+20	867.4	864.92
319+40	867.2	864.67
319+60	866.6	864.43
319+80	866.1	864.20
320+00	865.6	863.99
320+20	865.1	863.78
320+40	864.3	863.59
320+60	864.1	863.41
320+80	863.9	863.25
321+00	863.2	863.09
321+20	862.7	862.95
321+40	862.1	862.82
321+60	862.0	862.70
321+80	861.6	862.59
322+00	861.2	862.49
322+20	860.9	862.41
322+40	860.4	862.34
322+60	860.3	862.27
322+80	860.2	862.20
323+00	859.9	862.12
323+20	859.8	862.05
323+40	859.6	861.98
323+60	860.3	861.91
323+80	860.9	861.86
324+00	861.1	861.82
324+20	860.9	861.81
324+40	861.2	861.82
324+60	861.3	861.86
324+80	861.6	861.91
325+00	861.7	861.99

SAMPLE NO.		23
STATION		319+00
OFFSET		28′ Rt.
DEPTH		0.0′-7.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	50
	CLAY (- 0.002 mm)	47
LIQUID LIMIT		48
PLASTIC LIMIT		19
PLASTICITY INDEX		29
ACTIVITY INDEX		0.62
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-7-6(30)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		101.8
OPTIMUM MOISTURE (%)		19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

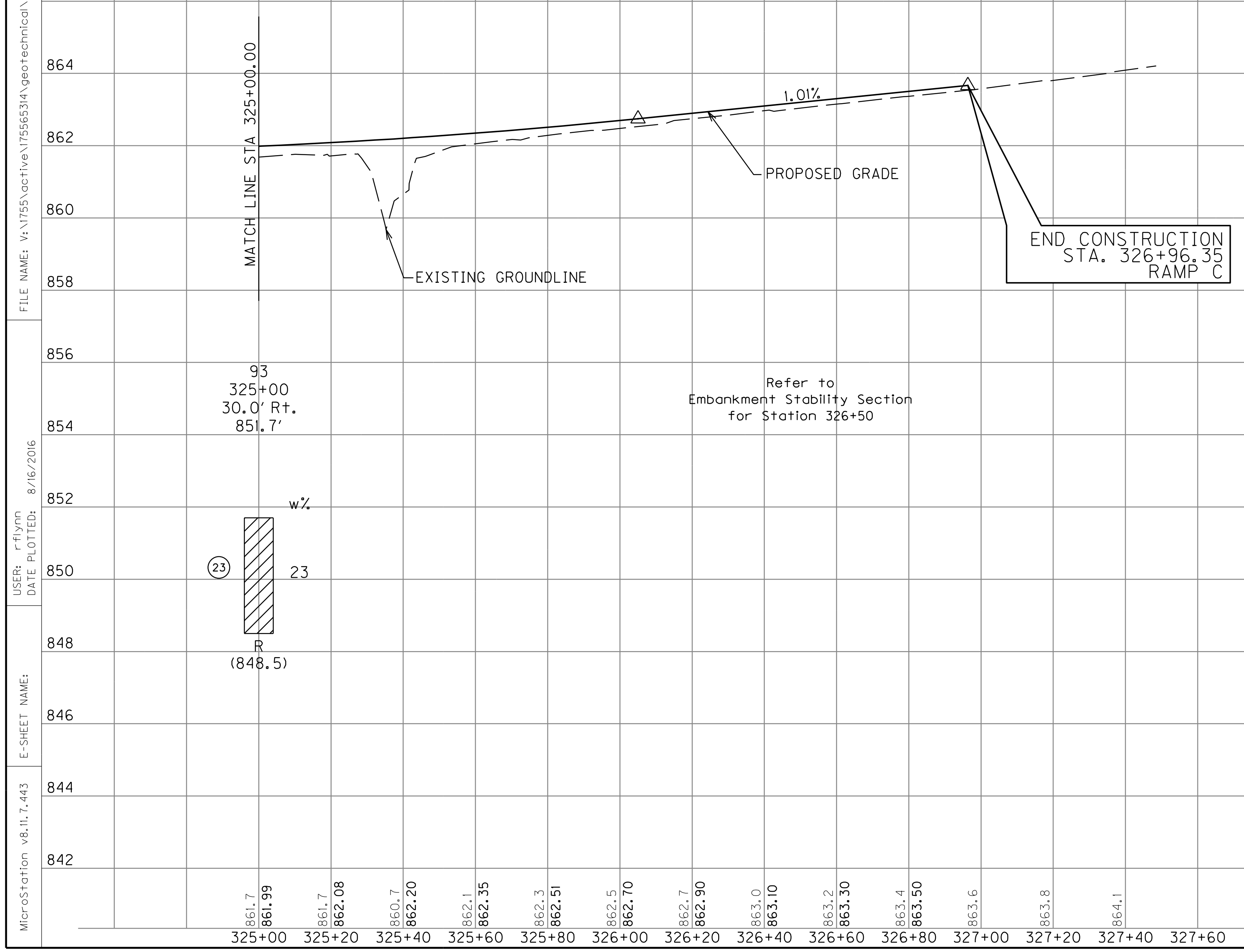
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

RAMP C
STA 319+00 TO STA 325+00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R05800PR-RC_KY338.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		23
STATION		319+00
OFFSET		28' Rt.
DEPTH		0.0'-7.4'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	50
	CLAY (- 0.002 mm)	47
LIQUID LIMIT		48
PLASTIC LIMIT		19
PLASTICITY INDEX		29
ACTIVITY INDEX		0.62
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-7-6(30)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		101.8
OPTIMUM MOISTURE (%)		19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



Refer to
Embankment Stability Section
for Station 326+50

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP C
STA 325+00 TO STA 326+96.35

Addendum 2 -- 7-11-19

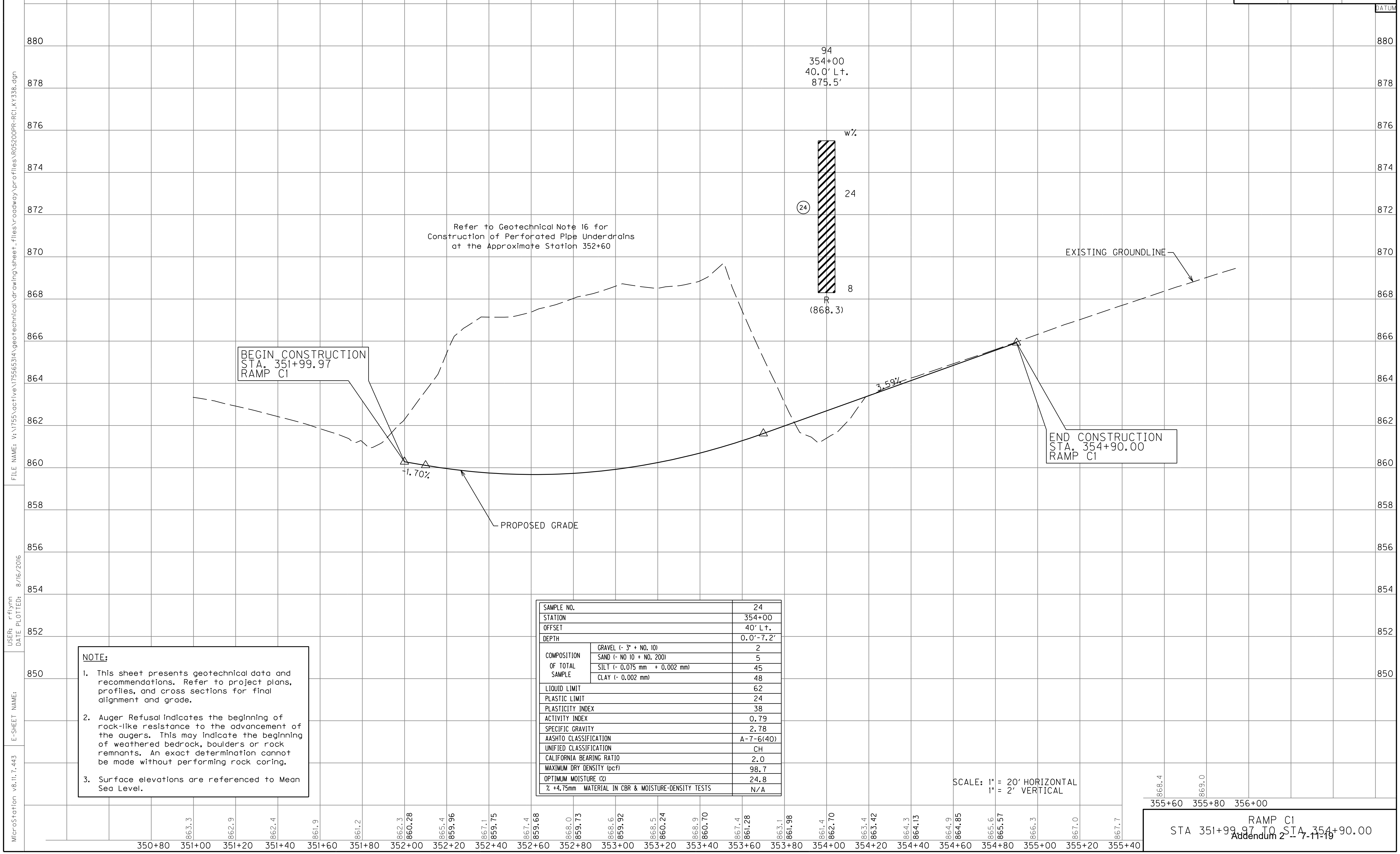
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R06000PR-RC_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		24
STATION		354+00
OFFSET		40' Lt.
DEPTH		0.0'-7.2'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	45
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		62
PLASTIC LIMIT		24
PLASTICITY INDEX		38
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		24.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP C1
STA 351+99.97 TO STA 354+90.00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R05200PR-RC1_KY338.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

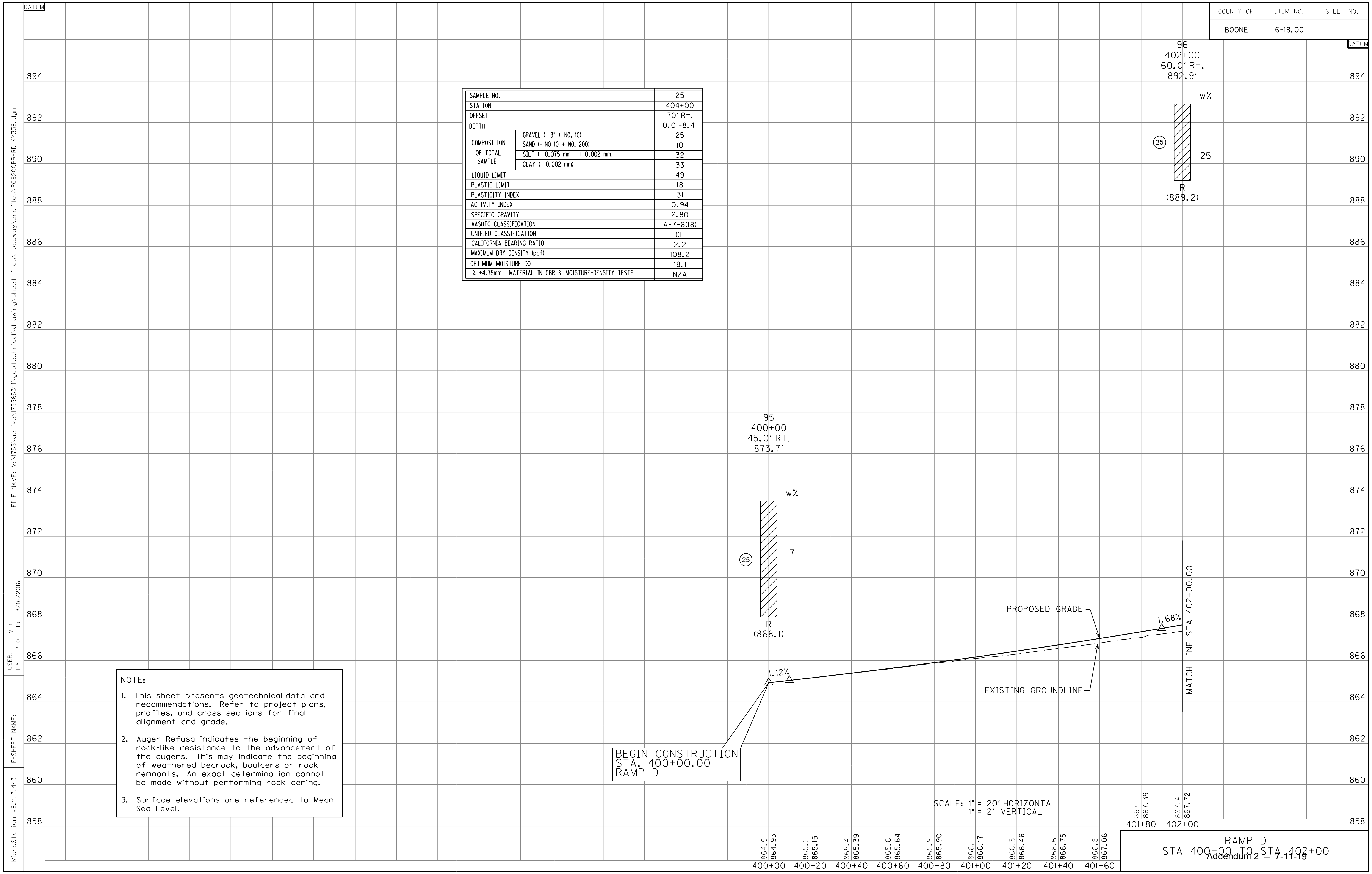
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R06200PR-RD_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443



SAMPLE NO.		25
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

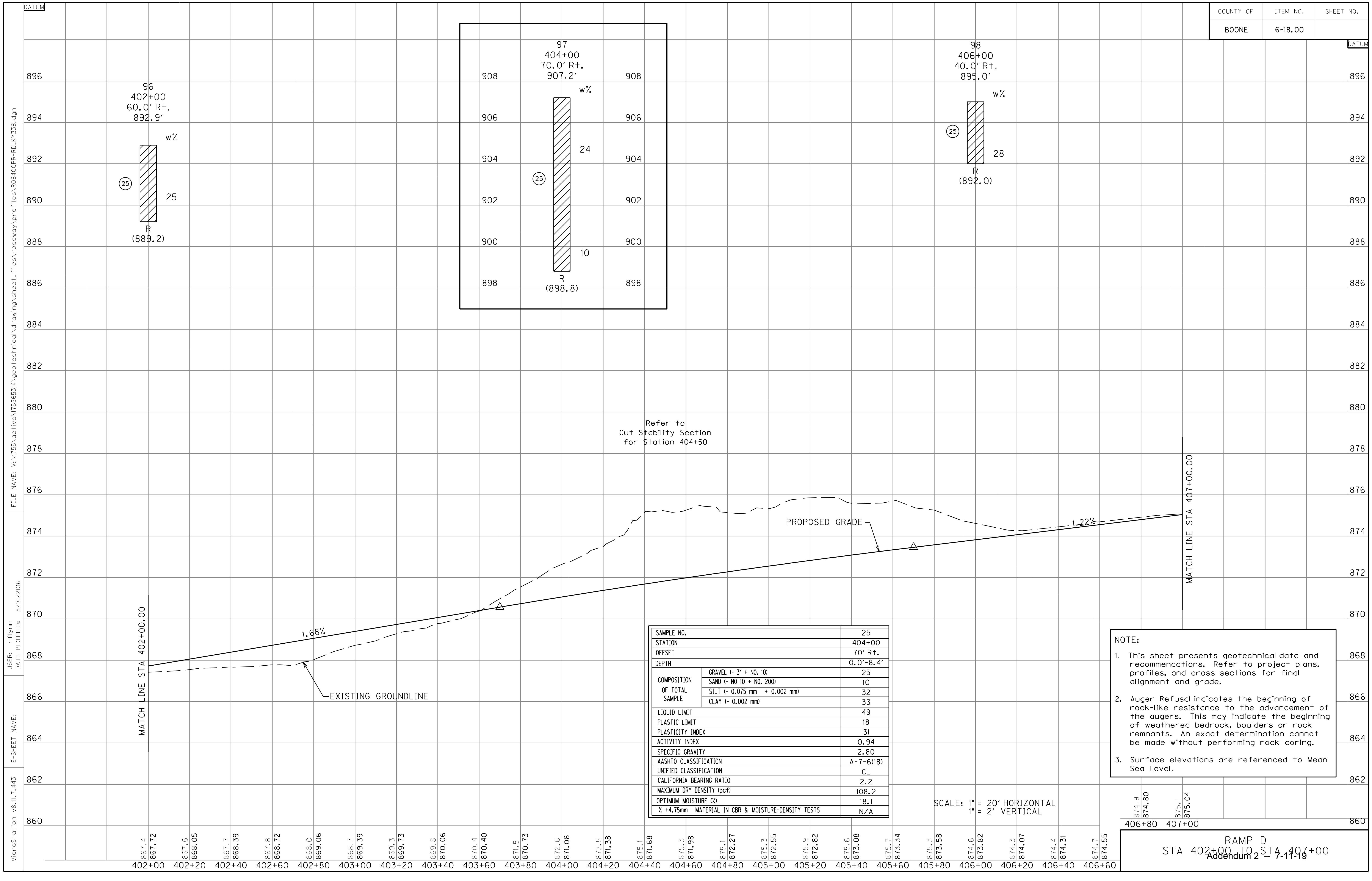
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP D
STA 400+00 TO STA 402+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		25
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

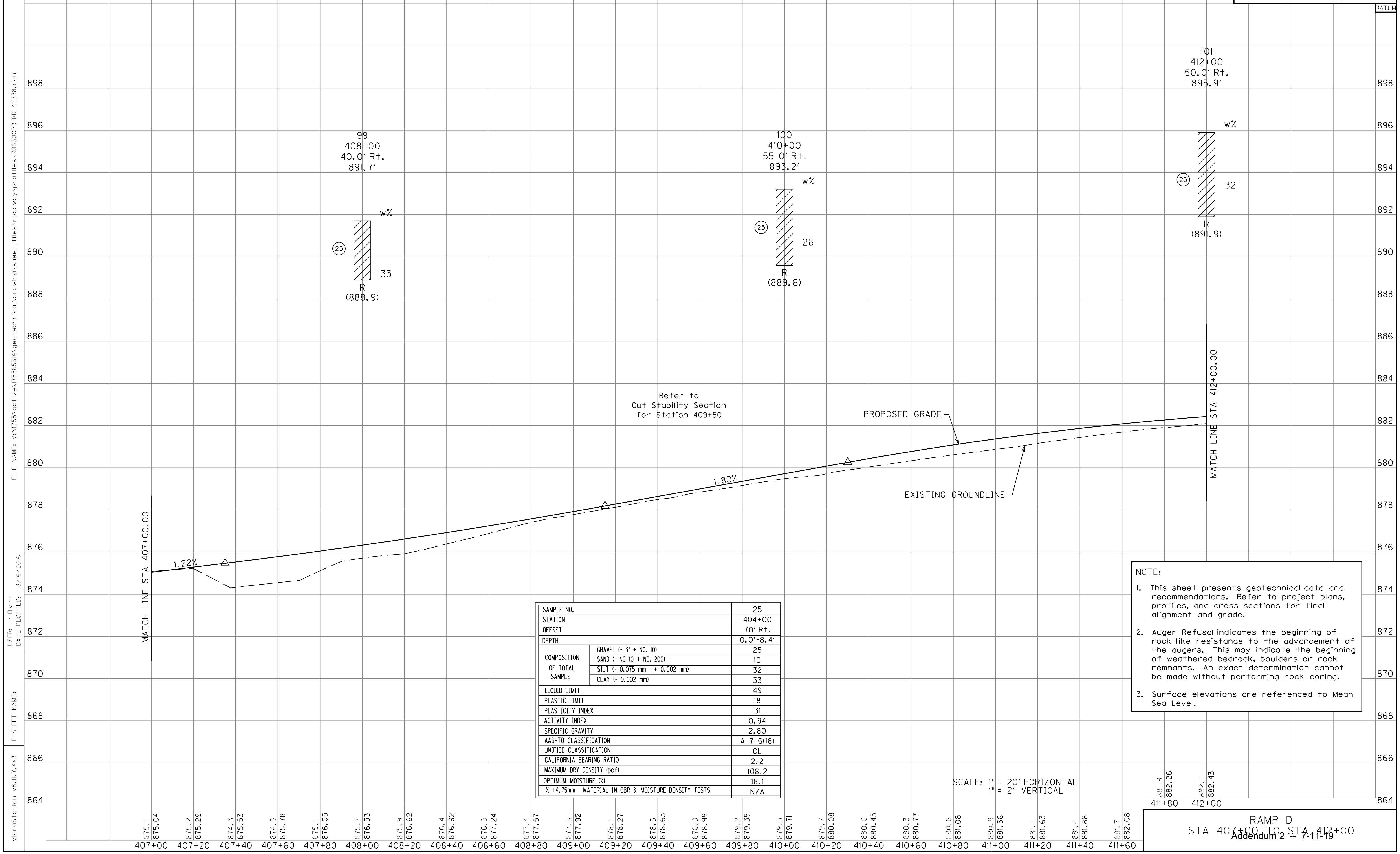
NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

RAMP D
STA 402+00 TO STA 407+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		25
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

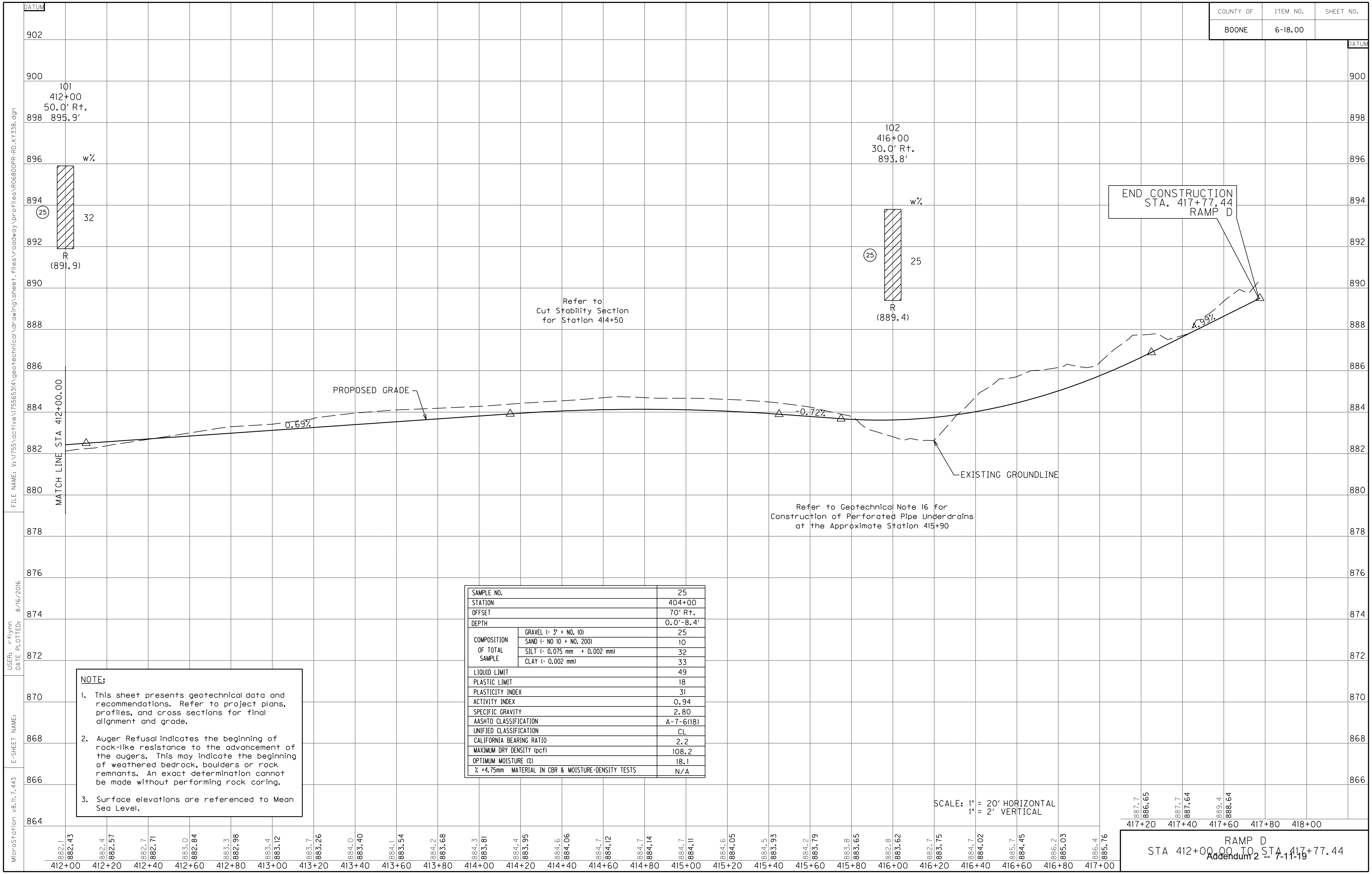
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP D
STA 407+00 TO STA 412+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to
Cut Stability Section
for Station 414+50

Refer to Geotechnical Note 16 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 415+90

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

412+00	882.1	882.43
412+20	882.4	882.57
412+40	882.7	882.71
412+60	883.0	882.84
412+80	883.3	882.98
413+00	883.4	883.12
413+20	883.7	883.26
413+40	884.0	883.40
413+60	884.1	883.54
413+80	884.2	883.68
414+00	884.3	883.81
414+20	884.4	883.95
414+40	884.6	884.06
414+60	884.7	884.12
414+80	884.7	884.14
415+00	884.7	884.11
415+20	884.6	884.05
415+40	884.5	883.93
415+60	884.2	883.79
415+80	883.8	883.65
416+00	882.8	883.62
416+20	882.7	883.75
416+40	884.7	884.02
416+60	885.7	884.45
416+80	886.2	885.03
417+00	886.4	885.76
417+20	887.7	886.65
417+40	887.7	887.64
417+60	889.4	888.64
417+80		
418+00		

SAMPLE NO.		25
STATION		404+00
OFFSET		70' Rt.
DEPTH		0.0'-8.4'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

RAMP D
STA 412+00.00 TO STA 417+77.44

Addendum 2 -- 7-11-19

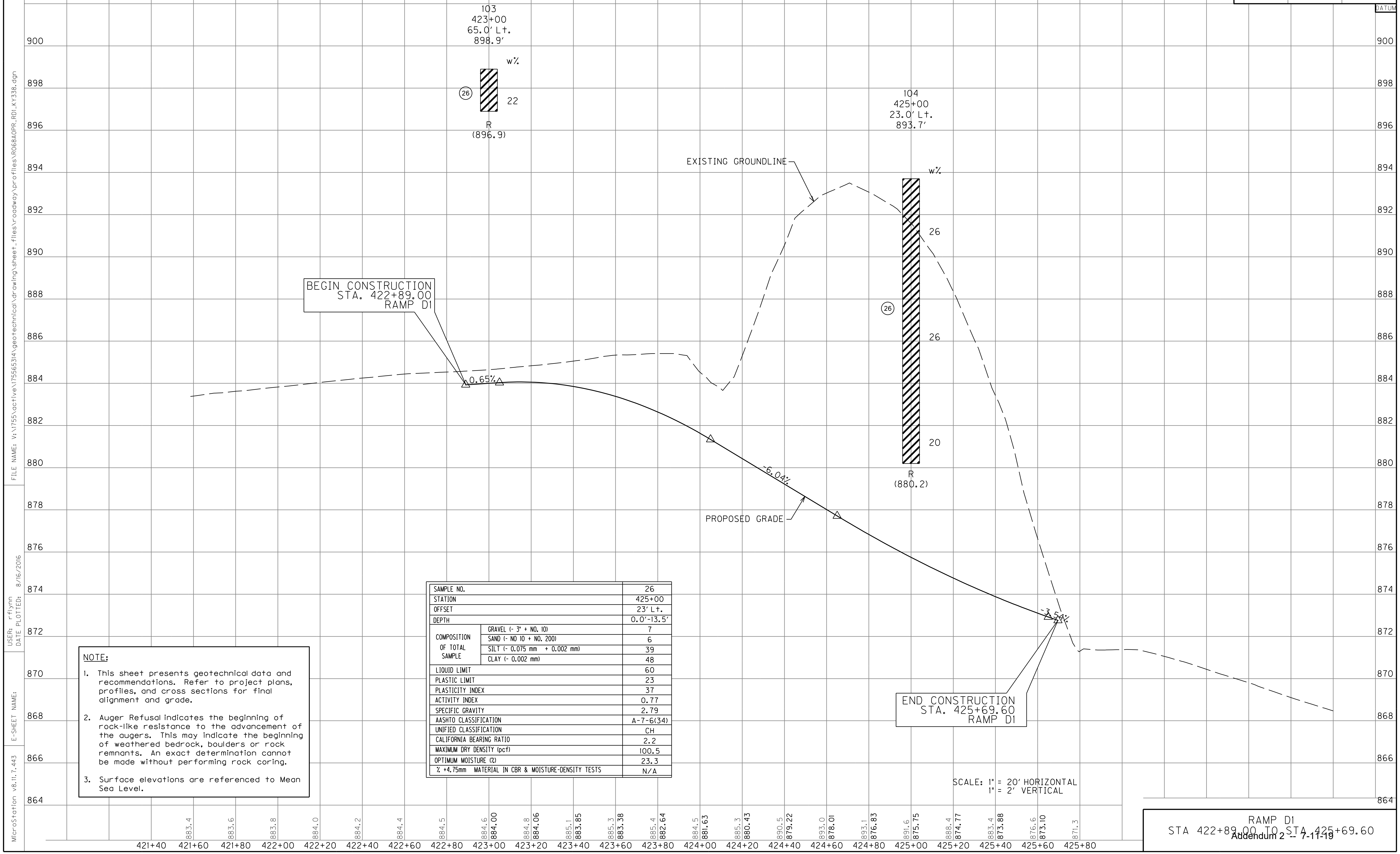
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R06800PR-RD_KY338.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		26
STATION		425+00
OFFSET		23′ Lt.
DEPTH		0.0′-13.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	39
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		60
PLASTIC LIMIT		23
PLASTICITY INDEX		37
ACTIVITY INDEX		0.77
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(34)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		100.5
OPTIMUM MOISTURE (%)		23.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP D1
STA 422+89.00 TO STA 425+69.60

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R068AOPR_RD1_KY338.dgn

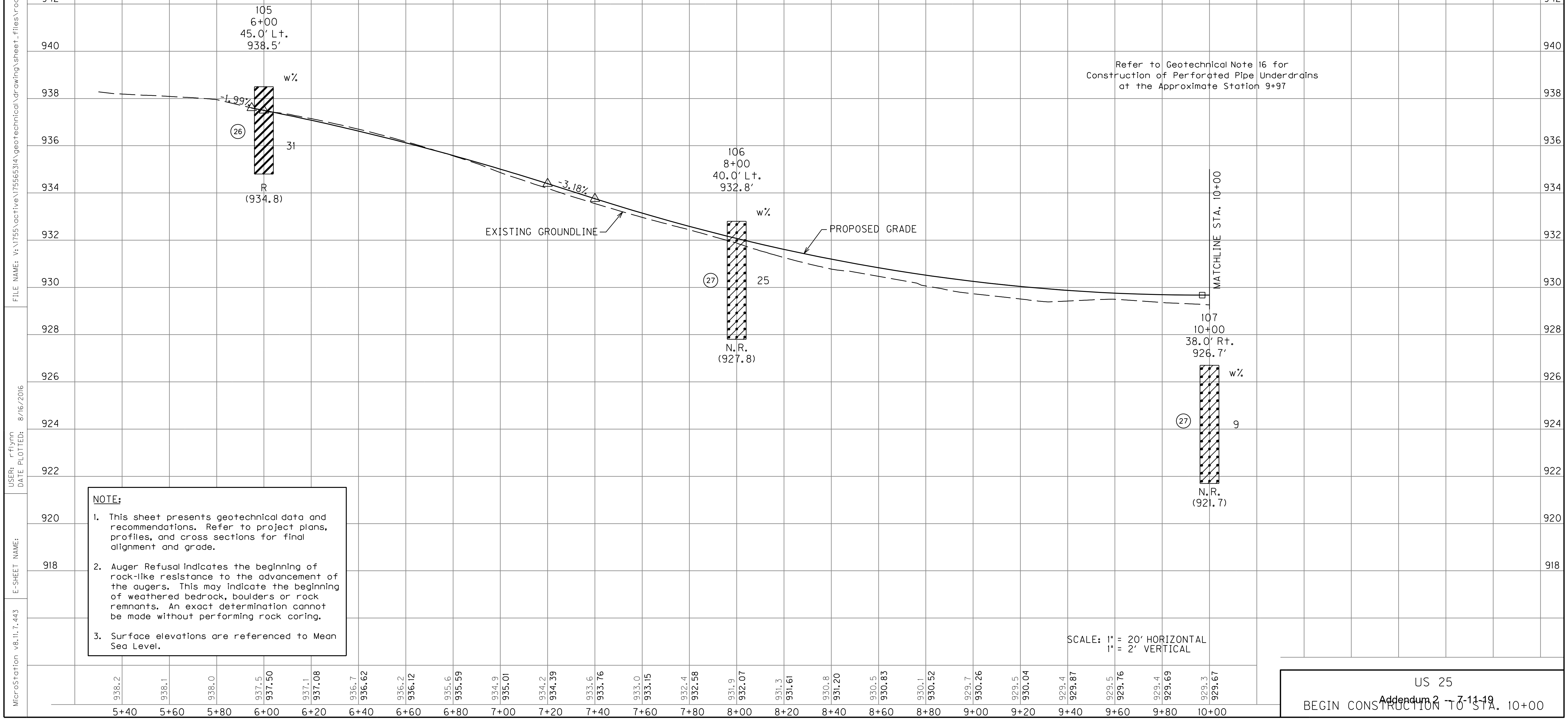
USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		26	27
STATION		425+00	10+00
OFFSET		23′ Lt.	38′ Rt.
DEPTH		0.0′-13.5′	0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7	41
	SAND (- NO 10 + NO. 200)	6	16
	SILT (- 0.075 mm + 0.002 mm)	39	25
	CLAY (- 0.002 mm)	48	18
LIQUID LIMIT		60	43
PLASTIC LIMIT		23	17
PLASTICITY INDEX		37	26
ACTIVITY INDEX		0.77	1.44
SPECIFIC GRAVITY		2.79	2.67
AASHTO CLASSIFICATION		A-7-6(34)	A-7-6(6)
UNIFIED CLASSIFICATION		CH	GC
CALIFORNIA BEARING RATIO		2.2	N/A
MAXIMUM DRY DENSITY (pcf)		100.5	N/A
OPTIMUM MOISTURE (%)		23.3	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 9+97

938.2		5+40
938.1		5+60
938.0		5+80
937.5	937.50	6+00
937.1	937.08	6+20
936.7	936.62	6+40
936.2	936.12	6+60
935.6	935.59	6+80
934.9	935.01	7+00
934.2	934.39	7+20
933.6	933.76	7+40
933.0	933.15	7+60
932.4	932.58	7+80
931.9	932.07	8+00
931.3	931.61	8+20
930.8	931.20	8+40
930.5	930.83	8+60
930.1	930.52	8+80
929.7	930.26	9+00
929.5	930.04	9+20
929.4	929.87	9+40
929.5	929.76	9+60
929.4	929.69	9+80
929.3	929.67	10+00

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\RI0200PF-US25.dgn

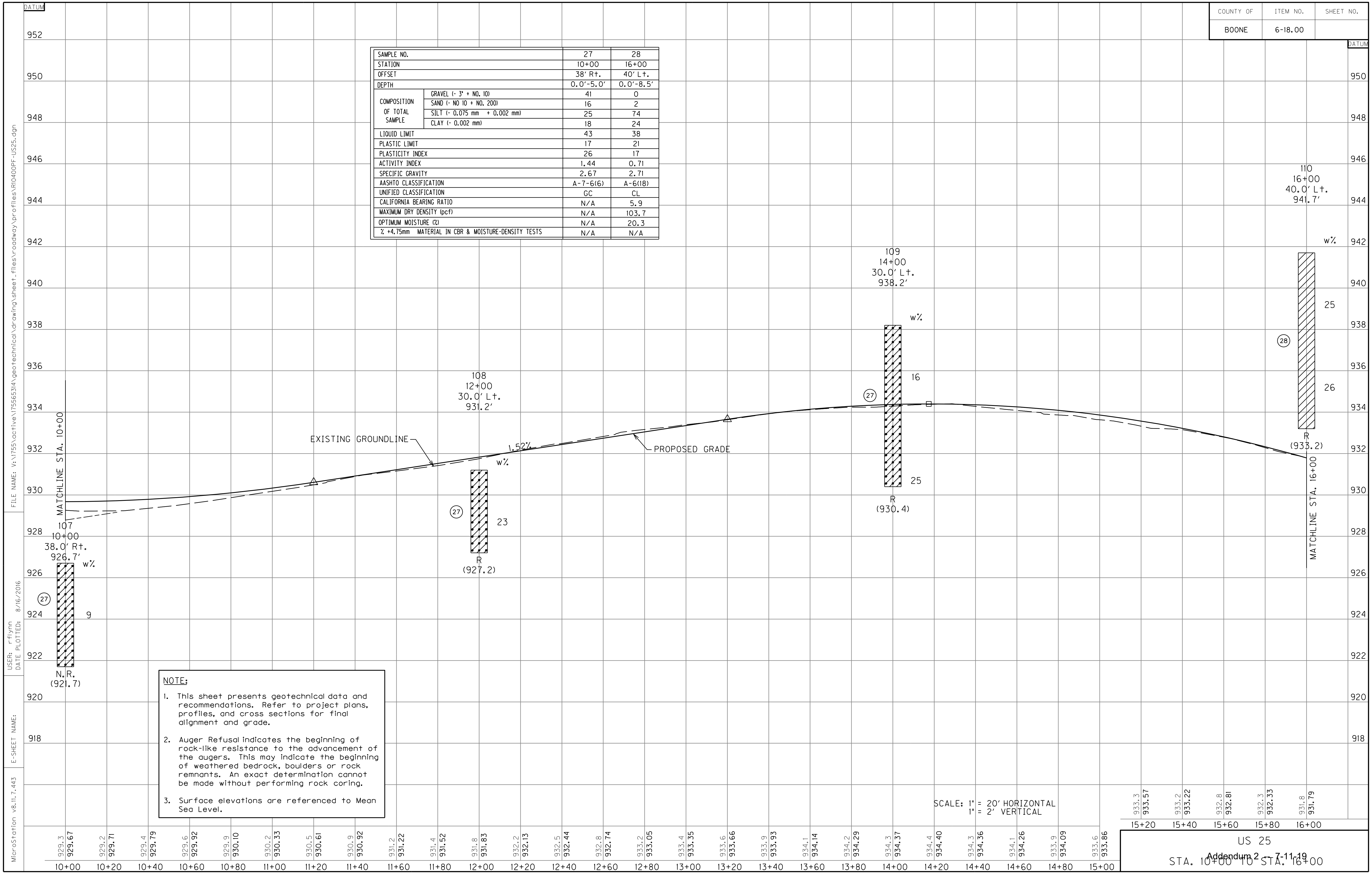
USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

US 25
BEGIN CONSTRUCTION TO STA. 10+00
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		27	28
STATION		10+00	16+00
OFFSET		38' Rt.	40' Lt.
DEPTH		0.0'-5.0'	0.0'-8.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	41	0
	SAND (- NO 10 + NO. 200)	16	2
	SILT (- 0.075 mm + 0.002 mm)	25	74
	CLAY (- 0.002 mm)	18	24
LIQUID LIMIT		43	38
PLASTIC LIMIT		17	21
PLASTICITY INDEX		26	17
ACTIVITY INDEX		1.44	0.71
SPECIFIC GRAVITY		2.67	2.71
AASHTO CLASSIFICATION		A-7-6(6)	A-6(18)
UNIFIED CLASSIFICATION		GC	CL
CALIFORNIA BEARING RATIO		N/A	5.9
MAXIMUM DRY DENSITY (pcf)		N/A	103.7
OPTIMUM MOISTURE (%)		N/A	20.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

10+00	929.3	929.67
10+20	929.2	929.71
10+40	929.4	929.79
10+60	929.6	929.92
10+80	929.9	930.10
11+00	930.2	930.33
11+20	930.5	930.61
11+40	930.9	930.92
11+60	931.2	931.22
11+80	931.4	931.52
12+00	931.8	931.83
12+20	932.2	932.13
12+40	932.5	932.44
12+60	932.8	932.74
12+80	933.2	933.05
13+00	933.4	933.35
13+20	933.6	933.66
13+40	933.9	933.93
13+60	934.1	934.14
13+80	934.2	934.29
14+00	934.3	934.37
14+20	934.4	934.40
14+40	934.3	934.36
14+60	934.1	934.26
14+80	933.9	934.09
15+00	933.6	933.86
15+20	933.3	933.57
15+40	933.2	933.22
15+60	932.8	932.81
15+80	932.3	932.33
16+00	931.8	931.79

US 25
STA. 10+00 TO STA. 16+00

Addendum 2 -- 7-11-19

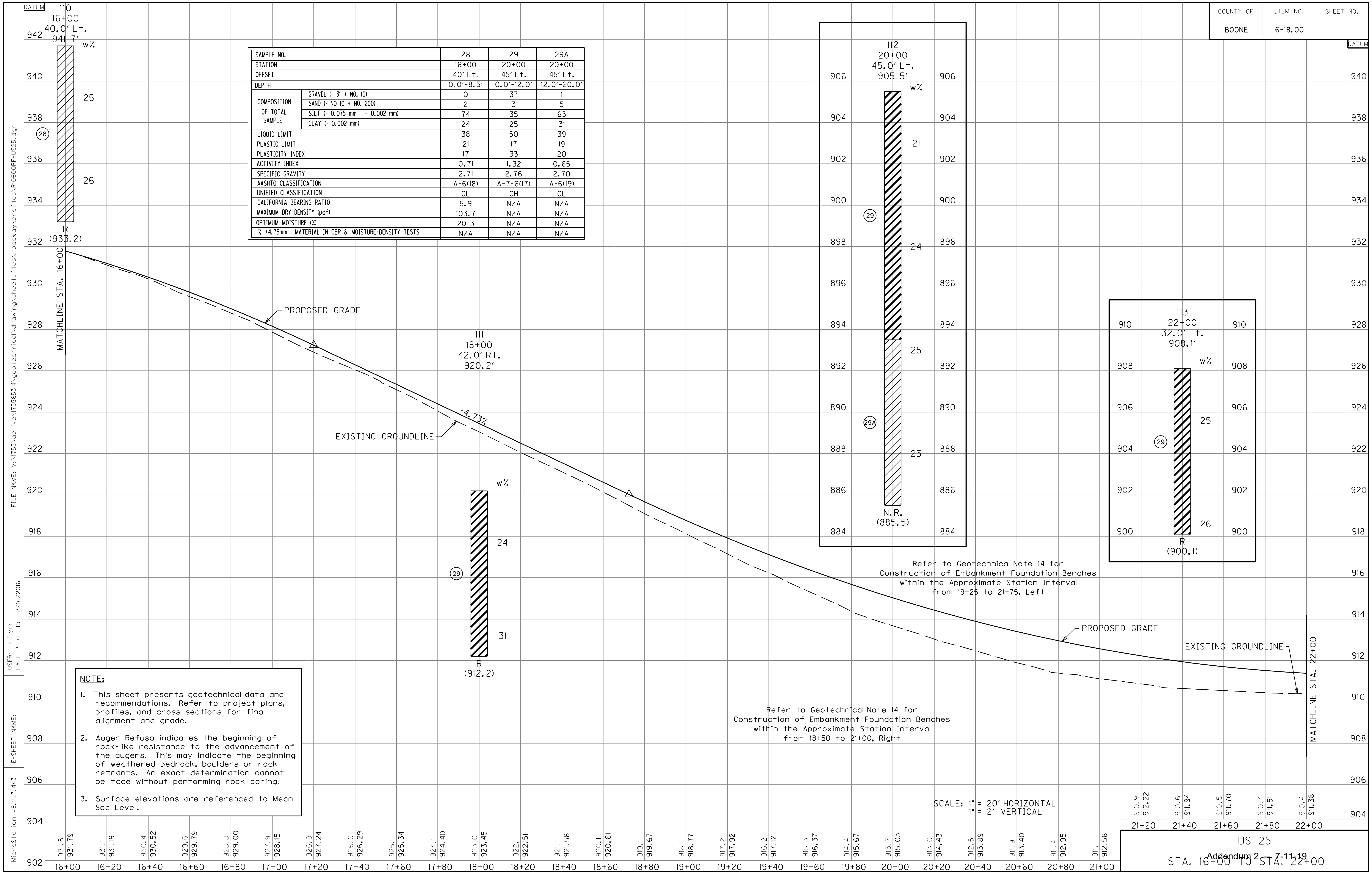
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R10400PF-US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		28	29	29A
STATION		16+00	20+00	20+00
OFFSET		40′ Lt.	45′ Lt.	45′ Lt.
DEPTH		0.0′-8.5′	0.0′-12.0′	12.0′-20.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	37	1
	SAND (- NO 10 + NO. 200)	2	3	5
	SILT (- 0.075 mm + 0.002 mm)	74	35	63
	CLAY (- 0.002 mm)	24	25	31
LIQUID LIMIT		38	50	39
PLASTIC LIMIT		21	17	19
PLASTICITY INDEX		17	33	20
ACTIVITY INDEX		0.71	1.32	0.65
SPECIFIC GRAVITY		2.71	2.76	2.70
AASHTO CLASSIFICATION		A-6(18)	A-7-6(17)	A-6(19)
UNIFIED CLASSIFICATION		CL	CH	CL
CALIFORNIA BEARING RATIO		5.9	N/A	N/A
MAXIMUM DRY DENSITY (pcf)		103.7	N/A	N/A
OPTIMUM MOISTURE (%)		20.3	N/A	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A	N/A

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 19+25 to 21+75, Left

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 18+50 to 21+00, Right

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

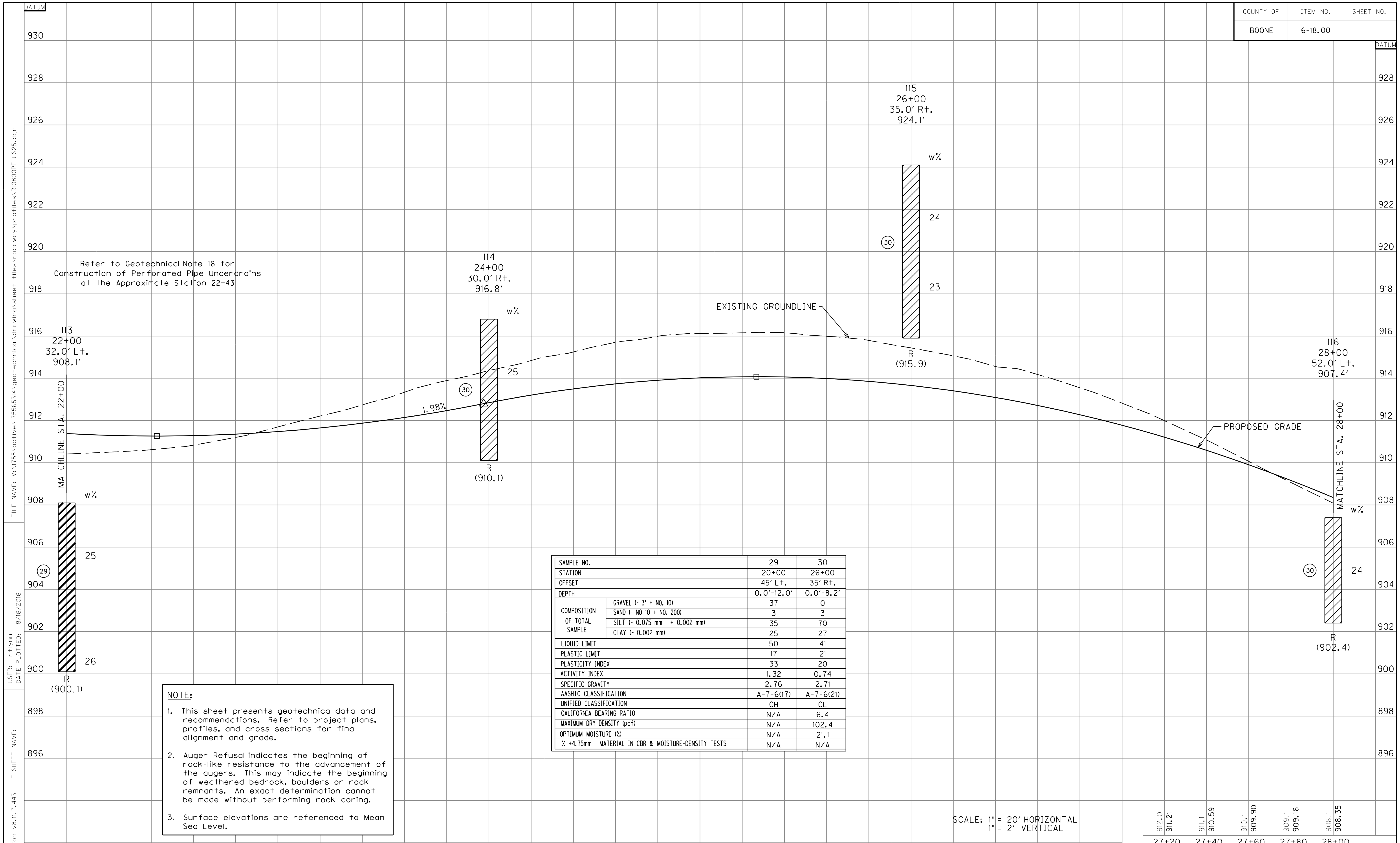
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 16+00 TO STA. 22+00

Addendum 2 – 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R10600PF-US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 22+43

SAMPLE NO.		29	30
STATION		20+00	26+00
OFFSET		45′ Lt.	35′ Rt.
DEPTH		0.0′-12.0′	0.0′-8.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	37	0
	SAND (- NO 10 + NO. 200)	3	3
	SILT (- 0.075 mm + 0.002 mm)	35	70
	CLAY (- 0.002 mm)	25	27
LIQUID LIMIT		50	41
PLASTIC LIMIT		17	21
PLASTICITY INDEX		33	20
ACTIVITY INDEX		1.32	0.74
SPECIFIC GRAVITY		2.76	2.71
AASHTO CLASSIFICATION		A-7-6(17)	A-7-6(21)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		N/A	6.4
MAXIMUM DRY DENSITY (pcf)		N/A	102.4
OPTIMUM MOISTURE (%)		N/A	21.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

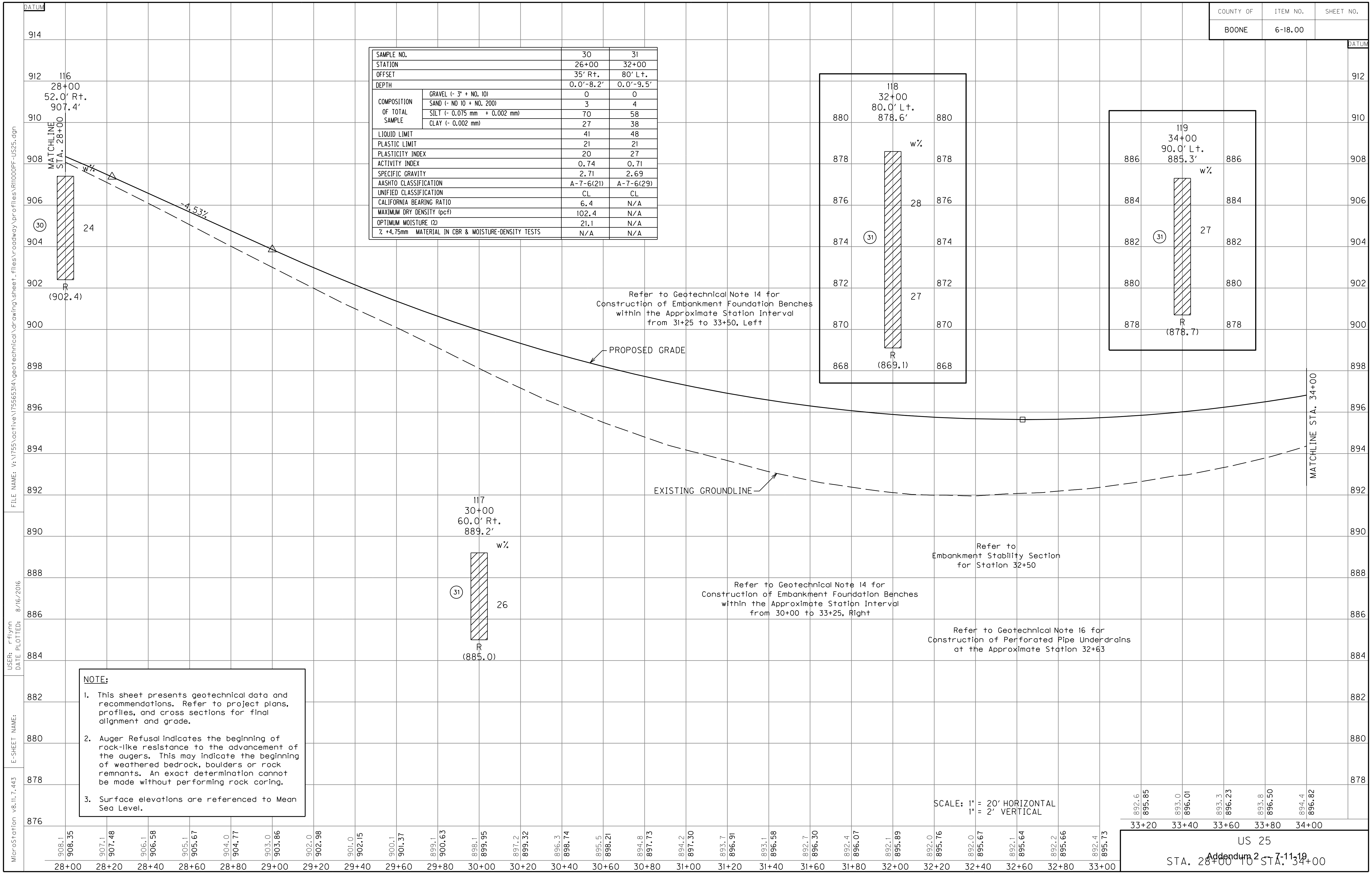
22+00	910.4	911.38
22+20	910.5	911.30
22+40	910.6	911.26
22+60	910.8	911.28
22+80	911.2	911.35
23+00	911.7	911.47
23+20	912.2	911.64
23+40	912.7	911.87
23+60	913.3	912.14
23+80	913.9	912.47
24+00	914.4	912.84
24+20	914.8	913.20
24+40	915.2	913.50
24+60	915.7	913.73
24+80	916.0	913.91
25+00	916.1	914.02
25+20	916.2	914.07
25+40	916.2	914.06
25+60	916.0	913.99
25+80	915.8	913.86
26+00	915.4	913.66
26+20	915.1	913.41
26+40	914.6	913.09
26+60	914.2	912.71
26+80	913.5	912.27
27+00	912.8	911.77
27+20	912.0	911.21
27+40	911.1	910.59
27+60	910.1	909.90
27+80	909.1	909.16
28+00	908.1	908.35

US 25
STA. 22+00 TO STA. 28+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R10800PF-US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		30	31
STATION		26+00	32+00
OFFSET		35' Rt.	80' Lt.
DEPTH		0.0'-8.2'	0.0'-9.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0
	SAND (- NO 10 + NO. 200)	3	4
	SILT (- 0.075 mm + 0.002 mm)	70	58
	CLAY (- 0.002 mm)	27	38
LIQUID LIMIT		41	48
PLASTIC LIMIT		21	21
PLASTICITY INDEX		20	27
ACTIVITY INDEX		0.74	0.71
SPECIFIC GRAVITY		2.71	2.69
AASHTO CLASSIFICATION		A-7-6(21)	A-7-6(29)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		6.4	N/A
MAXIMUM DRY DENSITY (pcf)		102.4	N/A
OPTIMUM MOISTURE (%)		21.1	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 31+25 to 33+50, Left

Refer to Embankment Stability Section for Station 32+50

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 30+00 to 33+25, Right

Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 32+63

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

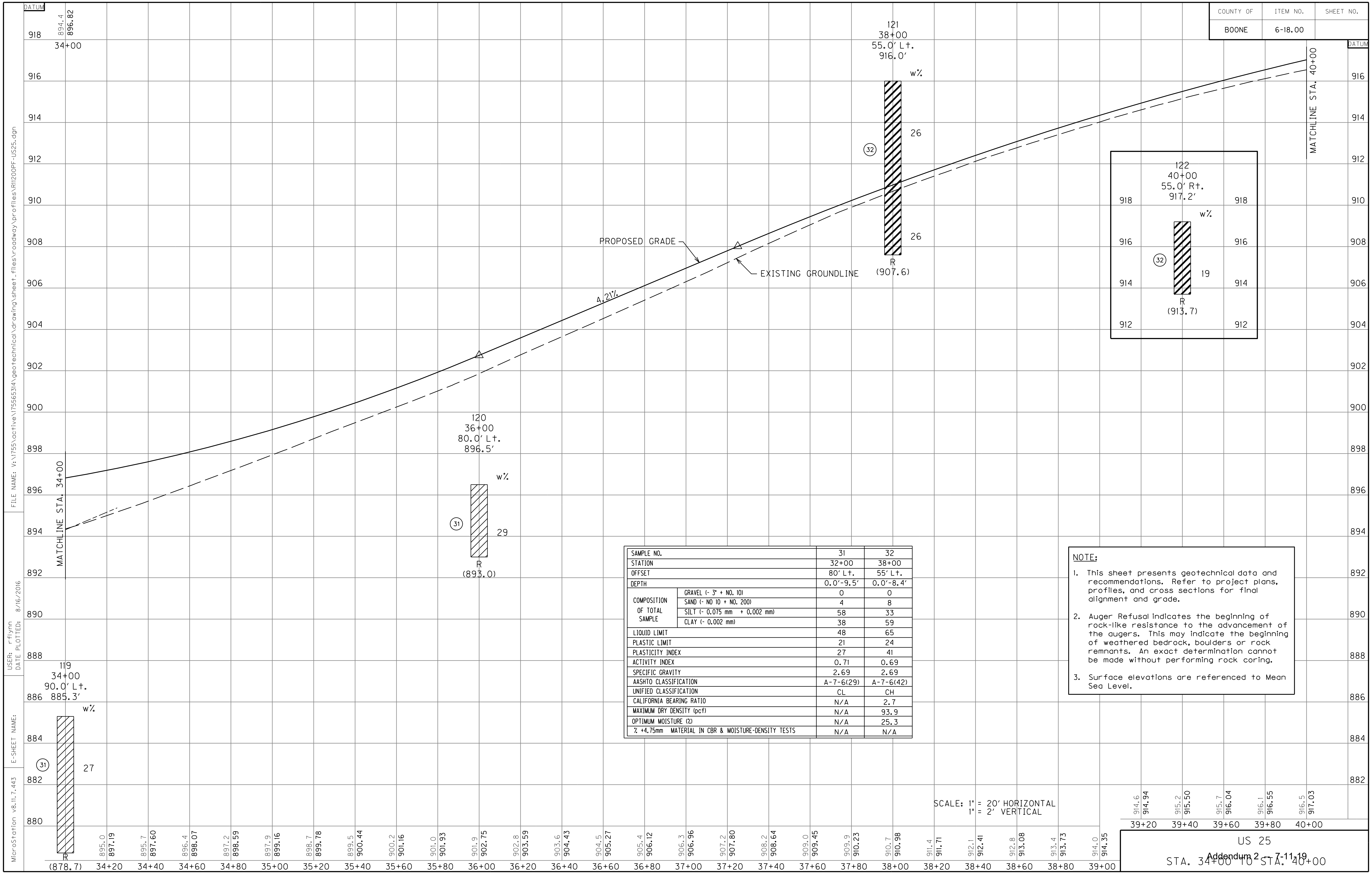
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

28+00	908.1	908.35
28+20	907.1	907.48
28+40	906.1	906.58
28+60	905.1	905.67
28+80	904.0	904.77
29+00	903.0	903.86
29+20	902.0	902.98
29+40	901.0	902.15
29+60	900.1	901.37
29+80	899.1	900.63
30+00	898.1	899.95
30+20	897.2	899.32
30+40	896.3	898.74
30+60	895.5	898.21
30+80	894.8	897.73
31+00	894.2	897.30
31+20	893.7	896.91
31+40	893.1	896.58
31+60	892.7	896.30
31+80	892.4	896.07
32+00	892.1	895.89
32+20	892.0	895.76
32+40	892.0	895.67
32+60	892.1	895.64
32+80	892.2	895.66
33+00	892.4	895.73
33+20	892.6	895.85
33+40	893.0	896.01
33+60	893.3	896.23
33+80	893.8	896.50
34+00	894.4	896.82

US 25
STA. 28+00 TO STA. 34+00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R11000PF-US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		31	32
STATION		32+00	38+00
OFFSET		80′ Lt.	55′ Lt.
DEPTH		0.0′-9.5′	0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0
	SAND (- NO 10 + NO. 200)	4	8
	SILT (- 0.075 mm + 0.002 mm)	58	33
	CLAY (- 0.002 mm)	38	59
LIQUID LIMIT		48	65
PLASTIC LIMIT		21	24
PLASTICITY INDEX		27	41
ACTIVITY INDEX		0.71	0.69
SPECIFIC GRAVITY		2.69	2.69
AASHTO CLASSIFICATION		A-7-6(29)	A-7-6(42)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		N/A	2.7
MAXIMUM DRY DENSITY (pcf)		N/A	93.9
OPTIMUM MOISTURE (%)		N/A	25.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 34+00 TO STA. 40+00

Addendum 2 -- 7-11-19

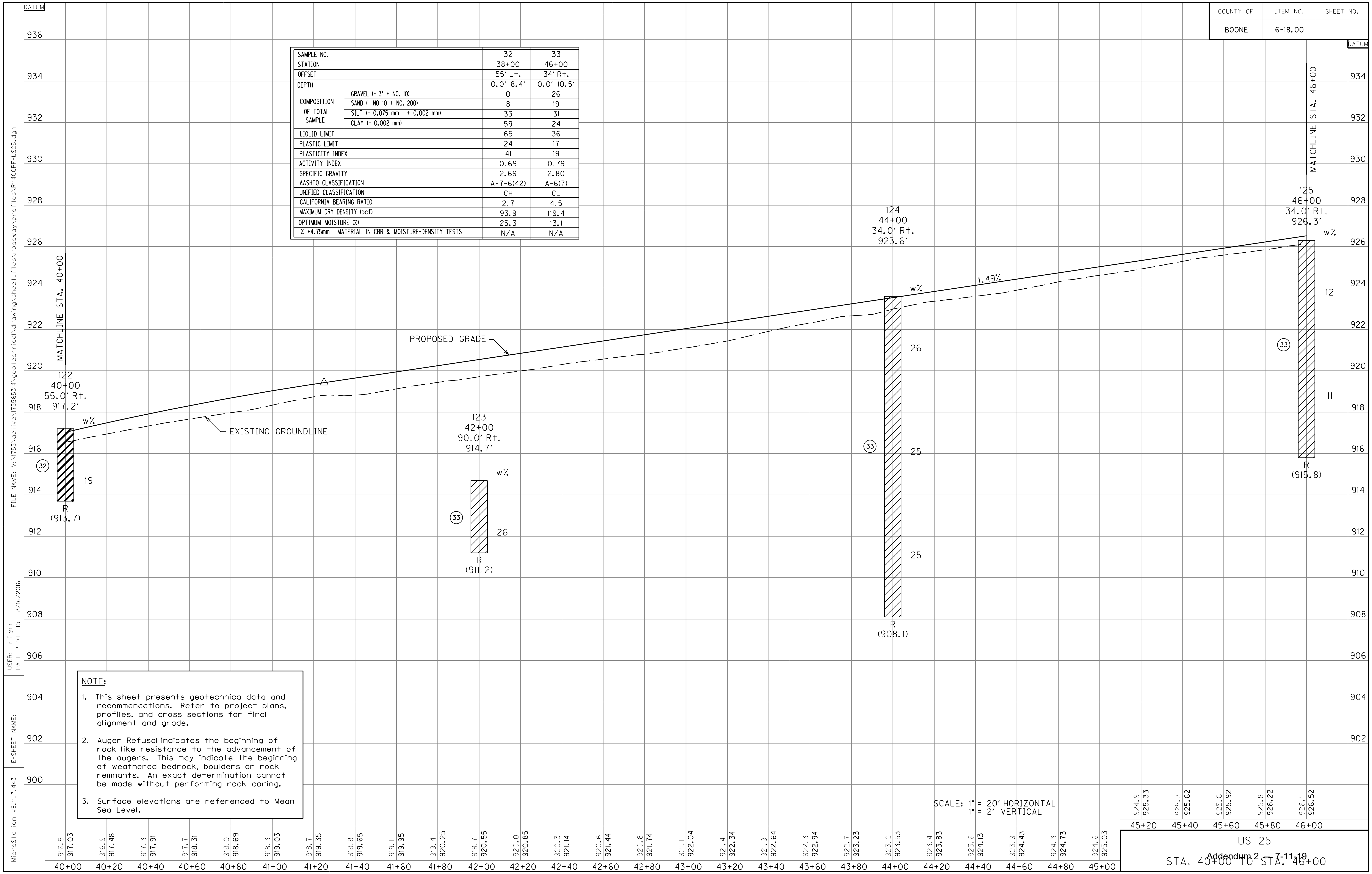
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R11200PF-US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



40+00	916.5	917.03
40+20	916.9	917.48
40+40	917.3	917.91
40+60	917.7	918.31
40+80	918.0	918.69
41+00	918.3	919.03
41+20	918.7	919.35
41+40	918.8	919.65
41+60	919.1	919.95
41+80	919.4	920.25
42+00	919.7	920.55
42+20	920.0	920.85
42+40	920.3	921.14
42+60	920.6	921.44
42+80	920.8	921.74
43+00	921.1	922.04
43+20	921.4	922.34
43+40	921.9	922.64
43+60	922.3	922.94
43+80	922.7	923.23
44+00	923.0	923.53
44+20	923.4	923.83
44+40	923.6	924.13
44+60	923.9	924.43
44+80	924.3	924.73
45+00	924.6	925.03
45+20	924.9	925.33
45+40	925.3	925.62
45+60	925.6	925.92
45+80	925.8	926.22
46+00	926.1	926.52

SAMPLE NO.		32	33
STATION		38+00	46+00
OFFSET		55′ Lt.	34′ Rt.
DEPTH		0.0′-8.4′	0.0′-10.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	26
	SAND (- NO 10 + NO. 200)	8	19
	SILT (- 0.075 mm + 0.002 mm)	33	31
	CLAY (- 0.002 mm)	59	24
LIQUID LIMIT		65	36
PLASTIC LIMIT		24	17
PLASTICITY INDEX		41	19
ACTIVITY INDEX		0.69	0.79
SPECIFIC GRAVITY		2.69	2.80
AASHTO CLASSIFICATION		A-7-6(42)	A-6(7)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		2.7	4.5
MAXIMUM DRY DENSITY (pcf)		93.9	119.4
OPTIMUM MOISTURE (%)		25.3	13.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25

STA. 40+00 TO STA. 46+00

Addendum 2 -- 7-11-19

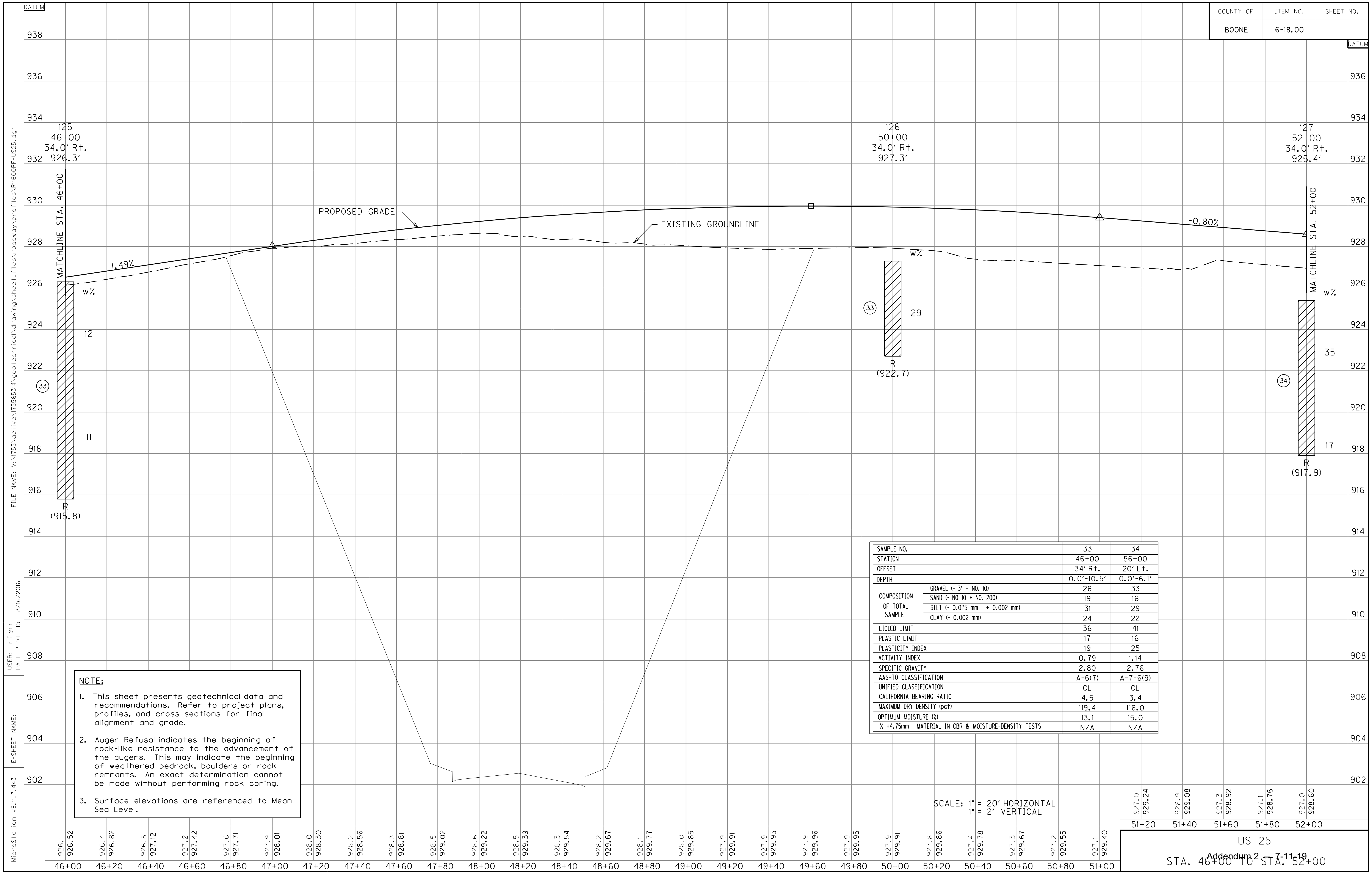
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R11400PF-US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



46+00	46+20	46+40	46+60	46+80	47+00	47+20	47+40	47+60	47+80	48+00	48+20	48+40	48+60	48+80	49+00	49+20	49+40	49+60	49+80	50+00	50+20	50+40	50+60	50+80	51+00	51+20	51+40	51+60	51+80	52+00
926.1	926.4	926.8	927.2	927.6	927.9	928.0	928.2	928.3	928.5	928.6	928.5	928.3	928.2	928.1	928.0	927.9	927.9	927.9	927.9	927.9	927.8	927.4	927.3	927.2	927.1	927.0	926.9	927.3	927.1	927.0
926.52	926.82	927.12	927.42	927.71	928.01	928.30	928.56	928.81	929.02	929.22	929.39	929.54	929.67	929.77	929.85	929.91	929.95	929.96	929.95	929.91	929.86	929.78	929.67	929.55	929.40	929.24	929.08	928.92	928.76	928.60

SAMPLE NO.		33	34
STATION		46+00	56+00
OFFSET		34′ Rt.	20′ Lt.
DEPTH		0.0′-10.5′	0.0′-6.1′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	26	33
	SAND (- NO 10 + NO. 200)	19	16
	SILT (- 0.075 mm + 0.002 mm)	31	29
	CLAY (- 0.002 mm)	24	22
LIQUID LIMIT		36	41
PLASTIC LIMIT		17	16
PLASTICITY INDEX		19	25
ACTIVITY INDEX		0.79	1.14
SPECIFIC GRAVITY		2.80	2.76
AASHTO CLASSIFICATION		A-6(7)	A-7-6(9)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		4.5	3.4
MAXIMUM DRY DENSITY (pcf)		119.4	116.0
OPTIMUM MOISTURE (%)		13.1	15.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 46+00 TO STA. 52+00

Addendum 2 -- 7-11-19

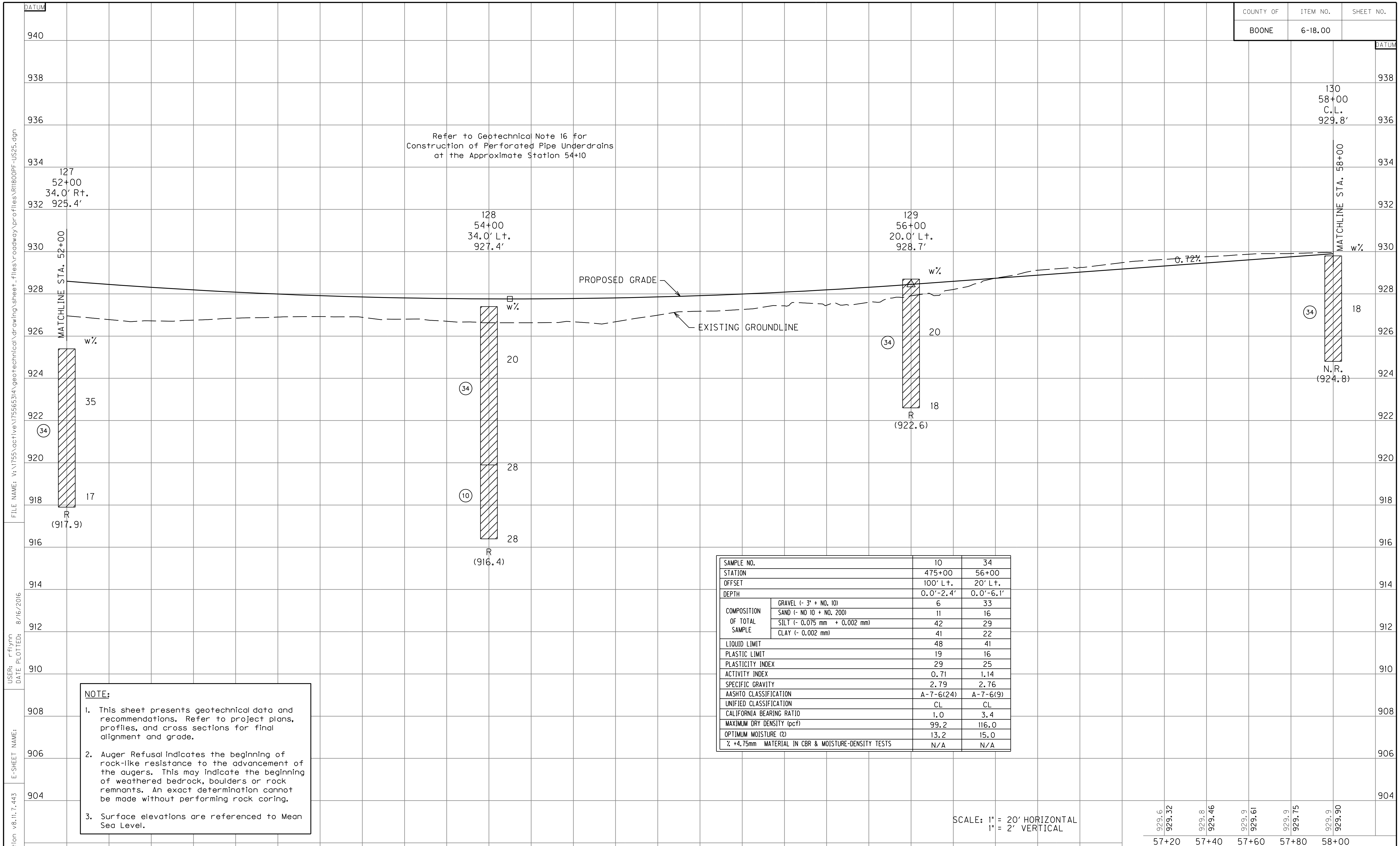
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R11600PF-US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 16 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 54+10

SAMPLE NO.		10	34
STATION		475+00	56+00
OFFSET		100′ Lt.	20′ Lt.
DEPTH		0.0′-2.4′	0.0′-6.1′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	33
	SAND (- NO 10 + NO. 200)	11	16
	SILT (- 0.075 mm + 0.002 mm)	42	29
	CLAY (- 0.002 mm)	41	22
LIQUID LIMIT		48	41
PLASTIC LIMIT		19	16
PLASTICITY INDEX		29	25
ACTIVITY INDEX		0.71	1.14
SPECIFIC GRAVITY		2.79	2.76
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(9)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	3.4
MAXIMUM DRY DENSITY (pcf)		99.2	116.0
OPTIMUM MOISTURE (%)		13.2	15.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

52+00	927.0	928.60
52+20	926.8	928.45
52+40	926.7	928.31
52+60	926.8	928.19
52+80	926.8	928.08
53+00	926.9	927.99
53+20	926.9	927.91
53+40	926.9	927.85
53+60	926.8	927.81
53+80	926.7	927.78
54+00	926.6	927.76
54+20	926.6	927.76
54+40	926.7	927.78
54+60	926.7	927.81
54+80	927.0	927.85
55+00	927.2	927.92
55+20	927.3	927.99
55+40	927.4	928.08
55+60	927.5	928.19
55+80	927.6	928.31
56+00	927.9	928.45
56+20	928.2	928.59
56+40	928.7	928.74
56+60	929.1	928.88
56+80	929.3	929.03
57+00	929.5	929.17
57+20	929.6	929.32
57+40	929.8	929.46
57+60	929.9	929.61
57+80	929.9	929.75
58+00	929.9	929.90

US 25

STA. 52+00 TO STA. 58+00

Addendum 2 -- 7-11-19

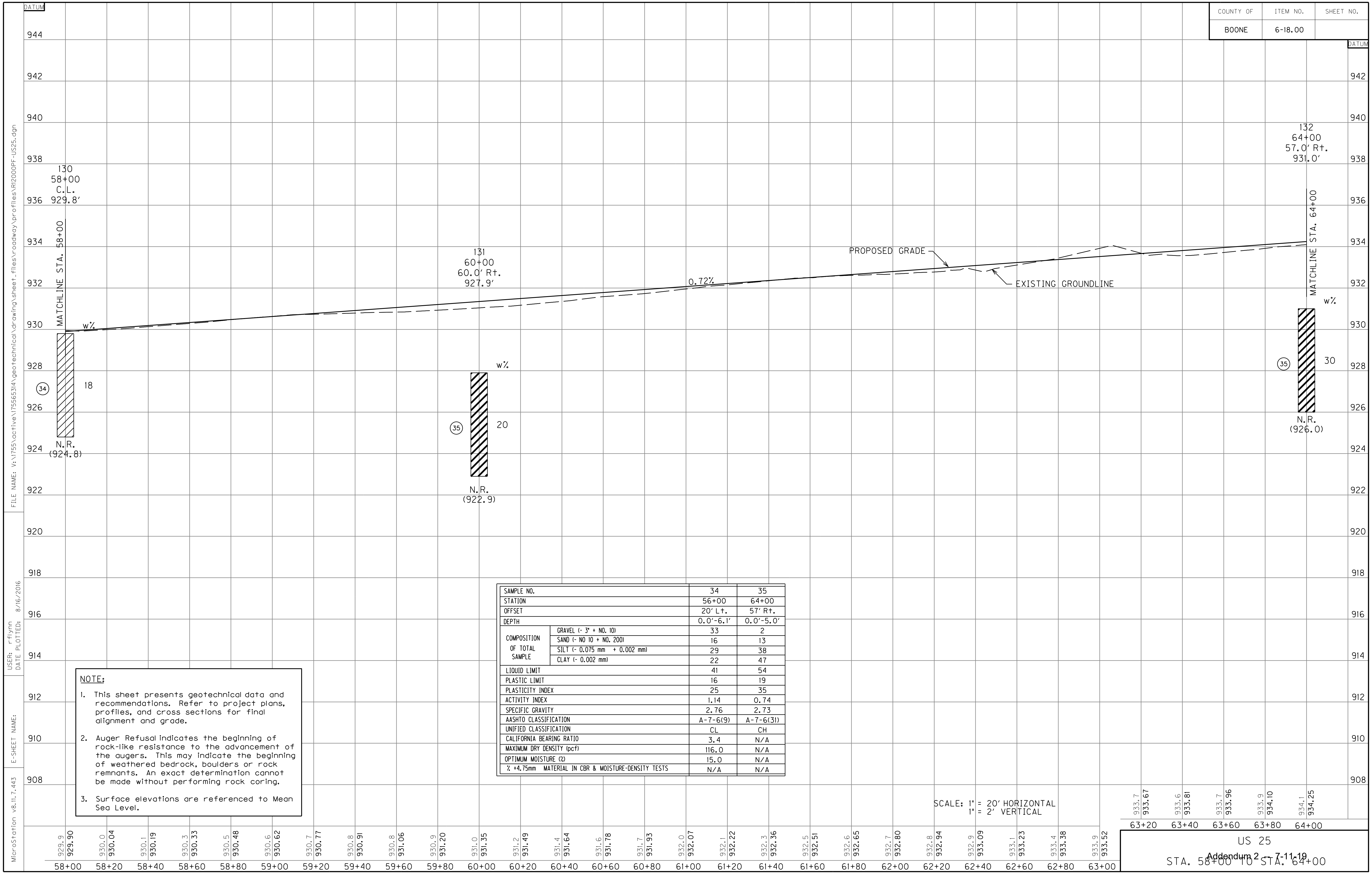
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\RI1800PF-US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		34	35
STATION		56+00	64+00
OFFSET		20′ Lt.	57′ Rt.
DEPTH		0.0′-6.1′	0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	33	2
	SAND (- NO 10 + NO. 200)	16	13
	SILT (- 0.075 mm + 0.002 mm)	29	38
	CLAY (- 0.002 mm)	22	47
LIQUID LIMIT		41	54
PLASTIC LIMIT		16	19
PLASTICITY INDEX		25	35
ACTIVITY INDEX		1.14	0.74
SPECIFIC GRAVITY		2.76	2.73
AASHTO CLASSIFICATION		A-7-6(9)	A-7-6(31)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		3.4	N/A
MAXIMUM DRY DENSITY (pcf)		116.0	N/A
OPTIMUM MOISTURE (%)		15.0	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

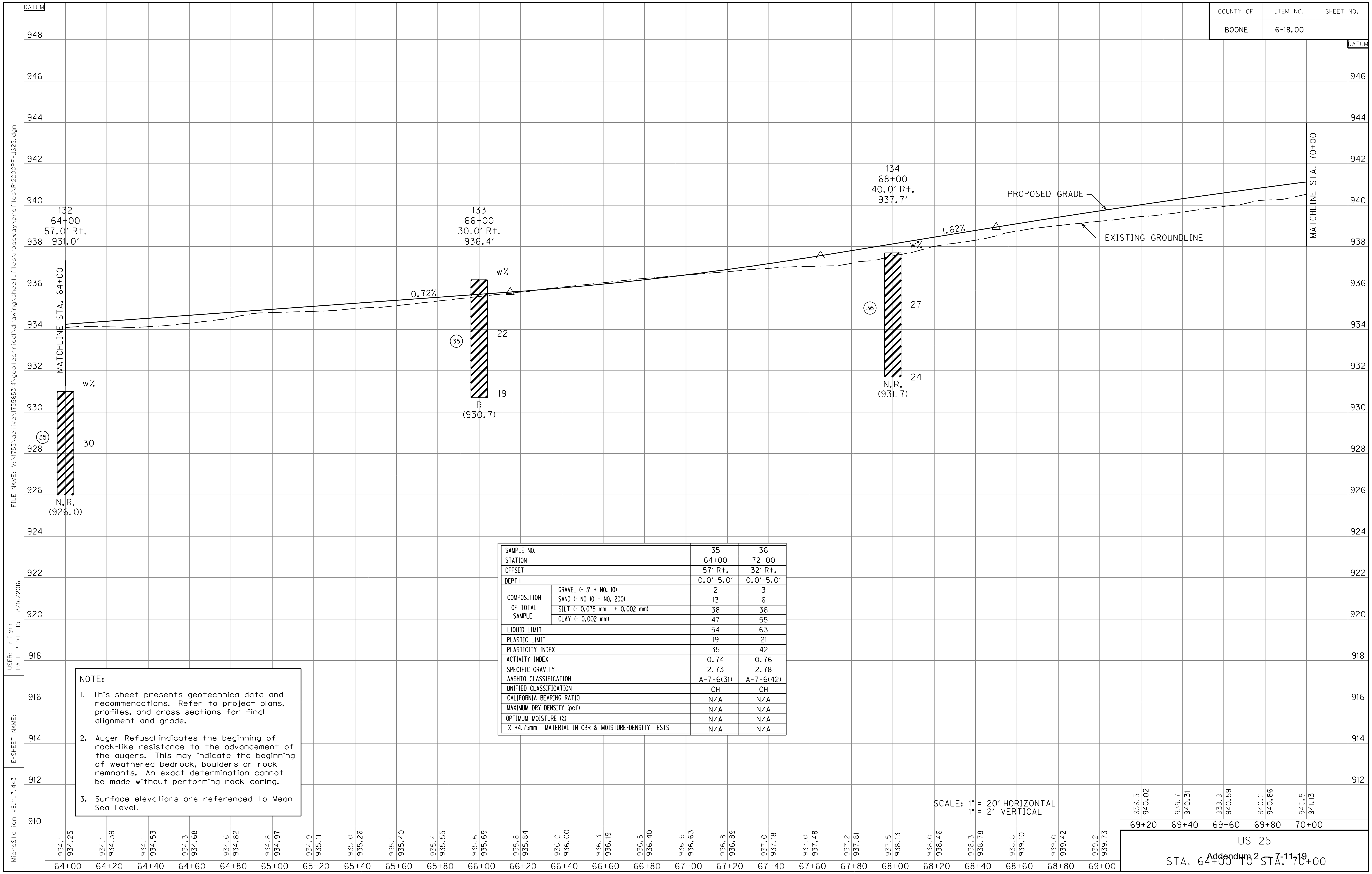
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 58+00 TO STA. 64+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\RI2000PF-US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



		35	36
SAMPLE NO.		35	36
STATION		64+00	72+00
OFFSET		57′ Rt.	32′ Rt.
DEPTH		0.0′-5.0′	0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2	3
	SAND (- NO 10 + NO. 200)	13	6
	SILT (- 0.075 mm + 0.002 mm)	38	36
	CLAY (- 0.002 mm)	47	55
LIQUID LIMIT		54	63
PLASTIC LIMIT		19	21
PLASTICITY INDEX		35	42
ACTIVITY INDEX		0.74	0.76
SPECIFIC GRAVITY		2.73	2.78
AASHTO CLASSIFICATION		A-7-6(31)	A-7-6(42)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		N/A	N/A
MAXIMUM DRY DENSITY (pcf)		N/A	N/A
OPTIMUM MOISTURE (%)		N/A	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

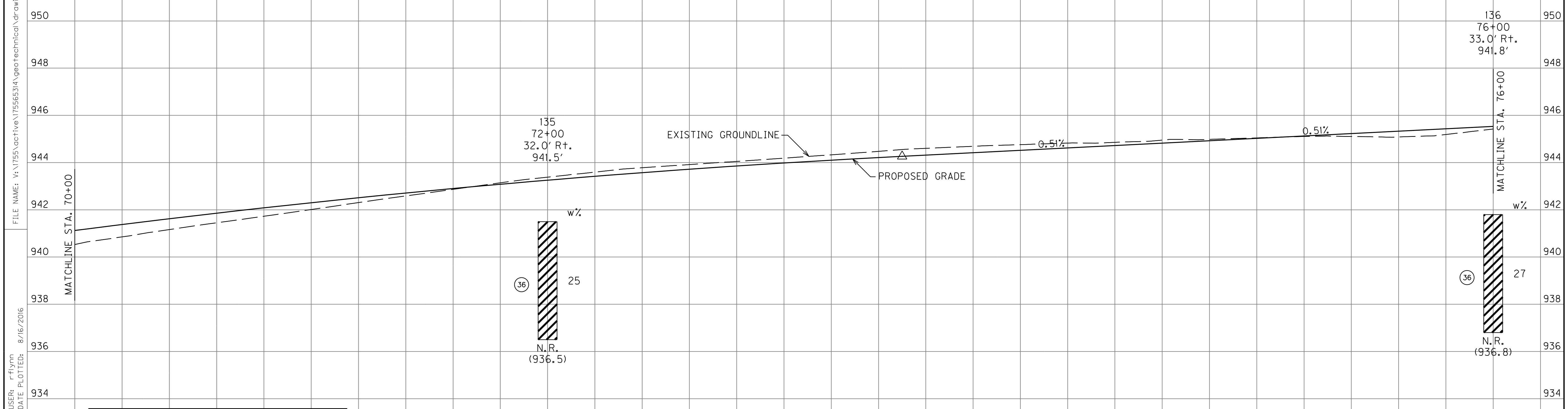
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 64+00 TO STA. 70+00
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R12200PF-US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		36
STATION		72+00
OFFSET		32′ Rt.
DEPTH		0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	3
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	36
	CLAY (- 0.002 mm)	55
LIQUID LIMIT		63
PLASTIC LIMIT		21
PLASTICITY INDEX		42
ACTIVITY INDEX		0.76
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(42)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

70+00	940.5	941.13
70+20	940.9	941.38
70+40	941.2	941.62
70+60	941.5	941.86
70+80	941.7	942.08
71+00	942.0	942.30
71+20	942.3	942.51
71+40	942.6	942.71
71+60	942.9	942.90
71+80	943.1	943.08
72+00	943.4	943.26
72+20	943.6	943.42
72+40	943.8	943.57
72+60	943.9	943.72
72+80	944.0	943.86
73+00	944.2	943.98
73+20	944.3	944.10
73+40	944.5	944.21
73+60	944.6	944.32
73+80	944.7	944.42
74+00	944.8	944.52
74+20	944.8	944.62
74+40	944.9	944.72
74+60	945.0	944.82
74+80	945.0	944.92
75+00	945.0	945.03
75+20	945.1	945.13
75+40	945.1	945.23
75+60	945.1	945.33
75+80	945.2	945.43
76+00	945.4	945.53

US 25

STA. 70+00 TO STA. 76+00

Addendum 2 - 7-11-19

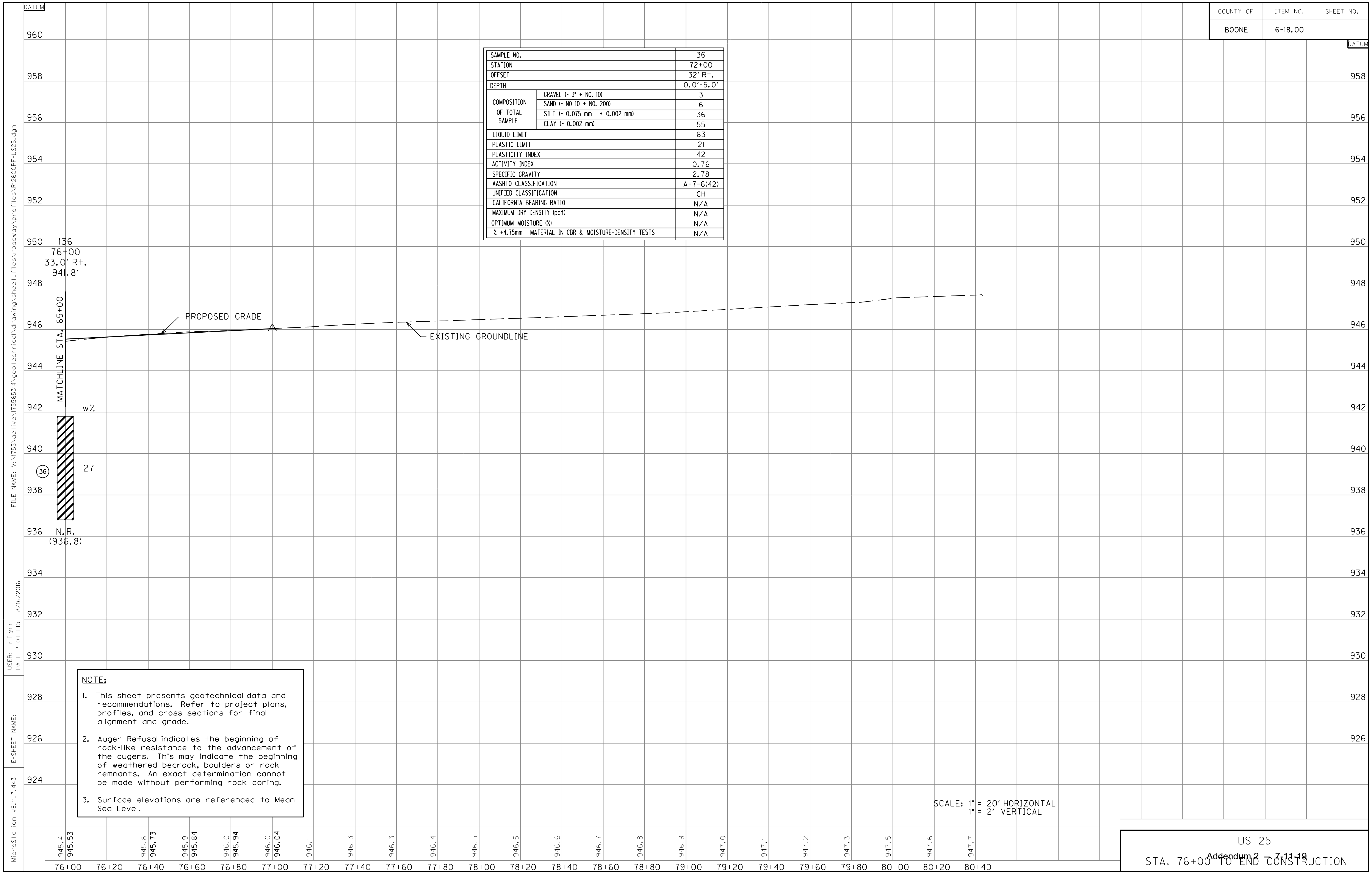
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\RI2400PF-US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		36
STATION		72+00
OFFSET		32′ Rt.
DEPTH		0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	3
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	36
	CLAY (- 0.002 mm)	55
LIQUID LIMIT		63
PLASTIC LIMIT		21
PLASTICITY INDEX		42
ACTIVITY INDEX		0.76
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(42)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

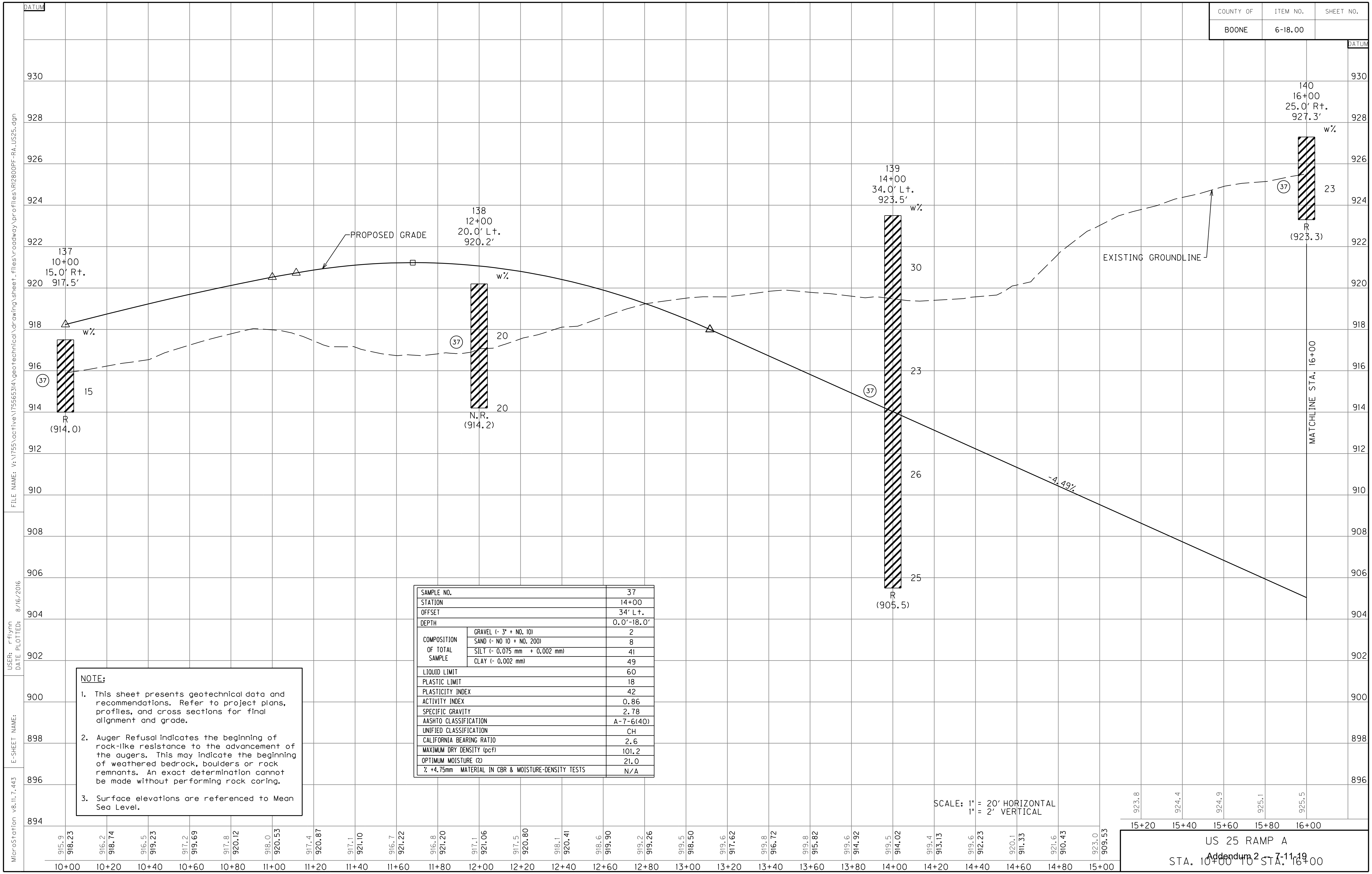
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 76+00 TO END CONSTRUCTION
Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\RI2600PF-US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		37
STATION		14+00
OFFSET		34′ Lt.
DEPTH		0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	41
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		60
PLASTIC LIMIT		18
PLASTICITY INDEX		42
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.6
MAXIMUM DRY DENSITY (pcf)		101.2
OPTIMUM MOISTURE (%)		21.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

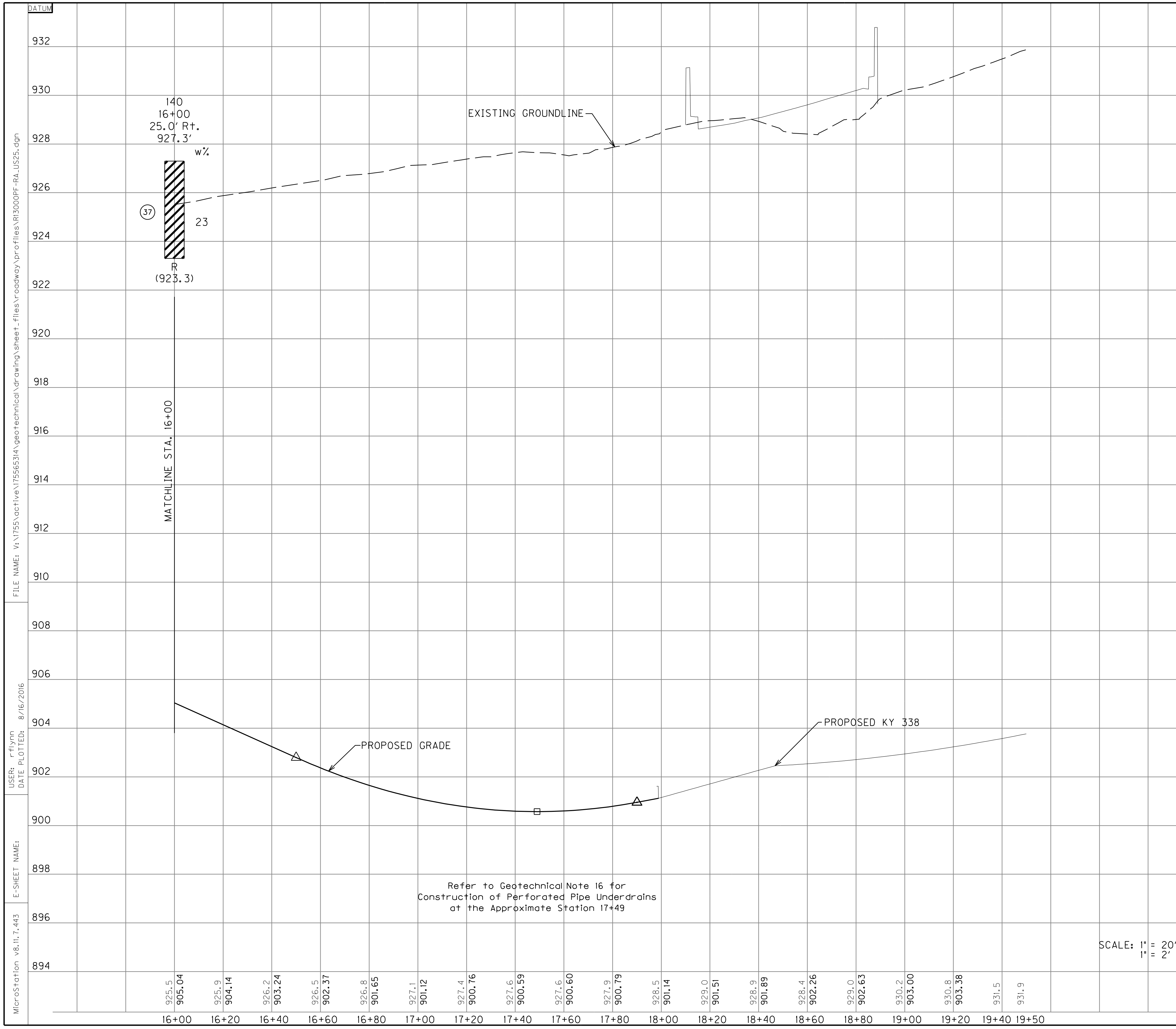
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP A
STA. 10+00 TO STA. 16+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R12800PF-RA_US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 16 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 17+49

SAMPLE NO.		37
STATION		14+00
OFFSET		34′ Lt.
DEPTH		0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	41
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		60
PLASTIC LIMIT		18
PLASTICITY INDEX		42
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.6
MAXIMUM DRY DENSITY (pcf)		101.2
OPTIMUM MOISTURE (%)		21.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

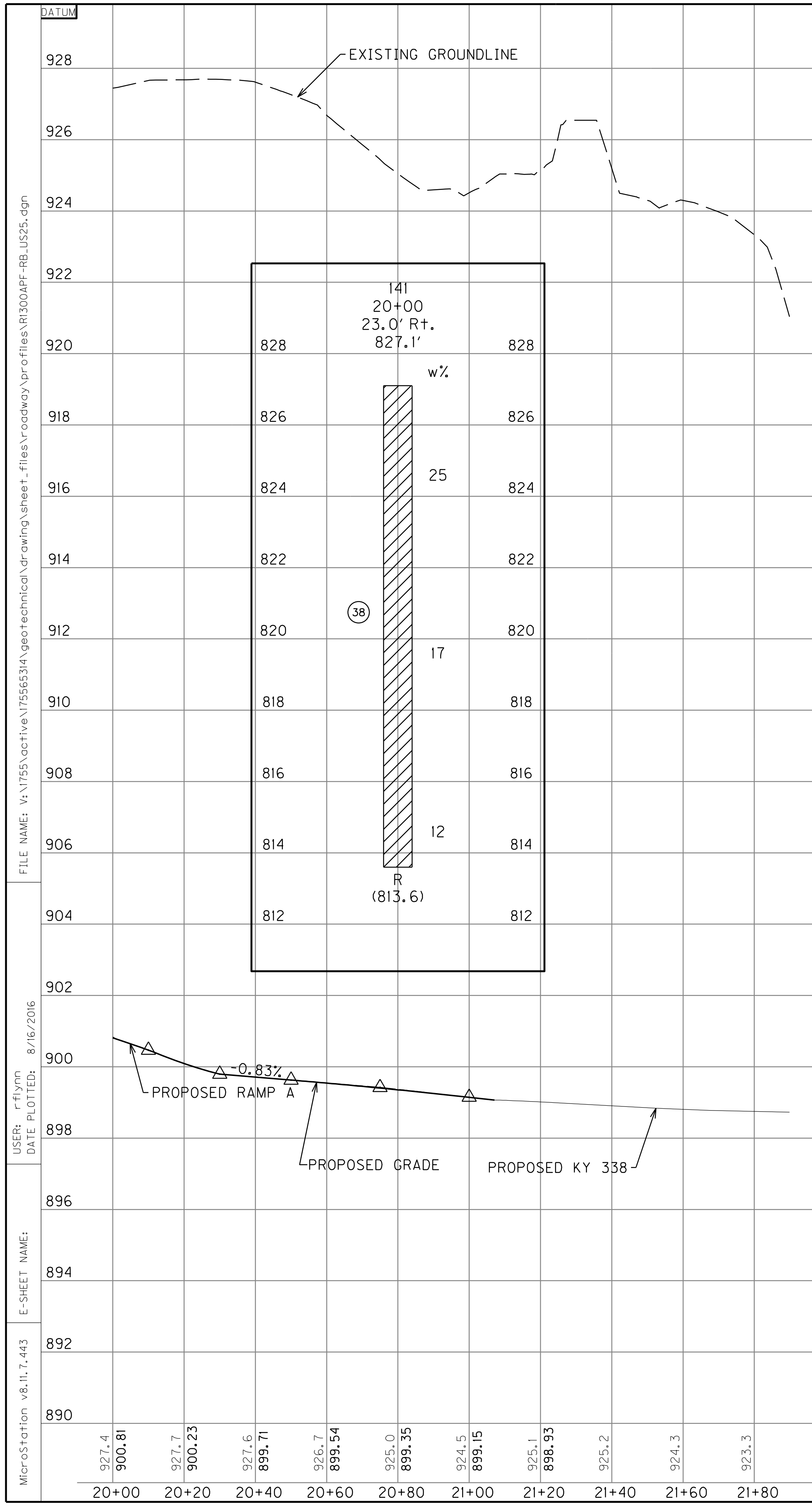
DATUM
930
928
926
924
922
920
918
916
914
912
910
908
906
904
902
900
898
896

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP A
STA. 16+00 TO STA. 19+50
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R13000PF-RA_US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R1300APF-RB_US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

SAMPLE NO.		38
STATION		20+00
OFFSET		23′ Rt.
DEPTH		0.0′-13.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	14
	SAND (- NO 10 + NO. 200)	12
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		42
PLASTIC LIMIT		18
PLASTICITY INDEX		24
ACTIVITY INDEX		0.71
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(16)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

DATUM
926
924
922
920
918
916
914
912
910
908
906
904
902
900
898
896
894
892

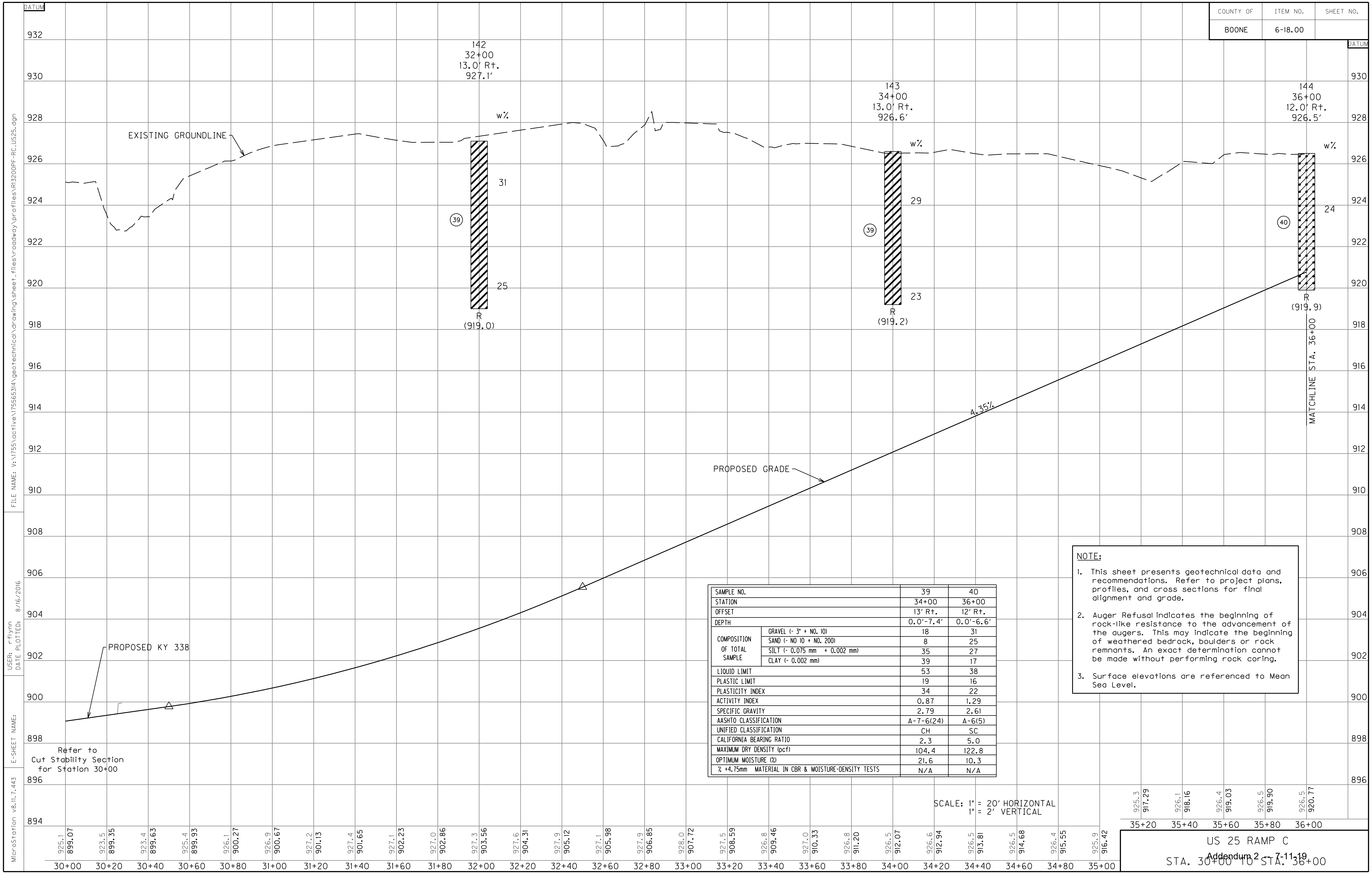
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP B

Addendum 2 - 7-11-19

STA. 20+00 TO STA. 21+37.04

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		39	40
STATION		34+00	36+00
OFFSET		13′ Rt.	12′ Rt.
DEPTH		0.0′-7.4′	0.0′-6.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	18	31
	SAND (- NO 10 + NO. 200)	8	25
	SILT (- 0.075 mm + 0.002 mm)	35	27
	CLAY (- 0.002 mm)	39	17
LIQUID LIMIT		53	38
PLASTIC LIMIT		19	16
PLASTICITY INDEX		34	22
ACTIVITY INDEX		0.87	1.29
SPECIFIC GRAVITY		2.79	2.61
AASHTO CLASSIFICATION		A-7-6(24)	A-6(5)
UNIFIED CLASSIFICATION		CH	SC
CALIFORNIA BEARING RATIO		2.3	5.0
MAXIMUM DRY DENSITY (pcf)		104.4	122.8
OPTIMUM MOISTURE (%)		21.6	10.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

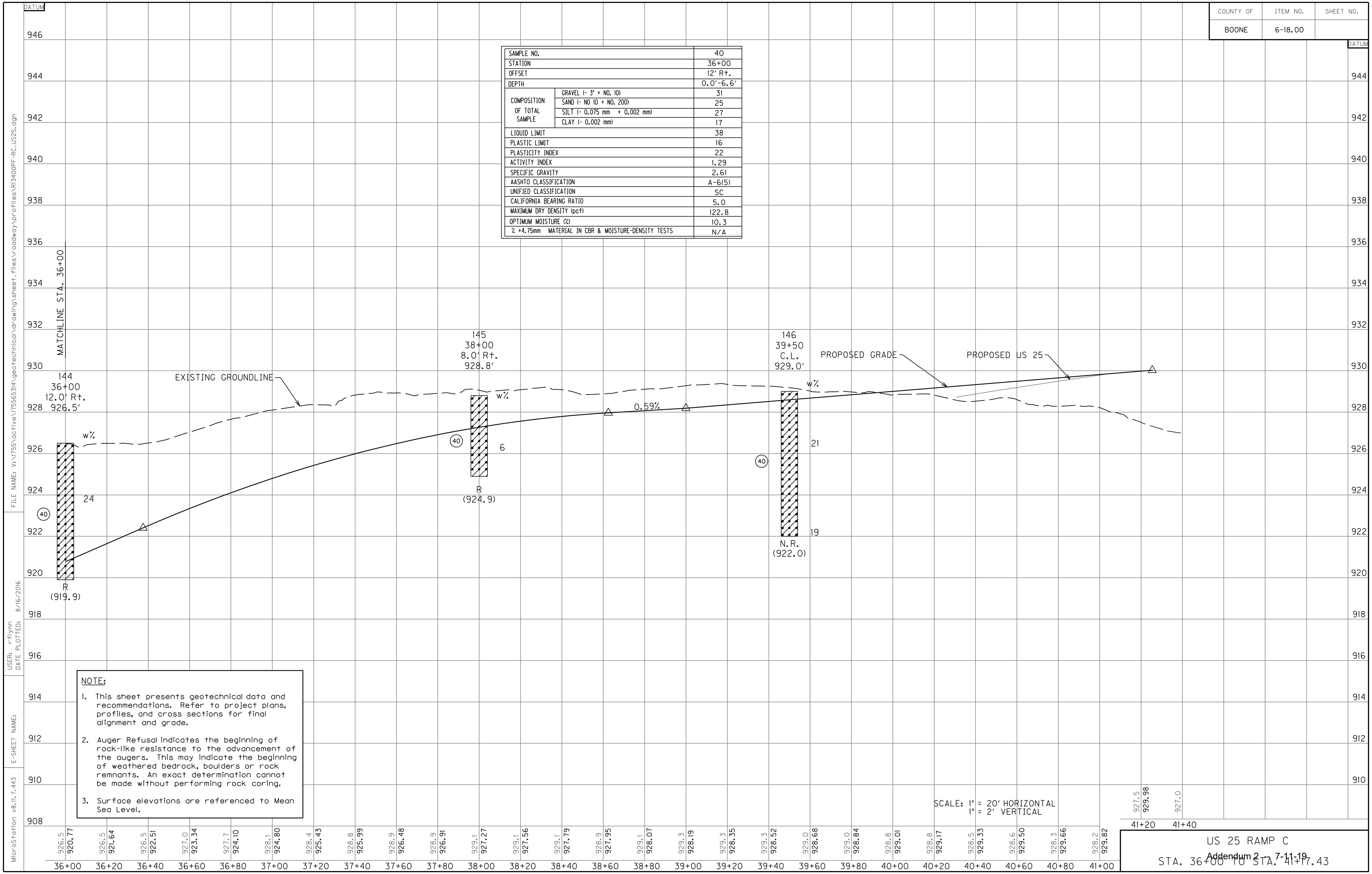
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP C
STA. 30+00 TO STA. 36+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



36+00	926.5	920.77
36+20	926.5	921.64
36+40	926.5	922.51
36+60	927.0	923.34
36+80	927.7	924.10
37+00	928.1	924.80
37+20	928.4	925.43
37+40	928.8	925.99
37+60	928.9	926.48
37+80	928.9	926.91
38+00	929.1	927.27
38+20	929.1	927.56
38+40	929.1	927.79
38+60	928.9	927.95
38+80	929.1	928.07
39+00	929.3	928.19
39+20	929.3	928.35
39+40	929.3	928.52
39+60	929.0	928.68
39+80	929.0	928.84
40+00	928.8	929.01
40+20	928.8	929.17
40+40	928.5	929.33
40+60	928.6	929.50
40+80	928.3	929.66
41+00	928.2	929.82
41+20	927.5	929.98
41+40	927.0	

SAMPLE NO.		40
STATION		36+00
OFFSET		12′ Rt.
DEPTH		0.0′-6.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	31
	SAND (- NO 10 + NO. 200)	25
	SILT (- 0.075 mm + 0.002 mm)	27
	CLAY (- 0.002 mm)	17
LIQUID LIMIT		38
PLASTIC LIMIT		16
PLASTICITY INDEX		22
ACTIVITY INDEX		1.29
SPECIFIC GRAVITY		2.61
AASHTO CLASSIFICATION		A-6(5)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		5.0
MAXIMUM DRY DENSITY (pcf)		122.8
OPTIMUM MOISTURE (%)		10.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

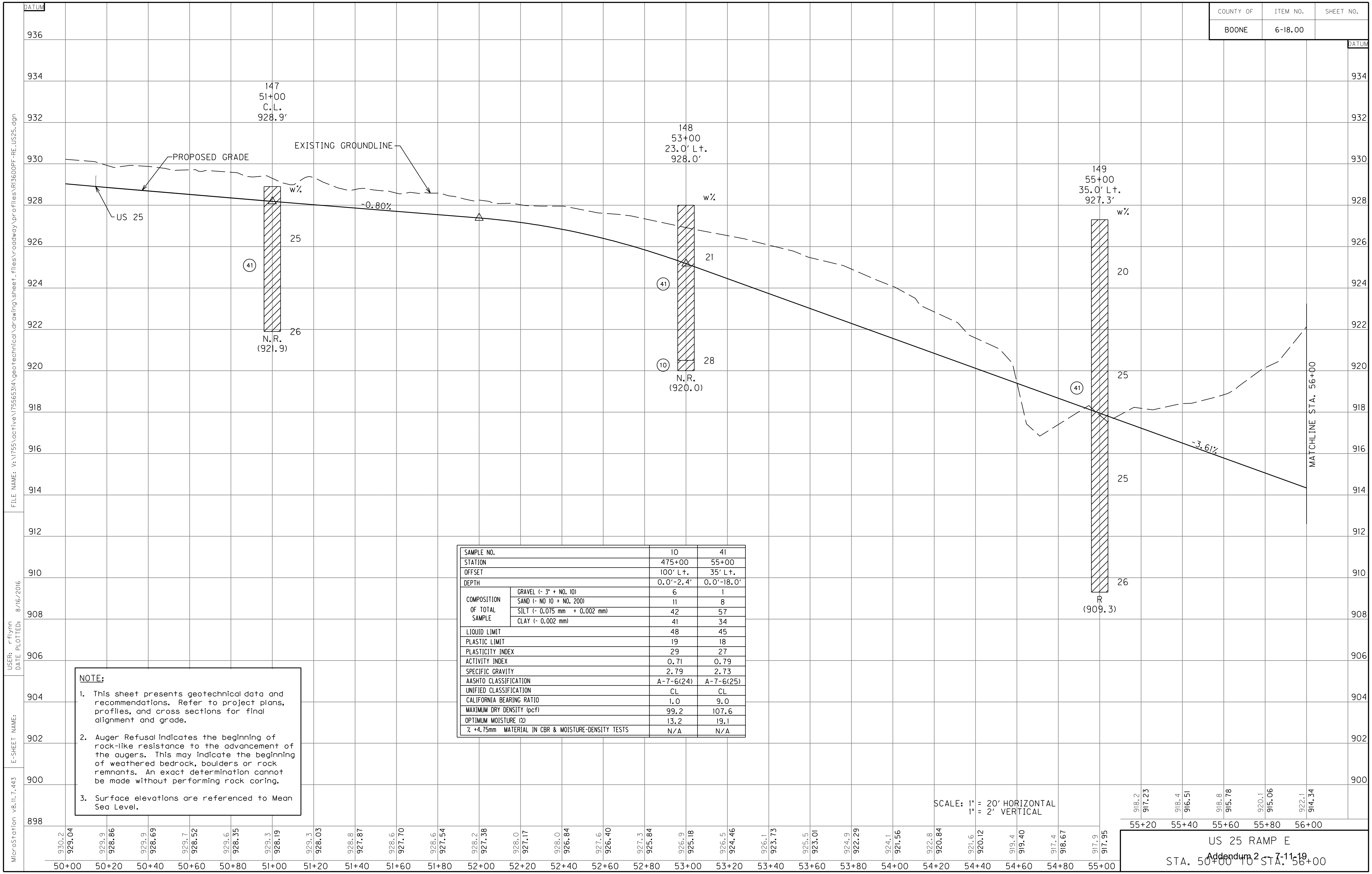
NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

US 25 RAMP C
STA. 36+00 TO STA. 41+17.43
Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R13400PF-RC_US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		10	41
STATION		475+00	55+00
OFFSET		100′ Lt.	35′ Lt.
DEPTH		0.0′-2.4′	0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	1
	SAND (- NO 10 + NO. 200)	11	8
	SILT (- 0.075 mm + 0.002 mm)	42	57
	CLAY (- 0.002 mm)	41	34
LIQUID LIMIT		48	45
PLASTIC LIMIT		19	18
PLASTICITY INDEX		29	27
ACTIVITY INDEX		0.71	0.79
SPECIFIC GRAVITY		2.79	2.73
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(25)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	9.0
MAXIMUM DRY DENSITY (pcf)		99.2	107.6
OPTIMUM MOISTURE (%)		13.2	19.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP E
STA. 50+00 TO STA. 56+00

Addendum 2 -- 7-11-19

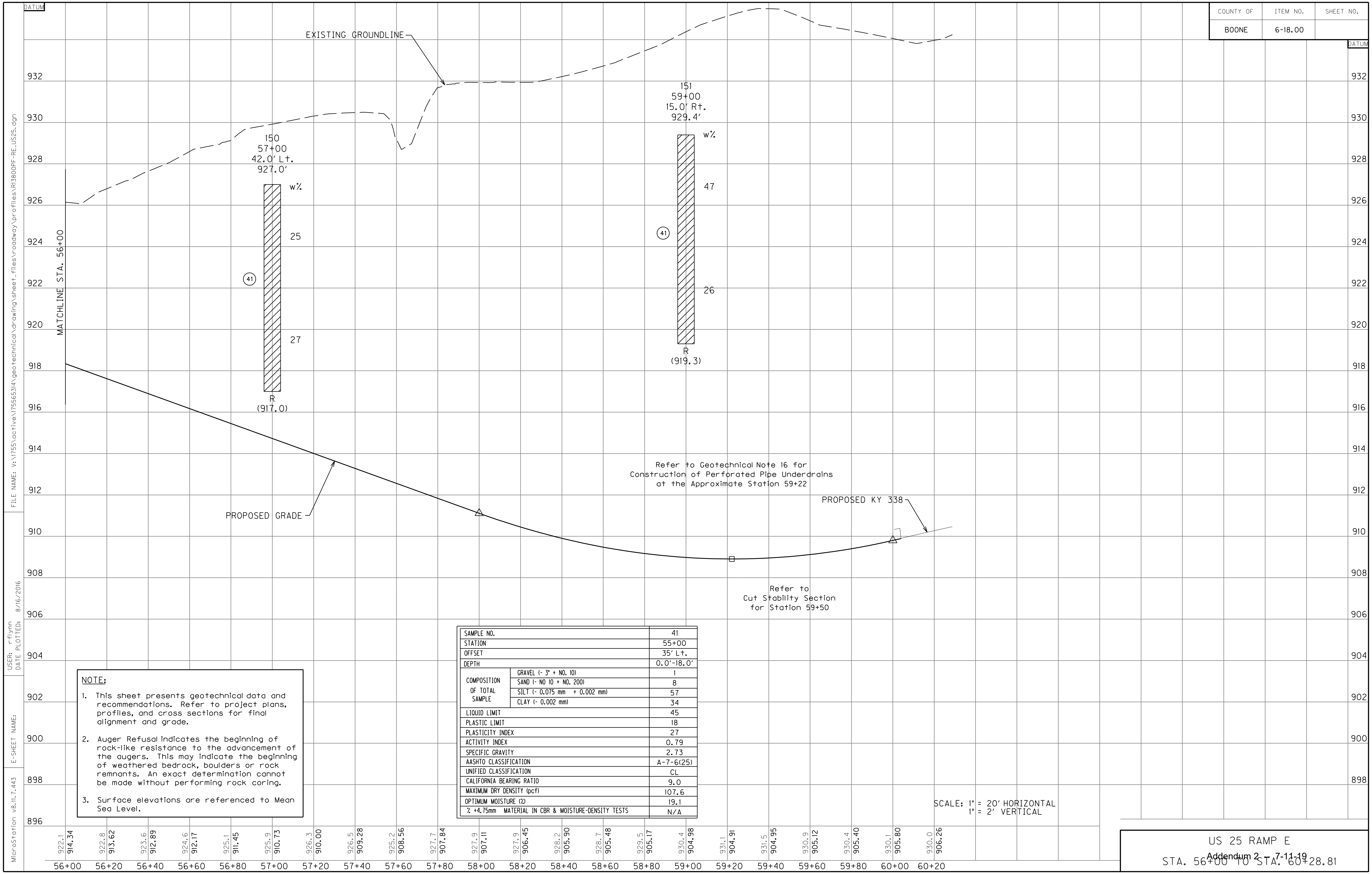
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R13600PF-RE_US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 59+22

Refer to Cut Stability Section for Station 59+50

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		41
STATION		55+00
OFFSET		35′ Lt.
DEPTH		0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	57
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		45
PLASTIC LIMIT		18
PLASTICITY INDEX		27
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.73
AASHTO CLASSIFICATION		A-7-6(25)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		9.0
MAXIMUM DRY DENSITY (pcf)		107.6
OPTIMUM MOISTURE (%)		19.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

56+00	922.1	914.34
56+20	922.8	913.62
56+40	923.6	912.89
56+60	924.6	912.17
56+80	925.1	911.45
57+00	925.9	910.73
57+20	926.3	910.00
57+40	926.5	909.28
57+60	925.2	908.56
57+80	927.7	907.84
58+00	927.9	907.11
58+20	927.9	906.45
58+40	928.2	905.90
58+60	928.7	905.48
58+80	929.5	905.17
59+00	930.4	904.98
59+20	931.1	904.91
59+40	931.5	904.95
59+60	930.9	905.12
59+80	930.4	905.40
60+00	930.1	905.80
60+20	930.0	906.26

US 25 RAMP E

Addendum 2 – 7-11-19

STA. 56+00 TO STA. 60+28.81

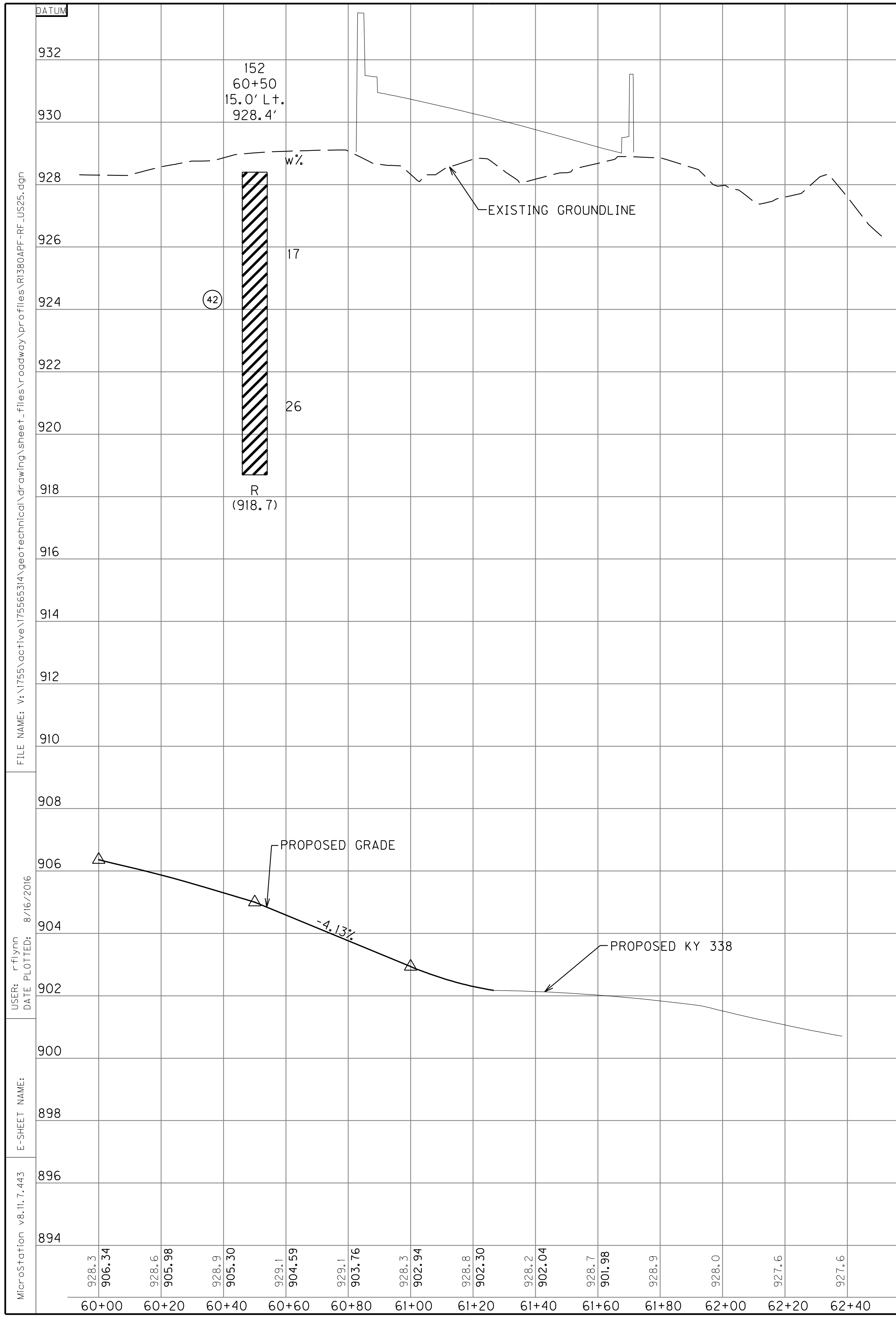
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R13800PF-RE_US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		42
STATION		60+50
OFFSET		15′ Lt.
DEPTH		0.0′-9.7′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		63
PLASTIC LIMIT		23
PLASTICITY INDEX		40
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.83
AASHTO CLASSIFICATION		A-7-6(39)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.9
MAXIMUM DRY DENSITY (pcf)		96.6
OPTIMUM MOISTURE (%)		25.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

DATUM

928
926
924
922
920
918
916
914
912
910
908
906
904
902
900
898
896

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP F
STA. 60+00 TO STA. 61+62.74

Addendum 2 -- 7-11-19

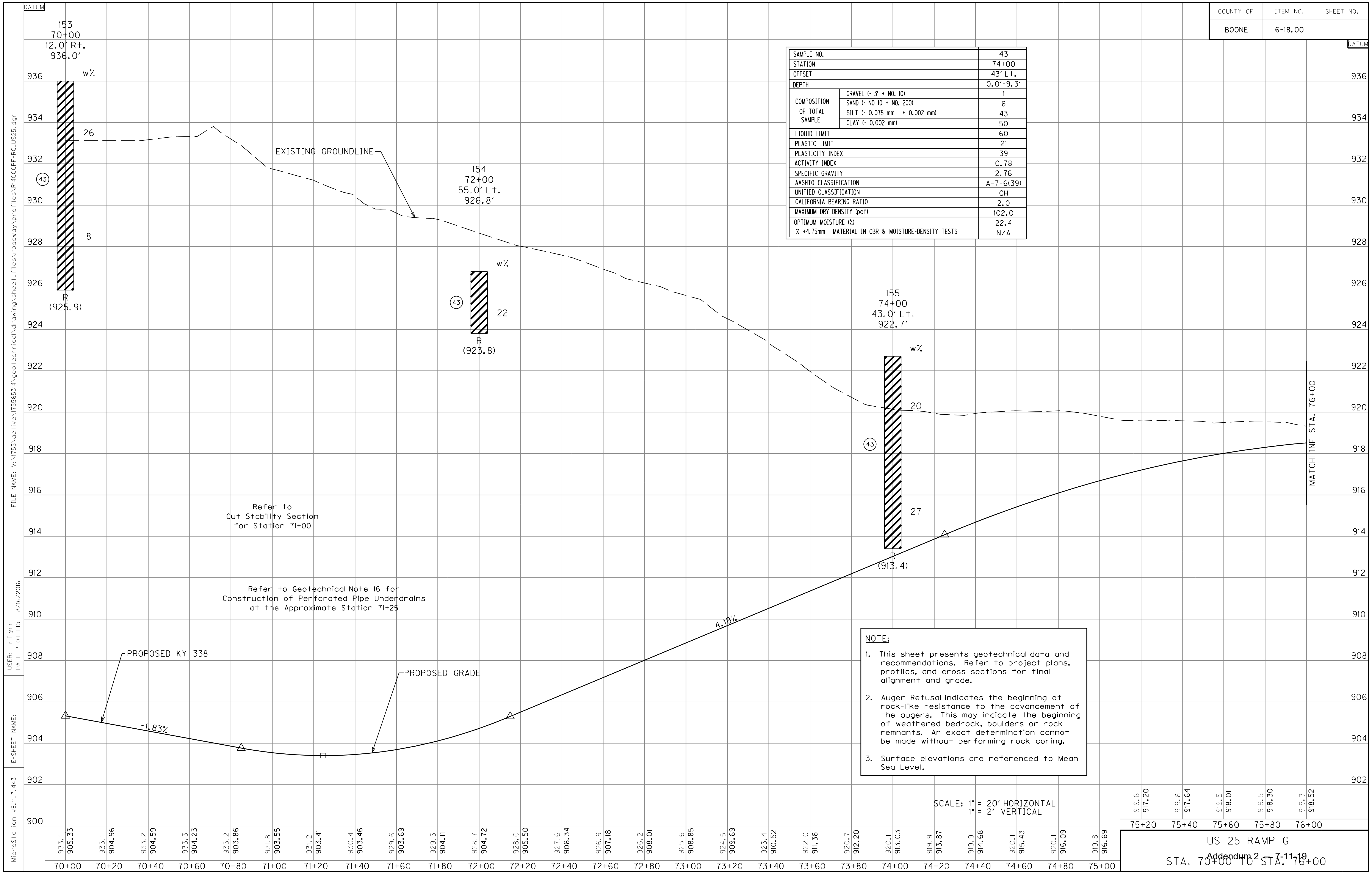
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R1380APF-RF_US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Cut Stability Section for Station 71+00

Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 71+25

SAMPLE NO.		43
STATION		74+00
OFFSET		43′ Lt.
DEPTH		0.0′-9.3′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	43
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		60
PLASTIC LIMIT		21
PLASTICITY INDEX		39
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(39)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		102.0
OPTIMUM MOISTURE (%)		22.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

933.1	905.33	70+00
933.1	904.96	70+20
933.2	904.59	70+40
933.3	904.23	70+60
933.2	903.86	70+80
931.8	903.55	71+00
931.2	903.41	71+20
930.4	903.46	71+40
929.6	903.69	71+60
929.3	904.11	71+80
928.7	904.72	72+00
928.0	905.50	72+20
927.6	906.34	72+40
926.9	907.18	72+60
926.2	908.01	72+80
925.6	908.85	73+00
924.5	909.69	73+20
923.4	910.52	73+40
922.0	911.36	73+60
920.7	912.20	73+80
920.1	913.03	74+00
919.9	913.87	74+20
919.9	914.68	74+40
920.1	915.43	74+60
920.1	916.09	74+80
919.8	916.69	75+00
919.6	917.20	75+20
919.6	917.64	75+40
919.5	918.01	75+60
919.5	918.30	75+80
919.3	918.52	76+00

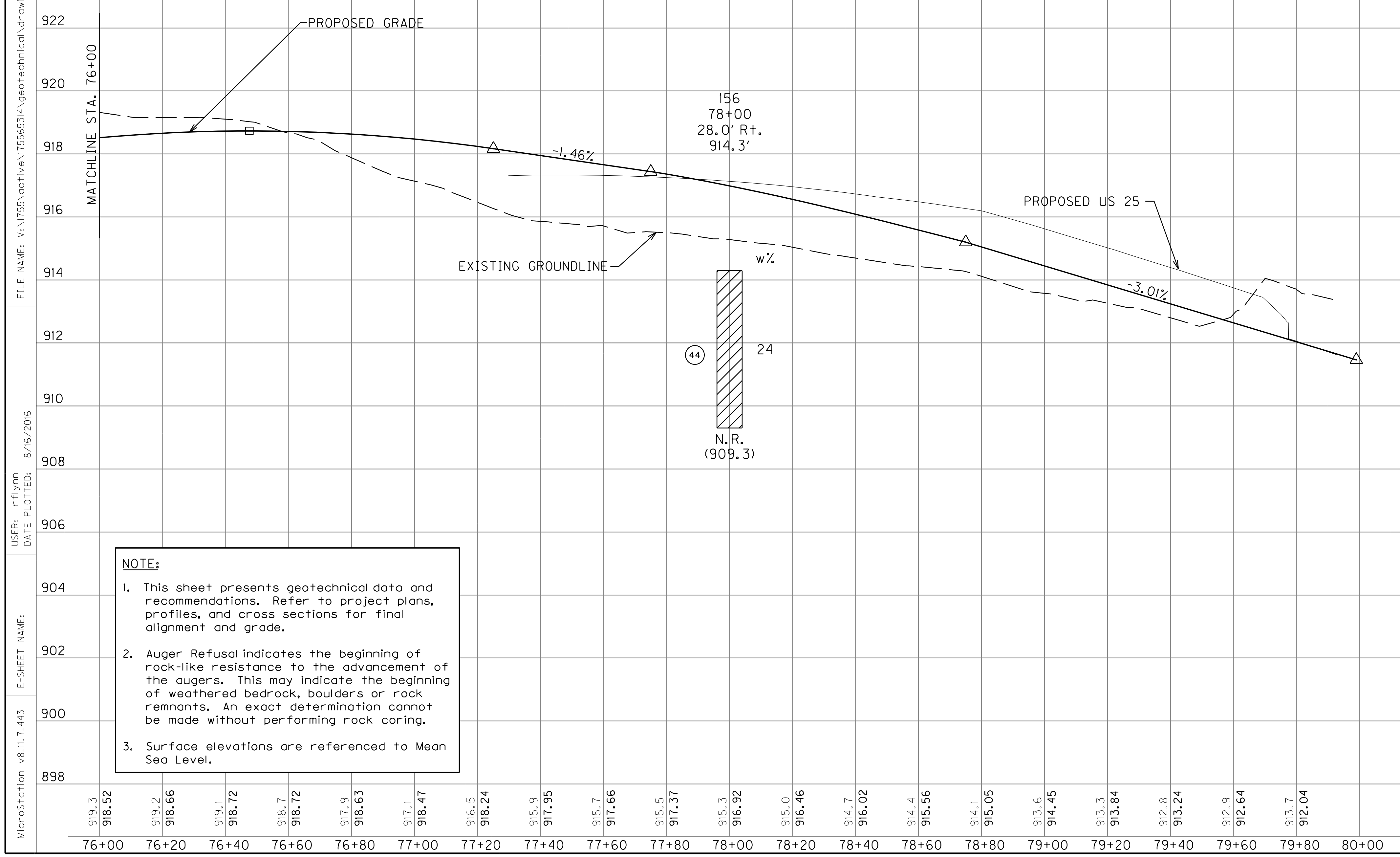
US 25 RAMP G
STA. 70+00 TO STA. 76+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R14000PF-RG_US25.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		44
STATION		82+00
OFFSET		25' Lt.
DEPTH		0.0'-4.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	39
LIQUID LIMIT		45
PLASTIC LIMIT		20
PLASTICITY INDEX		25
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(24)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		107.0
OPTIMUM MOISTURE (%)		20.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
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SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25 RAMP G
Addendum 2 -- 7-11-19
STA. 76+00 TO STA. 80+00

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R14200PF-RG_US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

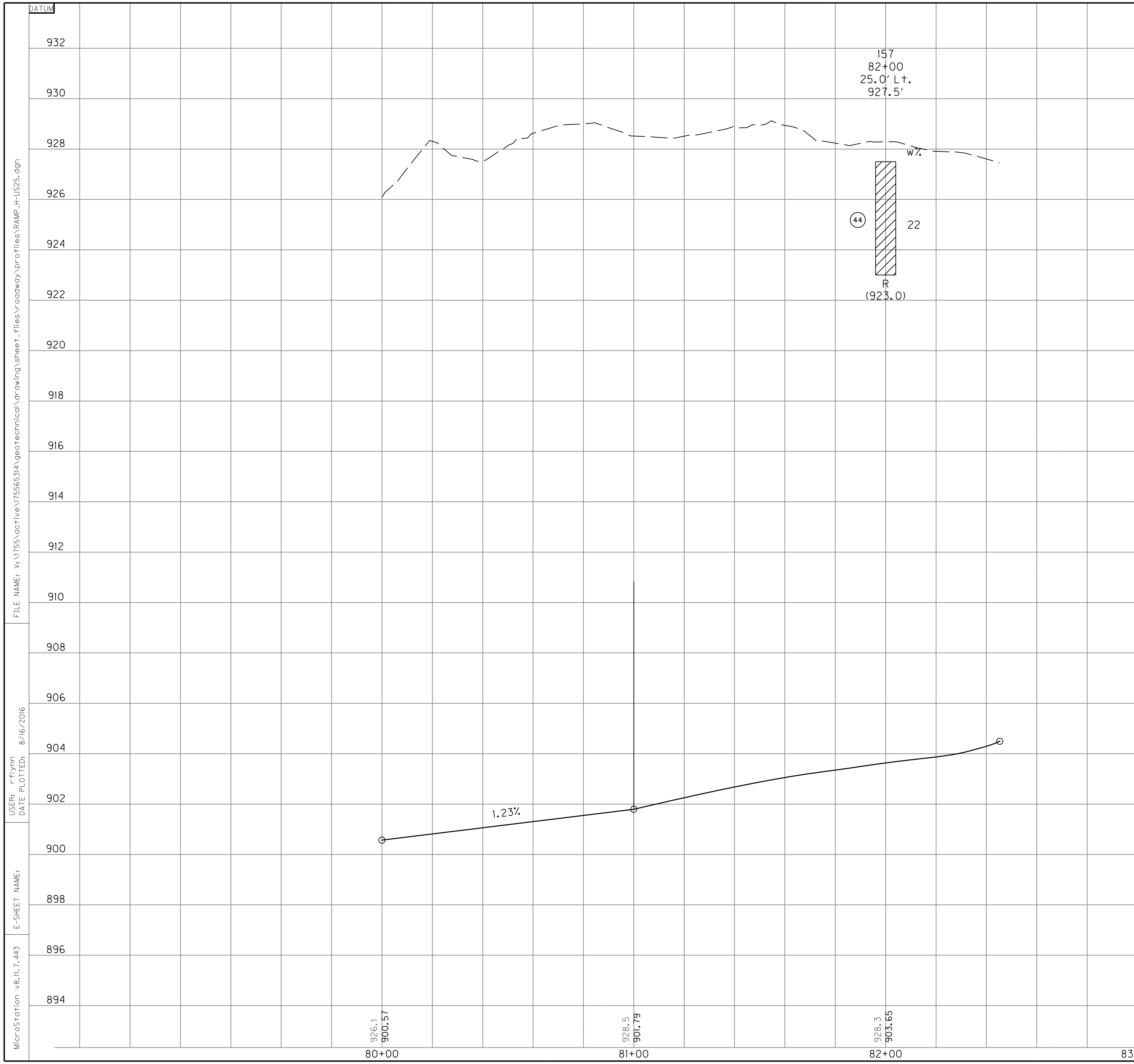
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\RAMP_H-US25.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443



SAMPLE NO.		44
STATION		82+00
OFFSET		25′ Lt.
DEPTH		0.0′-4.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	39
LIQUID LIMIT		45
PLASTIC LIMIT		20
PLASTICITY INDEX		25
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(24)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		107.0
OPTIMUM MOISTURE (%)		20.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

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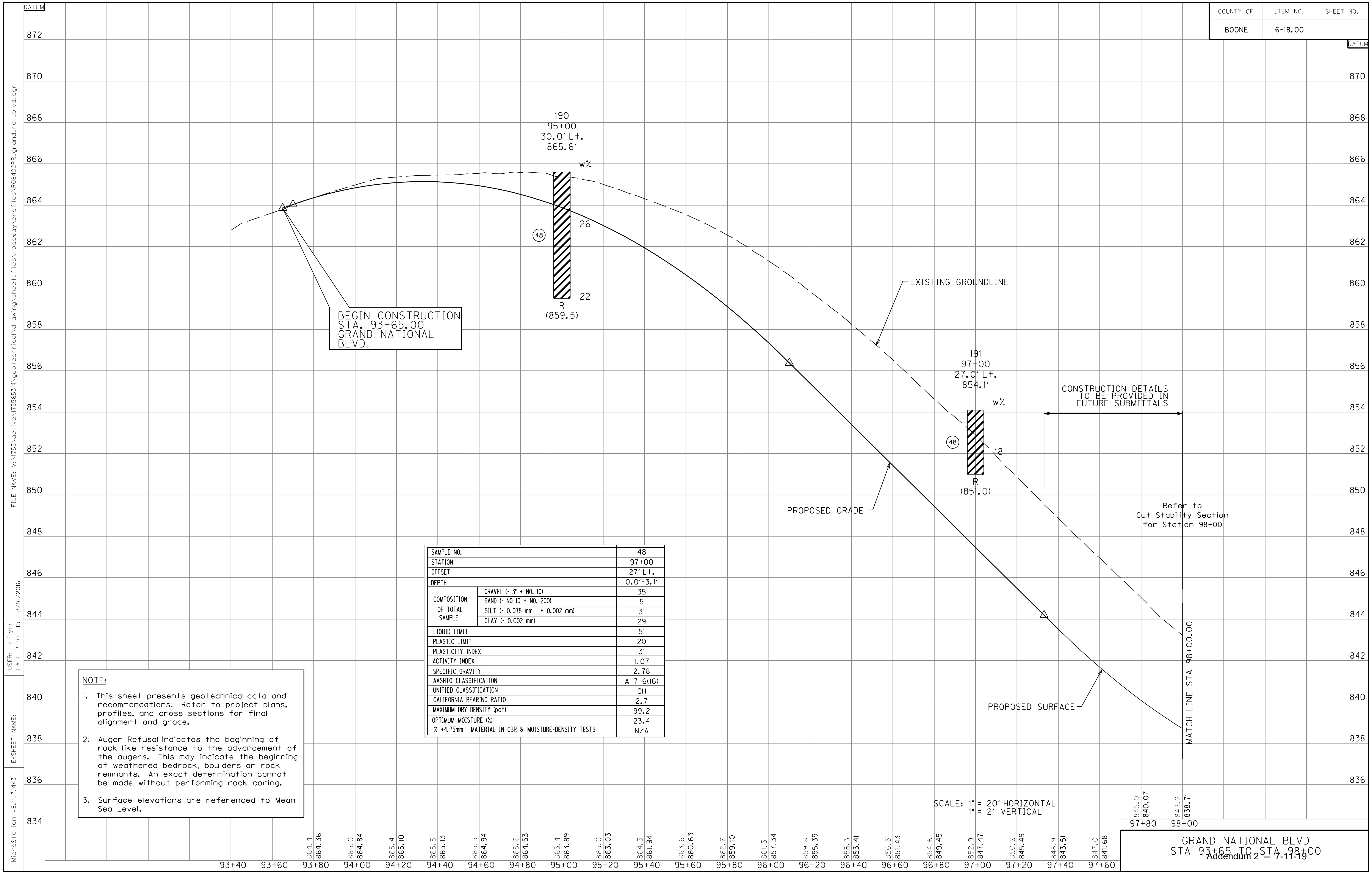
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

SOIL PROFILE SHEET
RAMP H
STA. 80+00 TO STA. 83+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		48
STATION		97+00
OFFSET		27' Lt.
DEPTH		0.0'-3.1'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	35
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	31
	CLAY (- 0.002 mm)	29
LIQUID LIMIT		51
PLASTIC LIMIT		20
PLASTICITY INDEX		31
ACTIVITY INDEX		1.07
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(16)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.7
MAXIMUM DRY DENSITY (pcf)		99.2
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R08400PR_grand_nat_blvd.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

GRAND NATIONAL BLVD
STA 93+65 TO STA 98+00

Addendum 2 -- 7-11-19

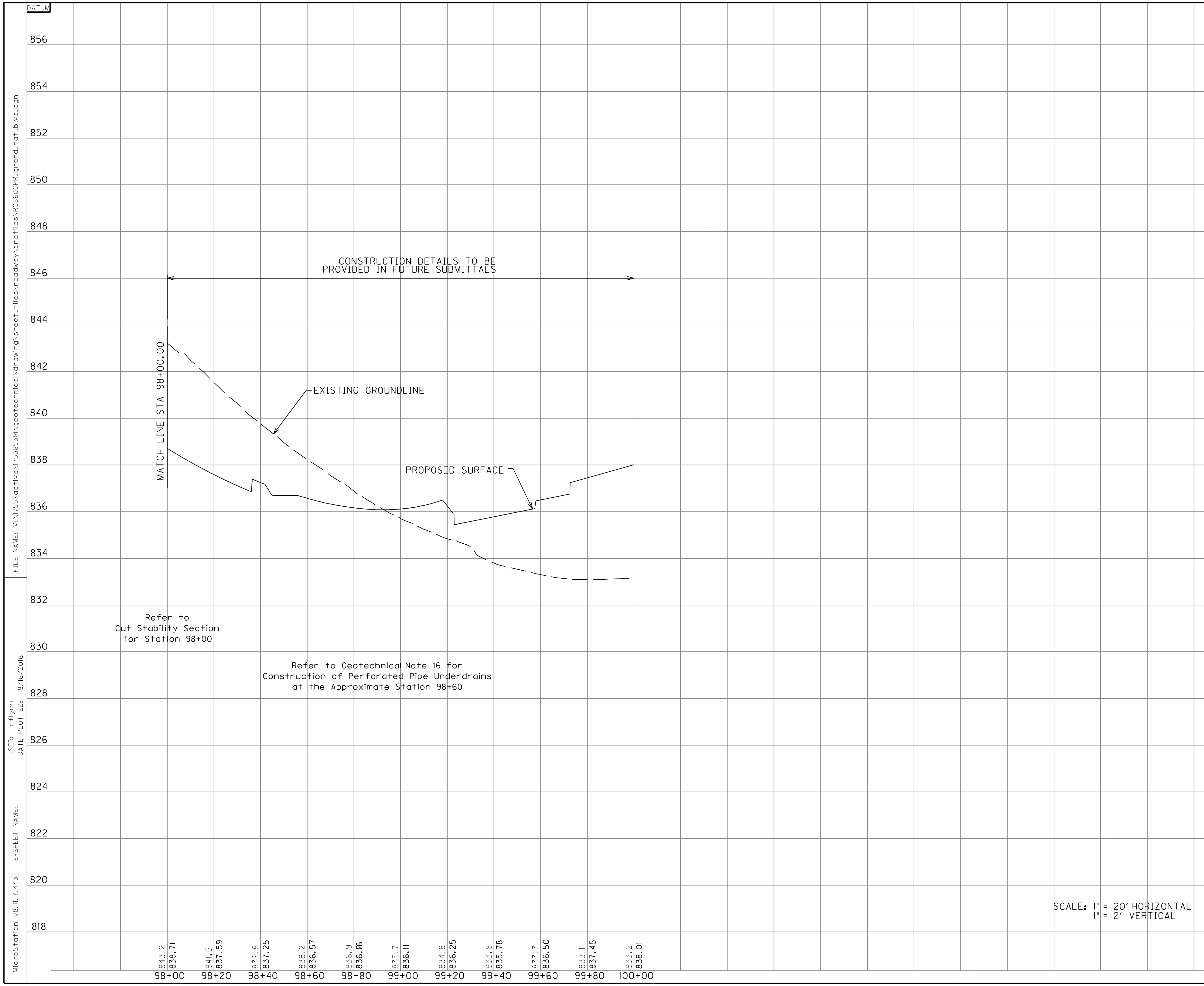
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R0860OPR_grand_nat_blvd.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

DATUM 854 852 850 848 846 844 842 840 838 836 834 832 830 828 826 824 822 820

GRAND NATIONAL BLVD
STA 98+00 TO STA 100+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

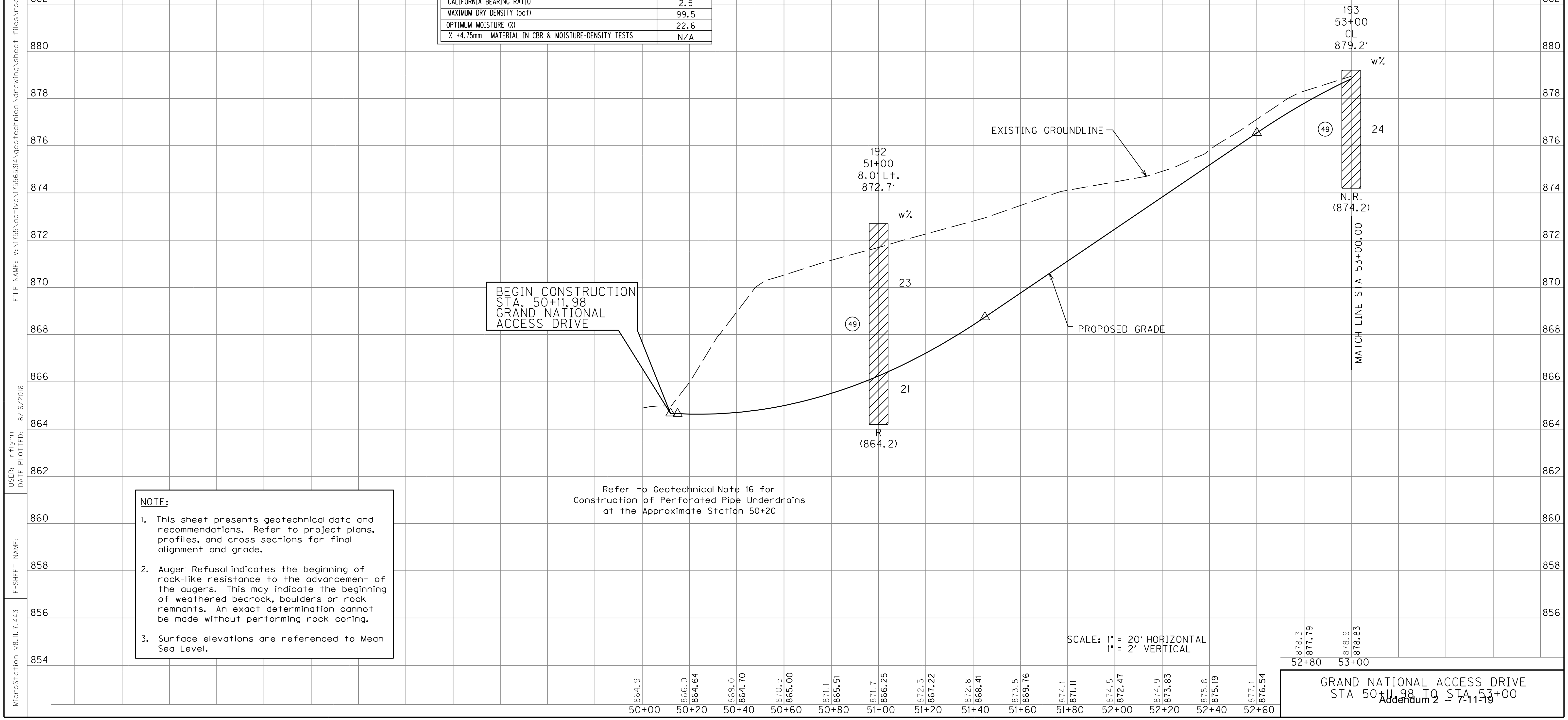
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R0800PR_grand_nat_access_dr.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

SAMPLE NO.		49
STATION		51+00
OFFSET		8′ Lt.
DEPTH		0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	32
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	25
LIQUID LIMIT		46
PLASTIC LIMIT		19
PLASTICITY INDEX		27
ACTIVITY INDEX		1.08
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(15)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		99.5
OPTIMUM MOISTURE (%)		22.6
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 50+20

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

GRAND NATIONAL ACCESS DRIVE
STA 50+11.98 TO STA 53+00

Addendum 2 -- 7-11-19

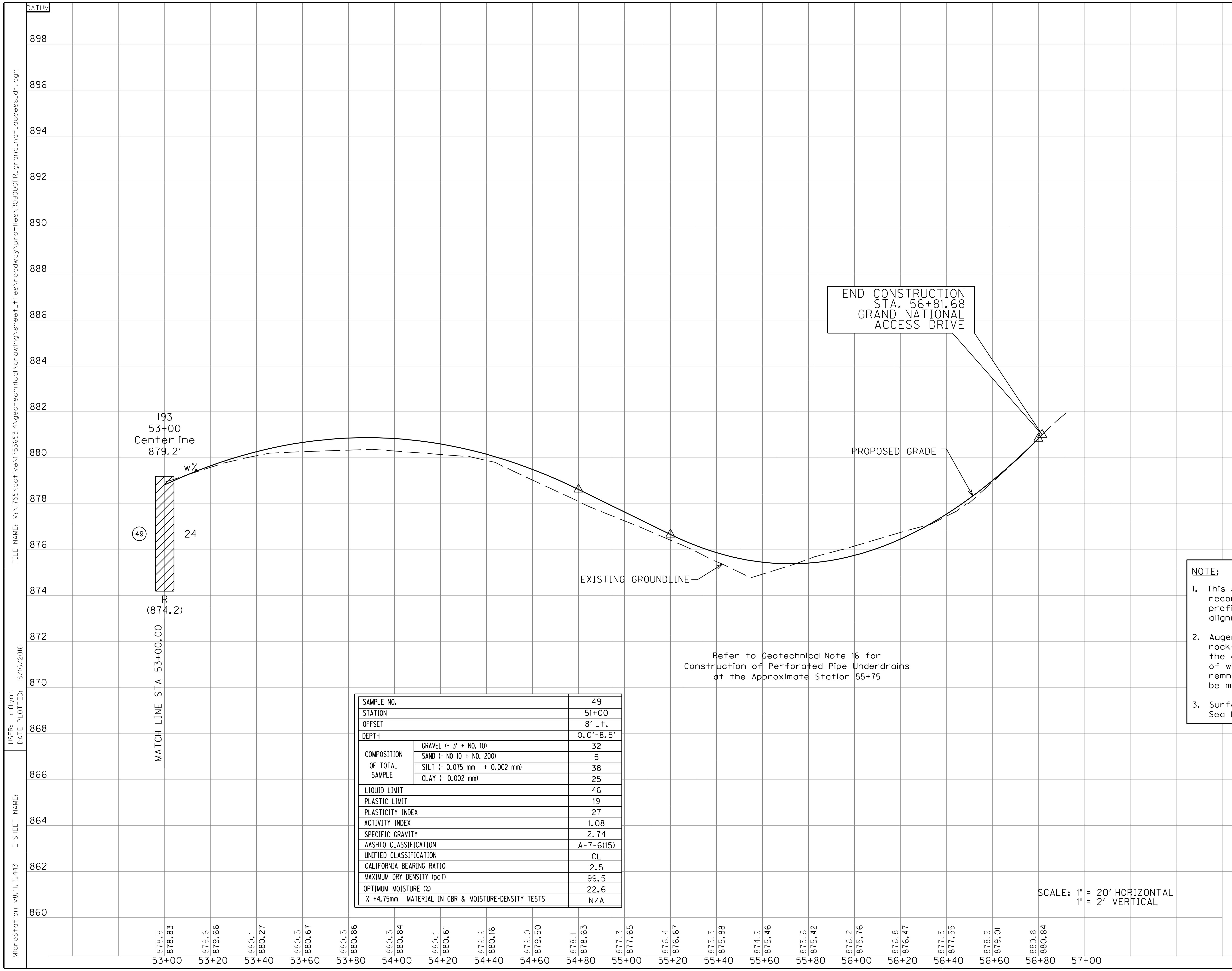
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R09000PR_grand_nat_access_dr.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443



53+00	878.9	878.83
53+20	879.6	879.66
53+40	880.1	880.27
53+60	880.3	880.67
53+80	880.3	880.86
54+00	880.3	880.84
54+20	880.1	880.61
54+40	879.9	880.16
54+60	879.0	879.50
54+80	878.1	878.63
55+00	877.3	877.65
55+20	876.4	876.67
55+40	875.5	875.88
55+60	874.9	875.46
55+80	875.6	875.42
56+00	876.2	875.76
56+20	876.8	876.47
56+40	877.5	877.55
56+60	878.9	879.01
56+80	880.8	880.84
57+00		

Refer to Geotechnical Note 16 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 55+75

SAMPLE NO.		49
STATION		51+00
OFFSET		8' Lt.
DEPTH		0.0'-8.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	32
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	25
LIQUID LIMIT		46
PLASTIC LIMIT		19
PLASTICITY INDEX		27
ACTIVITY INDEX		1.08
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(15)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		99.5
OPTIMUM MOISTURE (%)		22.6
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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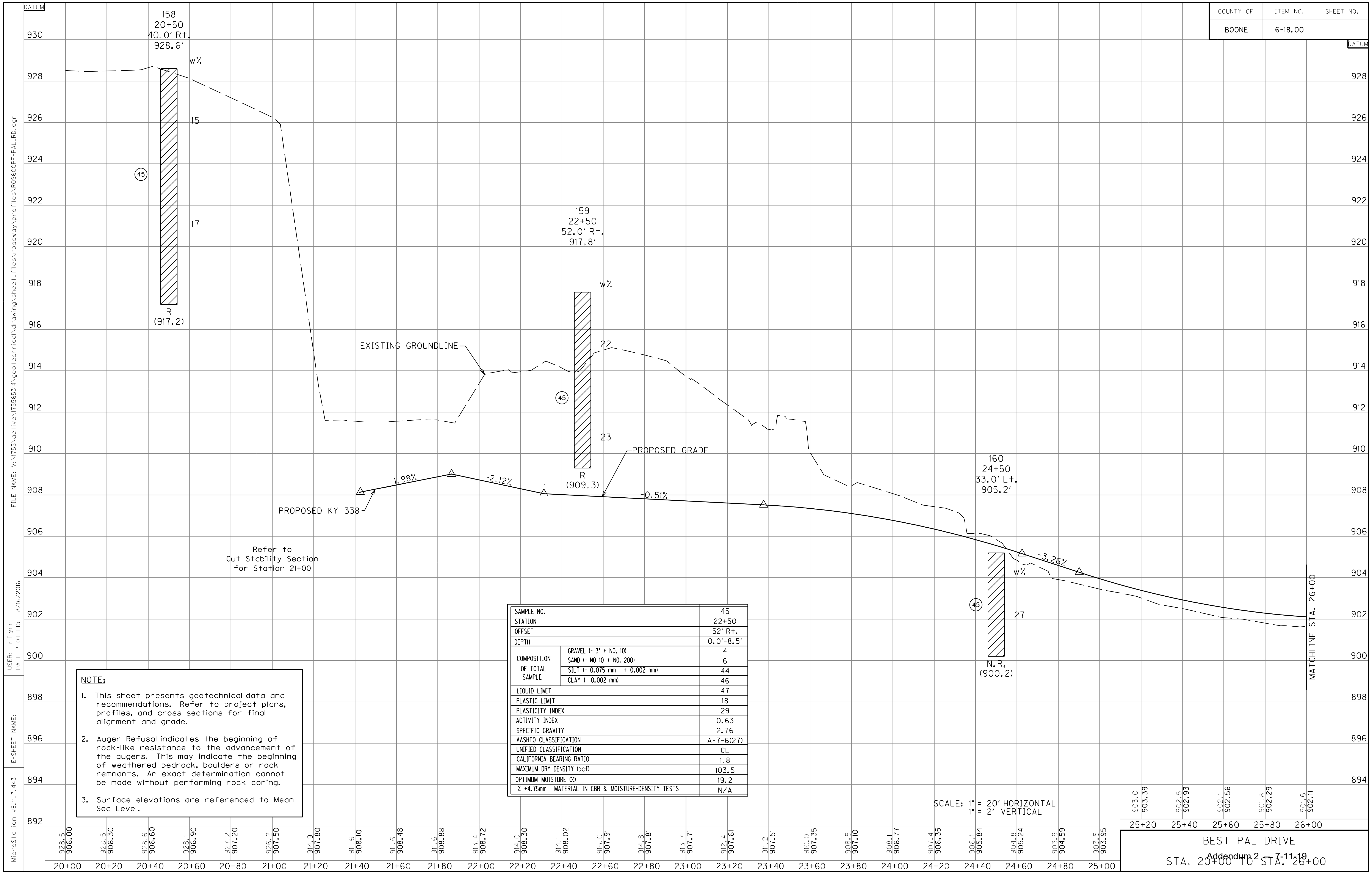
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

GRAND NATIONAL ACCESS DRIVE
STA 53+00 TO STA 56+81.68

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to
Cut Stability Section
for Station 21+00

SAMPLE NO.		45
STATION		22+50
OFFSET		52′ Rt.
DEPTH		0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	44
	CLAY (- 0.002 mm)	46
LIQUID LIMIT		47
PLASTIC LIMIT		18
PLASTICITY INDEX		29
ACTIVITY INDEX		0.63
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.8
MAXIMUM DRY DENSITY (pcf)		103.5
OPTIMUM MOISTURE (%)		19.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R09600PF-PAL_RD.dgn

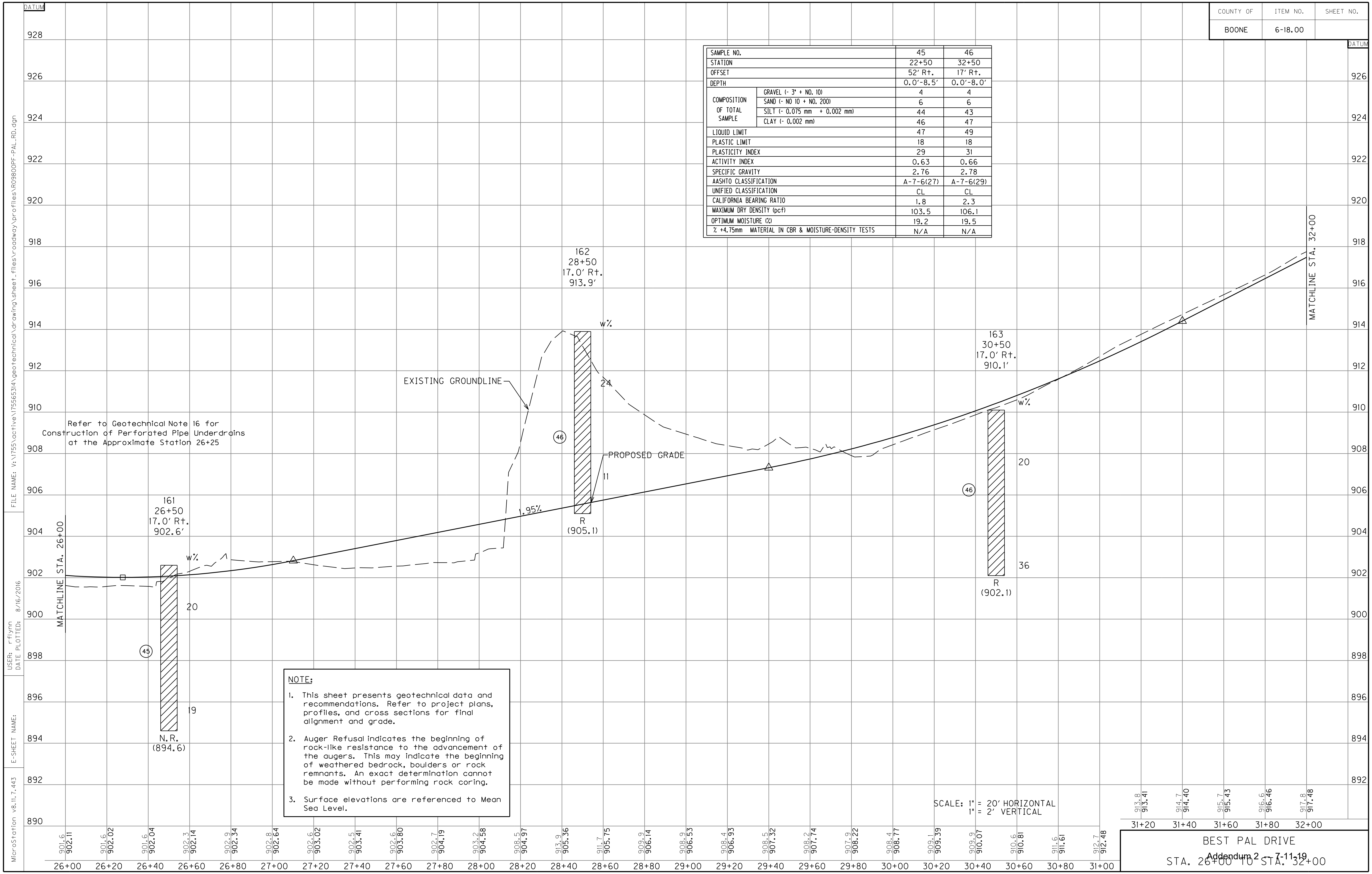
USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

BEST PAL DRIVE
Addendum 2 -- 7-11-19
STA. 20+00 TO STA. 26+00

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		45	46
STATION		22+50	32+50
OFFSET		52′ Rt.	17′ Rt.
DEPTH		0.0′-8.5′	0.0′-8.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4	4
	SAND (- NO 10 + NO. 200)	6	6
	SILT (- 0.075 mm + 0.002 mm)	44	43
	CLAY (- 0.002 mm)	46	47
LIQUID LIMIT		47	49
PLASTIC LIMIT		18	18
PLASTICITY INDEX		29	31
ACTIVITY INDEX		0.63	0.66
SPECIFIC GRAVITY		2.76	2.78
AASHTO CLASSIFICATION		A-7-6(27)	A-7-6(29)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.8	2.3
MAXIMUM DRY DENSITY (pcf)		103.5	106.1
OPTIMUM MOISTURE (%)		19.2	19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

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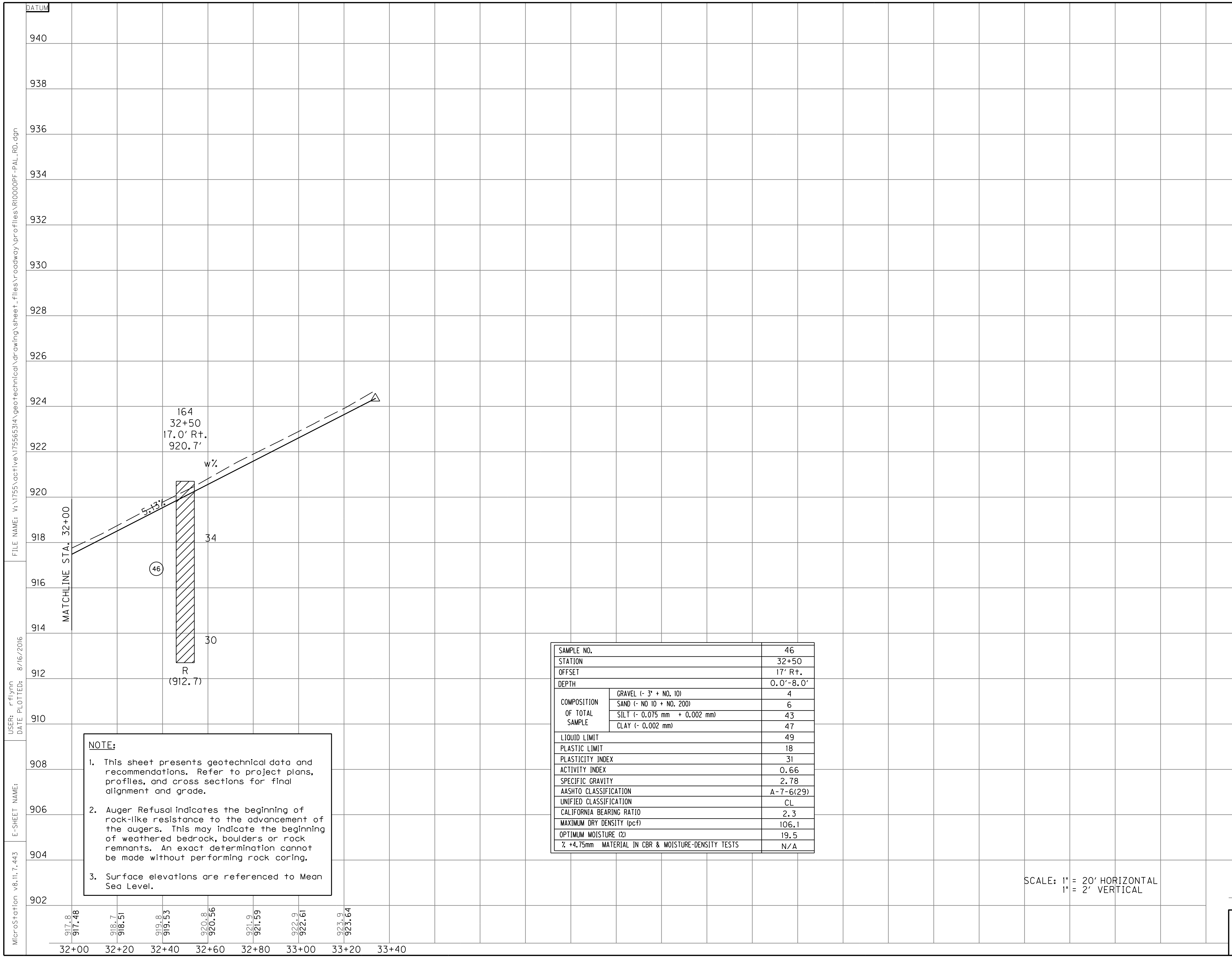
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

BEST PAL DRIVE
Addendum 2 -- 7-11-19
STA. 26+00 TO STA. 32+00

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R09800PF-PAL_RD.dgn
USER: rflynn
DATE PLOTTED: 8/16/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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SAMPLE NO.		46
STATION		32+50
OFFSET		17′ Rt.
DEPTH		0.0′-8.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	43
	CLAY (- 0.002 mm)	47
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.66
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(29)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.3
MAXIMUM DRY DENSITY (pcf)		106.1
OPTIMUM MOISTURE (%)		19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

DATUM

938
936
934
932
930
928
926
924
922
920
918
916
914
912
910
908
906
904

BEST PAL DRIVE

Addendum 2 - 7-11-19

STA. 32+00 TO STA. 33+33.79

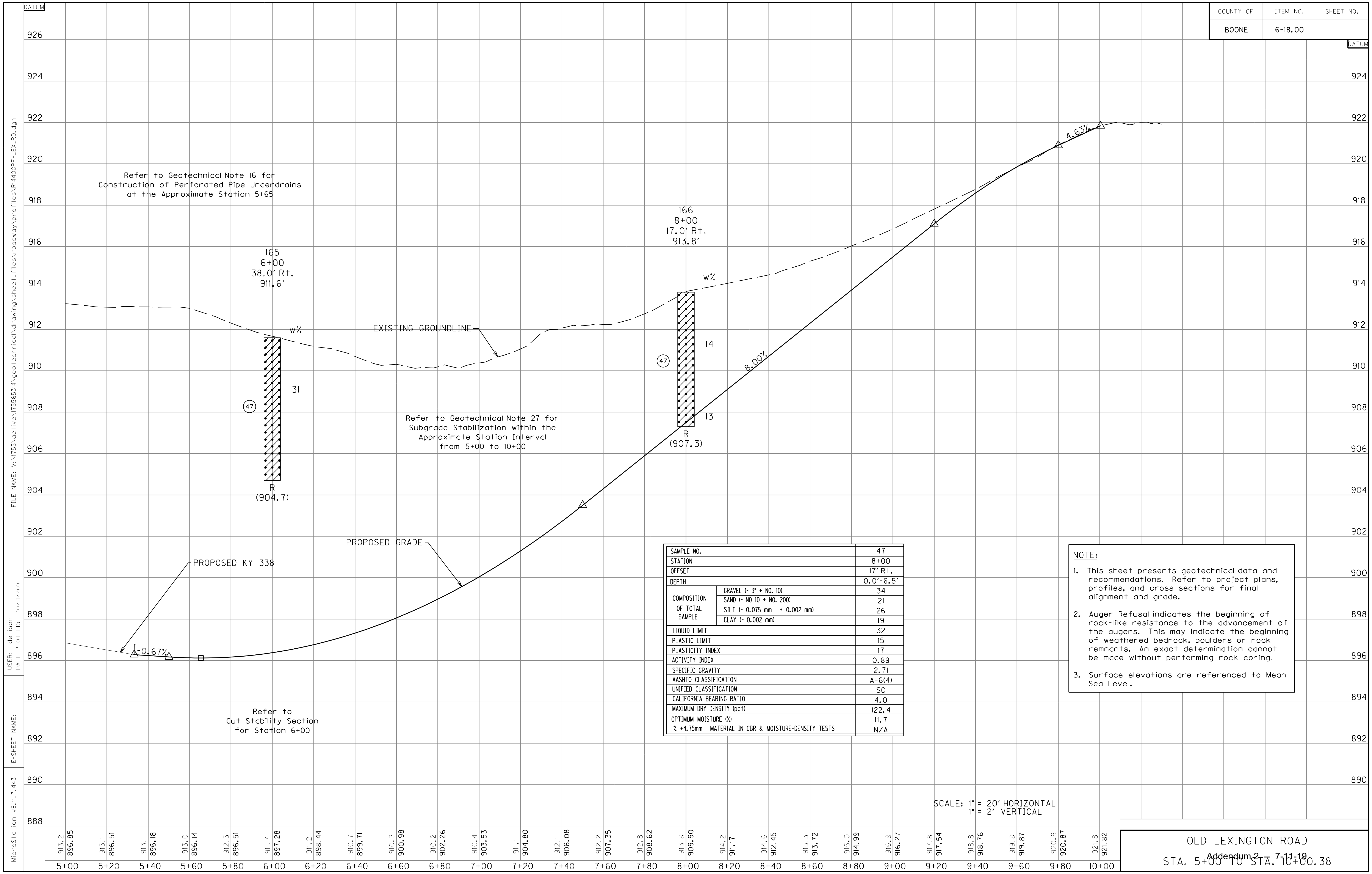
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R10000PF-PAL_RD.dgn

USER: rflynn
DATE PLOTTED: 8/16/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



5+00	913.2	896.85
5+20	913.1	896.51
5+40	913.1	896.18
5+60	913.0	896.14
5+80	912.3	896.51
6+00	911.7	897.28
6+20	911.2	898.44
6+40	910.7	899.71
6+60	910.3	900.98
6+80	910.2	902.26
7+00	910.4	903.53
7+20	911.1	904.80
7+40	912.1	906.08
7+60	912.2	907.35
7+80	912.8	908.62
8+00	913.8	909.90
8+20	914.2	911.17
8+40	914.6	912.45
8+60	915.3	913.72
8+80	916.0	914.99
9+00	916.9	916.27
9+20	917.8	917.54
9+40	918.8	918.76
9+60	919.8	919.87
9+80	920.9	920.87
10+00	921.8	921.82

SAMPLE NO.		47
STATION		8+00
OFFSET		17′ Rt.
DEPTH		0.0′-6.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	34
	SAND (- NO 10 + NO. 200)	21
	SILT (- 0.075 mm + 0.002 mm)	26
	CLAY (- 0.002 mm)	19
LIQUID LIMIT		32
PLASTIC LIMIT		15
PLASTICITY INDEX		17
ACTIVITY INDEX		0.89
SPECIFIC GRAVITY		2.71
AASHTO CLASSIFICATION		A-6(4)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		4.0
MAXIMUM DRY DENSITY (pcf)		122.4
OPTIMUM MOISTURE (%)		11.7
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

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FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\profiles\R14400PF-LEX_RD.dgn

USER: dellison
DATE PLOTTED: 10/11/2016

E-SHEET NAME:

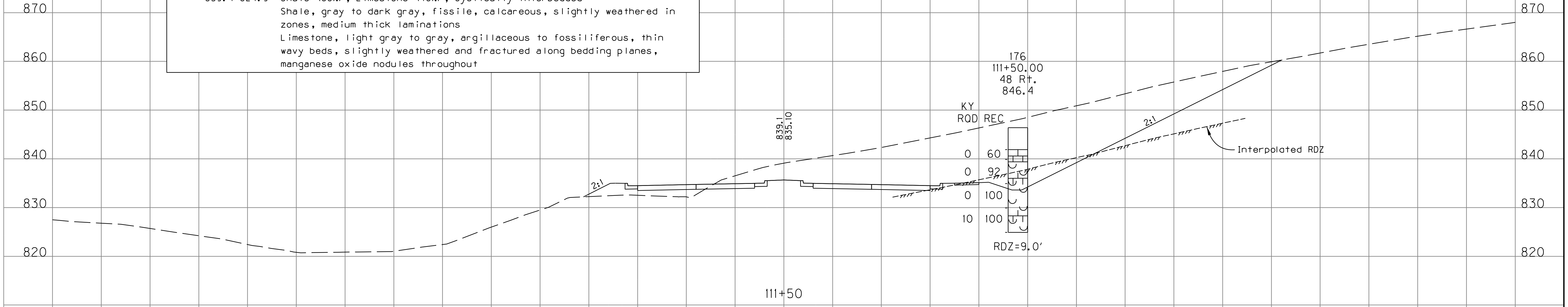
MicroStation v8.11.7.443

OLD LEXINGTON ROAD
STA. 5+00 TO STA. 10+00.38

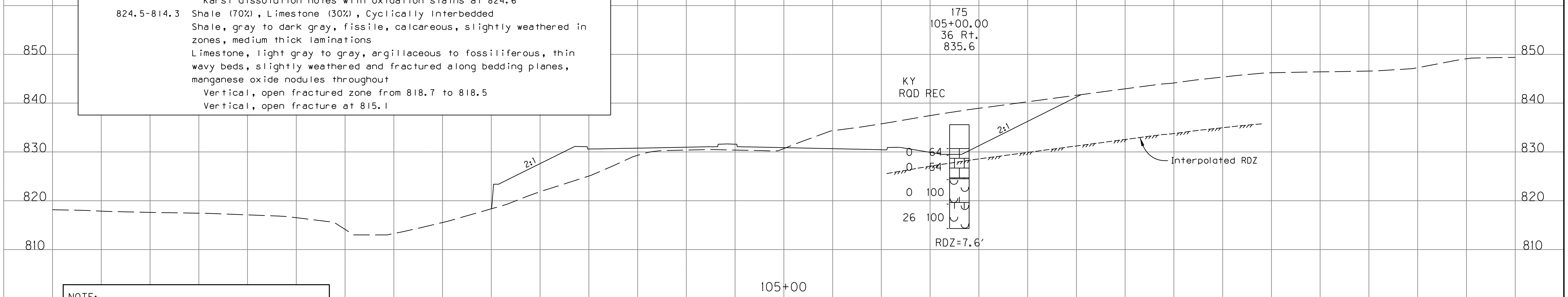
Addendum 2 – 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 107+75 to Sta. 114+75
Core Log Sta. 111+50.00, 48' Rt.
Elev. 846.4-841.9 Overburden
841.9-839.4 Limestone, gray to light brown, highly to severely weathered, fractured/fragmented with clay infilling
Highly fractured zone with moderate weathering and oxidation stains from 841.9 to 837.4
839.4-824.9 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout



Cut Limits from Sta. 99+25 to Sta. 107+25
Core Log Sta. 105+00.00, 36' Rt.
Elev. 835.6-830.7 Overburden
830.7-824.5 Limestone, gray to brown, highly weathered, contains vertical fractures, clay infilling
Karst dissolution holes with oxidation stains at 824.6
824.5-814.3 Shale (70%), Limestone (30%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Vertical, open fractured zone from 818.7 to 818.5
Vertical, open fracture at 815.1



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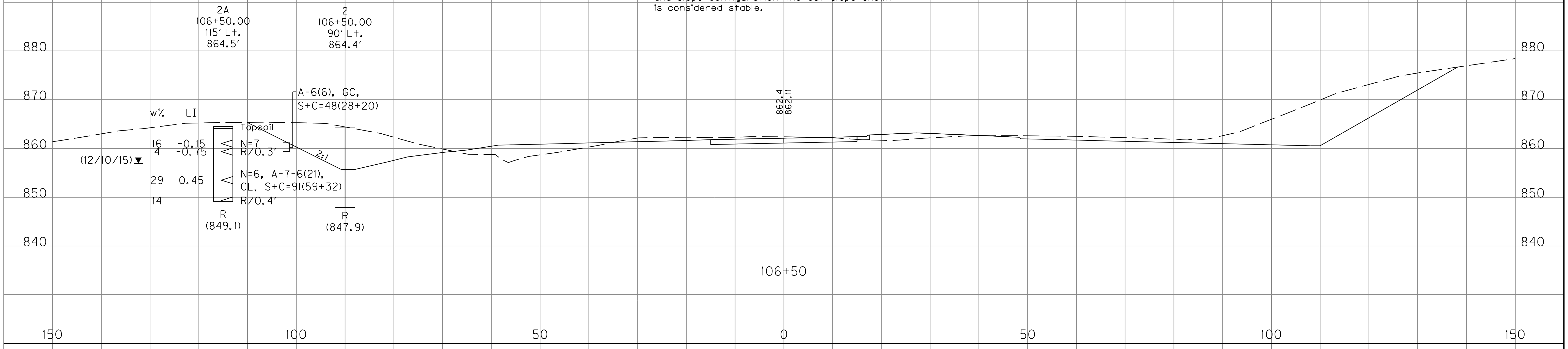
KY 338
CUT STABILITY SECTIONS
STA. 105+00 AND STA. 111+50

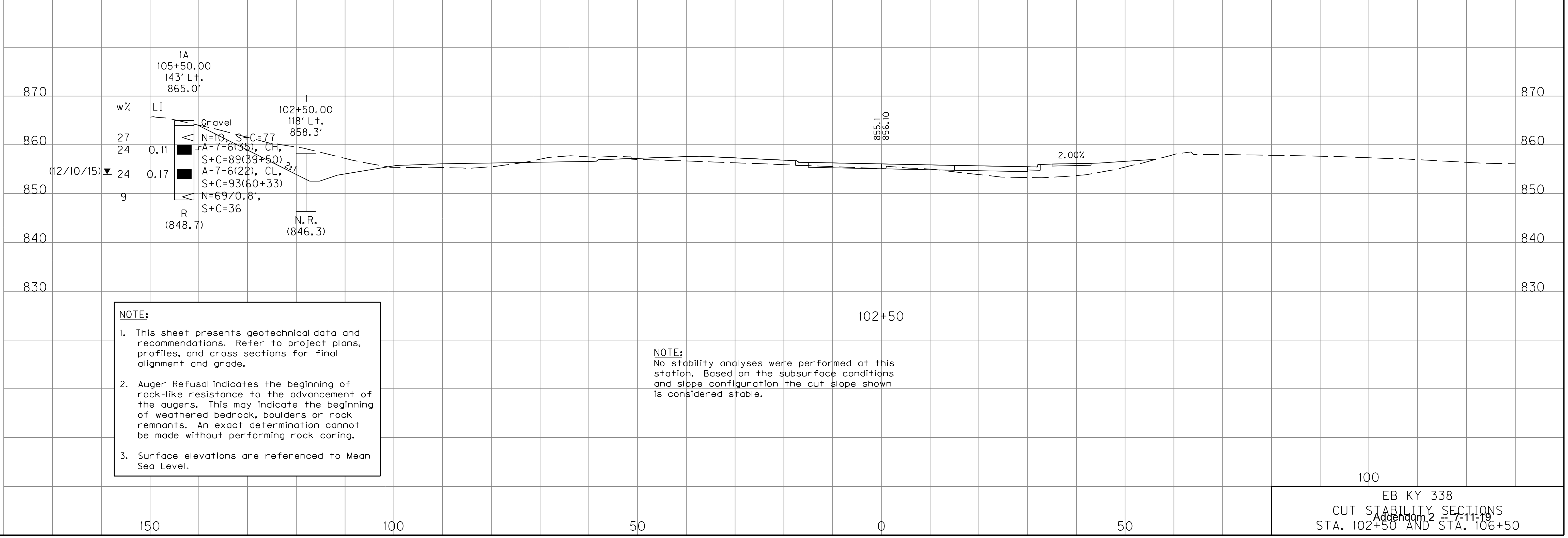
Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_ky388_2.dgn
USER: rflynn
DATE PLOTTED: 10/6/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

NOTE:
No stability analyses were performed at this station. Based on the subsurface conditions and slope configuration the cut slope shown is considered stable.





NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

NOTE:
No stability analyses were performed at this station. Based on the subsurface conditions and slope configuration the cut slope shown is considered stable.

EB KY 338
CUT STABILITY SECTIONS
STA. 102+50 AND STA. 106+50

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_eb_ky388_1.dgn

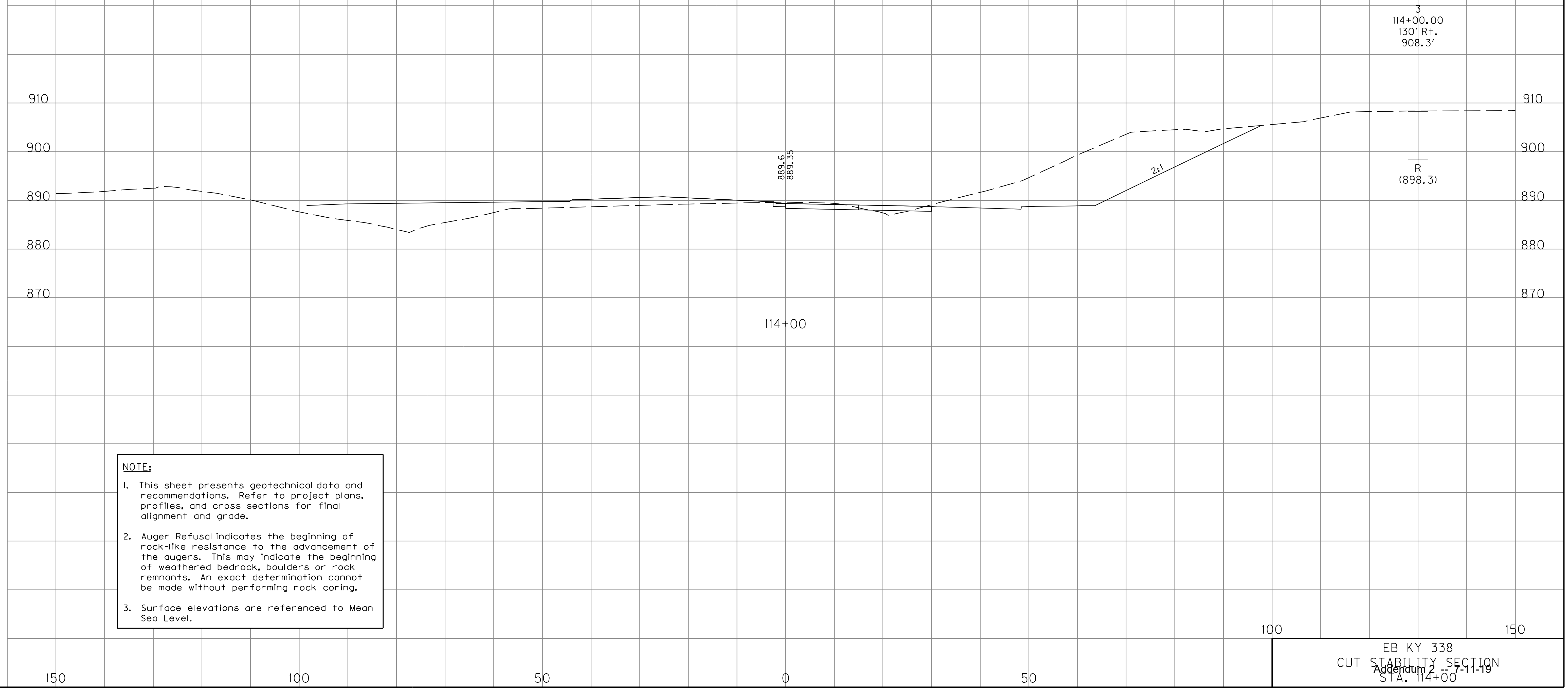
USER: rflynn
DATE PLOTTED: 10/6/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

NOTE:
No stability analyses were performed at this station. Based on the subsurface conditions and slope configuration the cut slope shown is considered stable.



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

EB KY 338
CUT STABILITY SECTION
STA. 114+00

Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_eb_ky388_2.dgn

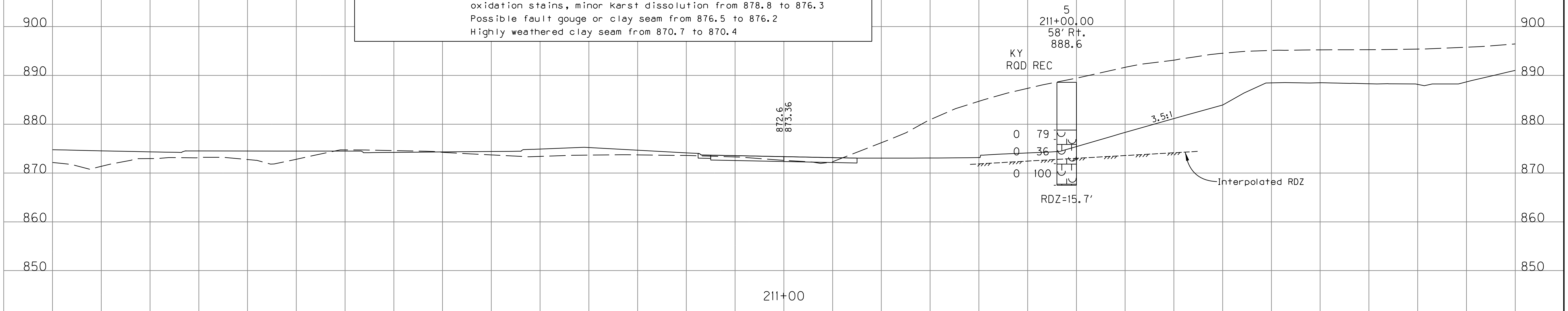
USER: rflynn
DATE PLOTTED: 10/6/2016

E-SHEET NAME:

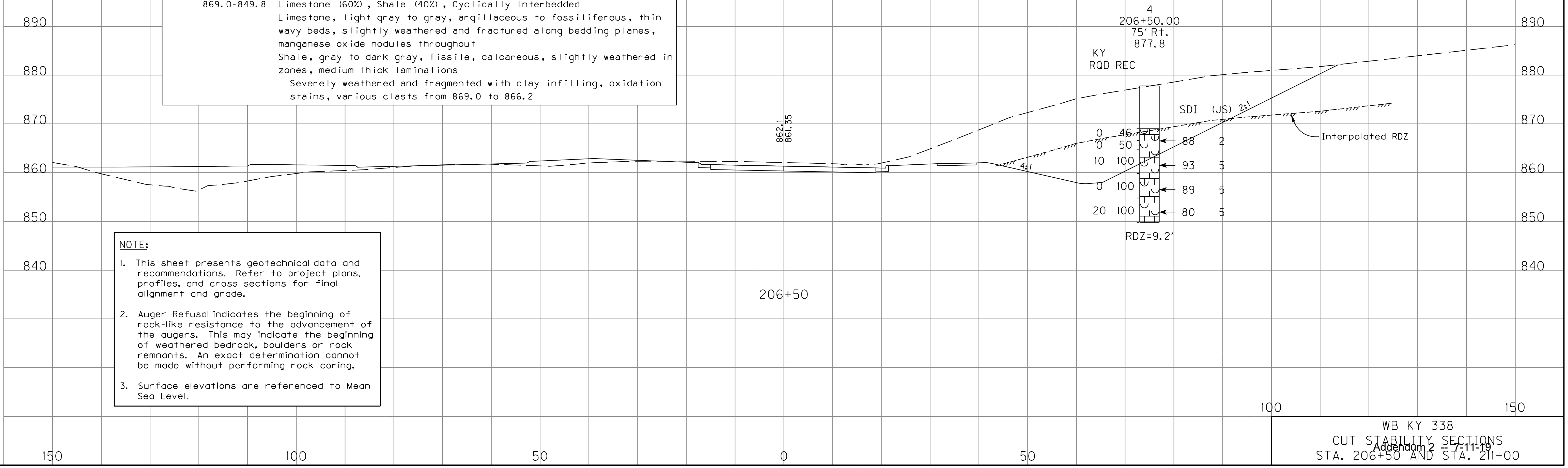
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 210+25 to Sta. 216+36
Core Log Sta. 211+00.00, 58′ Rt.
Elev. 888.6-878.8 Overburden
878.8-867.5 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Moderately weathered and slightly fractured with clay infilling, oxidation stains, minor karst dissolution from 878.8 to 876.3
Possible fault gouge or clay seam from 876.5 to 876.2
Highly weathered clay seam from 870.7 to 870.4



Cut Limits from Sta. 202+75 to Sta. 207+75
Core Log Sta. 206+50.00, 75′ Rt.
Elev. 877.8-869.0 Overburden
869.0-849.8 Limestone (60%), Shale (40%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Severely weathered and fragmented with clay infilling, oxidation stains, various clasts from 869.0 to 866.2



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

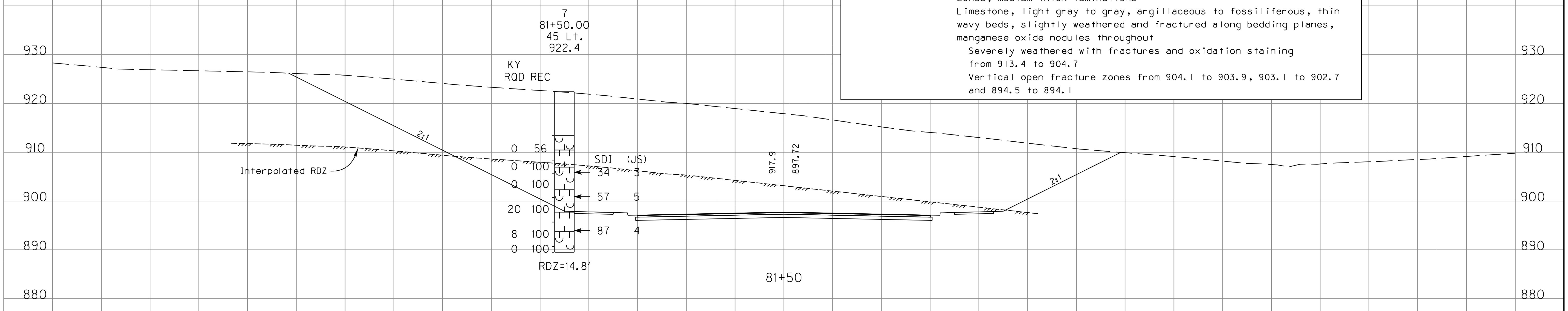
WB KY 338
CUT STABILITY SECTIONS
STA. 206+50 AND STA. 211+00

Addendum 2 - 7-11-19

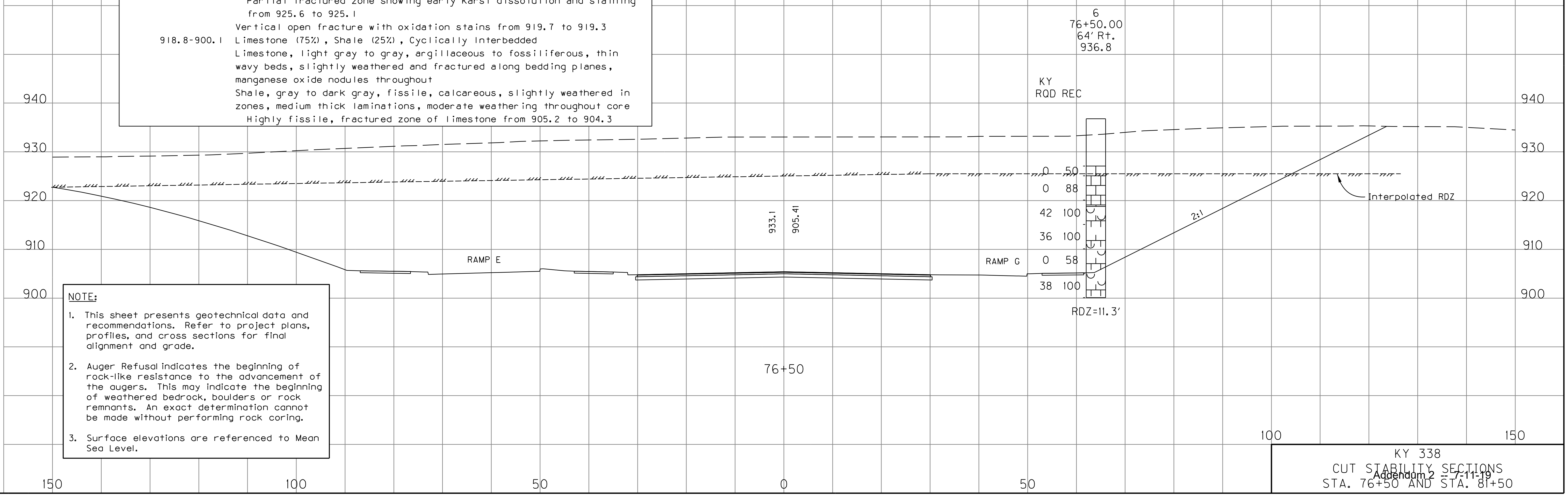
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_wb_ky388_1.dgn
USER: rflynn
DATE PLOTTED: 10/6/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 69+75 to Sta. 88+25
Core Log Sta. 81+50.00, 45′ Lt.
Elev. 922.4-913.4 Overburden
913.4-889.5 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Severely weathered with fractures and oxidation staining from 913.4 to 904.7
Vertical open fracture zones from 904.1 to 903.9, 903.1 to 902.7 and 894.5 to 894.1



Cut Limits from Sta. 69+75 to Sta. 88+25
Core Log Sta. 76+50.00, 64′ Rt.
Elev. 936.8-927.1 Overburden
927.1-918.8 Limestone, light gray to brown, finely crystalline, highly to severely weathered, oxidation staining, infilled zones of clay and various intraclasts
Partial fractured zone showing early karst dissolution and staining from 925.6 to 925.1
Vertical open fracture with oxidation stains from 919.7 to 919.3
918.8-900.1 Limestone (75%), Shale (25%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations, moderate weathering throughout core
Highly fissile, fractured zone of limestone from 905.2 to 904.3



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

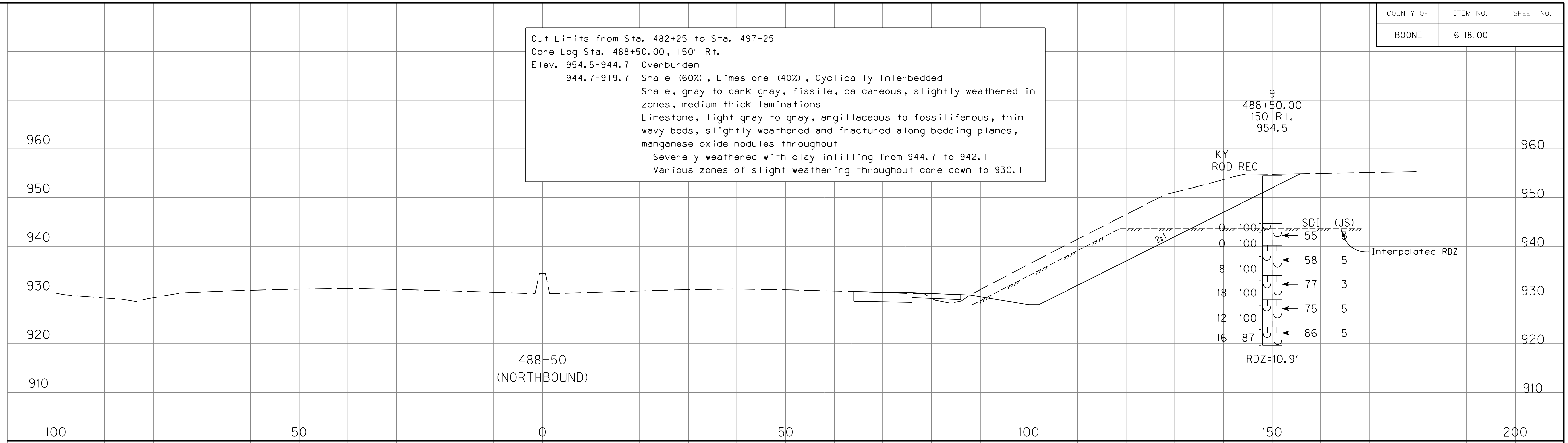
KY 338
CUT STABILITY SECTIONS
STA. 76+50 AND STA. 81+50

Addendum 2 - 7-11-19

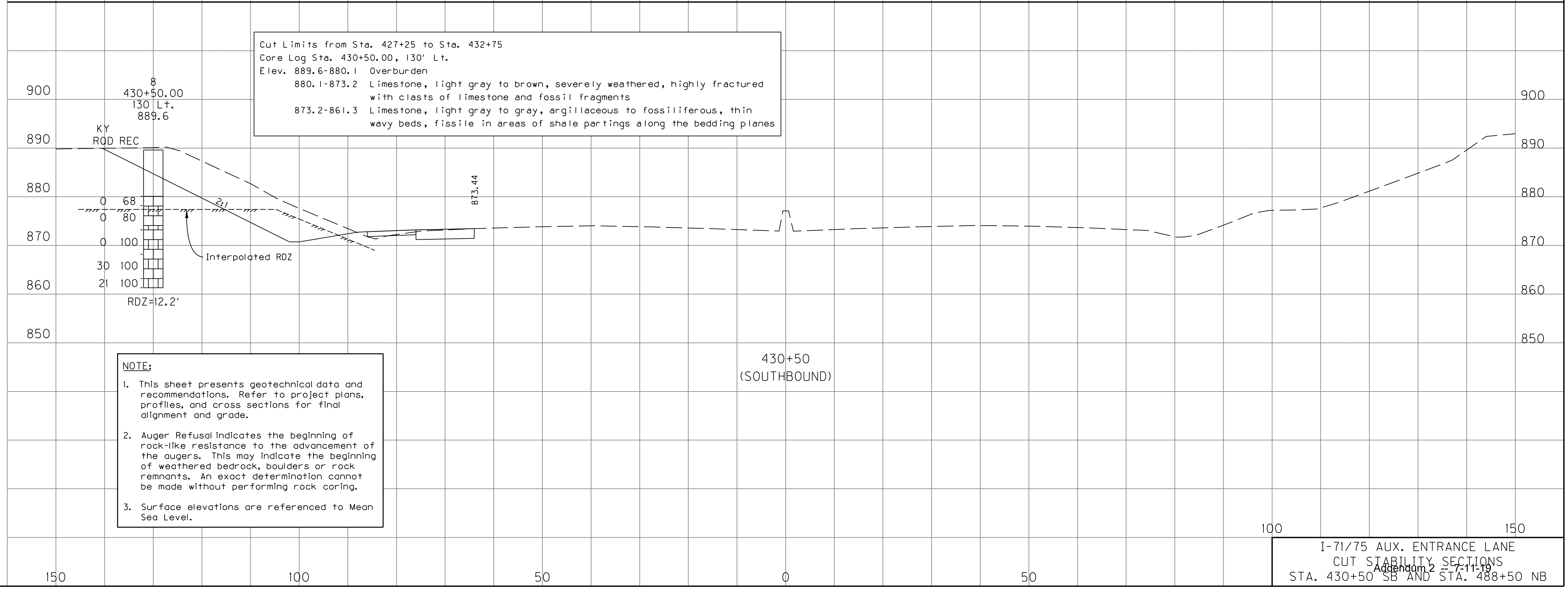
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_ky388_1.dgn
USER: rflynn
DATE PLOTTED: 10/6/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 482+25 to Sta. 497+25
Core Log Sta. 488+50.00, 150' Rt.
Elev. 954.5-944.7 Overburden
944.7-919.7 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Severely weathered with clay infilling from 944.7 to 942.1
Various zones of slight weathering throughout core down to 930.1



Cut Limits from Sta. 427+25 to Sta. 432+75
Core Log Sta. 430+50.00, 130' Lt.
Elev. 889.6-880.1 Overburden
880.1-873.2 Limestone, light gray to brown, severely weathered, highly fractured with clasts of limestone and fossil fragments
873.2-861.3 Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, fissile in areas of shale partings along the bedding planes



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

I-71/75 AUX. ENTRANCE LANE
CUT STABILITY SECTIONS
STA. 430+50 SB AND STA. 488+50 NB

Addendum 2 -- 7-11-19

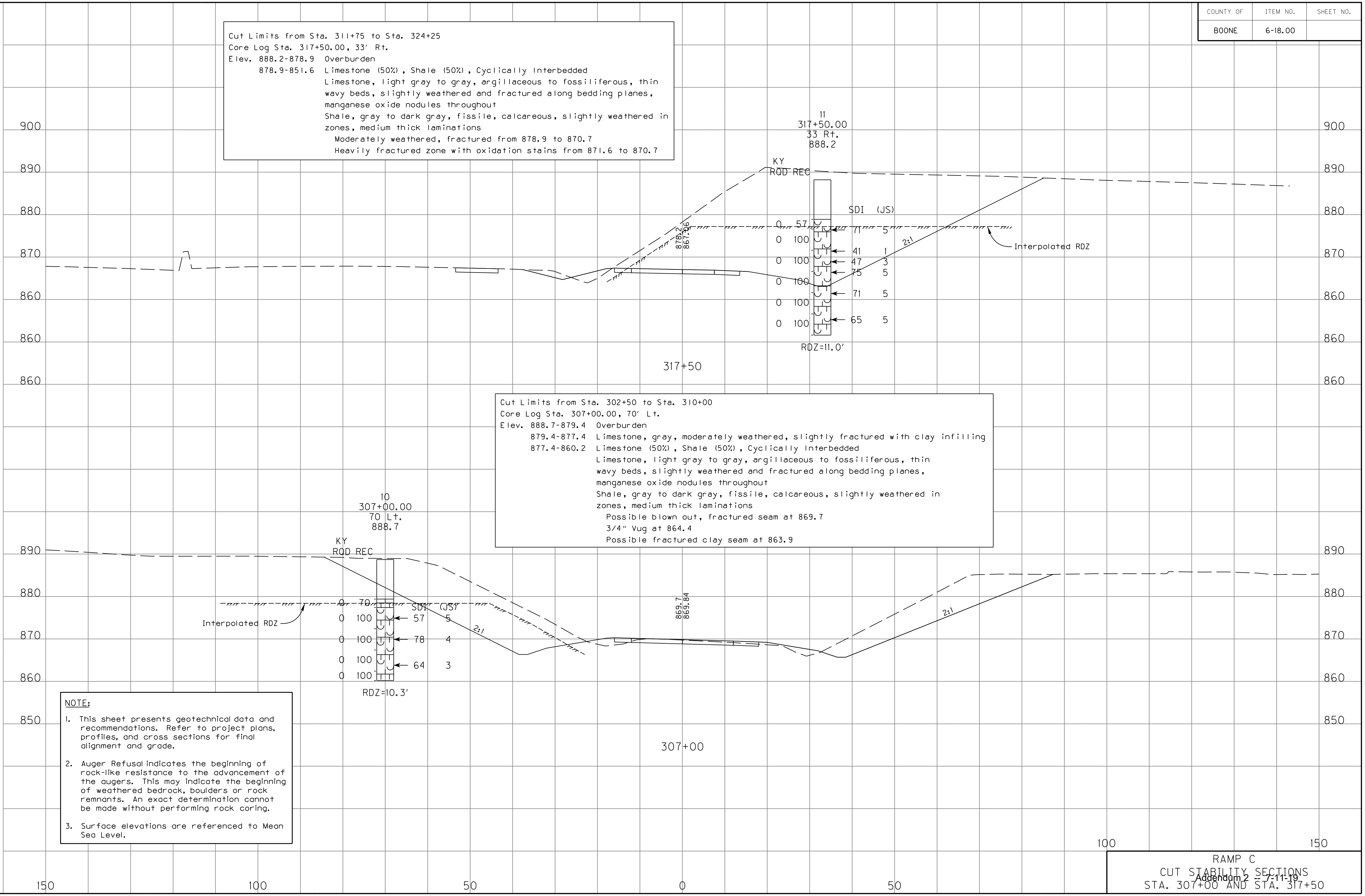
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_I71-75_accel_1.dgn

USER: rflynn
DATE PLOTTED: 10/6/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Cut Limits from Sta. 311+75 to Sta. 324+25
Core Log Sta. 317+50.00, 33' Rt.
Elev. 888.2-878.9 Overburden
878.9-851.6 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Moderately weathered, fractured from 878.9 to 870.7
Heavily fractured zone with oxidation stains from 871.6 to 870.7

Cut Limits from Sta. 302+50 to Sta. 310+00
Core Log Sta. 307+00.00, 70' Lt.
Elev. 888.7-879.4 Overburden
879.4-877.4 Limestone, gray, moderately weathered, slightly fractured with clay infilling
877.4-860.2 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Possible blown out, fractured seam at 869.7
3/4" Vug at 864.4
Possible fractured clay seam at 863.9

NOTE:

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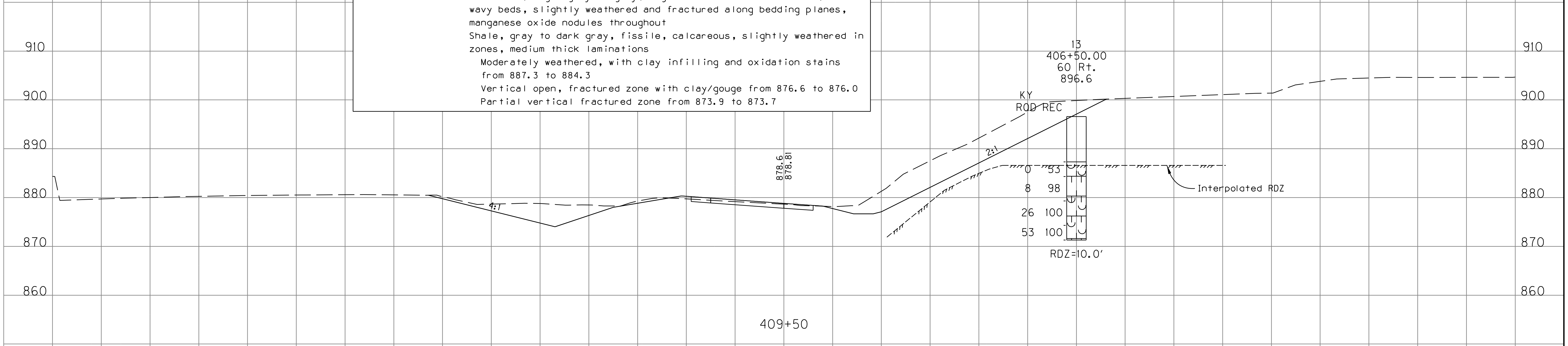
3. Surface elevations are referenced to Mean Sea Level.

RAMP C
CUT STABILITY SECTIONS
Addendum 2 -- 7-11-19
STA. 307+00 AND STA. 317+50

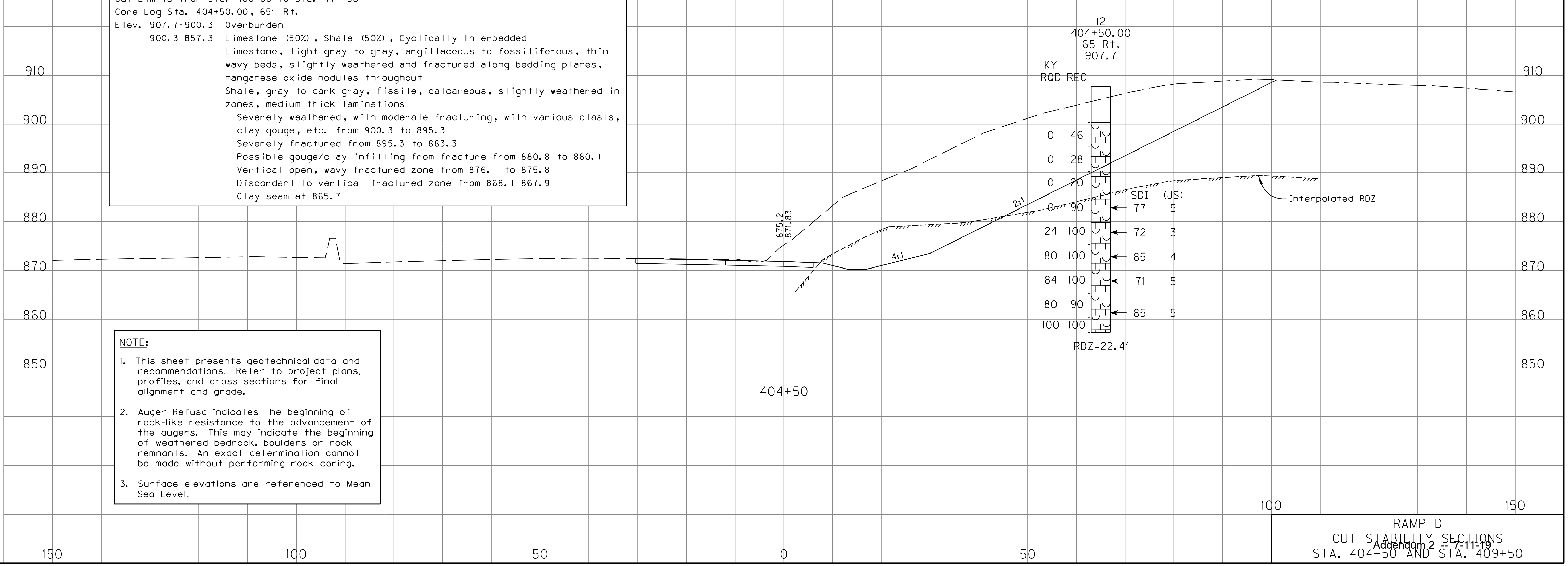
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_I71-75_rmpc_1.dgn
USER: rflynn
DATE PLOTTED: 10/6/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 406+50.00, 60' Rt.
Elev. 896.6-887.3 Overburden
887.3-871.3 Limestone (60%), Shale (40%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Moderately weathered, with clay infilling and oxidation stains from 887.3 to 884.3
Vertical open, fractured zone with clay/gouge from 876.6 to 876.0
Partial vertical fractured zone from 873.9 to 873.7



Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 404+50.00, 65' Rt.
Elev. 907.7-900.3 Overburden
900.3-857.3 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Severely weathered, with moderate fracturing, with various clasts, clay gouge, etc. from 900.3 to 895.3
Severely fractured from 895.3 to 883.3
Possible gouge/clay infilling from fracture from 880.8 to 880.1
Vertical open, wavy fractured zone from 876.1 to 875.8
Discordant to vertical fractured zone from 868.1 867.9
Clay seam at 865.7



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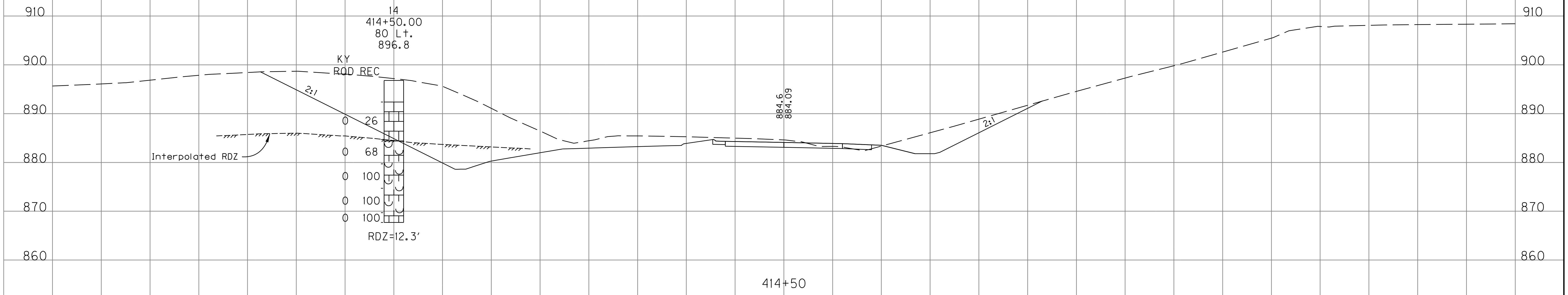
RAMP D
CUT STABILITY SECTIONS
STA. 404+50 AND STA. 409+50

Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_I71-75_rmpd_1.dgn
USER: rflynn
DATE PLOTTED: 10/6/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 414+50.00, 80' Lt.
Elev. 896.8-892.4 Overburden
892.4-884.4 Limestone, light gray to gray, finely crystalline to slightly fossiliferous, thin wavy bedding, slightly weathered, moderately to severely fractured/fragmented with clay infilling
884.4-867.7 Limestone (55%), Shale (45%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations,
Open fractured zone from 880.0 to 879.7
3/4" Vug at 873.4
Large clay seam from 872.2 to 871.9
Partial open fracture at 869.5



FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_I71-75_rmpd_2.dgn

USER: rflynn
DATE PLOTTED: 10/6/2016

E-SHEET NAME:

MicroStation v8.11.7.443

NOTE:

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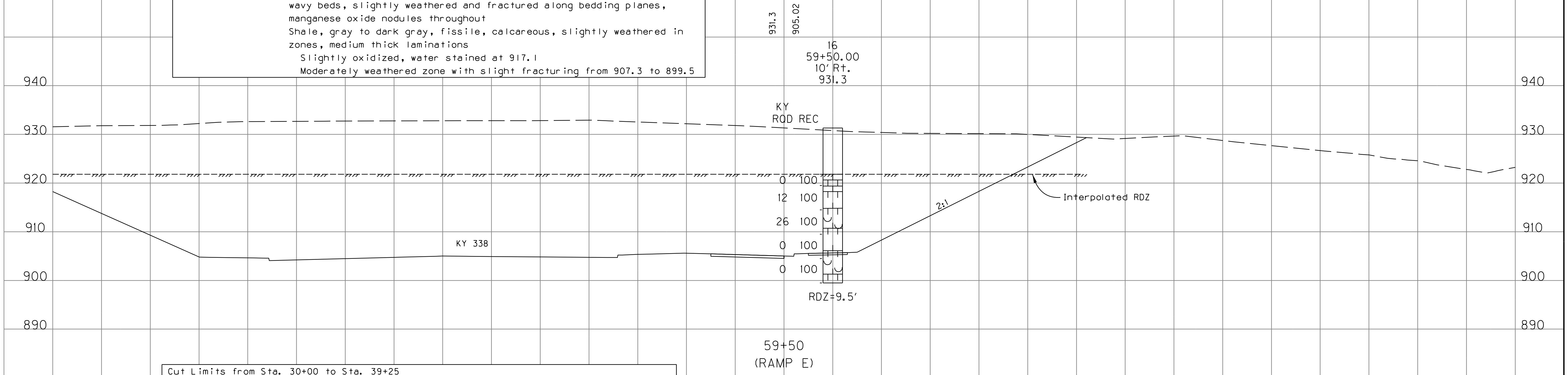
3. Surface elevations are referenced to Mean Sea Level.

RAMP D
CUT STABILITY SECTION
STA. 414+50

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 55+75 to Sta. 60+00
Core Log Sta. 59+50.00, 10' Rt.
Elev. 931.3-921.8 Overburden
921.8-919.4 Limestone, gray to light brown, argillaceous. highly weathered with clay infilling
919.4-899.5 Limestone (80%), Shale (20%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Slightly oxidized, water stained at 917.1
Moderately weathered zone with slight fracturing from 907.3 to 899.5

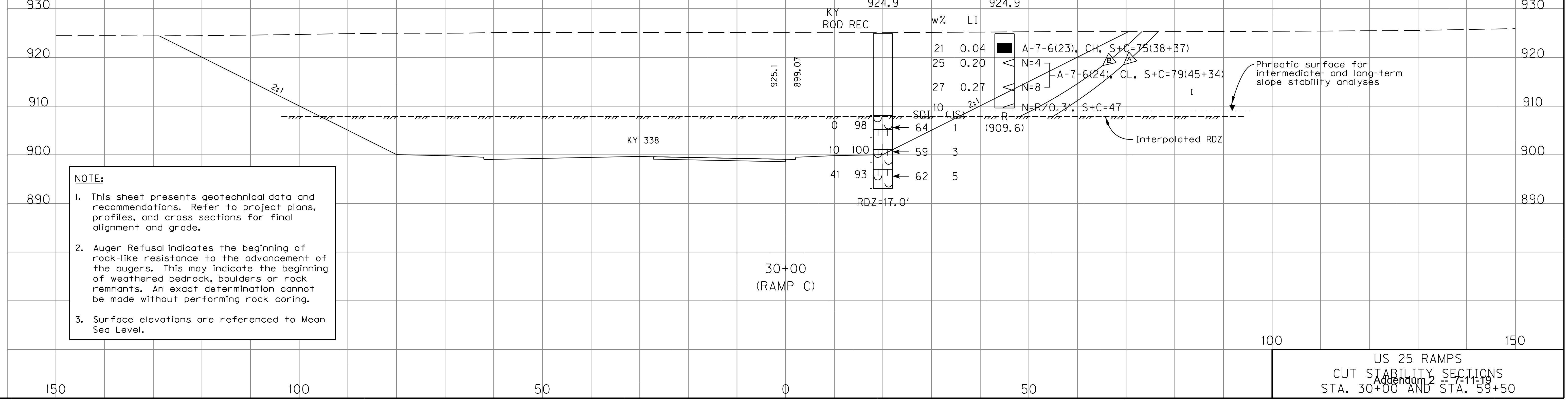


59+50
(RAMP E)

Cut Limits from Sta. 30+00 to Sta. 39+25
Core Log Sta. 30+00.00, 20' Rt.
Elev. 924.9-908.1 Overburden
908.1-893.1 Shale(70%), Limestone (30%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Highly weathered with clay infilling from 908.1 to 905.7
Slight to moderate weathering within zone from 905.7 to 902.4

FACTORS OF SAFETY		
INTERMEDIATE TERM	A	2.5
LONG TERM	B	1.5

ESTIMATED SOIL STRENGTH PARAMETERS	
SOIL	I
INTERMEDIATE TERM	γ = 120 pcf c = 270 psf ø = 28°
LONG TERM	γ = 120 pcf c̄ = 54 psf ø̄ = 28°



30+00
(RAMP C)

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

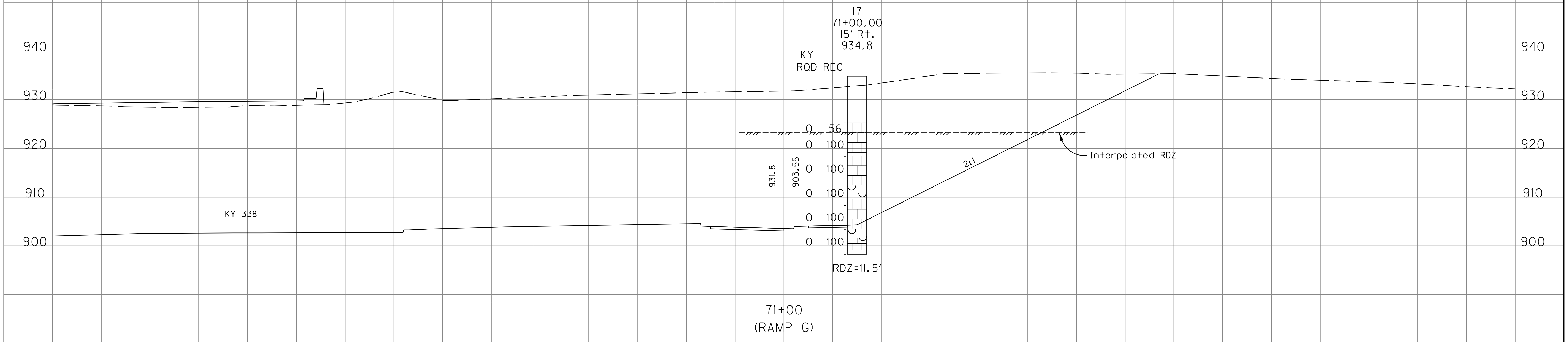
US 25 RAMPS
CUT STABILITY SECTIONS
STA. 30+00 AND STA. 59+50

Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_US25_rmps_1.dgn
USER: rflynn
DATE PLOTTED: 10/6/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 70+00 to Sta. 75+75
Core Log Sta. 71+00.00, 15′ Rt.
Elev. 934.8-925.2 Overburden
925.2-919.2 Limestone, gray to brown, highly weathered and fractured with clay infilling
Vertical, open fractured zone from 920.6 to 920.1
Discordant fracture to bedding plane at 919.4
919.2-898.3 Limestone (80%), Shale (20%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Moderately to highly weathered zone from 910.0 to 906.3



71+00
(RAMP G)

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

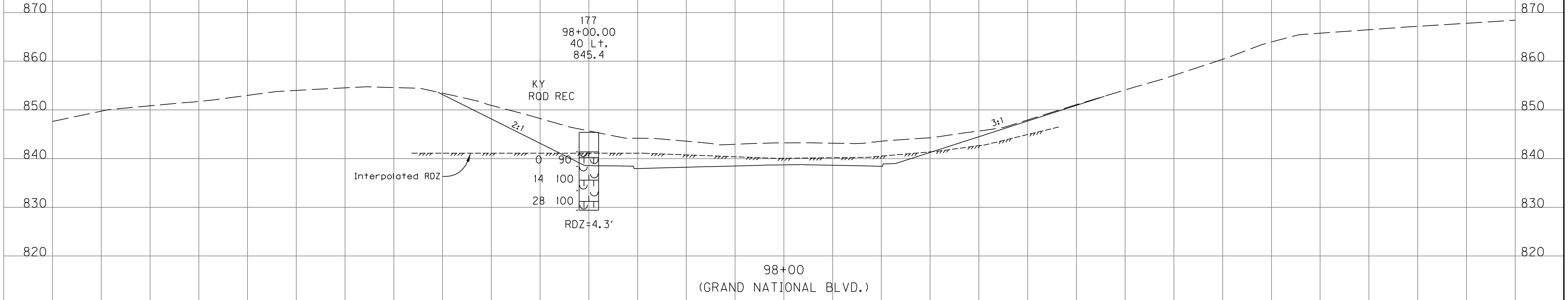
US 25 RAMPS
CUT STABILITY SECTIONS
STA. 71+00

Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_US25_rmps_2.dgn
USER: rflynn
DATE PLOTTED: 10/6/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 95+25 to Sta. 99+29
Core Log Sta. 98+00.00, 40′ Lt.
Elev. 845.4-841.4 Overburden
841.4-829.4 Shale (55%), Limestone (45%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout



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150 100 50 0 50 100 150

KY 338 SIDE ROAD
CUT STABILITY SECTION
STA. 98+00

Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_side_roads_2.dgn

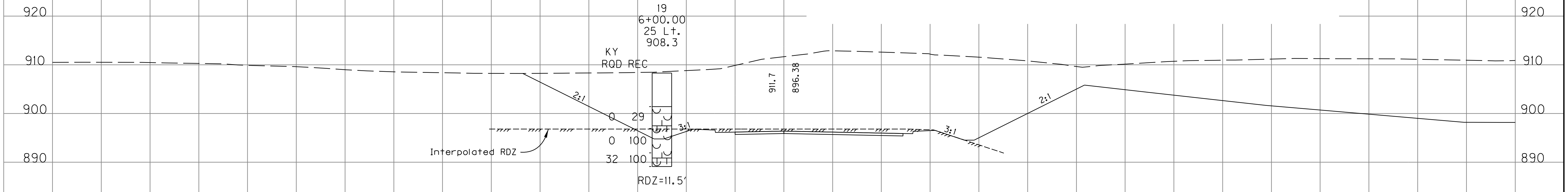
USER: rflynn
DATE PLOTTED: 10/6/2016

E-SHEET NAME:

MicroStation v8.11.7.443

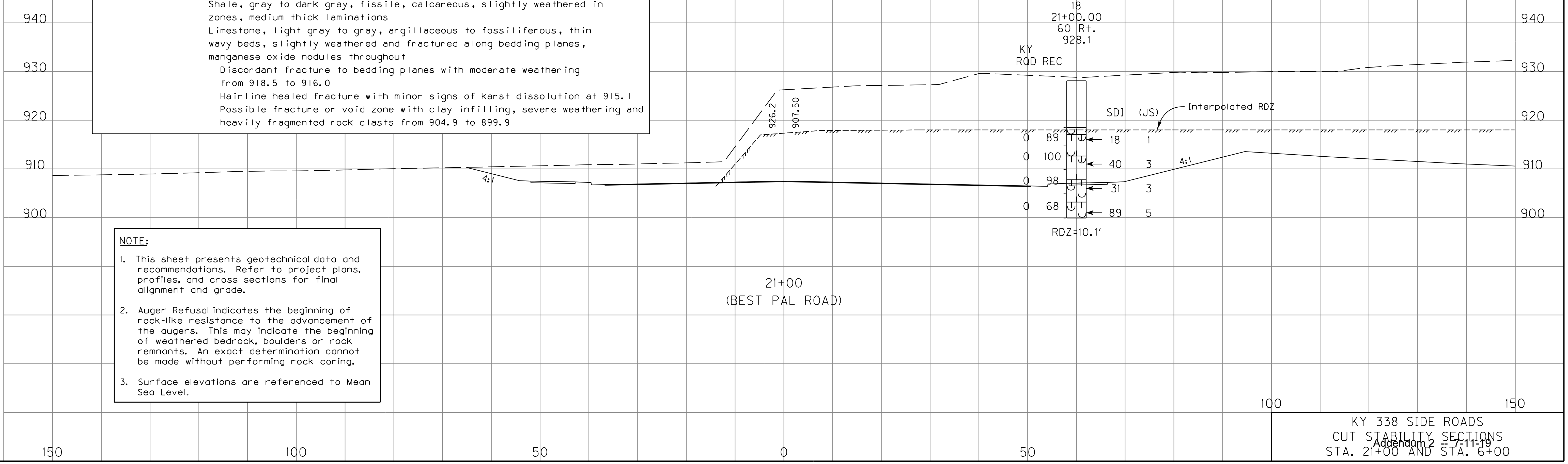
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 5+25 to Sta. 10+00
Core Log Sta. 6+00.00, 25′ Lt.
Elev. 908.3-901.4 Overburden
901.4-889.1 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Slight to moderate weathering with clay infilling and minor karst dissolution from 901.4 to 896.8
Large clay filled void from 896.3 to 895.6
Oxidation stains along bedding the planes from 894.5 to 894.3
Vertical, open fractured zone with slight weathering and oxidation stains from 892.6 to 892.4 and 890.9 to 890.6



6+00
(OLD LEXINGTON ROAD)

Cut Limits from Sta. 20+50 to Sta. 24+25
Core Log Sta. 21+00.00, 60′ Rt.
Elev. 928.1-918.5 Overburden
918.5-889.9 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Discordant fracture to bedding planes with moderate weathering from 918.5 to 916.0
Hairline healed fracture with minor signs of karst dissolution at 915.1
Possible fracture or void zone with clay infilling, severe weathering and heavily fragmented rock clasts from 904.9 to 899.9



21+00
(BEST PAL ROAD)

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

KY 338 SIDE ROADS
CUT STABILITY SECTIONS
STA. 21+00 AND STA. 6+00

Addendum 2 - 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshtc_side_roads_1.dgn

USER: rflynn
DATE PLOTTED: 10/6/2016

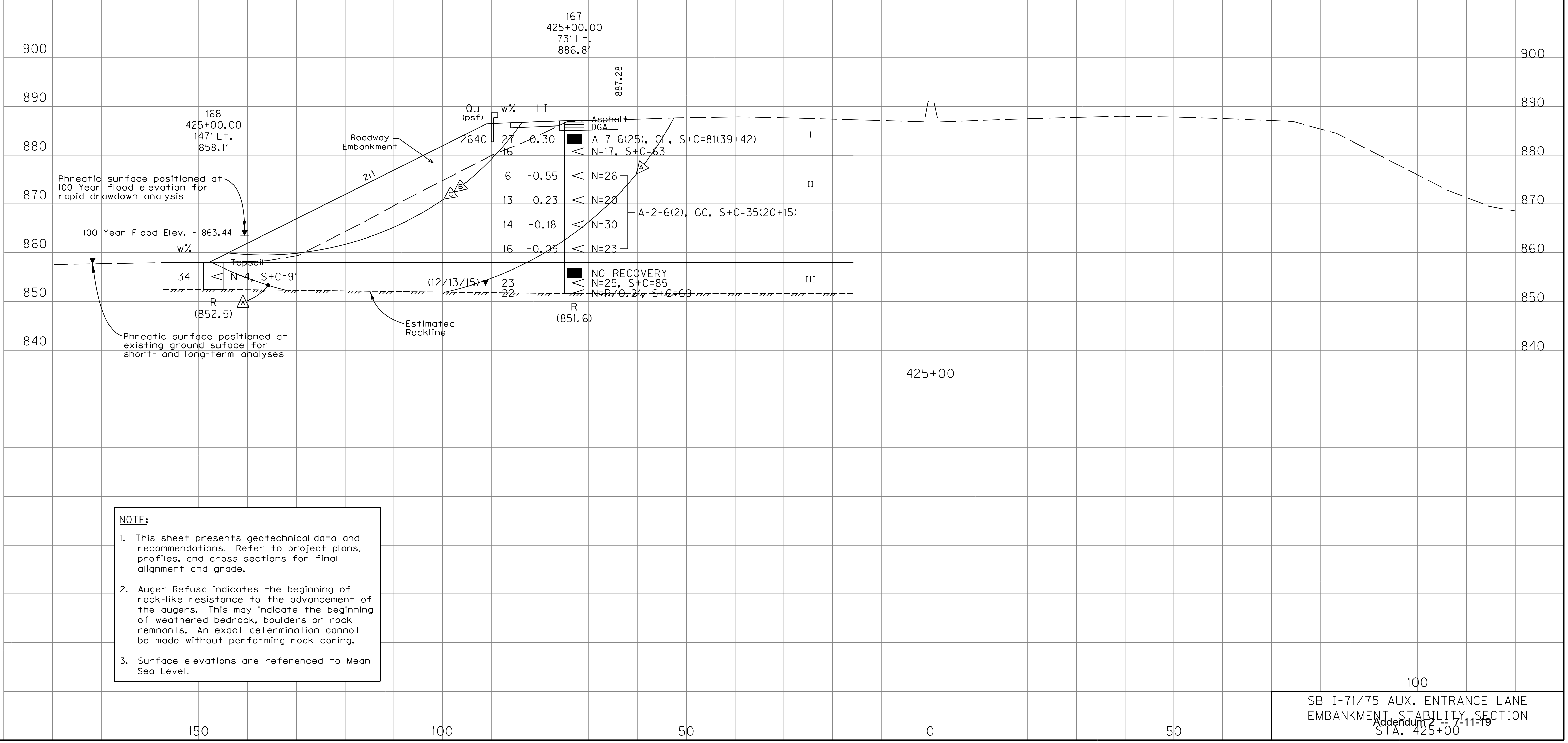
E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

ESTIMATED SOIL STRENGTH PARAMETERS				
SOIL	I	II	III	ROADWAY EMBANKMENT
SHORT TERM	γ = 120 pcf c = 1300 psf ϕ = 0°	γ = 133 pcf c = 0 psf ϕ = 34°	γ = 120 pcf c = 600 psf ϕ = 0°	γ = 125 pcf c = 1000 psf ϕ = 0°
LONG TERM AND RAPID DRAWDOWN	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{\phi}$ = 28°	γ = 133 pcf $\bar{c}$ = 0 psf $\bar{\phi}$ = 34°	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{\phi}$ = 28°	γ = 125 pcf $\bar{c}$ = 150 psf $\bar{\phi}$ = 25°

FACTORS OF SAFETY		
SHORT TERM	A	1.2
LONG TERM	B	1.5
RAPID DRAWDOWN	C	1.4



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SB I-71/75 AUX. ENTRANCE LANE
EMBANKMENT STABILITY SECTION
STA. 425+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshte_I71-75_ACCEL_1.dgn

USER: dellison
DATE PLOTTED: 10/11/2016

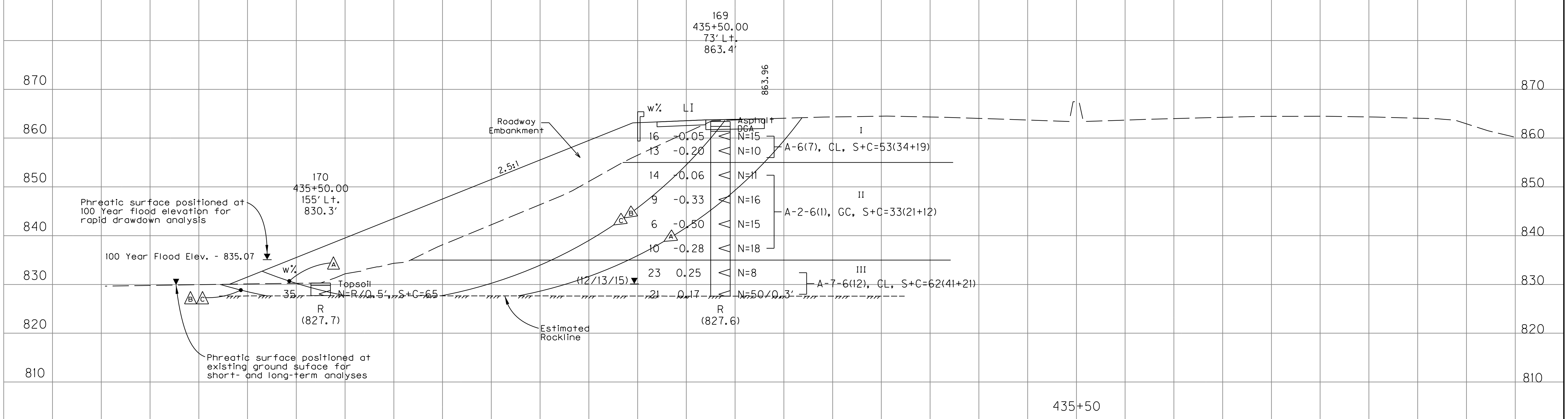
E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

ESTIMATED SOIL STRENGTH PARAMETERS				
SOIL	I	II	III	ROADWAY EMBANKMENT
SHORT TERM	γ = 120 pcf c = 1300 psf ϕ = 0°	γ = 133 pcf c = 0 psf ϕ = 34°	γ = 120 pcf c = 600 psf ϕ = 0°	γ = 125 pcf c = 1000 psf ϕ = 0°
LONG TERM AND RAPID DRAWDOWN	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{\phi}$ = 28°	γ = 133 pcf $\bar{c}$ = 0 psf $\bar{\phi}$ = 34°	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{\phi}$ = 28°	γ = 125 pcf $\bar{c}$ = 150 psf $\bar{\phi}$ = 25°

FACTORS OF SAFETY		
SHORT TERM	A	1.4
LONG TERM	B	1.7
RAPID DRAWDOWN	C	1.7



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SB I-71/75 AUX. ENTRANCE LANE
EMBANKMENT STABILITY SECTION
STA. 435+50

Addendum 2 -- 7-11-19

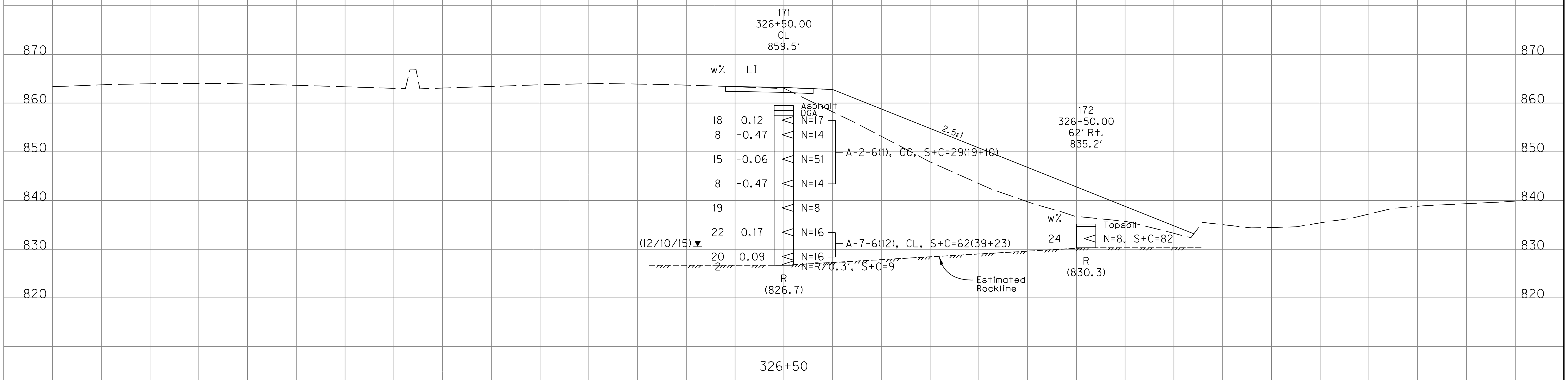
FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshte_I71-75_ACCEL_2.dgn

USER: dellison
DATE PLOTTED: 10/11/2016

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

NOTE:

This section is outside of the project limits but is still included for completeness. For stability analyses information, refer to SB I-71\I-75 Aux. Entrance Lane Embankment Stability Section Sta. 435+50, as this is the same section.

RAMP C
EMBANKMENT STABILITY SECTION
STA. 326+50

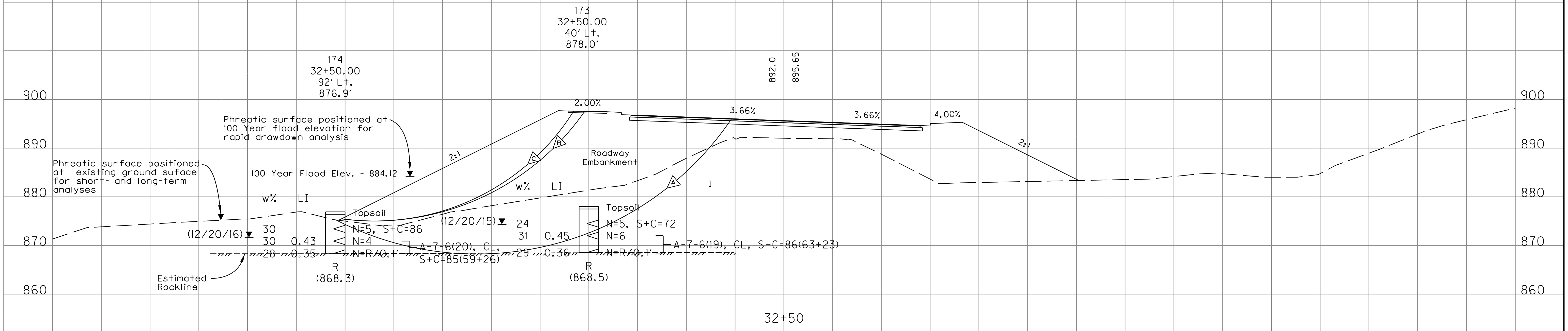
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshte_I71-75_RMPC_1.dgn
USER: dellison
DATE PLOTTED: 10/11/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

ESTIMATED SOIL STRENGTH PARAMETERS		
SOIL	I	ROADWAY EMBANKMENT
SHORT TERM	γ = 120 pcf c = 600 psf ø = 0°	γ = 125 pcf c = 1000 psf ø = 0°
LONG TERM AND RAPID DRAWDOWN	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{ø}$ = 28°	γ = 125 pcf $\bar{c}$ = 150 psf $\bar{ø}$ = 25°

FACTORS OF SAFETY		
SHORT TERM	A	1.6
LONG TERM	B	1.6
RAPID DRAWDOWN	C	1.3



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

US 25
EMBANKMENT STABILITY SECTION
STA. 32+50

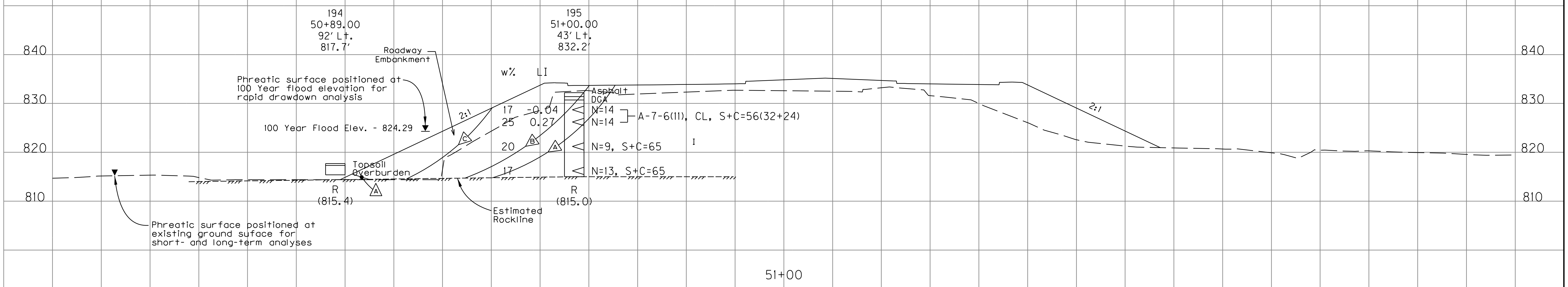
Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshte_US25_1.dgn
USER: dellison
DATE PLOTTED: 10/11/2016
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

ESTIMATED SOIL STRENGTH PARAMETERS		
SOIL	I	ROADWAY EMBANKMENT
SHORT TERM	γ = 120 pcf c = 1200 psf ø = 0°	γ = 125 pcf c = 1000 psf ø = 0°
LONG TERM AND RAPID DRAWDOWN	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{ø}$ = 28°	γ = 125 pcf $\bar{c}$ = 150 psf $\bar{ø}$ = 25°

FACTORS OF SAFETY		
SHORT TERM	A	4.0
LONG TERM	B	1.9
RAPID DRAWDOWN	C	1.5



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

TRIPLE CROWN BLVD
EMBANKMENT STABILITY SECTION
STA. 51+00

Addendum 2 -- 7-11-19

FILE NAME: V:\1755\active\175565314\geotechnical\drawing\sheet_files\roadway\sections\xshte_triple_crown_blvd_1.dgn

USER: dellison
DATE PLOTTED: 10/11/2016

E-SHEET NAME:

MicroStation v8.11.7.443

APPENDIX C
LABORATORY SOIL TESTING DATA

SUMMARY OF DISTURBED SOIL TESTING

JOB NAME: I-75/71 and KY 338 Interchange
Stantec Job No.: 175565314
Date: 6/28/2016
COUNTY: Boone County, Kentucky
ITEM NO: Item No. 6-18.00
Submitted By: A. Crace

Sample Identification					Classification Testing						Standard Proctor		
Hole No.	Station	Offset	Sample Depth (ft)	Sample Type	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Unified	Textural	AASHTO	Maximum Dry Density (pcf)	Optimum MC (%)	KY CBR (%)
Eastbound KY 338													
20	100+00	53' Rt	0.0-7.6	BAG	60	23	37	CH	Fat Clay	A-7-6 (37)			
23	110+50	60' Lt	0.0-9.0	BAG	42	19	23	CL	Lean Clay with Sand	A-7-6 (19)	107.1	19.7	2.4
Westbound KY 338													
27	211+00	58' Rt	0.0-9.8	BAG	62	20	42	CH	Fat Clay	A-7-6 (41)	98.7	23.4	2.0
KY 338													
35	82+00	45' Lt	0.0-6.5	BAG	54	18	36	CH	Fat Clay	A-7-6 (32)	107.4	17.8	1.6
39	90+50	52' Rt	0.0-6.0	BAG	50	22	28	CH	Fat Clay with Sand	A-7-6 (25)			
SB I-71/75 Acceleration Lane													
40	421+00	97' Lt	0.0-4.8	BAG	49	20	29	CL	Lean Clay with Sand	A-7-6 (26)			
43	429+00	120' Lt	0.0-8.9	BAG	63	21	42	CH	Fat Clay with Gravel	A-7-6 (36)	100.3	24.2	1.7
SB I-71/75 Deceleration Lane													
47	475+00	100' Lt	0.0-2.4	BAG	48	19	29	CL	Lean Clay with Sand	A-7-6 (24)	99.2	13.2	1.0
49	483+00	102' Lt	0.0-6.1	BAG	57	20	37	CH	Fat Clay	A-7-6 (38)			
NB I-71/75 Acceleration Lane													
52	473+00	119' Rt	0.0-5.0	BAG	66	23	43	CH	Fat Clay	A-7-6 (45)			
55	485+00	100' Rt	0.0-6.8	BAG	38	16	22	CL	Sandy Lean Clay w/ gravel	A-6 (10)	118.3	14.1	4.3
58	495+00	100' Rt	0.0-8.0	BAG	44	16	28	CL	Lean Clay	A-7-6 (26)	107.6	18.6	3.8
63	505+00	102' Rt	0.0-6.0	BAG	55	19	36	CH	Fat Clay	A-7-6 (36)			
I-75/71 Ramp A to KY 338													
66	92+00	30' Rt	4.5-10.0	BAG	44	18	26	CL	Lean Clay with Sand	A-7-6 (18)			
70	100+00	38' Rt	0.0-9.2	BAG	40	17	23	CL	Lean Clay with Sand	A-6 (16)	113.9	15.8	2.1
I-75/71 Ramp A1 to KY 338													
72	154+00	50' Rt	0.0-10.8	BAG	54	20	34	CH	Fat Clay with Gravel	A-7-6 (29)	102.1	21.4	1.8
I-75/71 Ramp B to KY 338													
74	253+00	55' Lt	0.0-7.1	BAG	37	18	19	CL	Gravelly Lean Clay w/ sand	A-6 (9)	121.7	11.6	4.8
74	253+00	55' Lt	7.1-12.5	BAG	50	20	30	CH	Fat Clay	A-7-6 (31)	101.2	20.9	3.7
78	261+50	27' Lt	0.0-4.7	BAG	23	13	10	SC	Clayey Sand with gravel	A-2-4 (0)			
I-75/71 Ramp B1 to KY 338													
81	202+50	38' Rt	0.0-5.5	BAG	62	22	40	CH	Fat Clay	A-7-6 (44)	98.9	24.0	1.7
I-75/71 Ramp C to KY 338													
85	309+00	65' Rt.	0.0-8.5	BAG	56	20	36	CH	Fat Clay with Gravel	A-7-6 (27)	111.0	16.8	0.9
90	319+00	28' Rt	0.0-7.4	BAG	48	19	29	CL	Lean Clay	A-7-6 (30)	101.8	19.5	2.5

SUMMARY OF DISTURBED SOIL TESTING

JOB NAME: I-75/71 and KY 338 Interchange
COUNTY: Boone County, Kentucky
ITEM NO: Item No. 6-18.00

Stantec Job No.: 175565314
Submitted By: A. Crace

Date: 6/28/2016

Sample Identification					Classification Testing						Standard Proctor		
Hole No.	Station	Offset	Sample Depth (ft)	Sample Type	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Unified	Textural	AASHTO	Maximum Dry Density (pcf)	Optimum MC (%)	KY CBR (%)
I-75/71 Ramp C1 to KY 338													
94	354+00	40' Lt	0.0-7.2	BAG	62	24	38	CH	Fat Clay	A-7-6 (40)	98.7	24.8	2.0
I-75/71 Ramp D to KY 338													
97	404+00	70' Rt	0.0-8.4	BAG	49	18	31	CL	Gravelly Lean Clay w/ sand	A-7-6 (18)	108.2	18.1	2.2
I-75/71 Ramp D1 to KY 338													
104	425+00	23' Lt	0.0-13.5	BAG	60	23	37	CH	Fat Clay	A-7-6 (34)	100.5	23.3	2.2
US 25													
107	10+00	38' Rt	0.0-5.0	BAG	43	17	26	GC	Clayey Gravel with Sand	A-7-6 (6)			
110	16+00	40' Lt	0.0-8.5	BAG	38	21	17	CL	Lean Clay	A-6 (18)	103.7	20.3	5.9
112	20+00	45' Lt	0.0-12.0	BAG	50	17	33	CH	Sandy Fat Clay	A-7-6 (17)			
112	20+00	45' Lt	12.0-20.0	BAG	39	19	20	CL	Lean Clay	A-6 (19)			
115	26+00	35' Rt	0.0-8.2	BAG	41	21	20	CL	Lean Clay	A-7-6 (21)	102.4	21.1	6.4
118	32+00	80' Lt	0.0-9.5	BAG	48	21	27	CL	Lean Clay	A-7-6 (29)			
121	38+00	55' Lt	0.0-8.4	BAG	65	24	41	CH	Fat Clay	A-7-6 (42)	93.9	25.3	2.7
125	46+00	34' Rt	0.0-10.5	BAG	36	17	19	CL	Sandy Lean Clay w/ gravel	A-6 (7)	119.4	13.1	4.5
129	56+00	20' Lt	0.0-6.1	BAG	41	16	25	CL	Gravelly Lean Clay w/ sand	A-7-6 (9)	116.0	15.0	3.4
132	64+00	57' Rt.	0.0-5.0	BAG	54	19	35	CH	Fat Clay	A-7-6 (31)			
135	72+00	32' Rt	0.0-5.0	BAG	63	21	42	CH	Fat Clay	A-7-6 (42)			
US 25 Ramp A													
139	14+00	34' Lt	0.0-18.0	BAG	60	18	42	CH	Fat Clay	A-7-6 (40)	101.2	21.0	2.6
US 25 Ramp B													
141	20+00	23' Rt	0.0-13.5	BAG	42	18	24	CL	Lean Clay with Sand	A-7-6 (16)	108.2	18.9	1.6
US 25 Ramp C													
143	34+00	13' Rt	0.0-7.4	BAG	53	19	34	CH	Fat Clay with Gravel	A-7-6 (24)	104.4	21.6	2.3
144	36+00	12' Rt	0.0-6.6	BAG	38	16	22	SC	Clayey Sand with gravel	A-6 (5)	122.8	10.3	5.0
US 25 Ramp E													
149	55+00	35' Lt	0.0-18.0	BAG	45	18	27	CL	Lean Clay	A-7-6 (25)	107.6	19.1	9.0
US 25 Ramp F													
152	60+50	15' Lt	0.0-9.7	BAG	63	23	40	CH	Fat Clay	A-7-6 (39)	96.6	25.1	1.9
US 25 Ramp G													

SUMMARY OF DISTURBED SOIL TESTING

JOB NAME: I-75/71 and KY 338 Interchange
COUNTY: Boone County, Kentucky
ITEM NO: Item No. 6-18.00

Stantec Job No.: 175565314
Submitted By: A. Crace

Date: 6/28/2016

Sample Identification					Classification Testing						Standard Proctor		
Hole No.	**Station**	**Offset**	**Sample Depth (ft)**	**Sample Type**	**Liquid Limit (LL)**	**Plastic Limit (PL)**	**Plasticity Index (PI)**	**Unified**	**Textural**	**AASHTO**	**Maximum Dry Density (pcf)**	**Optimum MC (%)**	**KY CBR (%)**
155	74+00	43' Lt	0.0-9.3	BAG	60	21	39	CH	Fat Clay	A-7-6 (39)	102.0	22.4	2.0
US 25 Ramp H													
157	82+00	25' Lt	0.0-4.5	BAG	45	20	25	CL	Lean Clay	A-7-6 (24)	107.0	20.0	1.7
Best PAL Drive													
159	22+50	52' Rt	0.0-8.5	BAG	47	18	29	CL	Lean Clay	A-7-6 (27)	103.5	19.2	1.8
164	32+50	17' Rt	0.0-8.0	BAG	49	18	31	CL	Lean Clay	A-7-6 (29)	106.1	19.5	2.3
Old Lexington Road													
166	8+00	17' Rt	0.0-6.5	BAG	32	15	17	SC	Clayey Sand with gravel	A-6 (4)	122.4	11.7	4.0
KY 338													
178	100+00	33' Rt	0.0-6.2	BAG	51	20	31	CH	Fat Clay	A-7-6 (28)	104.8	21.2	2.3
183	110+00	35' Rt	0.0-3.6	BAG	51	19	32	CH	Fat Clay with Gravel	A-7-6 (26)	105.1	21.5	2.2
Grand National Blvd													
191	97+00	27' Lt	0.0-3.1	BAG	51	20	31	CH	Sand Fat Clay	A-7-6 (16)	99.2	23.4	2.7
Grand National Access Drive													
192	51+00	8' Lt	0.0-8.5	BAG	46	19	27	CL	Sandy Lean Clay	A-7-6 (15)	99.5	22.6	2.5
										Average =	106.0	19.4	
											Yoder's 90th Percentile =		1.7

APPENDIX D
COORDINATE DATA SUBMISSION FORM

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date 10/23/2015

Road Number I-71/75 and KY 338 Interchange

Survey Crew / Consultant District-6

Contact Person Brian Cox

Item # 6-18.00

Mars #

Project #

Notes:

Borings were drilled by Stantec Consulting Services.

(circle one)

Elevation Datum **NAVD88** **Assumed**

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
1	38.917451557	84.631129243	1	102+50	118 L	858.322
2	38.917869720	84.629920914	2	106+50	90 L	864.379
3	38.917468915	84.627218934	3	114+00	130 R	908.269
4	38.917251323	84.629736721	4	206+50	75 R	877.774
5	38.917481959	84.628302055	5	211+00	58 R	888.604
6	38.918018058	84.624309359	6	76+50	64 R	936.838
7	38.918860452	84.622869414	7	81+50	45 L	922.428
8	38.909606353	84.628681993	8	430+50	130 L	889.557
9	38.925524472	84.629677313	9	488+50	150 R	954.494
10	38.916457393	84.629653079	10	307+00	70 L	888.692
11	38.913580426	84.629090827	11	317+50	33 R	888.162
12	38.914406771	84.628130343	12	404+50	65 R	907.717
13	38.915751411	84.628118128	13	406+50	60 R	896.643
14	38.917162346	84.628151086	14	414+50	80 L	896.837
15	38.918645331	84.623486175	15	30+00	20 R	924.93
16	38.918351474	84.624526204	16	59+50	10 R	931.367
17	38.917986948	84.624157795	17	71+00	15 R	934.831

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
18	38.917891736	84.625250001	18	21+00	60 R	928.158
19	38.918698823	84.622260081	19	6+00	25 L	908.303
20	38.916707004	84.631726667	20	100+00	53 R	847.24
21	38.917316425	84.631318448	21	102+00	77 L	856.643
22	38.917579341	84.630912790	22	104+00	130 L	856.271
23	38.918005395	84.628522074	23	110+50	60 L	873.569
24	38.918144987	84.627716835	24	112+50	100 L	876.25
25	38.917695605	84.627030387	25	114+50	60 R	901.785
26	38.917188534	84.629922887	26	206+00	75 R	873.68
27	38.917481682	84.628301980	27	211+00	58 R	888.638
28	38.917499598	84.627583161	28	212+50	116 R	893.243
29	38.917830958	84.626611146	29	216+00	72 R	904.734
30	38.918204495	84.625972491	30	72+00	45 L	908.661
31	38.917851035	84.625259870	31	74+00	89 R	927.709
32	38.918000713	84.624505054	32	76+00	54 R	935.971
33	38.918215426	84.623823993	33	78+00	53 R	928.514
34	38.918449300	84.623188142	34	80+00	50 R	923.869
35	38.918931020	84.622734068	35	82+00	45 L	920.962
36	38.919292227	84.622281419	36	84+00	45 L	908.846
37	38.919745719	84.621988006	37	86+00	40 L	899.531
38	38.920255958	84.621847798	38	88+00	20 L	894.671
39	38.920925102	84.621685786	39	90+50	52 R	892.821
40	38.907012199	84.628317586	40	421+00	97 L	887.434
41	38.907556964	84.628415399	41	423+00	110 L	879.151
42	38.908653074	84.628495774	42	427+00	103 L	878.083
43	38.909197622	84.628607837	43	429+00	120 L	889.269
44	38.909745131	84.628659876	44	431+00	120 L	884.265
45	38.910293221	84.628705712	45	433+00	118 L	859.121
46	38.910834674	84.628863042	46	435+00	148 L	835.139
47	38.921765346	84.363003237	47	475+00	100 L	913.33
48	38.922850054	84.630266736	48	479+00	123 L	902.014
49	38.923947992	84.630346425	49	483+00	102 L	921.362

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
50	38.925039967	84.630493415	50	487+00	100 L	930.675
51	38.926131569	84.630646626	51	491+00	100 L	930.742
52	38.921285183	84.629190660	52	473+00	119 R	904.471
53	38.922375424	84.629358191	53	477+00	115 R	918.737
54	38.923463536	84.629553667	54	481+00	103 R	915.469
55	38.924554312	84.629717676	55	485+00	100 R	928.818
56	38.925659379	84.629714140	56	489+00	145 R	954.199
57	38.926744868	84.629937511	57	493+00	125 R	942.444
58	38.927283238	84.630101682	58	495+00	100 R	927.872
59	38.927828929	84.630178456	59	497+00	100 R	921.028
60	38.928374743	84.630255225	60	499+00	100 R	922.505
61	38.928920627	84.630331950	61	501+00	100 R	922.037
62	38.929466312	84.630408766	62	503+00	100 R	919.014
63	38.930012744	84.630478521	63	505+00	102 R	909.538
64	38.921622878	84.630036092	64	88+00	28 R	914.213
65	38.921074492	84.929997650	65	90+00	25 R	906.666
66	38.920531122	84.630004639	66	92+00	30 R	897.559
67	38.920000855	84.630129497	67	94+00	48 R	885.084
68	38.919470504	84.630238649	68	96+00	40 R	888.804
69	38.918936423	84.630402103	69	98+00	38 R	882.548
70	38.918403754	84.630572175	70	100+00	38 R	874.679
71	38.917874313	84.630759763	71	102+00	43 R	857.142
72	38.918441134	84.630559428	72	154+00	50 R	875.848
73	38.918005453	84.628522032	73	251+00	50 L	873.372
74	38.918382004	84.628322716	74	253+00	55 L	883.174
75	38.918948317	84.628222459	75	255+00	43 R	891.66
76	38.919363918	84.628837640	76	257+10	53 L	888.743
77	38.919925939	84.628847550	77	259+00	20 R	891.508
78	38.920551727	84.629246082	78	261+50	27 L	905.666
79	38.921122585	84.629135062	79	263+50	40 R	899.353

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
80	38.918137659	84.627396363	80	200+50	37 R	891.396
81	38.918353259	84.627883249	81	202+50	38 R	879.89
82	38.917021824	84.630816936	82	303+00	30 R	858.462
83	38.916763796	84.630357426	83	305+00	42 R	862.08
84	38.916457395	84.629653137	84	307+00	70 L	888.648
85	38.915799065	84.629746437	85	309+00	65 R	885.536
86	38.915382541	84.629174154	86	311+00	37 L	871.868
87	38.914803609	84.629281597	87	313+00	37 R	875.747
88	38.914261016	84.629205106	88	315+00	38 R	885.343
89	38.913716547	84.629117372	89	317+00	35 R	890.333
90	38.913172712	84.629015382	90	319+00	28 R	878.731
91	38.912627523	84.628920521	91	321+00	23 R	867.263
92	38.912083467	84.628848322	92	323+00	23 R	864.604
93	38.911534963	84.628812465	93	325+00	30 R	851.739
94	38.916866847	84.630038790	94	354+00	40 L	875.517
95	38.913170939	84.628185120	95	400+00	45 R	873.75
96	38.913720347	84.628139365	96	402+00	60 R	892.912
97	38.914269113	84.628111006	97	404+00	70 R	907.28
98	38.914817767	84.628223293	98	406+00	40 R	895.008
99	38.915364236	84.628229162	99	408+00	40 R	891.726
100	38.915882244	84.628106875	100	410+00	55 R	893.288
101	38.916404953	84.627949590	101	412+00	50 R	895.97
102	38.917444298	84.627616477	102	416+00	30 R	893.887
103	38.917001304	84.628198786	103	423+00	65 L	898.909
104	38.917434901	84.628200293	104	425+00	23 L	893.738
105	38.907711819	84.618169458	105	6+00	45 L	938.532
106	38.908214058	84.618496612	106	8+00	40 L	932.884
107	38.908803412	84.618476638	107	10+00	38 R	926.671
108	38.909282057	84.618895599	108	12+00	30 L	931.184
109	38.909811024	84.619084346	109	14+00	30 L	938.218
110	38.910317671	84.619329434	110	16+00	40 L	941.699

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
111	38.910908759	84.619330288	111	18+00	42 R	920.208
112	38.911318815	84.619888582	112	20+00	45 L	905.468
113	38.911837370	84.620124165	113	22+00	32 L	908.085
114	38.912409118	84.620201436	114	24+00	30 R	916.77
115	38.912920981	84.620475860	115	26+00	35 R	924.07
116	38.913269198	84.621093762	116	28+00	52 L	907.409
117	38.913892322	84.621181104	117	30+00	60 R	889.209
118	38.914172109	84.621982800	118	32+00	80 L	878.595
119	38.914699521	84.622289097	119	34+00	90 L	885.267
120	38.915240709	84.622445434	120	36+00	80 L	896.486
121	38.915786154	84.622547561	121	38+00	55 L	916.023
122	38.916403576	84.622412685	122	40+00	55 R	917.223
123	38.916959581	84.622613779	123	42+00	90 R	914.79
124	38.917371914	84.623116288	124	44+00	34 R	923.634
125	38.917855926	84.623447881	125	46+00	34 R	926.345
126	38.918827368	84.624085039	126	50+00	34 R	927.268
127	38.919330014	84.624349076	127	52+00	34 R	925.404
128	38.919777394	84.624821647	128	54+00	34 L	927.405
129	38.920304580	84.625024513	129	56+00	20 L	928.784
130	38.920837055	84.625208727	130	58+00	CL	929.83
131	38.921408320	84.625277095	131	60+00	60 R	927.878
132	38.922422071	84.525817574	132	64+00	57 R	931.012
133	38.922902420	84.626170840	133	66+00	30 R	936.398
134	38.923421151	84.626426629	134	68+00	40 R	937.725
135	38.924385618	84.627111030	135	72+00	32 R	941.491
136	38.925359652	84.627655248	136	76+00	33 R	941.78
137	38.916399841	84.622407395	137	10+00	15 R	917.504
138	38.916886101	84.622747127	138	12+00	20 L	920.208
139	38.917355725	84.623106105	139	14+00	34 L	923.542
140	38.917917850	84.623244372	140	16+00	25 R	927.284
141	38.918190534	84.623384719	141	20+00	23 R	827.079

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
142	38.918886189	84.623920716	142	32+00	13 R	927.163
143	38.919387813	84.624199514	143	34+00	13 R	926.57
144	38.919896091	84.624465394	144	36+00	12 R	926.547
145	38.920764053	84.624997379	145	38+00	8 R	928.776
146	38.920764053	84.624997379	146	39+50	CL	929.045
147	38.920532257	84.625243488	147	51+00	CL	928.908
148	38.920028434	84.624952953	148	53+00	23 L	927.957
149	38.919515084	84.624699380	149	55+00	35 L	927.371
150	38.919014620	84.624447674	150	57+00	42 L	927.056
151	38.918463974	84.624461574	151	59+00	15 R	929.469
152	38.918581316	84.624200911	152	60+50	15 L	928.361
153	38.918008999	84.624463315	153	70+00	12 R	936.018
154	38.917887407	84.623739368	154	72+00	55 L	926.815
155	38.917414748	84.623417886	155	74+00	43 L	922.722
156	38.916384420	84.622889825	156	78+00	28 R	914.278
157	38.917996844	84.623814930	157	82+00	25 L	927.481
158	38.917747684	84.625292161	158	20+50	40 R	928.641
159	38.918304938	84.625361262	159	22+50	52 R	917.811
160	38.918593836	84.626075491	160	24+50	33 L	905.203
161	38.919155505	84.626281244	161	26+50	17 R	902.655
162	38.919676840	84.626539425	162	28+50	17 R	913.989
163	38.920067555	84.626543319	163	30+50	17 R	910.055
164	38.920402534	84.625986324	164	32+50	17 R	920.734
165	38.918660356	84.622475887	165	6+00	38 R	911.61
166	38.918152620	84.622441384	166	8+00	17 R	913.816
167	38.908112259	84.628338271	167	425+00	73 L	886.889
168	38.908097204	84.628597356	168	425+00	147 L	858.157
169	38.910986922	84.628613521	169	435+50	73 L	863.494
170	38.910970011	84.628900756	170	435+50	155 L	830.397
171	38.911132012	84.628662877	171	326+50	CL	859.577

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
172	38.911117577	84.628879762	172	326+50	62 R	835.22
173	38.914338556	84.621929583	173	32+50	40 L	877.951
174	38.914280126	84.622095875	174	32+50	92 L	876.917
175	38.91290334	84.62635448	175	105+00	36 R	835.636
176	38.9177654	84.62811516	176	111+50	48 R	876.381
177	38.91296096	84.63547301	177	98+00	40 L	845.386
178	38.91187922	84.63741176	178	100+00	33 R	824.445
179	38.91228685	84.63693446	179	102+00	43 R	828.384
180	38.91270719	84.63649641	180	104+00	36 R	833.549
181	38.91313057	84.6360489	181	106+00	20 R	834.021
182	38.91342899	84.63543459	182	108+00	69 R	839.745
183	38.91389055	84.63502973	183	110+00	35 R	841.118
184	38.91417368	84.63463864	184	111+50	48 R	846.391
185	38.91470442	84.63406839	185	114+00	48 R	833.242
186	38.91507226	84.63351946	186	116+00	90 R	840.182
187	38.91564116	84.63360738	187	117+50	55 L	843.62
188	38.91608206	84.63318837	188	119+50	57 L	847.019
189	38.91651148	84.63270748	189	121+50	53 L	847.18
190	38.91227795	84.63482508	190	95+00	30 L	865.55
191	38.91271881	84.6353156	191	97+00	27 L	854.149
192	38.9124283	84.63428356	192	51+00	8 L	872.728
193	38.91286162	84.63385101	193	53+00	CL	879.206
194	38.91341762	84.63622119	194	51+00	92 L	817.744
195	38.91353328	84.63612803	195	51+00	43 L	832.219

MEMORANDUM **(RA-010-2018)**

TO: **Randy Turner, PE**
Project Management Coordinator
Division of Highway Design

FROM: **Michael Carpenter, PE**
Geotechnical Branch Manager
Division of Structural Design

BY: **Erik Scott, PE**
Geotechnical Branch

DATE: **March 27, 2019**

SUBJECT: **Boone County**
FD04 008 0075 180-181
Reconstruction of I-75 / KY 338 (Richwood Road) Interchange
I-75 Milepoints 175.217 to 175.622
Norfolk Southern Railroad Station 0+00.0 to 29+49.95
Item No. 6-18.00
Mars No. 8433801D
Geotechnical Engineering Roadway Report Addendum

I. Project Background

The original geotechnical engineering report for the subject project (R-049-2015) was completed by Stantec Consulting Services, Inc. and approved / issued by the KYTC Geotechnical Branch on November 14, 2016. The project includes various improvements to the Norfolk Southern Railroad facilities within the project area. The purpose of this addendum is to provide geotechnical recommendations for those railway improvements, which were not included in the original report. Geotechnical recommendations for the new railroad structure over KY 338 will be provided as a separate report (S-066-2018). The addendum provides recommendations for the railroad shoofly, laydown yard, temporary spur and permanent spur. Additional revisions to geotechnical roadway recommendations and sheets will be addressed in a future addendum. Reduced-size geotechnical symbol, geotechnical notes, soil profile, cut and embankment stability sheets are attached. The CADD input for these sheets, in DGN format, is being e-mailed to the Design Consultants for incorporation into the roadway plans.

For discussion on geology and topography of the project area, refer to original roadway Report No. R-049-2015 by Stantec. The drilling for the original roadway project was performed by Stantec under Statewide Geotechnical Drilling Contract. Drilling for the structures was performed by Horn & Associates, Inc. under Statewide Contract. The KYTC Geotechnical Branch also performed several manual rod soundings for culverts and pipes, as well as at the railroad spur.

II. Laboratory Testing

Laboratory soils testing for the original roadway report was performed by Stantec under Statewide Geotechnical Engineering and Laboratory Testing Contract. Testing for the structures was performed jointly by the KYTC Geotechnical Branch and HDR, Inc. under Statewide Contract. Drilling and testing performed for the proposed roadway and structures were utilized for investigating the railroad improvements associated with the project.

Soil testing for borings nearby the railroad facilities revealed mostly low and high plasticity clays (CL and CH in the Unified Soil Classification System, respectively). High plasticity silts (MH), clayey sands (SC) and clayey gravels (GC) were also encountered. The soil testing indicated wet conditions, with natural moisture contents exceeding the optimum moisture content for some of the samples.

III. Engineering Analyses

a. Bearing Capacity Analysis

Evaluation of the bearing capacity of the soil underlying the ballast and sub-ballast is required by AREMA (2016 American Railway Engineering & Maintenance-of-Way Association Manual) Chapter 1, Section 2.11. Soil strengths for the bearing capacity calculations were taken from unconfined compression testing performed for adjacent structures. The testing was performed on 20 specimens taken from structure boring adjacent to the shoofly. The results were also deemed applicable to mainline track, laydown yard, temporary and permanent spur tracks. The test results are shown in Table 1 below. The average unconfined compressive strength was **3,381 lb/ft^2**. The testing resulted in an average undrained shear strength of **1,690 lb/ft^2**.

Table 1: Summary of Unconfined Compression Test Results

Hole No.	Station	Offset	Depth (ft)	Unconfined Compressive Strength (psf)
1030	US 25 Sta 47+50	11.5′ LT	2.5-4.5	2,342
1030	US 25 Sta 47+50	11.5′ LT	7.5-8.8	2,313
1051	KY 338 Sta 379+24.4	62.6′ RT	2.5-4.5	1,061
1052	KY 338 Sta 379+02	29.4′ RT	2.5-4.5	3,751
1053	KY 338 Sta 379+18	14.2′ LT	7.5-9.5	1,915
1001	US 25 Sta 42+40	34′ LT	12.5-14.5	5,280
1001	US 25 Sta 42+40	34′ LT	17.5-19.5	1,918
1001	US 25 Sta 42+40	34′ LT	22.5-24.5	2,839
1001	US 25 Sta 42+40	34′ LT	27.5-29.3	2,225
1003	US 25 Sta 43+50	34′ LT	2.5-4.5	2,683

1003	US 25 Sta 43+50	34′ LT	7.5-9.5	3,820
1003	US 25 Sta 43+50	34′ LT	12.5-14.5	4,059
1005	US 25 Sta 45+00	17′ LT	2-4	5,060
1008	US 25 Sta 42+40	38′ RT	2.5-4.5	4,891
1008	US 25 Sta 42+40	38′ RT	17.5-19.5	5,332
1010	US 25 Sta 43+50	38′ RT	12.5-14.5	2,397
1010	US 25 Sta 43+50	38′ RT	17.5-19.5	3,379
1010	US 25 Sta 43+50	38′ RT	22.5-23.9	4,761
1012	US 25 Sta 45+00	38′ RT	2.5-4.5	2,701
1014	US 25 Ramp A Sta 13+50	35′ RT	2.5-4.5	4,888

AREMA requires a safety factor of 2 to 5 against bearing capacity failure. A factor of safety of 3 is used for Mainline and Shoofly Tracks, and factor of safety of 2 is deemed acceptable for spur and yard tracks, with much lower speed and traffic volumes. The average undrained shear strength is converted to bearing capacity using the equation below. Resulting allowable bearing capacities for each factor of safety are provided below.

$$\textbf{Allowable Bearing Capacity} = \frac{\textbf{5.14 X (Average undrained shear strength)}}{\textbf{Factor of Safety}}$$

Allowable Bearing Capacity (factor of safety = 3): <u>2,900 psf</u>
Allowable Bearing Capacity (factor of safety = 2): <u>4,350 psf</u>

The applied pressures were calculated using a live load of 8,000 lb/ft (Live load E80 from AREMA Chapter 15, Section 1.3). The live load was distributed through the ballast and sub-ballast and an applied subgrade pressure was calculated at the base of sub-ballast per AREMA Chapter 1, Section 2.11.2.3. Table 2 below gives applied pressures from live load for the various railroad track sections. **The applied pressures for the different track sections were less than the allowable bearing capacities.**

Table 2: Applied Pressure @ Base of Sub-ballast (Live Load E80)

Railroad Section	**Ballast (in.)**	**Sub-Ballast (in.)**	**Applied Pressure (psf)**	**OK?**
Proposed Mainline Track	12	12	2,600	Y
Proposed Shoofly Track S1	12	12	2,600	Y
Temporary Spur Track SpT (Sta 0+00 to 2+43)	12	12	1,910	Y
Temporary Spur Track SpT (Sta 2+43 to 8+99)	6	8	3,750	Y
Proposed Spur Track Sp (Sta 0+00 to 3+32)	12	12	1,910	Y
Proposed Spur Track Sp (Sta 3+89 to 8+99)	6	8	3,750	Y
Proposed Laydown Yard Track Y	9	9	2,740	Y

b. Slope Stability Analyses

Proposed slopes were analyzed for slope stability where warranted per AREMA Chapter 1. Cut slopes in soil are generally considered for analysis for heights of fifteen (15) feet or greater, and ten (10) feet or greater for cohesive soils, per AREMA Chapter 1, Section 1.2.2.5 (Cuts in Soil). This is similar to the criteria used by the Geotechnical Branch for stability analysis in cuts. A cut stability analysis was required for the Temporary Spur Station 6+00. This slope will become the permanent slope near Proposed Spur Station 6+00. The analysis resulted in acceptable safety factors based on both AREMA and Department Geotechnical Manual requirements. See Table 3 below for required safety factors. Refer to the geotechnical cut stability section for analysis results.

Embankment stability analysis is recommended in AREMA Chapter 1, Section 1.2.3.3 (Soil Fills). The Department generally requires analysis for overall fills heights of twenty (20) feet or greater. The embankment section at laydown yard Station 9+50, Left, was the tallest for the proposed railroad improvements, at approximately twenty-five (25) feet. The analysis was acceptable based on AREMA and Department requirements. Refer to the geotechnical embankment stability section for analysis results.

Table 3: Required Safety Factors from KYTC Geotechnical Manual & AREMA

Entity	Short-Term (Roadway Embankments)	Short-Term (Roadway Cuts)	Intermediate-Term (Roadway Cuts)	Long-Term (Roadway Embankments)
KYTC	1.1-1.3	1.2-1.4	1.2-1.4	1.4-1.6
AREMA	***	***	***	1.5

IV. Soil Stabilization

Although the calculated allowable bearing capacity is adequate, subgrade problems may still occur in areas where soft soils are present and the railway template is in a shallow fill or cut condition. In addition, several soil samples exhibited natural moisture contents several percent above optimum moisture contents. Therefore, a two (2)-foot working platform consisting of non-erodible Granular Embankment underlain with Type V Geotextile Fabric is recommended in Geotechnical Note No. 17R for areas where subgrade problems are encountered. The treatment locations and required thicknesses will be determined by the Engineer during construction, and will depend on seasonal moisture variation. See Design Recommendations for quantity estimate information.

The wet/saturated conditions and poor soils mentioned above could also create problems during embankment construction. The extent of these problems will depend on the season of construction and on seasonal water table fluctuations. Geotechnical Recommendation No. 10R below provides for non-erodible Granular Embankment underlain with Type I Geotextile Fabric for stabilization of any such wet areas encountered during construction. See Design Recommendations for quantity estimate information.

GEOTECHNICAL NOTES FOR NORFOLK SOUTHERN RAILROAD:

1R) Clearing and grubbing of embankment areas shall be completed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction (Standard Specifications), and 2016 American Railway Engineering & Maintenance-of-Way Association Manual (AREMA) Chapter 1, Sections 1.2.3.2 (Foundations of Fills) and 1.3.6 (Clearing & Grubbing).

2R) Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the Standard Specifications.

3R) Procedures shall be performed as required to control erosion and water pollution in accordance with Sections 212 and 213 of the Standard Specifications and AREMA Chapter 1, Sections 1.4.4.2 (Earth Cuts) and 1.4.5 (Drainage and Erosion Control).

4R) All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the Standard Specifications.

5R) All catch basins and manholes shall be filled and capped and all septic tanks shall be filled in accordance with Section 708 of the Standard Specifications.

6R) All channel changes and special ditches shall be constructed prior to placement of any embankment materials adjacent to them in accordance with Section 206 of the Standard Specifications. Materials excavated from these areas may be utilized in construction of the embankments, but may require aeration to the proper moisture contents prior to compaction operations. No extra payment shall be permitted for re-handling, hauling, stockpiling, and/or manipulating these materials.

7R) In accordance with Section 206 of the Standard Specifications, the moisture content of embankment and subgrade materials shall not vary by more than ±2% from the optimum moisture content as determined by Kentucky Method (KM) 64-511, which generally follows AASHTO T 99. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

8R) All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for re-handling, hauling, stockpiling, and/or manipulating soils.

9R) The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be incidental to the earthwork.

10R) Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas as directed by the Engineer shall be drained and stabilized using non-erodible Granular Embankment meeting the requirements of Section 805 of the Standard Specifications. An estimated 2-foot working platform shall be constructed in such areas. The actual locations and thickness shall be determined by the Engineer during construction and may depend on seasonal fluctuations in the water table. The Granular Embankment shall be underlain with Geotextile Fabric, which meets requirements of Standard Specifications Sections 214 and 843 for a Type 1 Fabric, except that a Trapezoid Tear Strength of 80 lb is required. The geotextile fabric shall also meet the requirements of AREMA Chapter 1, Section 10.2 for a Class A Drainage Fabric (6-8 Oz/Sq Yd), except that 70% strength retention is required for UV Degradation at 500 hrs. (See Table 1-10-3.)

11R) Foundation embankment benches and longitudinal perforated pipe underdrains shall be constructed in accordance with Kentucky Department of Highways Standard Drawing No. RGX-010 at the locations listed below and/or as directed by the Engineer. Contrary to Standard Drawing RGX-010, the typical rise height for benching into soil/earth slopes shall be four (4) to six (6) feet. AREMA Chapter 1, Section 1.2.3.3.2 (Sidehill Fills) should also be followed. Benches in earth slopes shall be constructed one at a time beginning with the lowest bench, and each bench shall be backfilled prior to excavation of the next bench. If water is encountered during benching, construct a minimum one (1) foot thick drainage blanket as directed by the Engineer, or contact the Department's Geotechnical Branch for guidance. The drainage blanket shall consist of Kentucky Coarse Aggregate No. 2 in accordance with Section 805 of the Standard Specifications, or other available material deemed suitable by the Engineer. The drainage blanket shall extend to the toe of slope to provide positive drainage and shall be wrapped with Geotextile Fabric, which meets requirements of current Standard Specifications Sections 214 and 843 for a Type IV Fabric. Requirements shall also be met from AREMA Chapter 1, Section 10.2 for a Class B Drainage Fabric (4-6 Oz/Sq Yd). See Table 1-10-3.

Approximate Station Limits

<u>Proposed Shoofly Track S1</u>
24+75 to 25+75, Right

<u>Proposed Laydown Yard Track Y</u>
8+75 to 10+25, Left

12R) Conventional transverse benches shall be constructed and perforated pipe underdrains installed at the following approximate locations in accordance with Standard Drawings No. RDP-005 and RDP-006, project cross-sections (as applicable), and as directed by the Engineer. AREMA Chapter 1, Section 1.2.4.3.2 - Definition & Function of Subdrains (Underdrains) should also be followed.

Approximate Stations

Temporary Spur Track SpT
7+05

Proposed Shoofly Track S1
22+20

Proposed Laydown Yard Track Y
5+55

NSRR Laydown Access Drive
52+50
56+35

13R) Embankment construction shall be in accordance with Section 206 of the Standard Specifications and AREMA Chapter 1, Section 1.3.7.5 – Placement of Embankment. Note that AREMA requires eight (8)-inch loose lifts for construction of fills with common (soil) material, contrary to the Standard Specifications. Greater thicknesses may be permitted subject to approval of the Engineer, and may require rolling tests to determine required thickness and number of passes.

14R) All embankment construction using non-durable shale will be in accordance with Section 206 of the Standard Specifications, "Embankment Principally of Non-Durable Shale".

15R) Compact embankments and subgrades throughout to at least 95% of maximum density determined by KM 64-511 (which generally follows AASHTO T 99) in accordance with Sections 206 and 207 of the Standard Specifications and AREMA Chapter 1, Section 1.3.7.5 (Placement of Embankment). Check density with a nuclear gauge in accordance with Section 206 of the Standard Specifications.

16R) As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the Standard Specifications and backfilled with suitable subgrade material in accordance with Section 207 of the Standard Specifications.

Approximate Station Limits

Proposed Shoofly Track S1
4+25 to 4+72
16+19 to 16+45

Temporary Spur Track SpT
3+74 to 4+03

Proposed Mainline Track
5+51 to 5+99
17+28 to 17+68
21+00 to 22+20

Proposed Spur Track Sp
3+44 to 3+76

17R) The existing subgrade is anticipated to be wet and soft in areas where the railway template is in a shallow cut or fill. Therefore, a 2-foot working platform may be required in these areas consisting of non-erodible Granular Embankment, in accordance with Section 805 of the Standard Specifications. The actual locations and thickness shall be determined by the Engineer during construction and may depend on seasonal fluctuations in the water table. The Granular Embankment shall be underlain with Geotextile Fabric meeting the requirements of Standard Specifications Sections 214 and 843 for a Type V Fabric, except that the maximum Apparent Opening Size (AOS) shall be a No. 70 sieve. The geotextile fabric shall also meet the requirements of AREMA Chapter 1, Section 10.1 for an Extra Heavy Fabric (16-20 Oz/Sq Yd). See Table 1-10-2. The aggregate shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts to ensure positive drainage.

18R) Perforated pipe for subgrade drainage shall be placed at the following approximate locations, and/or where designated by the Engineer. Locations include the upgrade ends of structures and upgrade/downgrade of at-grade crossings. The pipe shall be in accordance with Standard Drawings No. RDP-005 and AREMA Chapter 1, Section 1.5.2 (See Figure 1-1-20). The minimum pipe diameter shall be six (6) inches, and ditch width shall include a minimum six (6) inches on either side of the pipe. The trench shall be lined with non-woven Geotextile Fabric and the pipe shall not be wrapped in geotextile fabric. The fabric shall meet requirements of Standard Specifications Sections 214 and 843 for a Type I Fabric, except the minimum Trapezoid Tear Strength is 80 lb. The geotextile shall also meet the requirements of AREMA Chapter 1, Section 10.2 for a Class A Drainage Fabric (6-8 Oz/Sq Yd), except that 70% strength retention is required for UV Degradation at 500 hrs. (See Table 1-10-3.)

Approximate Station Limits

Proposed Mainline Track
19+70

Proposed Spur Track Sp
3+40
3+85

19R) Shale (above or below the Rock Disintegration Zone (RDZ), durable or non-durable) cannot be used in the top 2 (two) feet of the subgrade.

20R) Borrow material, if required for the subgrade, shall meet the minimum California Bearing Ratio (CBR) value of 2.

21R) Temporary shoring or sheeting may be required at the approximate locations below to facilitate construction of the new railroad bridge over proposed Richwood Road (KY 338).

Approximate Station Limits

Proposed Shoofly Track S1
18+00 to 21+50, Left Side

22R) Use caution working near utilities at the following approximate locations. Make sure construction equipment does not exceed allowable pressures for the utilities.

Approximate Station Limits

Proposed Shoofly Track S1
4+60
3+60
16+00

Proposed Mainline Track
5+00
5+30
5+95
6+10
17+00

Proposed Spur Track Sp
3+60

DESIGN RECOMMENDATIONS:

1.) A California Bearing Ratio (CBR) design value of 2 may be used for area soils if needed for the design of pavements.

2.) An average soil shrinkage value of two (2) percent is estimated for this project. This value should be applied to the formula for calculating the Apparent Shrinkage as outlined in the Design Manual. The recommended rock swell is estimated to be ten (10) percent for material excavated below the rock disintegration zone (RDZ).

3.) This soil shrinkage value should only be applied to soil above the top of rock. A shrink/swell value of zero (0) should be applied to the weathered rock zone considered to be RDZ material.

4.) **For purposes of estimating quantities for Geotechnical Note No. 10R,** a 2-foot embankment working platform of non-erodible Granular Embankment, underlain with Type I Geotextile Fabric, may be assumed for **100 linear feet of railway** embankment, with an average width of 50 ft. Since the actual areas of treatment will be determined during construction based on site conditions, the rock layers do not need to be depicted on the cross-section sheets in the plans.

5.) **For purposes estimating quantities for Geotechnical Note No. 17R**, assume a two (2)-foot subgrade working platform of non-erodible Granular Embankment underlain with Type V Geotextile Fabric, for **650 linear feet of railway.** The treatment locations and required thicknesses will be determined by the Engineer during construction, and will depend on seasonal moisture variation.

cc: **Division of Right-of-Way and Utilities (Rail Coordinator)**
Division of Design (Plan Processing Section)
Division of Construction
TEBM for Project Delivery & Preservation (District 6)
TEBM for Project Development (District 6)
Project Manager (District 6)
HMB, Inc.
HDR, Inc.
Parsons

Attachments:

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	06-0018.00	____

GEOTECHNICAL SYMBOLS

AASHTO Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35% or less passing 0.075 mm)							Silt-Clay Materials (More than 35% passing 0.075 mm)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, Percent Passing											
2.00 mm (No. 10)	50 max	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
0.425 mm (No. 40)	30 max	50 max	51 min	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of Fraction Passing 0.425 mm (No. 40)											
Liquid Limit	- - -		- - -	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min

AI	Activity Index
LI	Liquidity Index
S+C	Silt + Clay (% finer than No.200 Sieve)
○	Rockline Soundings
◐	Disturbed Sample Boring
◎	Undisturbed Sample Boring
⊙	Undisturbed Sample Boring & Rock Core
●	Rock Core
⌖	Slope Inclinometer Installation typical applications: ⌖ ◐ ◎ ⊙ ●
OW	Observation Well
➡	Approximate Footing Elevation
▼ (Date)	Water Elevation

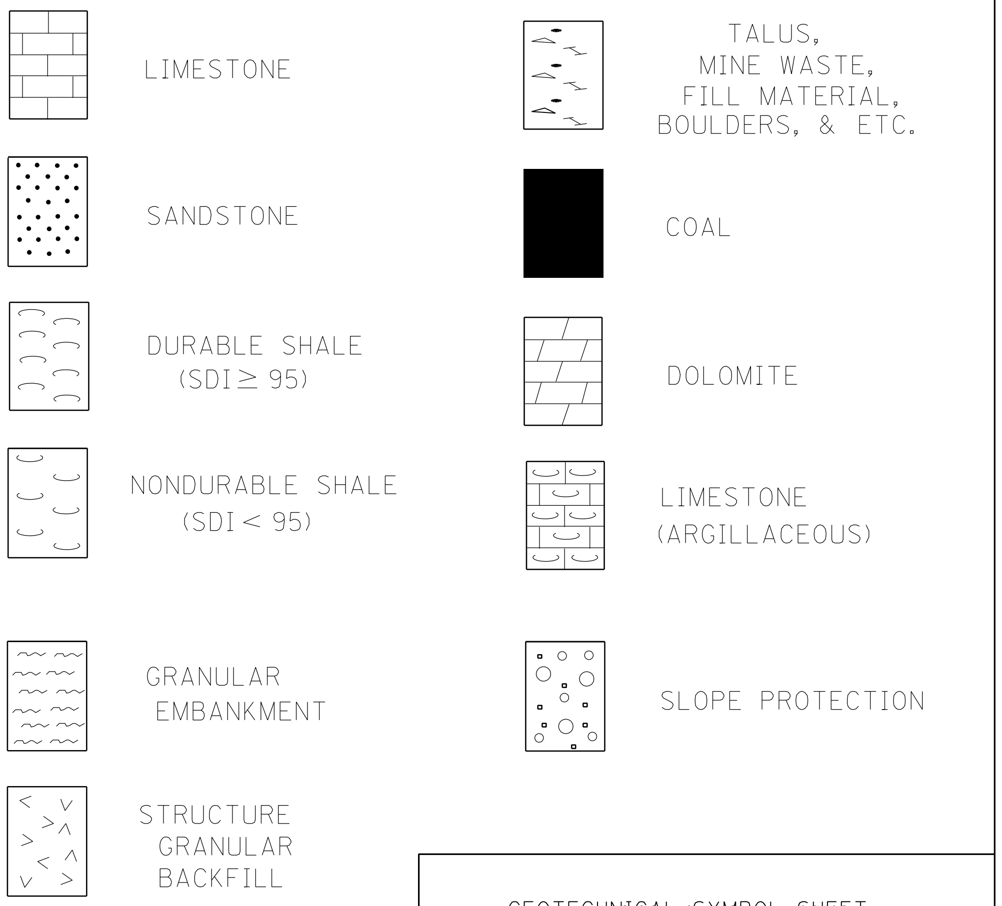
VS (psf)	Field Vane Shear Strength
■	Thin-walled Tube Sample
<	Standard Penetration Test Sample
N	Penetration Resistance
Qu (psf)	Unconfined Compressive Strength
UU (psf)	Unconsolidated Undrained Triaxial Strength
w%	Moisture Content
KY RQD	Rock Quality Designation (Kentucky Method)
STD RQD	Rock Quality Designation (Standard Method)
SDI(JS)	Slake Durability Index (Jar Slake Test)
REC	Core Recovery
$\emptyset$	Angle of Internal Friction (Total Stress)
$\overline{\emptyset}$	Angle of Internal Friction (Effective Stress)
c (psf)	Cohesion (Total Stress)
$\overline{c}$ (psf)	Cohesion (Effective Stress)
γ (pcf)	Total Unit Weight
RDZ	Rock Disintegration Zone
OB	Overburden Bench
IB	Intermediate Bench
R	Refusal
NR	Refusal Not Encountered

Unified Soil Classifications

MAJOR DIVISIONS		SYMBOL		NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW		Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP		Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GM		Silty gravels, gravel-sand-silt mixtures.
		GC		Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW		Well graded sands or gravelly sands, little or no fines.
		SP		Poorly graded sands or gravelly sands, little or no fines.
		SM		Silty sands, sand-silt mixtures.
		SC		Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS LL IS LESS THAN 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays.
		ML-CL		Silty clay-silty clay with sand and or gravel, sandy silty clay, sandy silty clay with gravel, gravelly silty clay, gravelly silty clay with sand
	SILTS AND CLAYS LL IS GREATER THAN 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH		Inorganic clays of high plasticity, fat clays.

Unified Soil Classifications - Continued

MAJOR DIVISIONS		SYMBOL		NAME
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GP-GC		Poorly graded gravel with clay (or silty clay), poorly graded gravel with clay and sand (or silty clay & sand)
		GP-GM		Poorly graded gravel with silt, poorly graded gravel with silt and sand
		GW-GC		Well graded gravel with clay (or silty clay), well graded gravel with clay and sand (or silty clay and sand)
		GW-GM		Well graded gravel with silt, well graded gravel with silt and sand
		GC-GM		Silty clayey gravel, silty clayey gravel with sand
	SAND AND SANDY SOILS	SW-SC		Well graded sand with clay (or silty clay), well graded sand with clay and gravel (or silty clay & gravel)
		SP-SC		Poorly graded sand with clay (or silty clay), poorly graded sand with clay and gravel (or silty clay and gravel)
		SP-SM		Poorly graded sand with silt, poorly graded sand with silt and gravel
		SC-SM		Silty clayey sand, silty clayey sand with gravel
		SW-SM		Well graded sand with silt, well graded sand with silt and gravel
UNCLASSIFIED MATERIAL		OH		Organic (High Plasticity)
		OL		Organic (Low Plasticity)



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GEOTECHNICAL SYMBOL SHEET

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
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GEOTECHNICAL NOTES FOR RAILROAD IMPROVEMENTS

1R) Clearing and grubbing of embankment areas shall be completed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction (Standard Specifications), and 2016 American Railway Engineering & Maintenance-of-Way Association Manual (AREMA) Chapter 1, Sections 1.2.3.2 (Foundations of Fills) and 1.3.6 (Clearing & Grubbing).

2R) Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the Standard Specifications.

3R) Procedures shall be performed as required to control erosion and water pollution in accordance with Sections 212 and 213 of the Standard Specifications and AREMA Chapter 1, Sections 1.4.4.2 (Earth Cuts) and 1.4.5 (Drainage and Erosion Control).

4R) All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the Standard Specifications.

5R) All catch basins and manholes shall be filled and capped and all septic tanks shall be filled in accordance with Section 708 of the Standard Specifications.

6R) All channel changes and special ditches shall be constructed prior to placement of any embankment materials adjacent to them in accordance with Section 206 of the Standard Specifications. Materials excavated from these areas may be utilized in construction of the embankments, but may require aeration to the proper moisture contents prior to compaction operations. No extra payment shall be permitted for re-handling, hauling, stockpiling, and/or manipulating these materials.

7R) In accordance with Section 206 of the Standard Specifications, the moisture content of embankment and subgrade materials shall not vary by more than *2% from the optimum moisture content as determined by Kentucky Method (KM) 64-511, which generally follows AASHTO T 99. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

8R) All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for re-handling, hauling, stockpiling, and/or manipulating soils.

9R) The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be incidental to the earthwork.

10R) Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas as directed by the Engineer shall be drained and stabilized using non-erodible Granular Embankment meeting the requirements of Section 805 of the Standard Specifications. An estimated 2-foot working platform shall be constructed in such areas. The actual locations and thickness shall be determined by the Engineer during construction and may depend on seasonal fluctuations in the water table. The Granular Embankment shall be underlain with Geotextile Fabric, which meets requirements of Standard Specifications Sections 214 and 843 for a Type 1 Fabric, except that a Trapezoid Tear Strength of 80 lb is required. The geotextile fabric shall also meet the requirements of AREMA Chapter 1, Section 10.2 for a Class A Drainage Fabric (6-8 Oz/Sq Yd), except that 70% strength retention is required for UV Degradation at 500 hrs. (See Table 1-10-3.)

11R) Foundation embankment benches and longitudinal perforated pipe underdrains shall be constructed in accordance with Kentucky Department of Highways Standard Drawing No. RGX-010 at the locations listed below and/or as directed by the Engineer. Contrary to Standard Drawing RGX-010, the typical rise height for benching into soil/earth slopes shall be four (4) to six (6) feet. AREMA Chapter 1, Section 1.2.3.3.2 (Sidehill Fills) should also be followed. Benches in earth slopes shall be constructed one at a time beginning with the lowest bench, and each bench shall be backfilled prior to excavation of the next bench. If water is encountered during benching, construct a minimum one (1) foot thick drainage blanket as directed by the Engineer, or contact the Department's Geotechnical Branch for guidance. The drainage blanket shall consist of Kentucky Coarse Aggregate No. 2 in accordance with Section 805 of the Standard Specifications, or other available material deemed suitable by the Engineer. The drainage blanket shall extend to the toe of slope to provide positive drainage and shall be wrapped with Geotextile Fabric, which meets requirements of current Standard Specifications Sections 214 and 843 for a Type IV Fabric. Requirements shall also be met from AREMA Chapter 1, Section 10.2 for a Class B Drainage Fabric (4-6 Oz/Sq Yd). See Table 1-10-3.

Approximate Station Limits

Proposed Shoofly Track S1
24+75 to 25+75, Right

Proposed Laydown Yard Track Y
8+75 to 10+25, Left

12R) Conventional transverse benches shall be constructed and perforated pipe underdrains installed at the following approximate locations in accordance with Standard Drawings No. RDP-005 and RDP-006, project cross-sections (as applicable), and as directed by the Engineer. AREMA Chapter 1, Section 1.2.4.3.2 - Definition & Function of Subdrains (Underdrains) should also be followed.

Approximate Stations

Temporary Spur Track SpT
7+05

Proposed Shoofly Track S1
22+20

Proposed Laydown Yard Track Y
5+55

NSRR Laydown Access Drive
52+50
56+35

13R) Embankment construction shall be in accordance with Section 206 of the Standard Specifications and AREMA Chapter 1, Section 1.3.7.5 - Placement of Embankment. Note that AREMA requires eight (8)-inch loose lifts for construction of fills with common (soil) material, contrary to the Standard Specifications. Greater thicknesses may be permitted subject to approval of the Engineer, and may require rolling tests to determine required thickness and number of passes.

14R) All embankment construction using non-durable shale will be in accordance with Section 206 of the Standard Specifications, "Embankment Principally of Non-Durable Shale".

15R) Compact embankments and subgrades throughout to at least 95% of maximum density determined by KM 64-511 (which generally follows AASHTO T 99) in accordance with Sections 206 and 207 of the Standard Specifications and AREMA Chapter 1, Section 1.3.7.5 (Placement of Embankment). Check density with a nuclear gauge in accordance with Section 206 of the Standard Specifications.

16R) As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the Standard Specifications and backfilled with suitable subgrade material in accordance with Section 207 of the Standard Specifications.

Approximate Station Limits

Proposed Shoofly Track S1
4+25 to 4+72
16+19 to 16+45

Temporary Spur Track SpT
3+74 to 4+03

Proposed Mainline Track
5+51 to 5+99
17+28 to 17+68
21+00 to 22+20

Proposed Spur Track Sp
3+44 to 3+76

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DATE SUBMITTED: ________

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF

PROJECT NUMBERS:

GEOTECHNICAL NOTES

Addendum 2 -- 7-11-19

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GEOTECHNICAL NOTES FOR RAILROAD IMPROVEMENTS (CONT.)

17R) The existing subgrade is anticipated to be wet and soft in areas where the railway template is in a shallow cut or fill. Therefore, a 2-foot working platform may be required in these areas consisting of non-erodible Granular Embankment, in accordance with Section 805 of the Standard Specifications. The actual locations and thickness shall be determined by the Engineer during construction and may depend on seasonal fluctuations in the water table. The Granular Embankment shall be underlain with Geotextile Fabric meeting the requirements of Standard Specifications Sections 214 and 843 for a Type V Fabric, except that the maximum Apparent Opening Size (AOS) shall be a No. 70 sieve. The geotextile fabric shall also meet the requirements of AREMA Chapter 1, Section 10.1 for an Extra Heavy Fabric (16-20 Oz/Sq Yd). See Table 1-10-2. The aggregate shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts to ensure positive drainage.

18R) Perforated pipe for subgrade drainage shall be placed at the following approximate locations, and/or where designated by the Engineer. Locations include the upgrade ends of structures and upgrade/downgrade of at-grade crossings. The pipe shall be in accordance with Standard Drawings No. RDP-005 and AREMA Chapter 1, Section 1.5.2 (See Figure 1-1-20). The minimum pipe diameter shall be six (6) inches, and ditch width shall include a minimum six (6) inches on either side of the pipe. The trench shall be lined with non-woven Geotextile Fabric and the pipe shall not be wrapped in geotextile fabric. The fabric shall meet requirements of Standard Specifications Sections 214 and 843 for a Type I Fabric, except the minimum Trapezoid Tear Strength is 80 lb. The geotextile shall also meet the requirements of AREMA Chapter 1, Section 10.2 for a Class A Drainage Fabric (6-8 Oz/Sq Yd), except that 70% strength retention is required for UV Degradation at 500 hrs. (See Table 1-10-3.)

Approximate Station Limits

Proposed Mainline Track
19+70

Proposed Spur Track Sp
3+40
3+85

19R) Shale (above or below the Rock Disintegration Zone (RDZ), durable or non-durable) cannot be used in the top 2 (two) feet of the subgrade.

20R) Borrow material, if required for the subgrade, shall meet the minimum California Bearing Ratio (CBR) value of 2.

21R) Temporary shoring or sheeting may be required at the approximate locations below to facilitate construction of the new railroad bridge over proposed Richwood Road (KY 338).

Approximate Station Limits

Proposed Shoofly Track S1
18+00 to 21+50, Left Side

22R) Use caution working near utilities at the following approximate locations. Make sure construction equipment does not exceed allowable pressures for the utilities.

Approximate Station Limits

Proposed Shoofly Track S1
4+60
3+60
16+00

Proposed Mainline Track
5+00
5+30
5+95
6+10
17+00

Proposed Spur Track Sp
3+60

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DATE SUBMITTED: ________

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT
NUMBERS:

GEOTECHNICAL NOTES

Addendum 2 -- 7-11-19

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Field Drilling and Sampling were performed from 2015 to 2018.

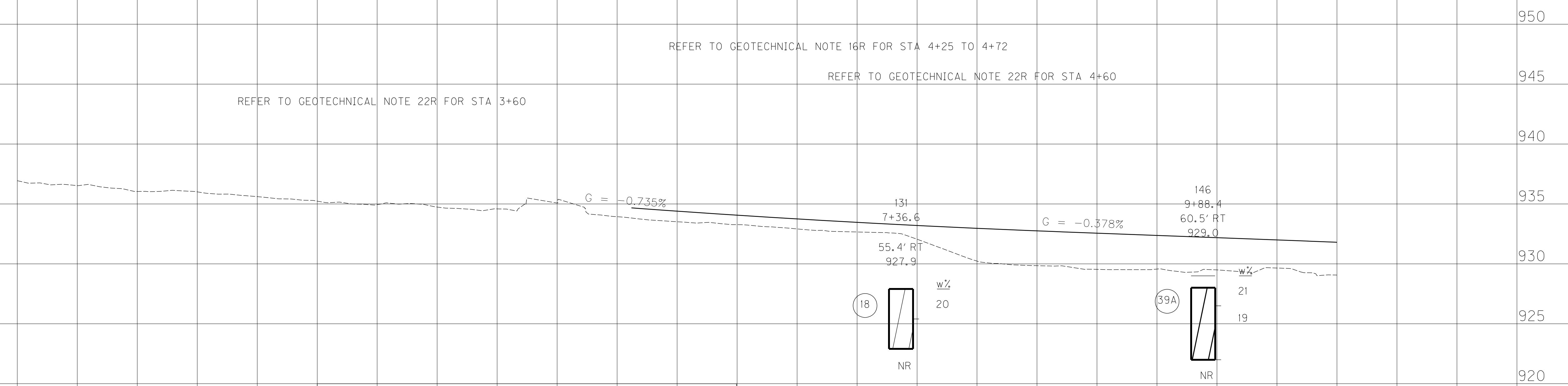
Detailed data and interpretation of subsurface conditions encountered in individual borings are shown on the soil profile. Soil and rock strata descriptions and indicated boundaries are based on engineering interpretation of available subsurface information obtained at selected locations, and may not necessarily reflect the actual variation in subsurface conditions between borings and samples.

The observed water levels and/or subsurface conditions indicated on the soil profile are as recorded at the time of exploration. These water levels and/or subsurface conditions may vary considerable with time, according to the prevailing climate, rainfall or other factors and are otherwise dependent on the duration of and methods used in the exploration program.

Selected rock cores and all applicable drill logs, are stored at the Division of Structural Design in Frankfort and are available for inspection request. Contact the Division of Structural Design, Geotechnical Branch for availability information and to schedule an inspection.

NOTICE – Without regard to the materials encountered, all roadway and drainage excavation shall be unclassified and shall be designated as Roadway Excavation. It shall be distinctly understood that any reference to rock, earth or any other materials on the plans or cross sections whether in numbers, words, letters, or lines, is solely for the Department's information and is not to be taken as an indication of classified excavation or the quantity of either rock, earth or any other material involved.

The bidder must draw his own conclusions as to the conditions to be encountered. The Department does not give any guarantee as to the accuracy of the data and no claim will be considered for additional compensation when the materials encountered are not in accord with the classification shown



SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

915

SAMPLE NO.		18	39A
STATION (SHOOFLY UNLESS OTHERWISE NOTED)		253+00*	34+00**
OFFSET		55.0' Lt.	13.0' Rt.
DEPTH		0.3-7.1	0.3-7.4
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	29	18
	SAND (- NO 10 + NO. 200)	10	8
	SILT (- 0.075 mm + 0.002 mm)	38	35
	CLAY (- 0.002 mm)	23	39
LIQUID LIMIT		37	53
PLASTIC LIMIT		18	19
PLASTICITY INDEX		19	34
ACTIVITY INDEX		0.84	0.87
SPECIFIC GRAVITY		2.76	2.79
AASHTO CLASSIFICATION		A-6(9)	A-7-6(24)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		5	2
MAXIMUM DRY DENSITY (pcf)		118	104
OPTIMUM MOISTURE (%)		13	22
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		23	15

* I-75/I-71 RAMP A/KY 338

** US 25 RAMP C

929.65
932.00
929.07
931.81
11+00

936.95
936.54
0+00
936.04
936.02
1+00
935.61
935.24
2+00
934.95
934.75
3+00
934.59
935.09
4+00
933.94
933.52
934.40
5+00
933.27
934.07
6+00
932.92
933.75
932.66
933.47
7+00
932.06
933.21
930.23
932.97
8+00
929.85
932.76
929.54
932.57
9+00
929.57
932.38
929.50
932.19
10+00

DESIGNED BY: ____________

DATE SUBMITTED: ________

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF

BOONE

PROJECT NUMBERS: ____________

SOIL PROFILE, PROPOSED SHOOFLY
STA. 0+00 TO 11+00

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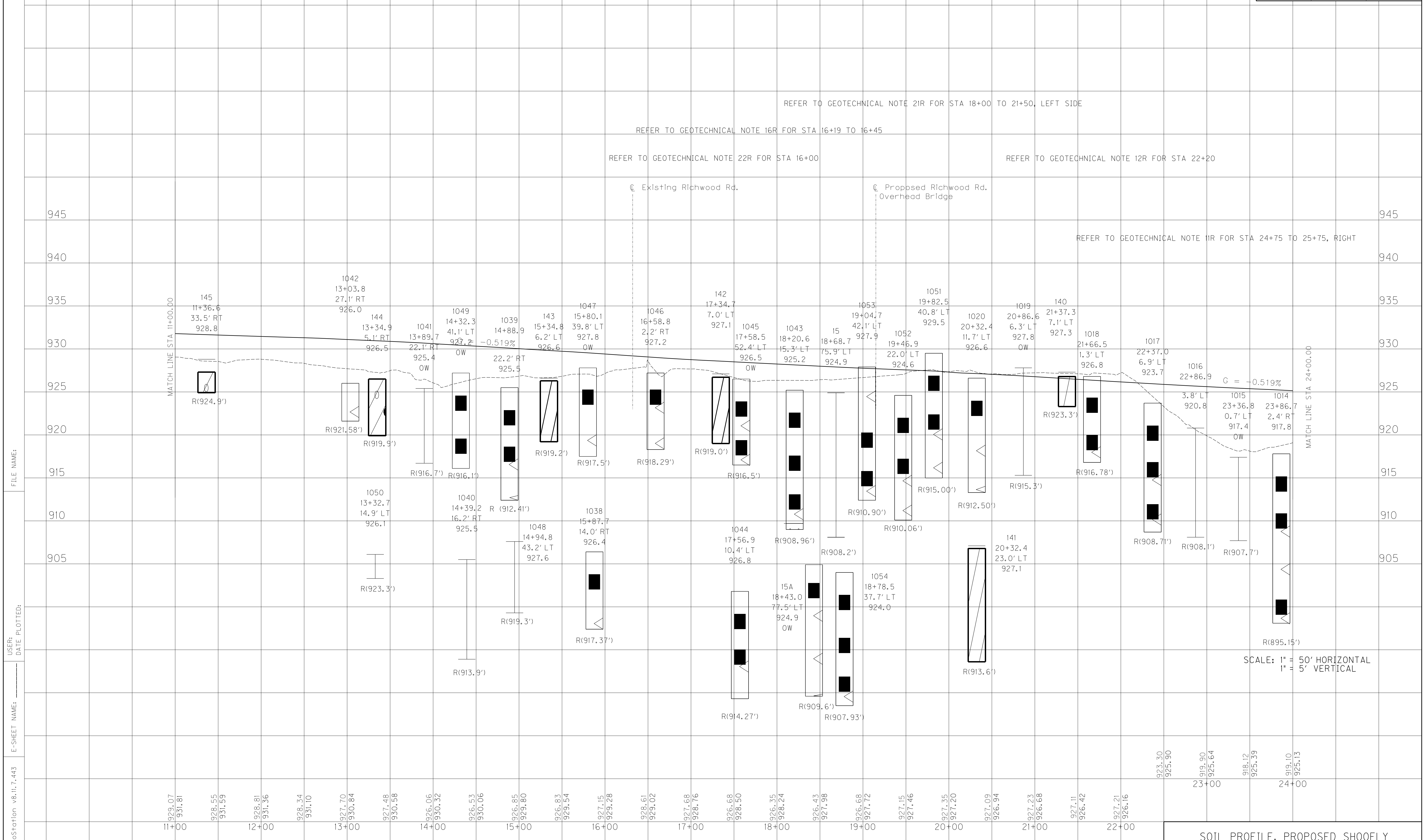

SOIL PROFILE, PROPOSED SHOOFLY
STA 11+00 TO 24+00

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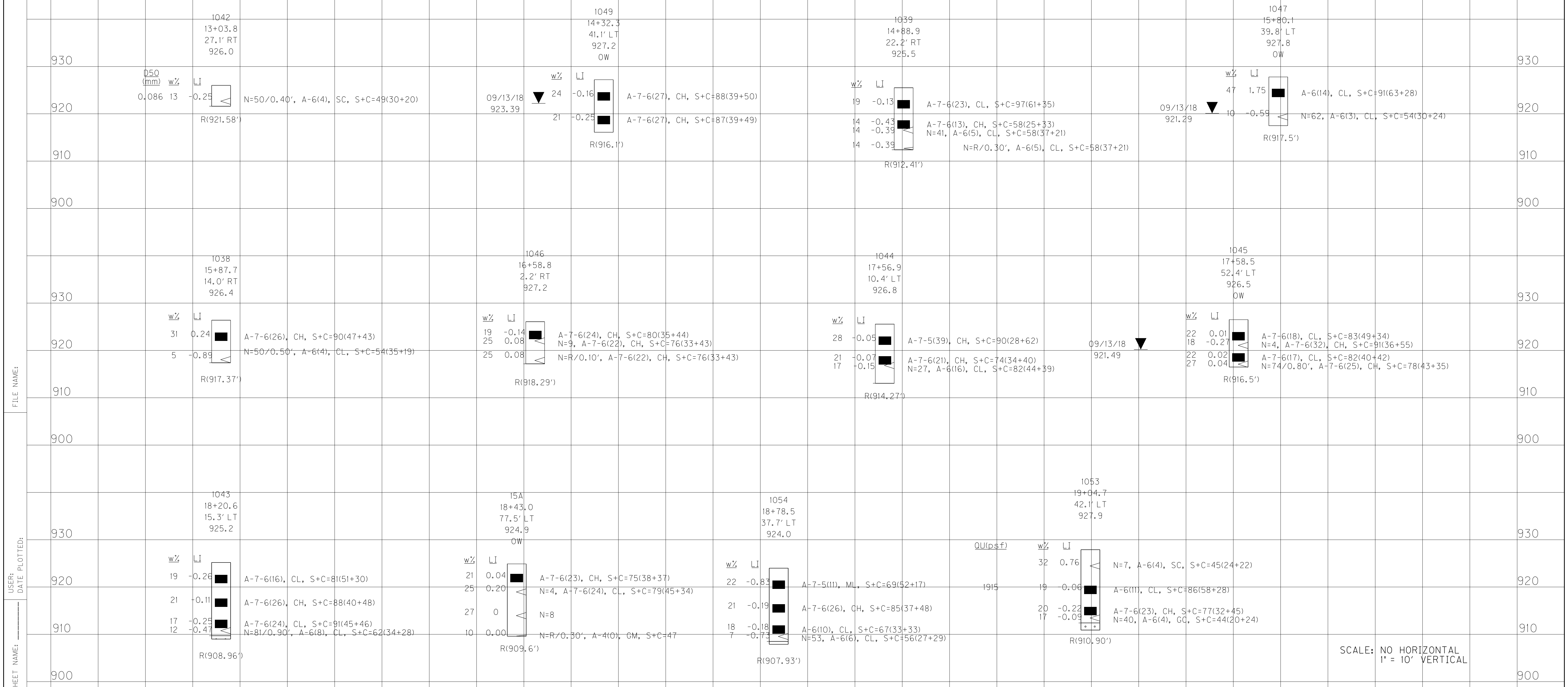

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1" = 10' VERTICAL

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TEST DATA, PROPOSED SHOOFLY
STA [illegible] TO 19+10

Addendum 2 – 7-11-19

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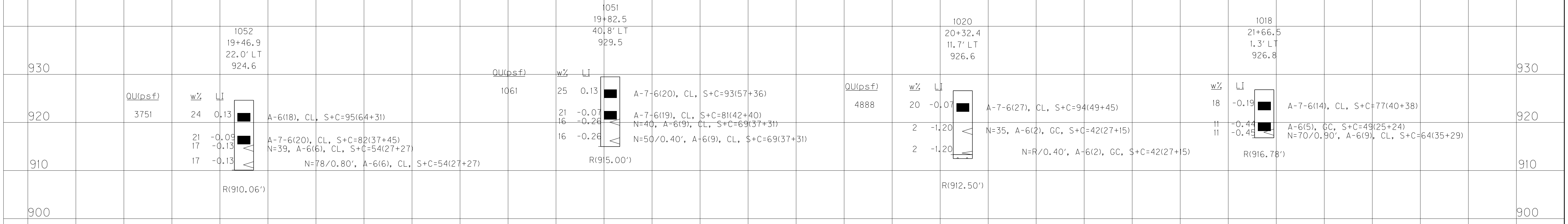
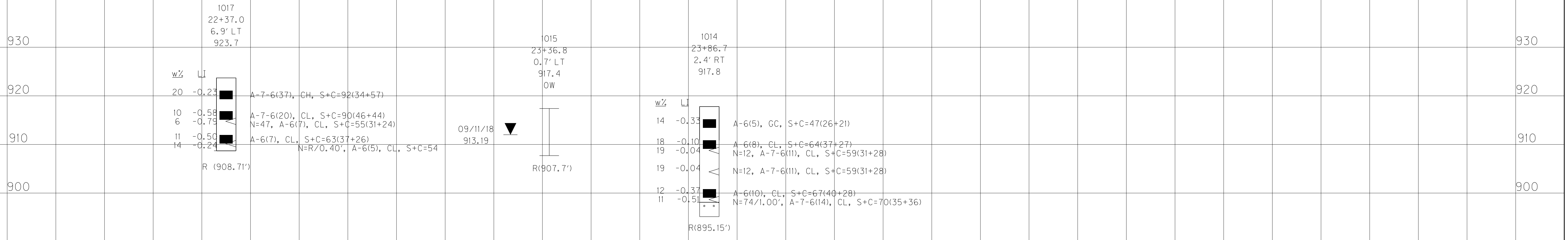
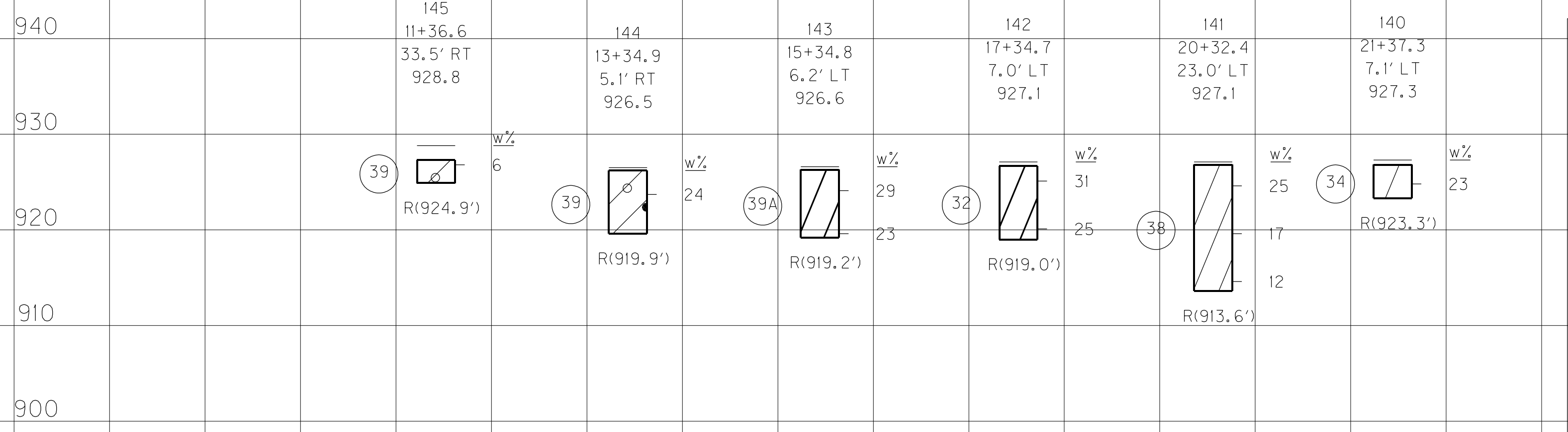




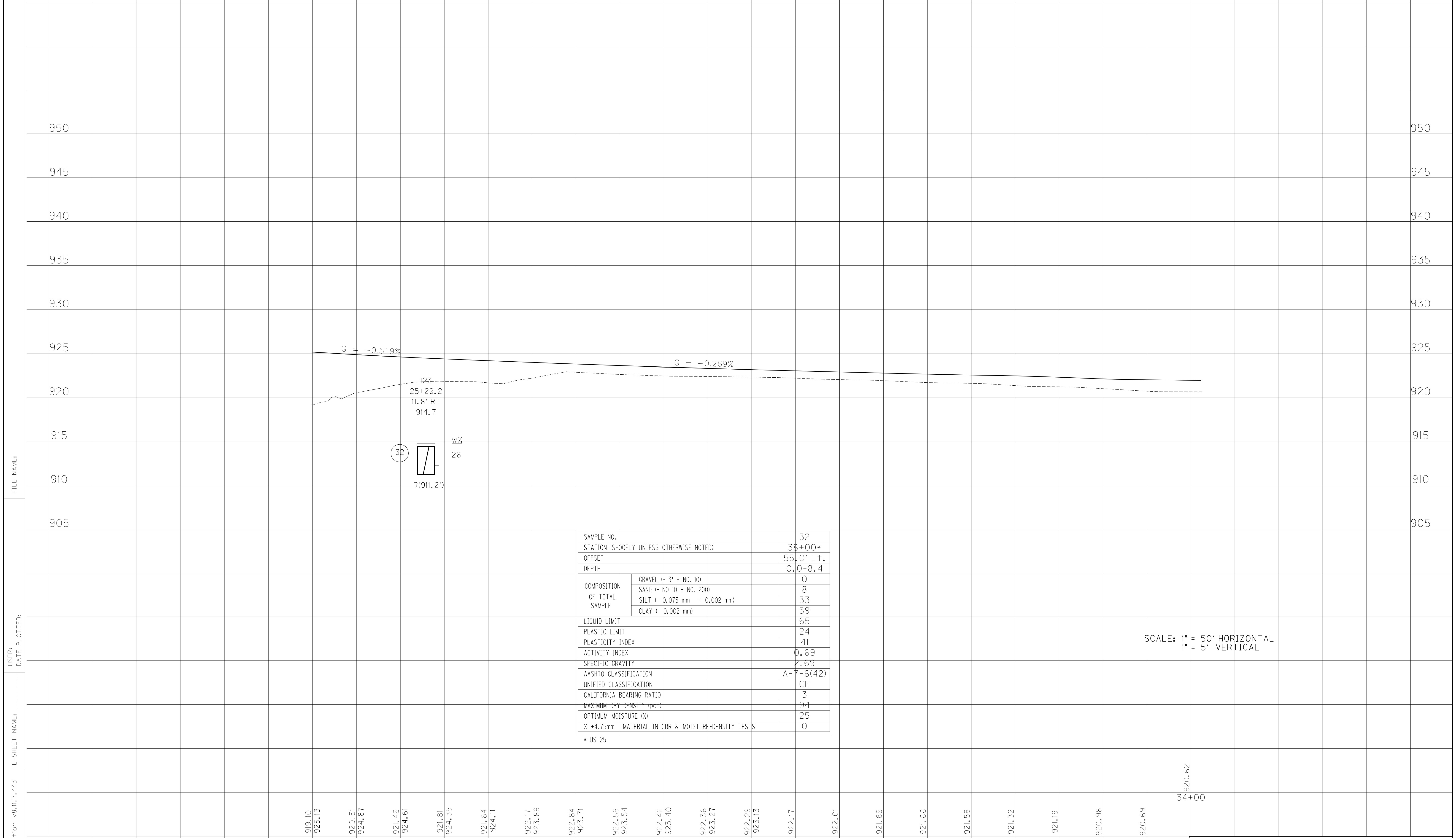


SAMPLE NO.		32	34	38	39	39A
STATION (SHOOFLY UNLESS OTHERWISE NOTED)		38+00*	56+00*	20+32.4	13+34.9	15+34.8
OFFSET		55.0′ Lt.	20.0′ Lt.	23.0′ Lt.	5.1′ Rt.	6.2′ Lt.
DEPTH		0.0-8.4	1.1-6.1	0.3-13.5	0.0-6.6	0.3-7.4
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	33	14	31	18
	SAND (- NO 10 + NO. 200)	8	15	12	25	8
	SILT (- 0.075 mm + 0.002 mm)	33	29	40	27	35
	CLAY (- 0.002 mm)	59	22	34	17	39
LIQUID LIMIT		65	41	42	38	53
PLASTIC LIMIT		24	16	18	16	19
PLASTICITY INDEX		41	25	24	22	34
ACTIVITY INDEX		0.69	1.12	0.7	1.27	0.87
SPECIFIC GRAVITY		2.69	2.76	2.8	2.61	2.79
AASHTO CLASSIFICATION		A-7-6(42)	A-7-6(9)	A-7-6(16)	A-6(5)	A-7-6(24)
UNIFIED CLASSIFICATION		CH	CL	CL	SC	CH
CALIFORNIA BEARING RATIO		3	3	2	5	2
MAXIMUM DRY DENSITY (pcf)		94	116	108	123	104
OPTIMUM MOISTURE (%)		25	15	19	10	22
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		0	25	11	18	15

* US 25

TEST DATA, PROPOSED SHOOFLY
STA S1 19+40 TO 24+00
Addendum 2 -- 7-11-19
BULK SAMPLE STA S1 11+00 TO 24+00

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	06-0018.00	____



SAMPLE NO.		32
STATION (SHOOFLY UNLESS OTHERWISE NOTED)		38+00*
OFFSET		55.0' Lt.
DEPTH		0.0-8.4
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	33
	CLAY (- 0.002 mm)	59
LIQUID LIMIT		65
PLASTIC LIMIT		24
PLASTICITY INDEX		41
ACTIVITY INDEX		0.69
SPECIFIC GRAVITY		2.69
AASHTO CLASSIFICATION		A-7-6(42)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		3
MAXIMUM DRY DENSITY (pcf)		94
OPTIMUM MOISTURE (%)		25
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		0

* US 25

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

FILE NAME:

USER:
DATE PLOTTED:

E-SHEET NAME: ______

MicroStation v8.11.7.443

SOIL PROFILE, PROPOSED SHOOFLY
STA S[illegible] 24+00 TO 34+00

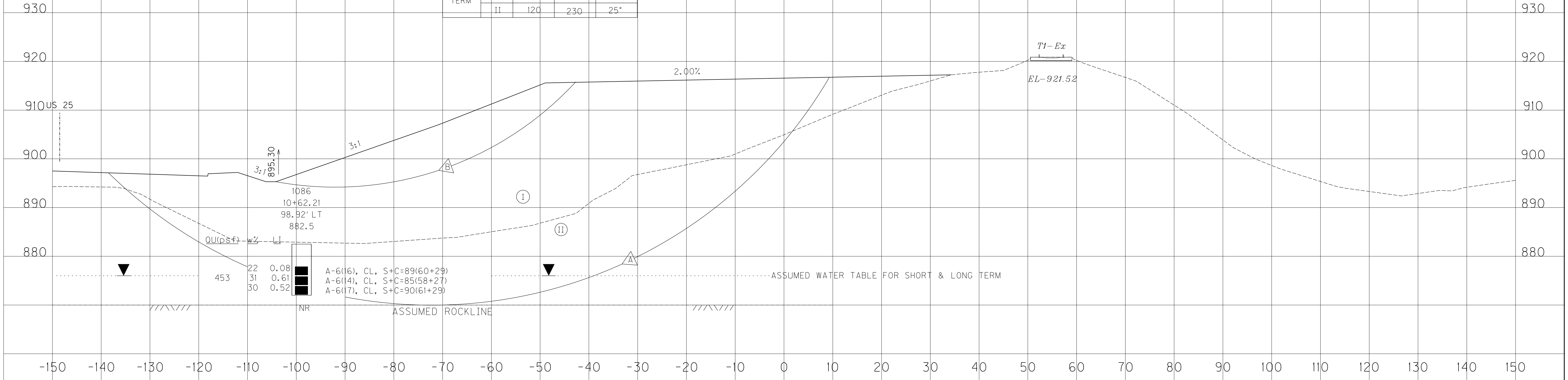
Addendum 2 — 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	06-0018.00	____

FACTORS OF SAFETY		
SHORT TERM	A	1.6
LONG TERM	B	2.7

ASSUMED SOIL STRENGTH PARAMETERS				
SHORT TERM	SOIL	∅ (pcf)	c (psf)	ø (deg)
	I	125	1000	0°
	II	120	600	0°
LONG TERM	SOIL	∅ (pcf)	c̄ (psf)	ø̄ (deg)
	I	125	270	28°
	II	120	230	25°

NOTE : LIVE LOADS INCLUDED PER AREMA FOR MAINLINE TRACK, LAYDOWN YARD, AND LAYDOWN ACCESS DRIVE.

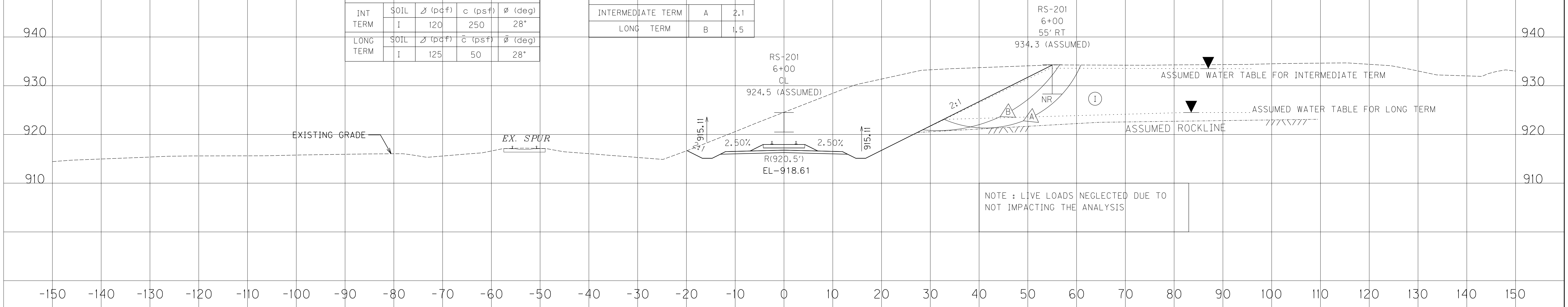


9+50

PROPOSED LAYDOWN YARD

ASSUMED SOIL STRENGTH PARAMETERS				
INT TERM	SOIL	∅ (pcf)	c (psf)	ø (deg)
	I	120	250	28°
LONG TERM	SOIL	∅ (pcf)	c̄ (psf)	ø̄ (deg)
	I	125	50	28°

FACTORS OF SAFETY		
INTERMEDIATE TERM	A	2.1
LONG TERM	B	1.5



NOTE : LIVE LOADS NEGLECTED DUE TO NOT IMPACTING THE ANALYSIS

6+00

PROPOSED TEMPORARY SPUR

SCALE: 1" = 10′ HORIZONTAL
1" = 10′ VERTICAL

CUT / EMBANKMENT STABILITY SECTION
PROPOSED LAYDOWN YARD STA 9+50
PROPOSED TEMPORARY SPUR STA 6+00

Addendum 2 - 7-11-19

M E M O R A N D U M **(RA-002-2019)**

TO: **Randy Turner, PE**
Project Management Coordinator
Division of Highway Design

FROM: **Michael Carpenter, PE**
Geotechnical Branch Manager
Division of Structural Design

BY: **Erik Scott, PE**
Geotechnical Branch

DATE: **April 4, 2019**

SUBJECT: **Boone County**
FD04 008 0075 175-176
Reconstruction of I-75 / I-71 & KY 338 (Richwood Road) Interchange
KY 338 (Richwood Road) Station 99+00.00 to 392+43.78
US 25 (Dixie Highway) Station 5+83.94 to 77+00.00
I-75/71 Station 419+03.64 to 506+17.60
I-75 Milepoints 175.217 to 175.622
Item No. 6-18.00
Mars No. 8433801D
Geotechnical Engineering Roadway Report Addendum

I. Project Background

The original geotechnical engineering report for the subject project (R-049-2015) was completed by Stantec Consulting Services, Inc. and approved / issued by the KYTC Geotechnical Branch on November 14, 2016. Since that time various revisions have been made to the plans, which will require an updated geotechnical report. No additional drilling or testing were required for the addendum. A previous addendum (RA-010-2018), issued March 27, 2019, provided recommendations for the Norfolk Southern Railroad non-structural improvements. Structure foundation reports for the railroad bridge and other structures are being issued under separate covers.

This addendum includes updated subgrade recommendations, realignment at Best Pal Drive and the Pilot Entrance, and wall elimination or limit changes. In addition, the addendum provides subsurface information for pipes of 54-in diameter or larger, lightweight fill requirements for two box culvert extensions, and updates geotechnical notes as needed to reflect current wording and station references. Only revised geotechnical notes and recommendations are provided below. Only revised geotechnical sheets are attached (geotechnical notes, soil profile, cut stability, and embankment stability sheets). The CADD input for the revised or new roadway geotechnical sheets, in DGN format, is being e-mailed to the Designer, HDR Inc., for incorporation into the roadway plans. Other original DGNs that were not changed are still acceptable for use.

II. Subgrade Stabilization

The original report recommended chemical stabilization of the subgrade using lime. After the original report, the chemical was switched to cement due to a desire to save construction time. The soils on the project are highly favorable for lime stabilization. After further discussion, the stabilization will be changed back to lime. To address concerns for needing faster construction, especially for ramps, a special note is included for accelerated cement stabilization. This will be allowed provided that the existing DGA, and optionally some of the existing asphalt, is mixed with the cement and soil. This will allow the cement to work with area soils, and has been used on past projects in the area. Other chemically stabilized areas will require lime stabilization.

The original report recommended alternate stabilization methods where chemical stabilization may not be feasible due to cross-overs, property entrances, and narrow part-width construction. Coarse Aggregate wrapped with fabric was originally recommended. This stabilization recommendation is being changed to additional base aggregate underlain with geosynthetics. The Special Note for Spot Subgrade Stabilization will address this treatment. See Geotechnical Note No. 7.19 below for more information. For quantity estimation only, 4,000 linear feet of roadway should be included in the plans for this treatment. The bid item for this work will be Subgrade Stabilization.

III. Lightweight Fill

The structure geotechnical investigations were performed after the initial roadway work, and identified two culvert extension locations where lightweight fill will be required above the existing culverts. The first is the 8′X5′ RCBC Extension Left of I-75/I-71 Station 435+53. Construction plans for the existing culvert show a stepped-down top slab from the outlet extending back twenty-nine (29) feet toward I-75/I-71. Since the stepped top slab was not designed for the full existing embankment height, lightweight fill will be required to make sure applied pressures to the existing culvert are not increased with the new embankment. Evaluation of alternates by the Geotechnical Branch revealed two possible lightweight material options: lightweight cellular concrete, or expanded polystyrene (EPS) geofoam. Details sheets are being provided for both lightweight options for inclusion in the plans. Also the ***Special Note for EPS Block Embankments*** and the ***Special Note for Cellular Concrete Fill*** are being provided for inclusion with the contract proposal documents.

The second location is the 4′X4′ RCBC Extension Left and Right of US 25 Station 32+06. Existing plans could not be located to determine if the culvert was stepped. The project team suspected the culvert was likely not stepped due to the lower fill height. However, additional fill is being added above the existing culvert, so lightweight fill will be required to keep applied pressures from increasing. Lightweight cellular concrete or expanded polystyrene (EPS) geofoam alternates are suitable for this location. Details sheets are being provided for both options at this location. The same special notes will apply to both culvert locations.

IV. Updated Slope Stability Analyses

One original stability analysis had to be updated with this addendum. The stability analysis at I-75/I-71 Station 435+50 had to be updated to reflect the lightweight fill required for the culvert. Both the cellular concrete and geofoam options were evaluated for stability and the safety factors exceeded those from the original analyses. The railroad geotechnical recommendations required stability analyses for the embankment at Proposed Laydown Yard Station 9+50, and the cut at Proposed Temporary Spur Station 6+00. These analyses were included in the previous addendum with railroad geotechnical recommendations.

V. Changes to Roadway Plans

After the original geotechnical report was issued, there were minor changes to the begin/end stations for several routes. Also, the naming of several ramps was adjusted, and the I-75/I-71 auxiliary entrance and exit ramps were renamed to use I-75/I-71 stationing. All these changes were reflected in the updated notes and recommendations.

Major changes were made to the alignment of Best Pal Drive, which intersects proposed KY 338 at Station 373+27. These changes also affected the Pilot Entrance, which intersects proposed Best al Drive at Station 32+00. The geotechnical recommendations and drawings were updated for these changes, including revisions to three soil profile sheets and one cut stability sheet.

VI. Pipe Subsurface Information

There are several large reinforced concrete pipes proposed for the project. The Geotechnical Branch typically obtains rockline soundings for pipes with diameters of 54 inches or greater. Manual rod soundings were obtained for the proposed 72-inch pipe extensions on Triple Crown Boulevard. Specific pipe sounding information was not obtained for the other larger pipes, however nearby borings are used where available to provide rockline information.

A geotechnical note has been added referencing the locations of pipes at least 54 inches in diameter. (See Table 1 on the following page.) Available subsurface information for each pipe will be tabulated on the appropriate soil profile sheet. This will give the Contractor a better idea of the bedrock location in these areas, and the type of excavation that will be required.

Table 1: Summary of Pipe Subsurface Information (≥ 54″ Diameter)			
Proposed Size (in.)	**Approximate Location**	**Boring Nos.**	**Notes**
72	Triple Crown Blvd., Sta 51+00, LT.	194, 195	Extension of existing RCBC
72	Triple Crown Blvd., Sta 51+00, RT.	203	Extension of existing RCBC
72	KY 338, 119+50 to 124+07 EB KY 338, 100+00 to 105+00	20, 82, 94	4 segments. Connects existing 8'X4' RCBC & 72" pipe east of I-75/I-71 Ramp C
72	EB KY 338, Sta 105+91	2, 26	2 segments. Inlet north of I-75/I-71 Ramp A1; connects to proposed 72" pipe

REVISED GEOTECHNICAL NOTES:

7.1 Clearing and grubbing of embankment areas shall be completed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.2 Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.3 Procedures shall be performed as required to control erosion and water pollution in accordance with Sections 212 and 213 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.4 All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.5 All catch basins and manholes shall be filled and capped and all septic tanks shall be filled in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.6 All channel changes and special ditches shall be constructed prior to placement of any embankment materials adjacent to them in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Materials excavated from these areas may be utilized in construction of the embankments, but may require aeration to the proper moisture contents prior to compaction operations. No extra payment shall be permitted for re-handling, hauling, stockpiling, and/or manipulating these materials.

7.7 In accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, the moisture content of embankment and subgrade materials shall not vary from the optimum moisture content, as determined by KM 64-511, by more than ±2%. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

7.8 All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for re-handling, hauling, stockpiling, and/or manipulating soils.

7.9 The Contractor shall conduct grading operations in such a manner that limestone obtained from roadway excavation shall be stockpiled separately or otherwise manipulated so that ample quantities are available for those areas requiring said material. No direct payment will be allowed for such necessary manipulating as stockpiling and/or double handling the material. Limestone shall not be wasted unless prior approval is obtained from the Engineer.

7.10 The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be incidental to the earthwork.

7.11 Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas as directed by the Engineer shall be drained and stabilized using non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. An estimated 3-foot working platform shall be constructed in such areas.

7.12 As directed by the Engineer, a three-foot thickness of non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction shall be utilized to fill full-width and stabilize the existing drainage swales or stream channels located within the limits of the roadway embankment. The granular embankment shall also be placed over all adjacent areas that may be soft and saturated. Positive drainage of these abandoned stream channels shall be maintained to reduce the possibility of trapping water within the roadway embankments.

7.13 The Contractor shall construct embankment foundation benches and transverse benches as indicated on the plans or as directed by the Engineer, prior to placement of embankments in areas requiring such benches.

7.14 Foundation embankment benches and longitudinal perforated pipe underdrains shall be constructed in accordance with Standard Drawing RGX-010 at the locations listed below and/or as directed by the Engineer. Contrary to Standard Drawing RGX-010, the typical rise height for benching into soil/earth slopes shall be four (4) to six (6) feet. Benches in earth slopes shall be constructed one at a time beginning with the lowest bench, and each bench shall be backfilled prior to excavation of the next bench. If water is encountered during benching, construct a minimum one (1) foot thick drainage blanket as directed by the Engineer, or contact the Geotechnical Branch for guidance. The drainage blanket shall consist of Kentucky Coarse Aggregate No. 2 in accordance with Section 805 of the current Standard Specifications, or other available material deemed suitable by the Engineer. The drainage blanket shall extend to the toe of slope to provide positive drainage and shall be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

Approximate Station Limits

KY 338
99+25 to 106+75, Left
107+75 to 108+25, Left
387+50 to 390+75, Right

I-71/I-75
421+75 to 426+75, Left
432+75 to 437+75, Left

478+25 to 482+75, Left
479+75 to 483+00, Right

I-71/I-75 Ramp A
93+75 to 95+75, Right

I-75/I-71 Ramp B
256+25 to 264+25, Right

US 25
18+50 to 23+75, Left
18+25 to 21+25, Right
30+00 to 33+25, Right
31+25 to 33+50, Left

Triple Crown Blvd
50+75 to 51+75, Lt. and Rt.

7.15 Conventional transverse benches shall be constructed and perforated pipe underdrains installed at the following approximate locations in accordance with Kentucky Department of Highways Standard Drawings RDP-005 and RDP-006, project cross-sections (as applicable), and as directed by the Engineer. Contrary to Standard Drawing RDP-006, transverse benches and perforated pipe underdrains shall be installed in both uphill and downhill transition areas between cuts and fills. Existing perforated pipe underdrains should be extended.

Approximate Stations

I-75/I-71 Ramp A1
155+52
157+20

I-75/I-71 Ramp B
252+20

I-75/I-71 Ramp B1
202+02

TA Entrance
51+60
53+5

7.16 Perforated pipes for subgrade drainage shall be installed or extended at vertical sags and at the upgrade ends of structures, in accordance with Kentucky Department of Highways Standard Drawing RDP-005 and/or as directed by the Engineer. These drainage features shall be installed at the following approximate locations.

Approximate Stations

KY 338
100+25
108+60
113+40

I-75/I-71 Ramp A1
156+90

I-75/I-71 Ramp B1
202+45

I-75/I-71 Ramp C1
352+60

I-75/I-71 Ramp D
415+90

US 25
9+97
22+43
32+63
54+10

US 25 Ramp A
17+49

US 25 Ramp D
42+05

US 25 Ramp E
59+22

US 25 Ramp G
71+25

Grand National Blvd
98+90

Grand National Access Drive
50+20
55+75

Triple Crown Blvd
51+80

Best Pal Drive
17+68
26+28

TA Entrance
50+99

Old Lexington Pike
5+65

Frogtown Connector Road
600+70

I-75 / I-71
439+50

Ridge Transportation Entrance 1
10+48

Ridge Transportation Entrance 2
19+62

Richwood Road
22+95

7.17 The Contractor shall conduct grading operations in such a manner that soil (free of rock larger than 4 inches) from roadway excavation be stockpiled separately or otherwise manipulated so that ample quantities are available for a chemically stabilized roadbed meeting the requirements of Section 208 of the current Standard Specifications for Road and Bridge Construction. No direct payment will be allowed for such necessary manipulating as stockpiling, hauling and/or handling the material.

7.18 Construct an eight (8)-inch **lime stabilized** soil subgrade for the project. Apply the lime in accordance with Section 208 of the Standard Specifications for Road and Bridge Construction. Where soft and/or wet subgrade is encountered during construction, the thickness of the chemically modified soil may need to be adjusted (increased up to 16-inch max) to also serve as a working platform for subgrade stabilization. These adjustments shall be as directed by the Engineer, and may depend on the seasonal fluctuations in the water table. In areas where existing Dense Graded Aggregate (DGA) and/or milled asphalt can be incorporated into the 8-inches of chemically stabilized soil, cement may be used for stabilization in lieu of lime. This may result in a decreased curing time. The stabilization shall be in accordance with the Special Note for Accelerated Cement Subgrade Stabilization and payment shall use lime stabilization bid items.

7.19 In areas where the chemical stabilization is not feasible (such as cross-overs, tie-ins, narrow widenings, etc.) the subgrade shall be constructed with either eight (8) additional inches of Crushed Stone Base (CSB) underlain with geogrid or six (6) additional inches of Crushed Stone Base (CSB) underlain with high-strength fabric. Geogrid, if used, shall be underlain with Geotextile Fabric, in accordance with Sections 214 & 843 of the current Standard Specifications. Contrary to the Standard Specifications, Type IV Geotextile Fabric shall be used in lieu of Type III Fabric. The subgrade material properties and installation shall be in accordance with the Special Note for Spot Subgrade Stabilization (Alternatives C or D only) and the current Standard Specifications for Road and Bridge Construction. The aggregate shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction.

7.20 Where non-durable shale (SDI ≤ 95) or limestone bedrock is encountered at the top of subgrade in the cuts, the roadbed shall be undercut one (1) foot below the proposed grade and the limits of the roadbed excavation shall be extended to the ditchlines. The refill shall consist of soil for a chemically stabilized roadbed in accordance with Section 208 of the current Standard Specifications for Road and Bridge Construction.

7.21 Where pile foundations are utilized for bridges, pile cores shall be constructed in accordance with Kentucky Standard Drawings RGX-100 and RGX-105, meeting the material requirements of the current edition of Special Provision 69.

7.22 As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and backfilled with suitable subgrade material in accordance with Section 207 of the current Standard Specifications.

Approximate Station Limits

KY 338
99+00 to 124+07
370+20 to 371+50
388+50 to 392+00

EB KY 338
100+00 to 105+00
112+00 to 116+07

WB KY 338
205+00 to 216+22

I-75/I-71
419+04 to 443+50
475+00 to 506+18

I-75/I-71 Ramp A
87+60 to 97+00

I-75/I-71 Ramp B
255+50 to 265+40

I-75/I-71 Ramp C
304+50 to 313+50

I-75/I-71 Ramp D
400+00 to 410+50
415+50 to 416+00

US 25
5+84 to 22+90
27+60 to 30+80
34+00 to 77+00

Triple Crown Blvd
50+00 to 53+14

Best Pal Drive
24+25 to 28+25

Paddock Drive
201+00 to 203+40

Frogtown Connector
601+50 to 602+50

Old Lexington Road
9+50 to 11+50

Richwood Road
19+00 to 21+00

7.23 As directed by the Engineer, existing bituminous concrete at the following approximate locations that is positioned within the limits of new roadway embankments and positioned at a distance greater than three feet below proposed subgrade elevation, shall be scarified or broken until all cleavage planes are destroyed, or the pavement shall be removed entirely as conditions demand in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Subgrade materials remaining after removal of pavements may need to be stabilized prior to placement of new pavement sections, as directed by the Engineer.

Approximate Station Limits

US 25
30+80 to 34+00

7.24 The retaining walls at the following locations will affect the cut slope and embankment construction. For these areas, please refer to the structural plans for specific instructions for cut slope and embankment construction.

Approximate Station Limits

KY 338
Retaining Wall No. 1: 103+88 to 106+10, Left
Retaining Wall No. 1A: 107+72 to 108+28, Left
Retaining Wall No. 2: 113+80 to 114+70, Left

WB KY 338
Retaining Wall No. 3: 201+13 to 202+73, Left
Retaining Wall No. 15: 207+80 to 209+45, Right

EB KY 338
Retaining Wall No. 14: 107+85 to 109+58, Left

Best Pal Drive
Retaining Wall No. 4: 23+00 to 24+48, Right

US 25
Retaining Wall No. 7: 42+25 to 46+68.52, Left
Retaining Wall No. 8: 49+57.27 to 55+25, Left
Retaining Wall No. 9: 42+25 to 46+68.52, Left
Retaining Wall No. 10: 49+56.52 to 54+25, Right

US 25: Ramp A / Ramp B
Retaining Wall No. 11: 13+50 (Ramp A to 20+60.93 (Ramp B), Right

US 25: Ramp C
Retaining Wall No. 12: 30+45.8 to 31+50, Right

I-75/I-71
Retaining Wall No. 13: 489+85 to 490+25, Right

7.25 Embankment slopes at the following location will need to be flatter than a 2:1 (H:V) to maintain minimum factor of safety requirements for slope stability. The fill limits and required sections show the flattened slopes and results of the stability analysis.

Approximate Station Limits	**Steepest Allowable Slope**
I-75/I-71: 434+80 to 436+20	2.5:1 (H:V)

7.26 All embankment construction using non-durable shale will be in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction, "Embankment Principally of Non-Durable Shale".

7.27 Some areas of the project may contain silts or sands at subgrade. Lime may not be effective in stabilizing these materials. If such soils are encountered cement should be more effective. The Stabilization Contractor shall adjust the stabilization techniques, as directed by the Engineer. Based on boring information, these soils may be encountered at the following locations. Geotechnical Branch personnel are available to assist in identifying these soil types and providing alternative treatment recommendations, if needed. The original lime stabilization bid items will be used for payment for any such changes.

Approximate Station Limits

I-75/I-71 Ramp B
260+50 to 265+40

Old Lexington Pike
5+00 to 10+00

7.28 Soil borings were performed near the reinforced concrete pipe culverts (RCPs) at the following locations. See the Geotechnical Profile Sheets for rockline information.

Approximate Stations

EB KY 338
100+00
105+91

Triple Crown Blvd.
51+00

Lightweight Fill for Culvert Extensions @ I-75/I-71 Sta 435+53, US 25 Sta 32+06:

7.29 Place lightweight fill material as shown in the plans and in accordance with the Special Note for Cellular Concrete Fill OR the Special Note for EPS Foam Block Embankments, and the appropriate Lightweight Fill Detail Sheet. These documents provide additional detail on the construction of the lightweight fill. The fill shall extend perpendicular to the culvert to the minimum limits shown on the detail sheets.

7.30 Lightweight fill shall be covered with a minimum two (2)-foot of soil cap when it is not directly beneath pavement and base aggregate. The soil shall consist of clay classified as either CL or CH in the Unified Soil Classification System (USCS) and placed and compacted in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction.

7.31 When EPS geofoam fill is within five (5) feet of the proposed road grade, a concrete load distributor is required above the top layer of geofoam blocks. The Special Note for EPS Foam Block Embankments provides details for the concrete load distributor.

7.32 Temporary sheeting or shoring may be required for construction of the lightweight fill. The specific designs for any necessary sheeting and shoring shall be performed by the Contractor and approved by the Engineer. Construction and stability of temporary slopes required for lightweight fill placement are the responsibility of the Contractor. Caution should be used with sheeting/shoring or temporary slopes adjacent to existing roadways. The time any temporary cut slopes are left open should be minimized to reduce the likely of slope instability.

7.33 Any changes in lightweight fill configuration and material type from the applicable Lightweight Fill Detail Sheet and Special Note will require additional design and analysis by the Contractor or Supplier, meeting the approval of the Engineer.

7.34 A proposed soundwall will be constructed in the area of the 8X5 culvert extension at I-75/I-71 Station 435+53. Drilled shaft soundwall foundations should be considered prior to lightweight fill placement to prevent negative impact to the lightweight fill materials. For any drilled shafts within the lightweight fill zone, drilling should not be performed through geofoam materials. Drilled shaft side capacity should be neglected in lightweight fill materials, unless updated designs are provided by the Contractor and approved by the Department.

REVISED DESIGN RECOMMENDATIONS:

8.1 The project shall be designed using a soil CBR of 2 beneath the chemically stabilized soil.

8.2 The project should be designed for a chemically stabilized subgrade. Chemical treatment for the top eight (8) inches of subgrade is recommended. The appropriate chemical for treating the soil types encountered on this project is **lime.** It is suggested that 6 percent, by dry mass, be utilized to determine plan quantities, using an average dry density of 101 lb/ft^3. The chemical shall be applied in accordance with Section 208 of the Standard Specifications for Road and Bridge Construction, current edition.

8.3 An average soil shrinkage value of 3% is recommended for soil to be excavated on this project. This value is to be used in calculating an "apparent" shrinkage value in accordance with Section 61-03.0400 of the Kentucky Transportation Cabinet Division of Design Guidance Manual. This shrinkage value should be applied only to soil positioned above the top of rock. A shrink/swell value of zero (0) should be applied to Rock Disintegration Zone (RDZ) material.

8.4 The recommended rock swell factor is 10% for material excavated below the RDZ.

8.5 Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas directed by the Engineer shall be drained and stabilized, as specified in Geotechnical Note 7.11 of this report. For quantity estimating purposes only, the following areas shall be considered for this treatment.

Approximate Station Limits

EB KY 338
110+50 to 116+00, Left

I-71/I-75
422+50 to 438+75, Left

US 25
32+00 to 33+00, Left
60+00 to 62+00, Right

8.6 As directed by the Engineer, existing drainage swales or stream channels shall be filled and stabilized with non-erodible Granular Embankment, as specified in Geotechnical Note 7.12 of this report. For quantity estimating purposes only, the following intervals shall be considered.

Approximate Station Limits

KY 338
107+75 to 108+25, Left

<u>WB KY 338</u>
214+00 to 216+00, Left

<u>I-75/I-71</u>
433+00 to 434+25, Left

<u>I-75/I-71</u>
479+50 to 480+25, Right
482+00 to 484+00, Right

<u>I-75/I-71 Ramp A</u>
94+00 to 95+50, Right

<u>I-75/I-71 Ramp B</u>
251+50 to 252+25, Right

<u>I-75/I-71 Ramp B1</u>
200+00 to 201+50, Left and Right

cc: **Division of Design (Plan Processing Section)**
TEBM for Pavement Design
Division of Construction
TEBM for Project Delivery & Preservation (District 6)
TEBM for Project Development (District 6)
Project Manager (District 6)
HMB, Inc.
HDR, Inc.
Parsons

Attachments:

Attachment #1

Revised Geotechnical Drawings

GEOTECHNICAL NOTES

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

1. Clearing and grubbing of embankment areas shall be completed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

2. Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

3. Procedures shall be performed as required to control erosion and water pollution in accordance with Sections 212 and 213 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

4. All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

5. All catch basins and manholes shall be filled and capped and all septic tanks shall be filled in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

6. All channel changes and special ditches shall be constructed prior to placement of any embankment materials adjacent to them in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Materials excavated from these areas may be utilized in construction of the embankments, but may require aeration to the proper moisture contents prior to compaction operations. No extra payment shall be permitted for re-handling, hauling, stockpiling, and/or manipulating these materials.

7. In accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, the moisture content of embankment and subgrade materials shall not vary from the optimum moisture content, as determined by KM 64-511, by more than *2%. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

8. All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for re-handling, hauling, stockpiling, and/or manipulating soils.

9. The Contractor shall conduct grading operations in such a manner that limestone obtained from roadway excavation shall be stockpiled separately or otherwise manipulated so that ample quantities are available for those areas requiring said material. No direct payment will be allowed for such necessary manipulating as stockpiling and/or double handling the material. Limestone shall not be wasted unless prior approval is obtained from the Engineer.

10. The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be incidental to the earthwork.

11. Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas as directed by the Engineer shall be drained and stabilized using non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. An estimated 3-foot working platform shall be constructed in such areas.

12. As directed by the Engineer, a three-foot thickness of non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction shall be utilized to fill full-width and stabilize the existing drainage swales or stream channels located within the limits of the roadway embankment. The granular embankment shall also be placed over all adjacent areas that may be soft and saturated. Positive drainage of these abandoned stream channels shall be maintained to reduce the possibility of trapping water within the roadway embankments.

13. The Contractor shall construct embankment foundation benches and transverse benches as indicated on the plans or as directed by the Engineer, prior to placement of embankments in areas requiring such benches.

14. Foundation embankment benches and longitudinal perforated pipe underdrains shall be constructed in accordance with Standard Drawing RGX-010 at the locations listed below and/or as directed by the Engineer. Contrary to Standard Drawing RGX-010, the typical rise height for benching into soil/earth slopes shall be four (4) to six (6) feet. Benches in earth slopes shall be constructed one at a time beginning with the lowest bench, and each bench shall be backfilled prior to excavation of the next bench. If water is encountered during benching, construct a minimum one (1) foot thick drainage blanket as directed by the Engineer, or contact the Geotechnical Branch for guidance. The drainage blanket shall consist of Kentucky Coarse Aggregate No. 2 in accordance with Section 805 of the current Standard Specifications, or other available material deemed suitable by the Engineer. The drainage blanket shall extend to the toe of slope to provide positive drainage and shall be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

Approximate Station Limits
KY 338
99+25 to 106+75, Left
107+75 to 108+25, Left
387+50 to 390+75, Right

I-71/I-75
421+75 to 426+75, Left
432+75 to 437+75, Left
478+25 to 482+75, Left
479+75 to 483+00, Right

I-75/I-71 Ramp A
93+75 to 95+75, Right

I-75/I-71 Ramp B
256+25 to 264+25, Right

US 25
18+50 to 23+75, Left
18+25 to 21+25, Right
30+00 to 33+25, Right
31+25 to 33+50, Left

Triple Crown Blvd
50+75 to 51+75, Left and Right

15. Conventional transverse benches shall be constructed and perforated pipe underdrains installed at the following approximate locations in accordance with Kentucky Department of Highways Standard Drawings RDP-005 and RDP-006, project cross-sections (as applicable), and as directed by the Engineer. Contrary to Standard Drawing RDP-006, transverse benches and perforated pipe underdrains shall be installed in both uphill and downhill transition areas between cuts and fills. Existing perforated pipe underdrains should be extended.

Approximate Station Limits
I-75/I-71 Ramp A1
155+52
157+20

I-75/I-71 Ramp B
252+20

I-75/I-71 Ramp B1
202+02

TA Entrance
51+60
53+50

16. Perforated pipes for subgrade drainage shall be installed or extended at vertical sags and at the upgrade ends of structures, in accordance with Kentucky Department of Highways Standard Drawing RDP-005 and/or as directed by the Engineer. These drainage features shall be installed at the following approximate locations.

Approximate Station Limits
KY 338
100+25
108+60
113+40

I-75/I-71
439+50

I-75/I-71 Ramp A1
156+90

I-75/I-71 Ramp B1
202+45

I-75/I-71 Ramp C1
352+60

I-75/I-71 Ramp D
415+90

US 25
9+97
22+43
32+63
54+10

US 25 Ramp A
17+49

US 25 Ramp D
42+05

US 25 Ramp E
59+22

US 25 Ramp G
71+25

Grand National Blvd
98+90

Grand National Access Drive
50+20
55+75

Triple Crown Blvd
51+80

Best Pal Drive
17+68
26+28

TA Entrance
50+99

Old Lexington Pike
5+65

Frogtown Connector Road
600+70

Ridge Transportation Entrance 1
10+48

Ridge Transportation Entrance 2
19+62

Richwood Road
22+95

17. The Contractor shall conduct grading operations in such a manner that soil (free of rock larger than 4 inches) from roadway excavation be stockpiled separately or otherwise manipulated so that ample quantities are available for a chemically stabilized roadbed meeting the requirements of Section 208 of the current Standard Specifications for Road and Bridge Construction. No direct payment will be allowed for such necessary manipulating as stockpiling, hauling and/or handling the material.

18. Construct an eight (8)-inch lime stabilized soil subgrade for the project. Apply the lime in accordance with Section 208 of the Standard Specifications for Road and Bridge Construction. Where soft and/or wet subgrade is encountered during construction, the thickness of the chemically modified soil may need to be adjusted (increased up to 16-inch max) to also serve as a working platform for subgrade stabilization. These adjustments shall be as directed by the Engineer, and may depend on the seasonal fluctuations in the water table. In areas where existing Dense Graded Aggregate (DGA) and/or milled asphalt can be incorporated into the 8-inches of chemically stabilized soil, cement may be used for stabilization in lieu of lime. This may result in a decreased curing time. The stabilization shall be in accordance with the Special Note for Accelerated Cement Subgrade Stabilization and payment shall use lime stabilization bid items.

DESIGNED BY:
DATE SUBMITTED:

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS: FD52 008 0075 I75-176

GEOTECHNICAL NOTES
Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

GEOTECHNICAL NOTES

19. In areas where the chemical stabilization is not feasible (such as cross-overs, tie-ins, narrow widenings, etc.) the subgrade shall be constructed with either eight (8) additional inches of Crushed Stone Base (CSB) underlain with geogrid or six (6) additional inches of Crushed Stone Base (CSB) underlain with high-strength fabric. Geogrid, if used, shall be underlain with Geotextile Fabric, in accordance with Sections 214 & 843 of the current Standard Specifications. Contrary to the Standard Specifications, Type IV Geotextile Fabric shall be used in lieu of Type III Fabric. The subgrade material properties and installation shall be in accordance with the Special Note for Spot Subgrade Stabilization (Alternatives C or D only) and the current Standard Specifications for Road and Bridge Construction. The aggregate shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction.

20. Where shale (or limestone) bedrock is encountered at the top of subgrade in the cuts, the roadbed shall be undercut one foot below the proposed grade and the limits of the roadbed excavation shall be extended to the ditchlines. The refill shall consist of soil and shall be constructed as specified in Section 204 of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, current edition. Shale cannot be used in the top one foot of the subgrade. For Roadway Excavation projects, the placement of soil refill shall be incidental. For Embankment-in-Place projects, the placement of soil refill shall be paid at the unit bid price for Embankment-in-Place and the excavation of the bedrock material shall be incidental. For either case, no compensation shall be made for the incidental portions of this work.

21. Pile cores shall be constructed at the bridge approach embankments in accordance with Kentucky Standard Drawings RGX-100 and RGX-105, meeting the material requirements of the current edition of Special Provision 69.

22. As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and backfilled with suitable subgrade material in accordance with Section 207 of the current Standard Specifications.

Approximate Station Limits
KY 338
99+00 to 124+07
370+20 to 371+50
388+50 to 392+00

EB KY 338
100+00 to 105+00
112+00 to 116+07

WB KY 338
205+00 to 216+22

SB I-71/I-75 AUX. ENTRANCE RAMP
419+04 to 443+50
475+00 to 506+18

I-75/I-71 Ramp A
87+60 to 97+00

I-75/I-71 Ramp B
255+50 to 265+40

I-75/I-71 Ramp C
304+50 to 313+50

I-75/I-71 Ramp D
400+00 to 410+50
415+50 to 416+00

US 25
5+84 to 22+90
27+60 to 30+80
34+00 to 77+00

Triple Crown Blvd
50+00 to 53+14

Paddock Drive
201+00 to 203+40

Best Pal Drive
24+25 to 28+25

Frogtown Connector
601+50 to 602+50

Old Lexington Road
9+50 to 11+50

Richwood Road
19+00 to 21+00

23. As directed by the Engineer, existing bituminous concrete at the following approximate locations that is positioned within the limits of new roadway embankments and positioned at a distance greater than three feet below proposed subgrade elevation, shall be scarified or broken until all cleavage planes are destroyed, or the pavement shall be removed entirely as conditions demand in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Subgrade materials remaining after removal of pavements may need to be stabilized prior to placement of new pavement sections, as directed by the Engineer.

Approximate Station Limits
US 25
30+80 to 34+00

24. The retaining walls at the following locations will affect the cut slope and embankment construction. For these areas, please refer to the structural plans for specific instructions for cut slope and embankment construction.

Approximate Station Limits

KY 338
Retaining Wall No. 1: 103+88 to 106+10, Left
Retaining Wall No. 1A: 107+72 to 108+28, Left
Retaining Wall No. 2: 113+80 to 114+70, Left

EB KY 338
Retaining Wall No. 14: 107+85 to 109+58, Left

WB KY 338
Retaining Wall No. 3: 201+13 to 202+73, Left
Retaining Wall No. 15: 207+80 to 209+45, Right

US 25
Retaining Wall No. 7: 42+25 to 46+68.52, Left
Retaining Wall No. 8: 49+57.27 to 55+25, Left
Retaining Wall No. 9: 42+25 to 46+68.52, Left
Retaining Wall No. 10: 49+56.52 to 54+25, Right

US 25 Ramp A / Ramp B
Retaining Wall No. 11: 13+50 (RAMP A to 20+60.93 (RAMP B), Right

US 25 Ramp C
Retaining Wall No. 12: 30+45.8 to 31+50, Right

I-75/I-71
Retaining Wall No. 13: 489+85 to 490+25, Right

25. Embankment slopes at the following location will need to be flatter than a 2:1 (H:V) to maintain minimum factor of safety requirements for slope stability. The fill limitsand required sections show the flattened slopes and results of the stability analysis.

Approximate Station Limits	Steepest Allowable Slope
I-75/I-71: 434+80 to 436+20	2.5:1 (H:V)

26. All embankment construction using non-durable shale will be in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction, "Embankment Principally of Non-Durable Shale".

27. Some areas of the project may contain silts or sands at subgrade. Lime may not be effective in stabilizing these materials. If such soils are encountered cement should be more effective. The Stabilization Contractor shall adjust the stabilization techniques, as directed by the Engineer. Based on boring information, these soils may be encountered at the following locations. Geotechnical Branch personnel are available to assist in identifying these soil types and providing alternative treatment recommendations, if needed. The original lime stabilization bid items will be used for payment for any such changes.

Approximate Station Limits
RAMP B
260+50 to 265+40

OLD LEXINGTON PIKE
5+00 to 10+00

28. Soil borings were performed near the reinforced concrete pipe culverts (RCPs) at the following locations. See the Geotechnical Profile Sheets for rockline information.

Approximate Station Limits
EB KY 338
100+00
105+91

Triple Crown Blvd
51+00

DESIGNED BY:
DATE SUBMITTED:

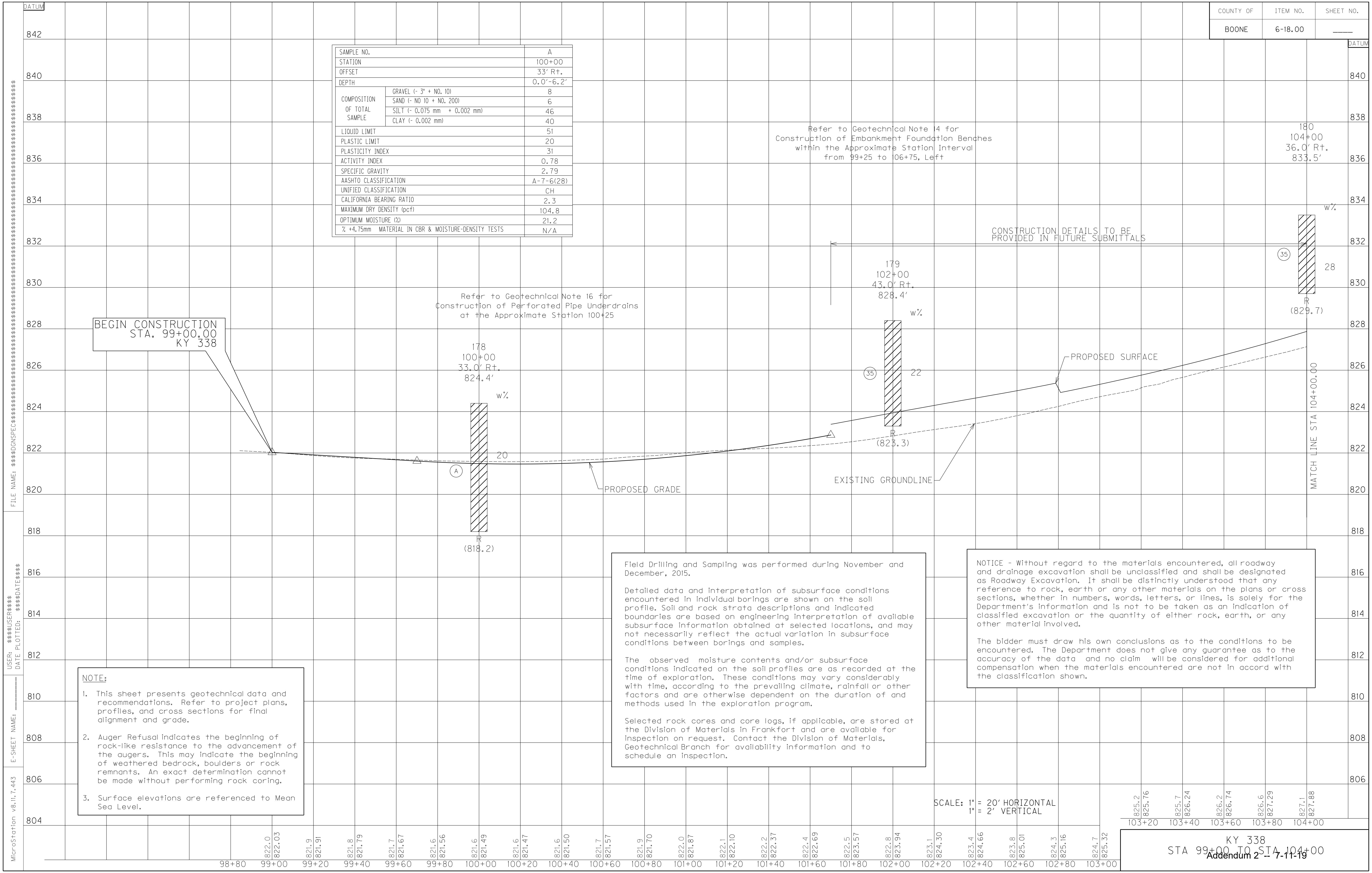
Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS: FD52 008 0075 175-176

GEOTECHNICAL NOTES
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		A
STATION		100+00
OFFSET		33′ Rt.
DEPTH		0.0′-6.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	8
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		20
PLASTICITY INDEX		31
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(28)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.3
MAXIMUM DRY DENSITY (pcf)		104.8
OPTIMUM MOISTURE (%)		21.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



Field Drilling and Sampling was performed during November and December, 2015.

Detailed data and interpretation of subsurface conditions encountered in individual borings are shown on the soil profile. Soil and rock strata descriptions and indicated boundaries are based on engineering interpretation of available subsurface information obtained at selected locations, and may not necessarily reflect the actual variation in subsurface conditions between borings and samples.

The observed moisture contents and/or subsurface conditions indicated on the soil profiles are as recorded at the time of exploration. These conditions may vary considerably with time, according to the prevailing climate, rainfall or other factors and are otherwise dependent on the duration of and methods used in the exploration program.

Selected rock cores and core logs, if applicable, are stored at the Division of Materials in Frankfort and are available for inspection on request. Contact the Division of Materials, Geotechnical Branch for availability information and to schedule an inspection.

NOTICE - Without regard to the materials encountered, all roadway and drainage excavation shall be unclassified and shall be designated as Roadway Excavation. It shall be distinctly understood that any reference to rock, earth or any other materials on the plans or cross sections, whether in numbers, words, letters, or lines, is solely for the Department's information and is not to be taken as an indication of classified excavation or the quantity of either rock, earth, or any other material involved.

The bidder must draw his own conclusions as to the conditions to be encountered. The Department does not give any guarantee as to the accuracy of the data and no claim will be considered for additional compensation when the materials encountered are not in accord with the classification shown.

NOTE:

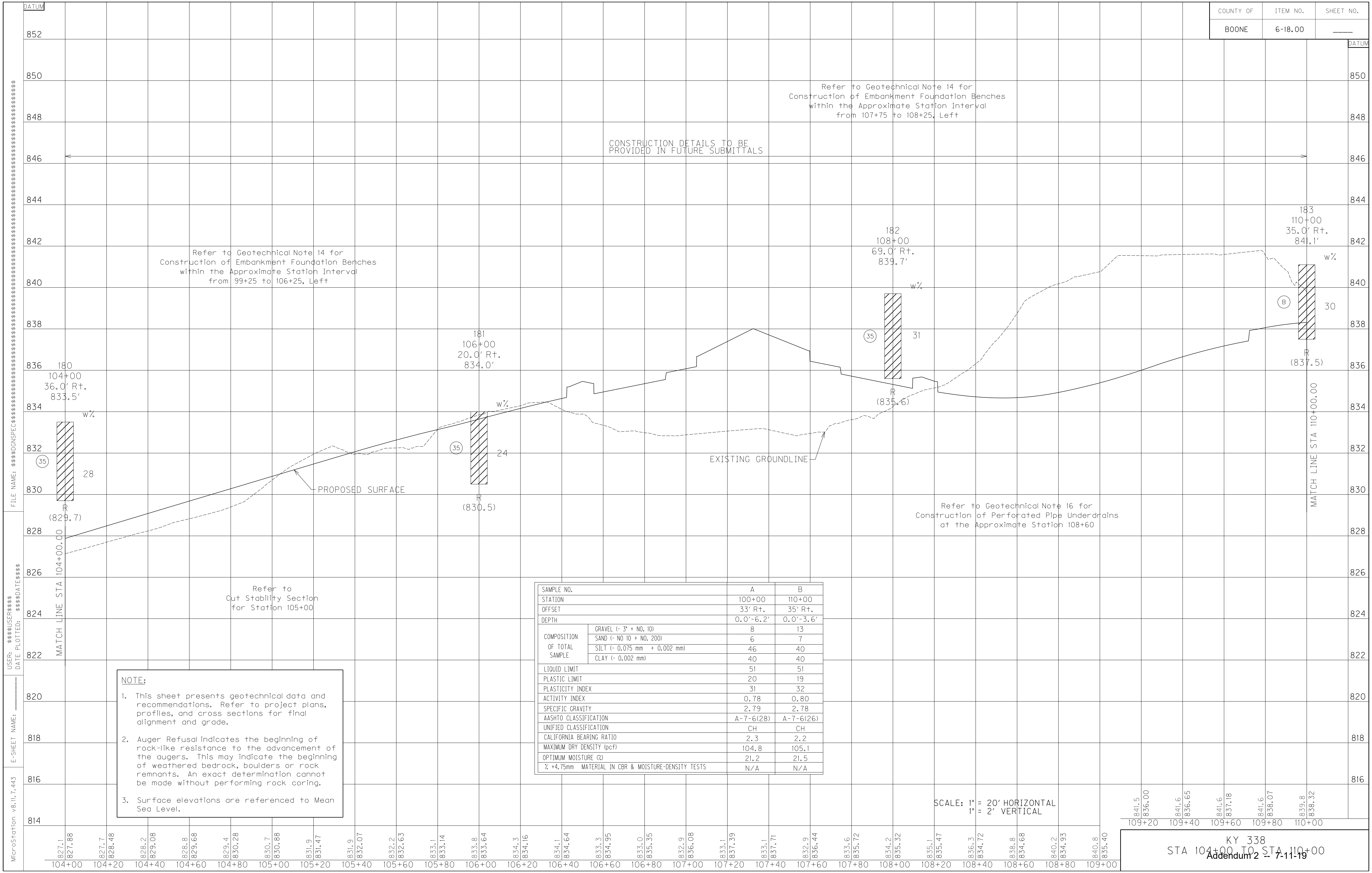
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA 99+00 TO STA 104+00
Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME: ________
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		A	B
STATION		100+00	110+00
OFFSET		33' Rt.	35' Rt.
DEPTH		0.0'-6.2'	0.0'-3.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	8	13
	SAND (- NO 10 + NO. 200)	6	7
	SILT (- 0.075 mm + 0.002 mm)	46	40
	CLAY (- 0.002 mm)	40	40
LIQUID LIMIT		51	51
PLASTIC LIMIT		20	19
PLASTICITY INDEX		31	32
ACTIVITY INDEX		0.78	0.80
SPECIFIC GRAVITY		2.79	2.78
AASHTO CLASSIFICATION		A-7-6(28)	A-7-6(26)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		2.3	2.2
MAXIMUM DRY DENSITY (pcf)		104.8	105.1
OPTIMUM MOISTURE (%)		21.2	21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 338
STA 104+00 TO STA 110+00

Addendum 2 -- 7-11-19

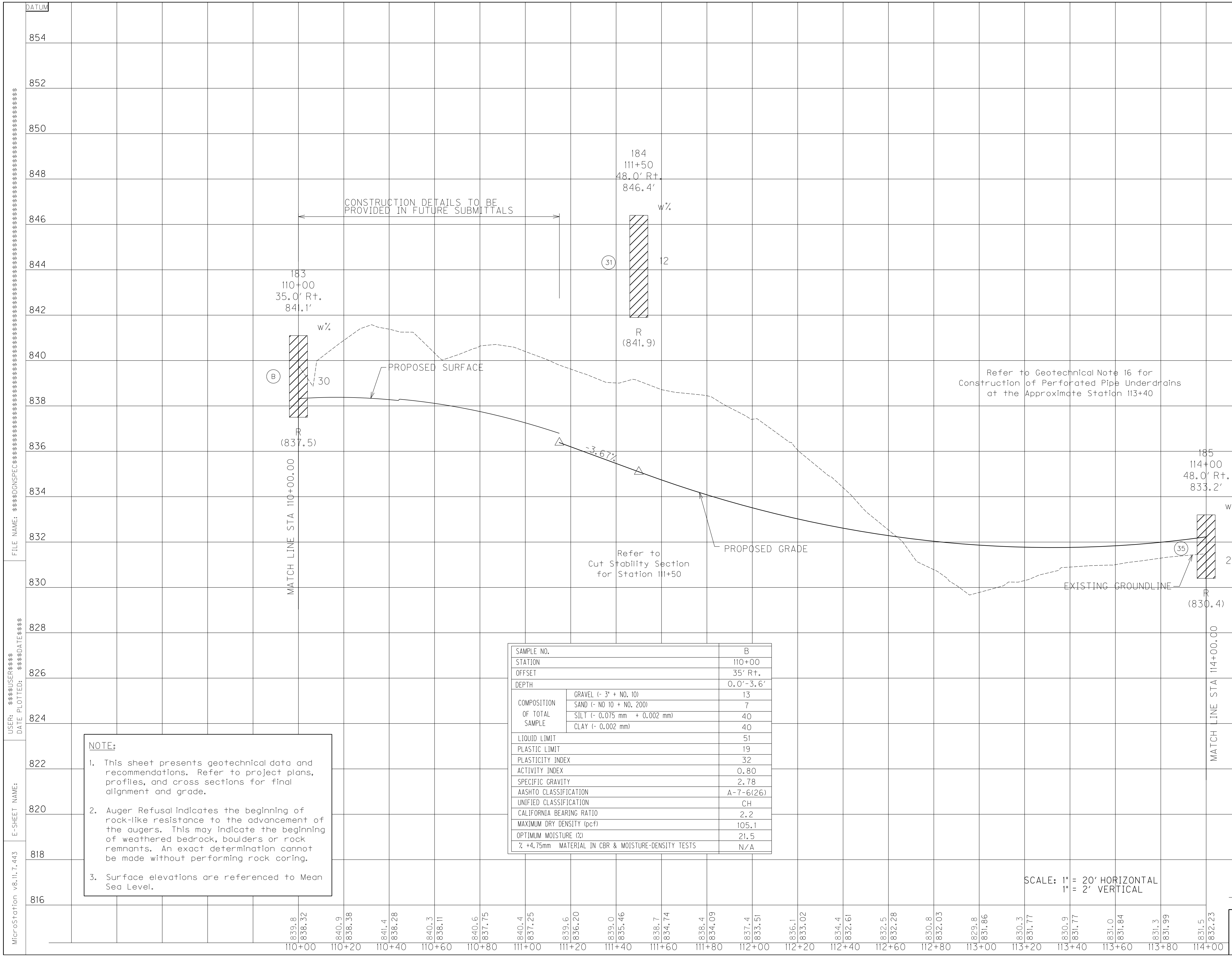
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ______

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		B
STATION		110+00
OFFSET		35′ Rt.
DEPTH		0.0′-3.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

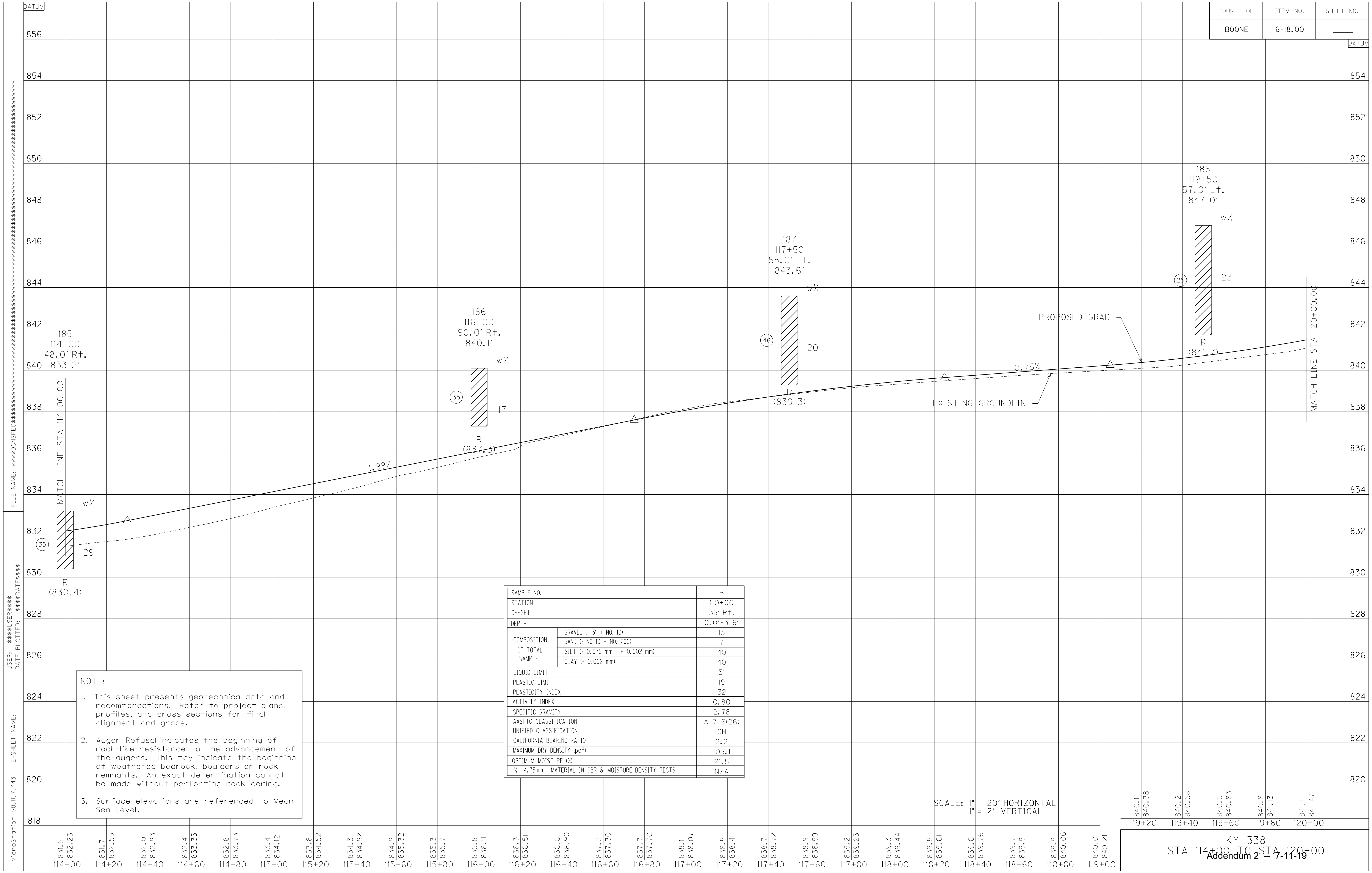
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA 110+00 TO STA 114+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

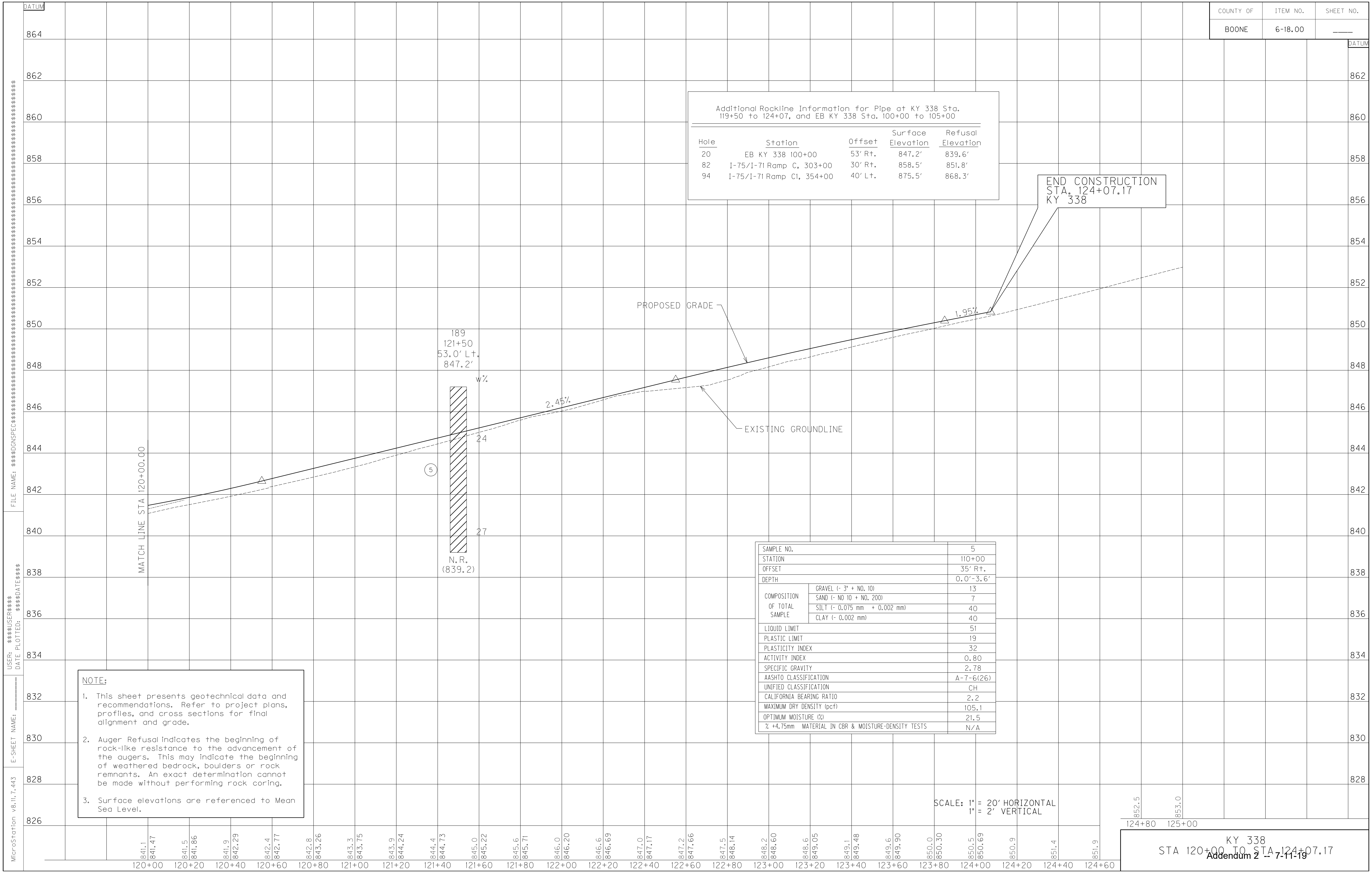
SAMPLE NO.		B
STATION		110+00
OFFSET		35′ Rt.
DEPTH		0.0′-3.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA 114+00 TO STA 120+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



120+00	841.1	841.47
120+20	841.5	841.86
120+40	841.9	842.29
120+60	842.4	842.77
120+80	842.8	843.26
121+00	843.3	843.75
121+20	843.9	844.24
121+40	844.4	844.73
121+60	845.0	845.22
121+80	845.6	845.71
122+00	846.0	846.20
122+20	846.6	846.69
122+40	847.0	847.17
122+60	847.2	847.66
122+80	847.5	848.14
123+00	848.2	848.60
123+20	848.6	849.05
123+40	849.1	849.48
123+60	849.6	849.90
123+80	850.0	850.30
124+00	850.5	850.69
124+20	850.9	
124+40	851.4	
124+60	851.9	
124+80	852.5	
125+00	853.0	

Additional Rockline Information for Pipe at KY 338 Sta. 119+50 to 124+07, and EB KY 338 Sta. 100+00 to 105+00

Hole	Station	Offset	Surface Elevation	Refusal Elevation
20	EB KY 338 100+00	53' Rt.	847.2'	839.6'
82	I-75/I-71 Ramp C, 303+00	30' Rt.	858.5'	851.8'
94	I-75/I-71 Ramp C1, 354+00	40' Lt.	875.5'	868.3'

SAMPLE NO.		5
STATION		110+00
OFFSET		35' Rt.
DEPTH		0.0'-3.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME: ____
MicroStation v8.11.7.443

KY 338
STA 120+00 TO STA 124+07.17

Addendum 2 -- 7-11-19

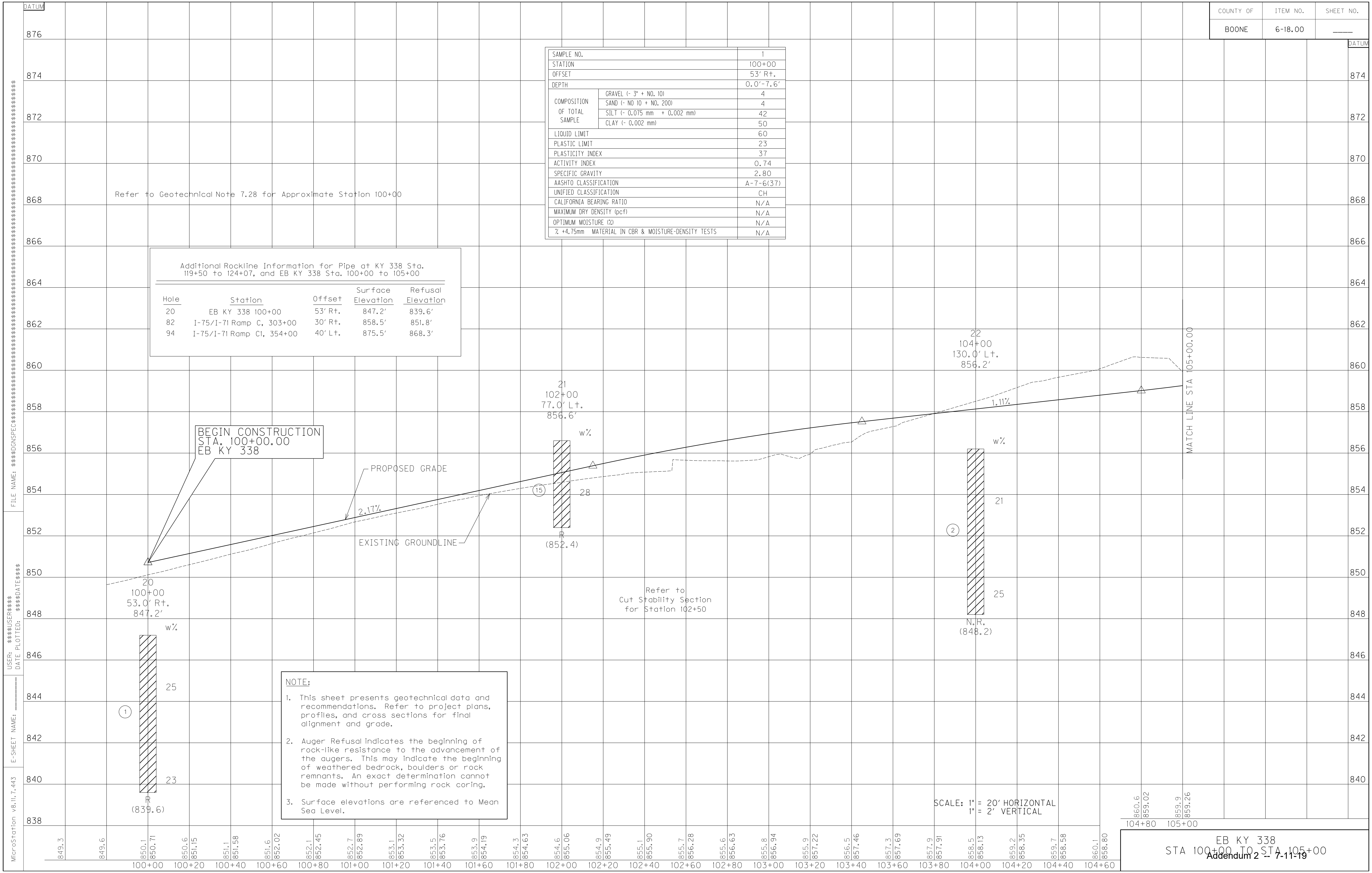
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		1
STATION		100+00
OFFSET		53′ Rt.
DEPTH		0.0′-7.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	42
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		60
PLASTIC LIMIT		23
PLASTICITY INDEX		37
ACTIVITY INDEX		0.74
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(37)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Refer to Geotechnical Note 7.28 for Approximate Station 100+00

Additional Rockline Information for Pipe at KY 338 Sta. 119+50 to 124+07, and EB KY 338 Sta. 100+00 to 105+00

Hole	Station	Offset	Surface Elevation	Refusal Elevation
20	EB KY 338 100+00	53′ Rt.	847.2′	839.6′
82	I-75/I-71 Ramp C, 303+00	30′ Rt.	858.5′	851.8′
94	I-75/I-71 Ramp C1, 354+00	40′ Lt.	875.5′	868.3′



NOTE:

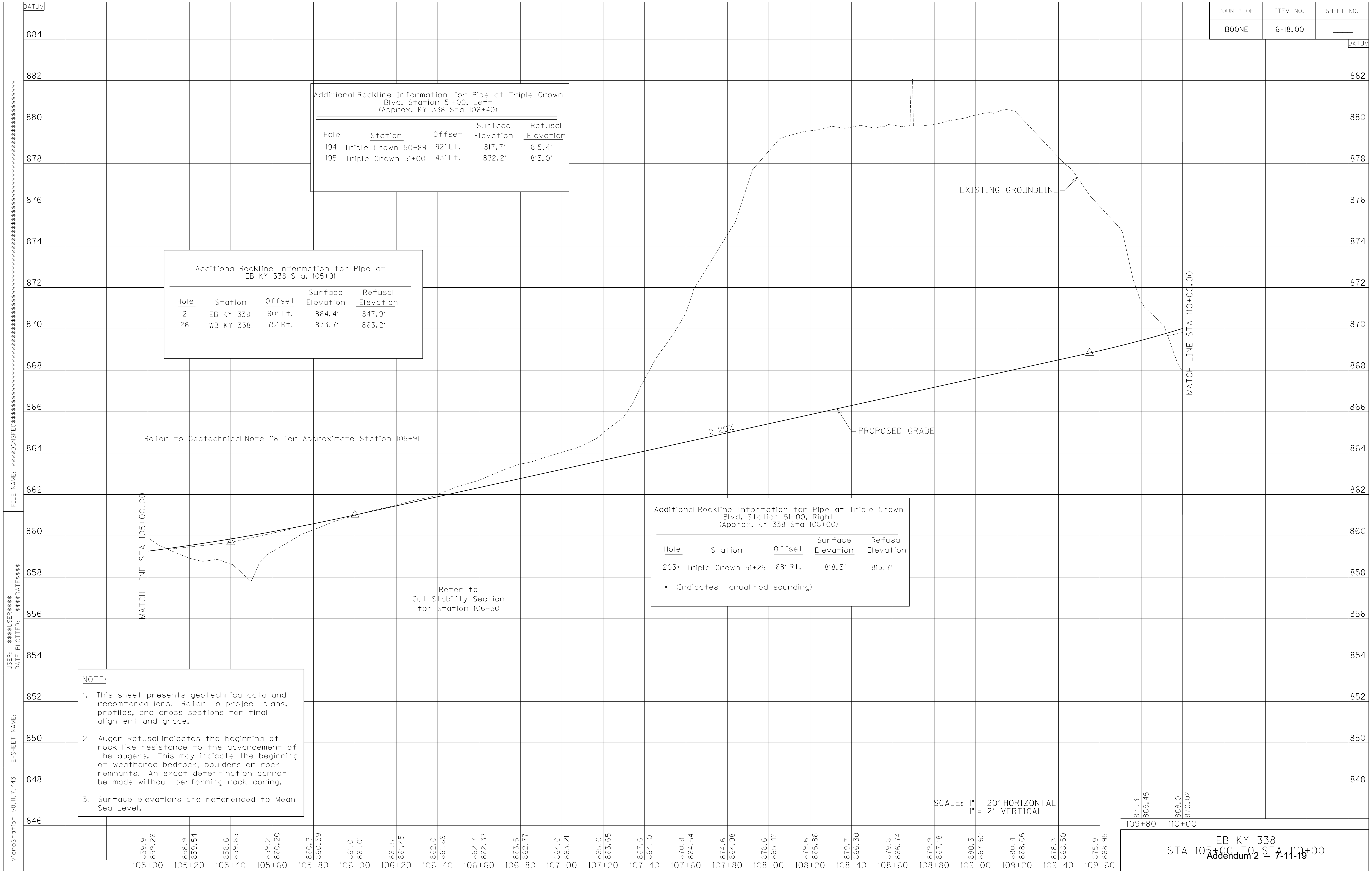
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

EB KY 338
STA 100+00 TO STA 105+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



Additional Rockline Information for Pipe at Triple Crown Blvd. Station 51+00, Left (Approx. KY 338 Sta 106+40)

Hole	Station	Offset	Surface Elevation	Refusal Elevation
194	Triple Crown 50+89	92′ Lt.	817.7′	815.4′
195	Triple Crown 51+00	43′ Lt.	832.2′	815.0′

Additional Rockline Information for Pipe at EB KY 338 Sta. 105+91

Hole	Station	Offset	Surface Elevation	Refusal Elevation
2	EB KY 338	90′ Lt.	864.4′	847.9′
26	WB KY 338	75′ Rt.	873.7′	863.2′

Refer to Geotechnical Note 28 for Approximate Station 105+91

Additional Rockline Information for Pipe at Triple Crown Blvd. Station 51+00, Right (Approx. KY 338 Sta 108+00)

Hole	Station	Offset	Surface Elevation	Refusal Elevation
203*	Triple Crown 51+25	68′ Rt.	818.5′	815.7′

* (Indicates manual rod sounding)

Refer to Cut Stability Section for Station 106+50

NOTE:

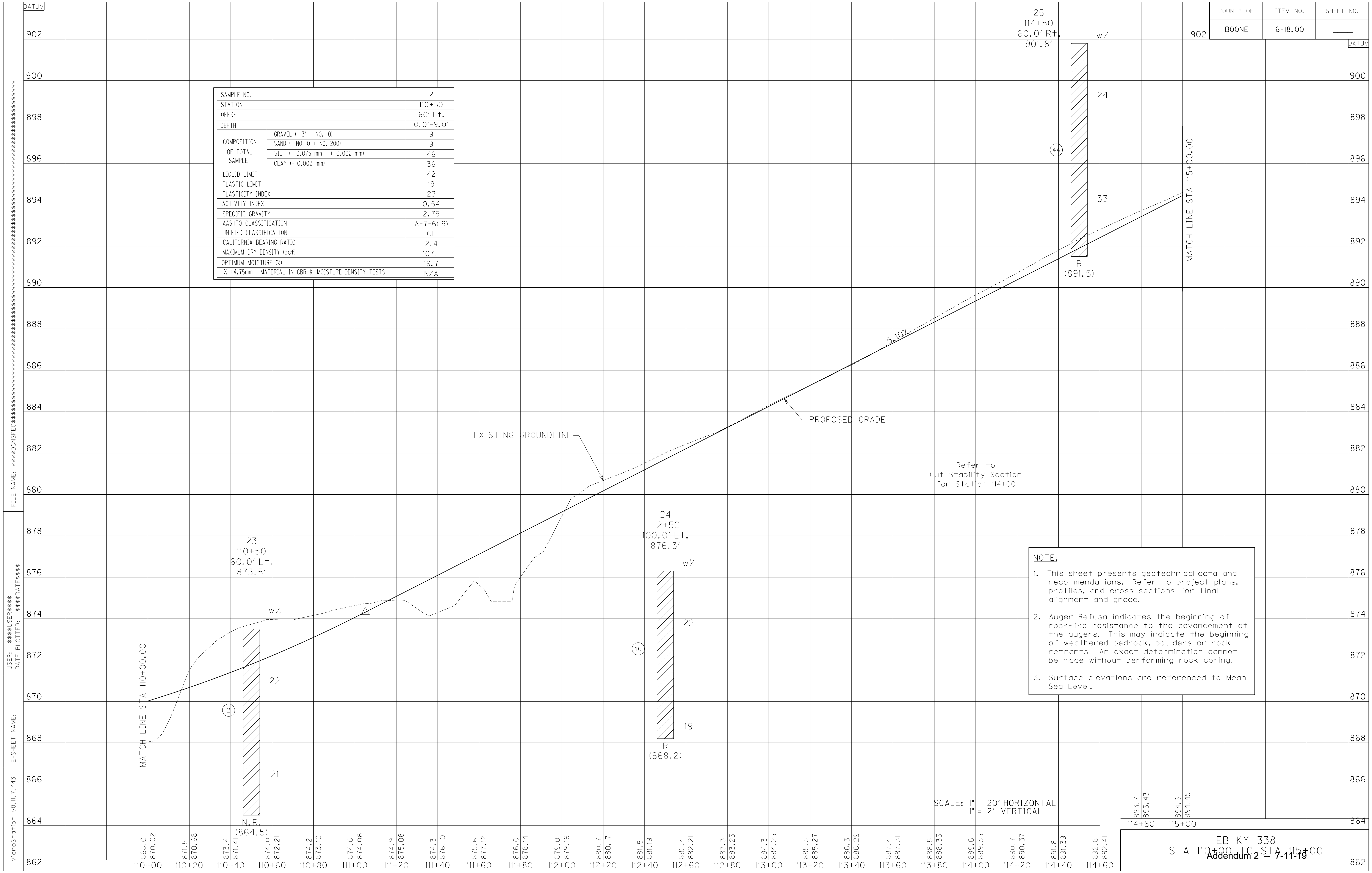
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

EB KY 338
STA 105+00 TO STA 110+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		2
STATION		110+50
OFFSET		60′ Lt.
DEPTH		0.0′-9.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	9
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	36
LIQUID LIMIT		42
PLASTIC LIMIT		19
PLASTICITY INDEX		23
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.75
AASHTO CLASSIFICATION		A-7-6(19)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.4
MAXIMUM DRY DENSITY (pcf)		107.1
OPTIMUM MOISTURE (%)		19.7
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

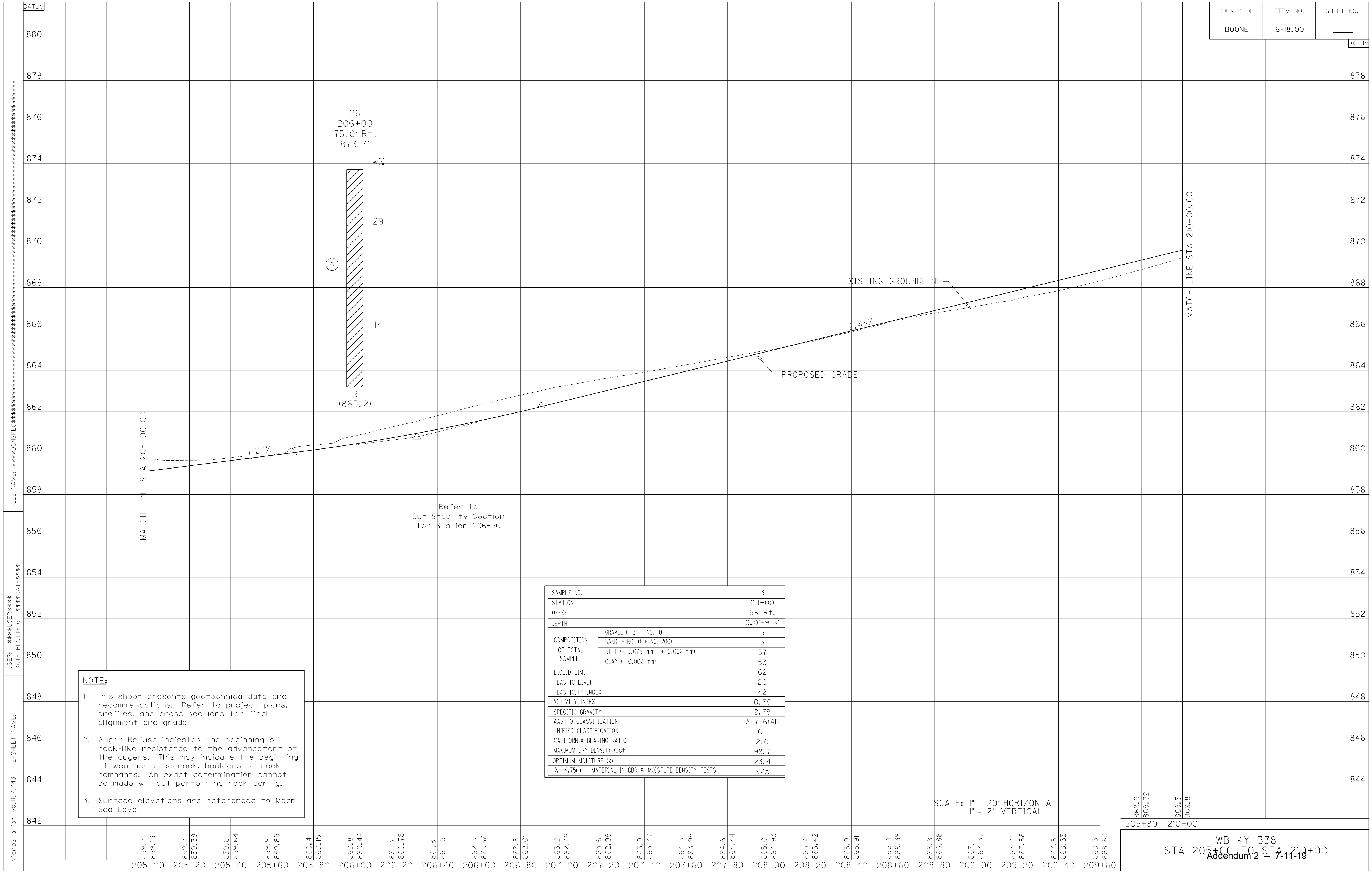
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

EB KY 338
STA 110+00 TO STA 115+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		3
STATION		211+00
OFFSET		58′ Rt.
DEPTH		0.0′-9.8′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

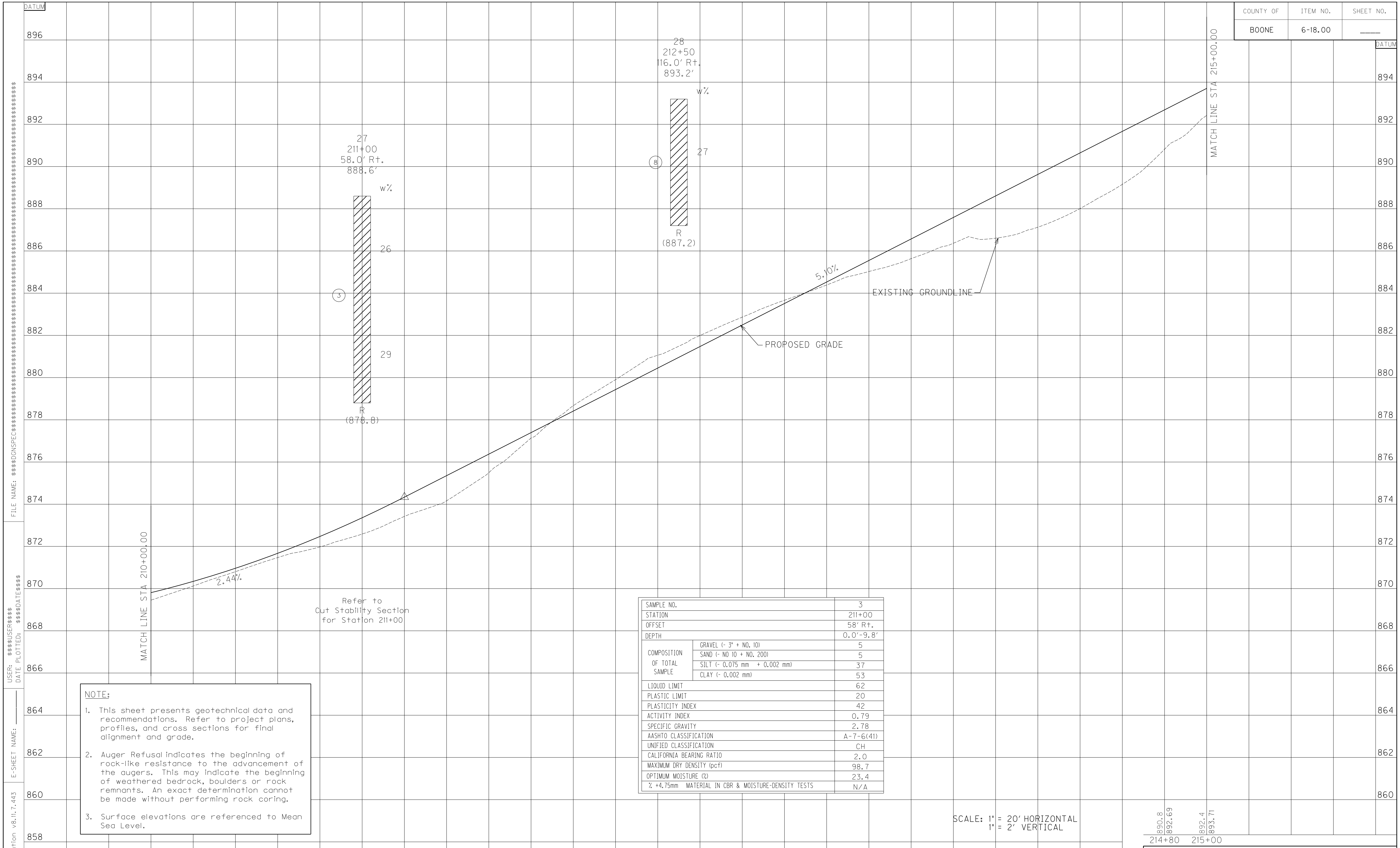
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

WB KY 338
STA 205+00 TO STA 210+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		3
STATION		211+00
OFFSET		58' Rt.
DEPTH		0.0'-9.8'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

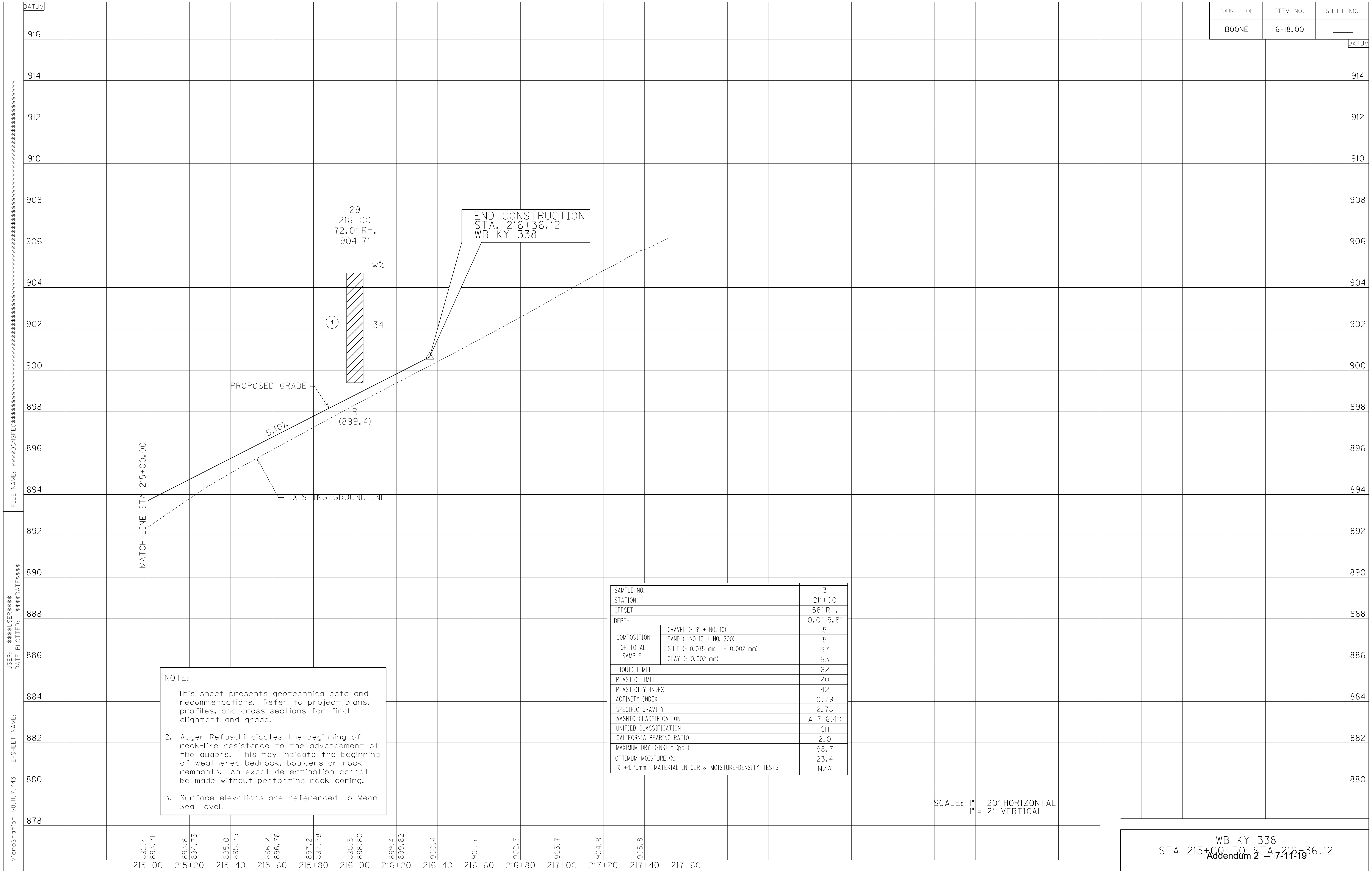
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

869.5	869.81	210+00
870.1	870.34	210+20
870.8	870.96	210+40
871.5	871.67	210+60
872.0	872.47	210+80
872.6	873.36	211+00
873.4	874.33	211+20
874.2	875.35	211+40
875.5	876.37	211+60
877.1	877.39	211+80
878.7	878.41	212+00
879.9	879.43	212+20
881.1	880.45	212+40
882.0	881.47	212+60
882.9	882.49	212+80
883.7	883.51	213+00
884.4	884.53	213+20
885.0	885.55	213+40
885.6	886.57	213+60
886.4	887.59	213+80
886.6	888.61	214+00
887.1	889.63	214+20
888.0	890.65	214+40
889.2	891.67	214+60
890.8	892.69	214+80
892.4	893.71	215+00

WB KY 338
STA 210+00 TO STA 215+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		3
STATION		211+00
OFFSET		58′ Rt.
DEPTH		0.0′-9.8′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

WB KY 338
STA 215+00 TO STA 216+36.12

Addendum 2 -- 7-11-19

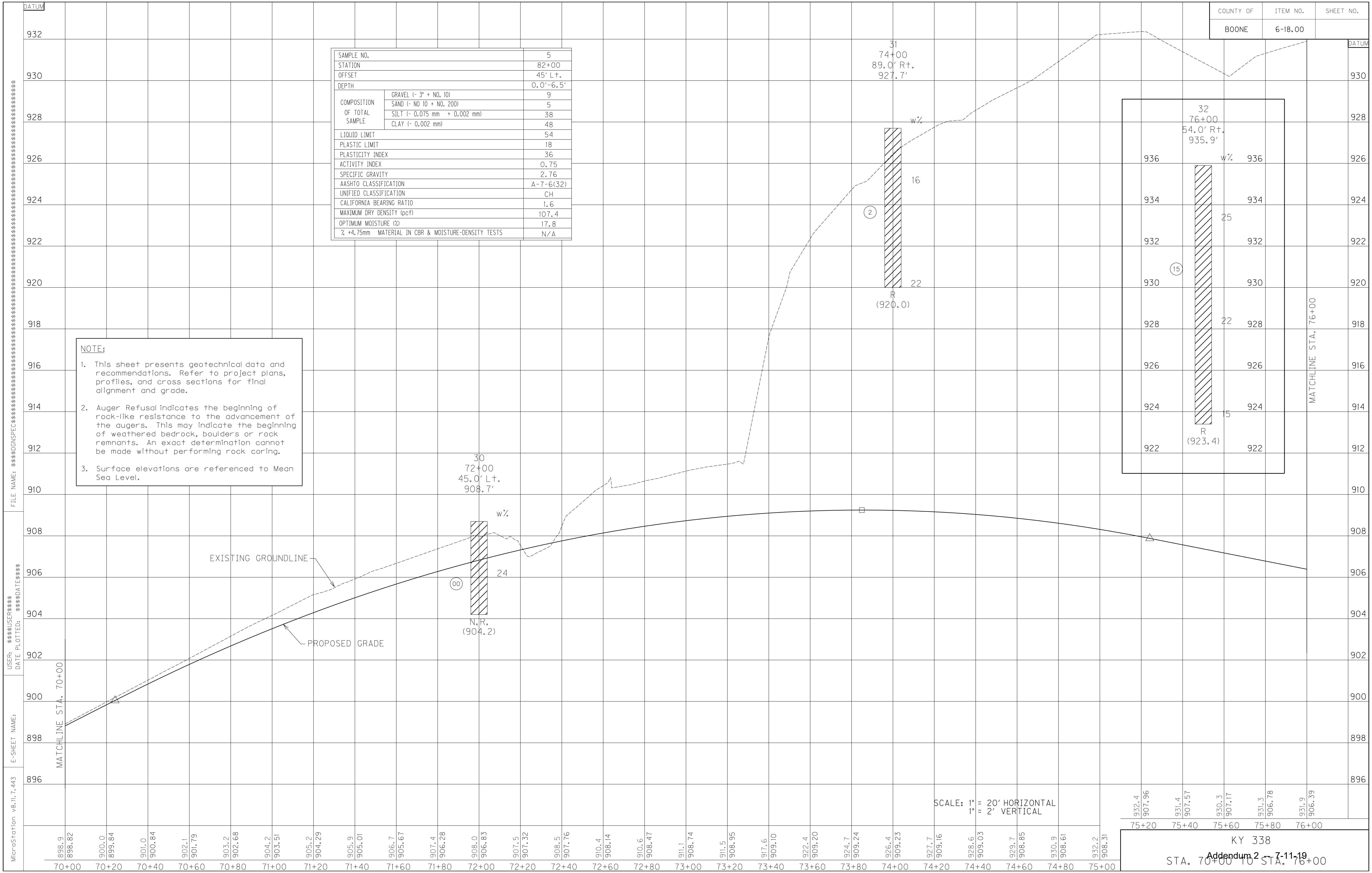
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ______

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		5
STATION		82+00
OFFSET		45′ Lt.
DEPTH		0.0′-6.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		54
PLASTIC LIMIT		18
PLASTICITY INDEX		36
ACTIVITY INDEX		0.75
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(32)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		107.4
OPTIMUM MOISTURE (%)		17.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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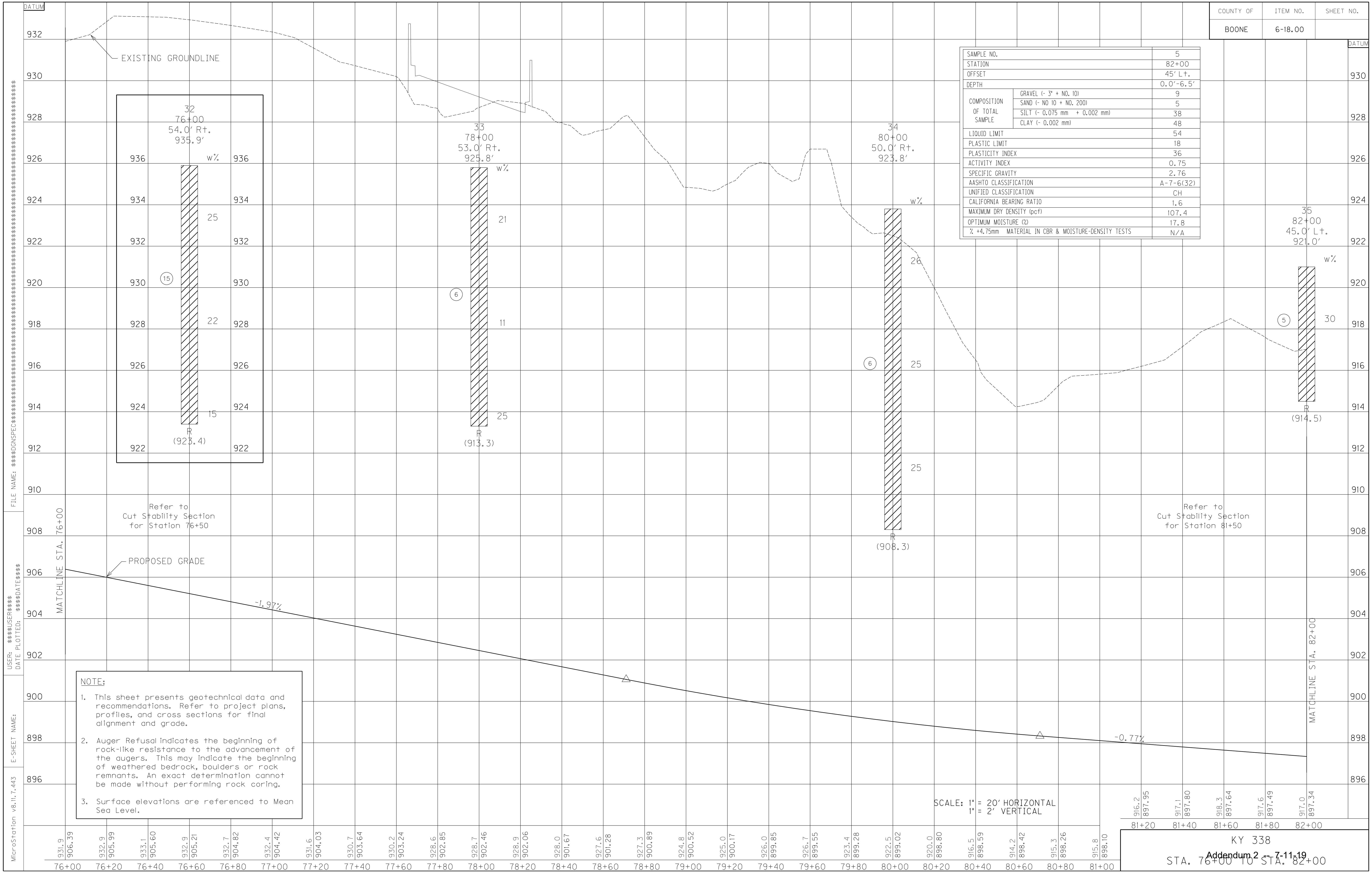
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA. 70+00 TO STA. 76+00
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		5
STATION		82+00
OFFSET		45′ Lt.
DEPTH		0.0′-6.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		54
PLASTIC LIMIT		18
PLASTICITY INDEX		36
ACTIVITY INDEX		0.75
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(32)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		107.4
OPTIMUM MOISTURE (%)		17.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

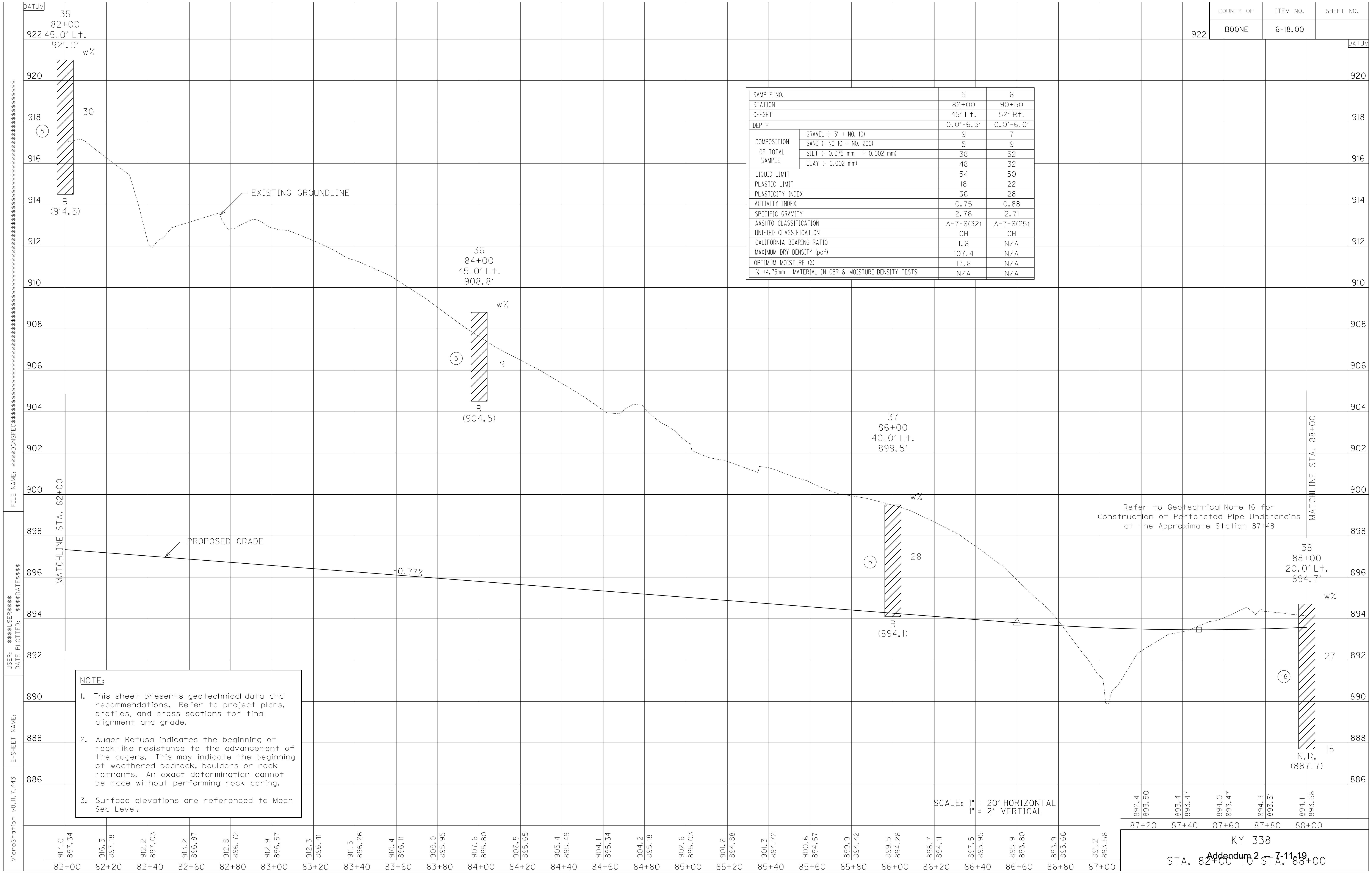
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA. 76+00 TO STA. 82+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



917.0	897.34	82+00
916.3	897.18	82+20
912.2	897.03	82+40
913.2	896.87	82+60
912.8	896.72	82+80
912.9	896.57	83+00
912.3	896.41	83+20
911.3	896.26	83+40
910.4	896.11	83+60
909.0	895.95	83+80
907.6	895.80	84+00
906.5	895.65	84+20
905.4	895.49	84+40
904.1	895.34	84+60
904.2	895.18	84+80
902.6	895.03	85+00
901.6	894.88	85+20
901.3	894.72	85+40
900.6	894.57	85+60
899.9	894.42	85+80
899.5	894.26	86+00
898.7	894.11	86+20
897.5	893.95	86+40
895.9	893.80	86+60
893.9	893.66	86+80
891.2	893.56	87+00
892.4	893.50	87+20
893.4	893.47	87+40
894.0	893.47	87+60
894.3	893.51	87+80
894.1	893.58	88+00

SAMPLE NO.		5	6
STATION		82+00	90+50
OFFSET		45′ Lt.	52′ Rt.
DEPTH		0.0′-6.5′	0.0′-6.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9	7
	SAND (- NO 10 + NO. 200)	5	9
	SILT (- 0.075 mm + 0.002 mm)	38	52
	CLAY (- 0.002 mm)	48	32
LIQUID LIMIT		54	50
PLASTIC LIMIT		18	22
PLASTICITY INDEX		36	28
ACTIVITY INDEX		0.75	0.88
SPECIFIC GRAVITY		2.76	2.71
AASHTO CLASSIFICATION		A-7-6(32)	A-7-6(25)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		1.6	N/A
MAXIMUM DRY DENSITY (pcf)		107.4	N/A
OPTIMUM MOISTURE (%)		17.8	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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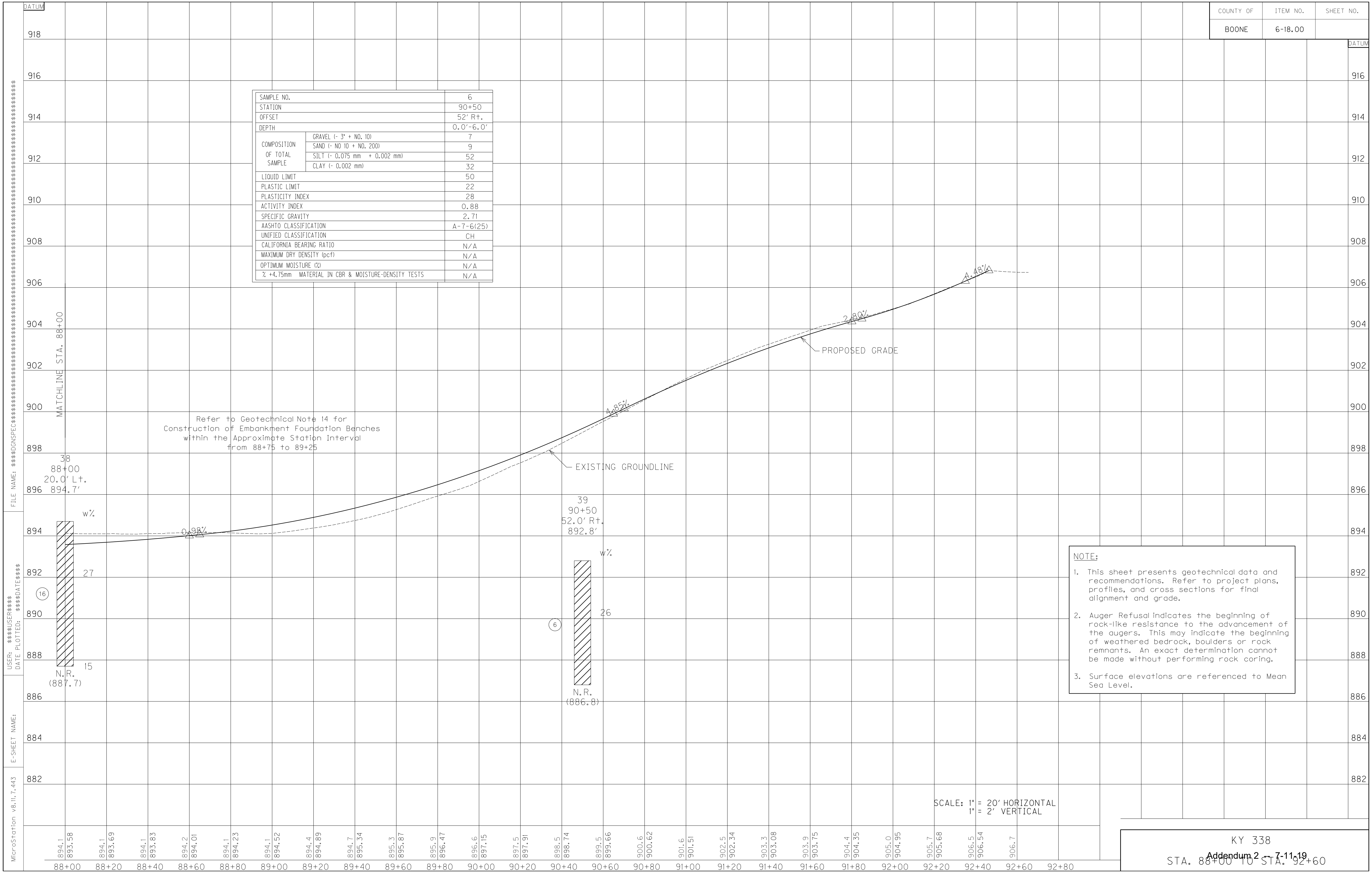
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

KY 338

STA. 82+00 TO STA. 88+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		6
STATION		90+50
OFFSET		52' Rt.
DEPTH		0.0'-6.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7
	SAND (- NO 10 + NO. 200)	9
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	32
LIQUID LIMIT		50
PLASTIC LIMIT		22
PLASTICITY INDEX		28
ACTIVITY INDEX		0.88
SPECIFIC GRAVITY		2.71
AASHTO CLASSIFICATION		A-7-6(25)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

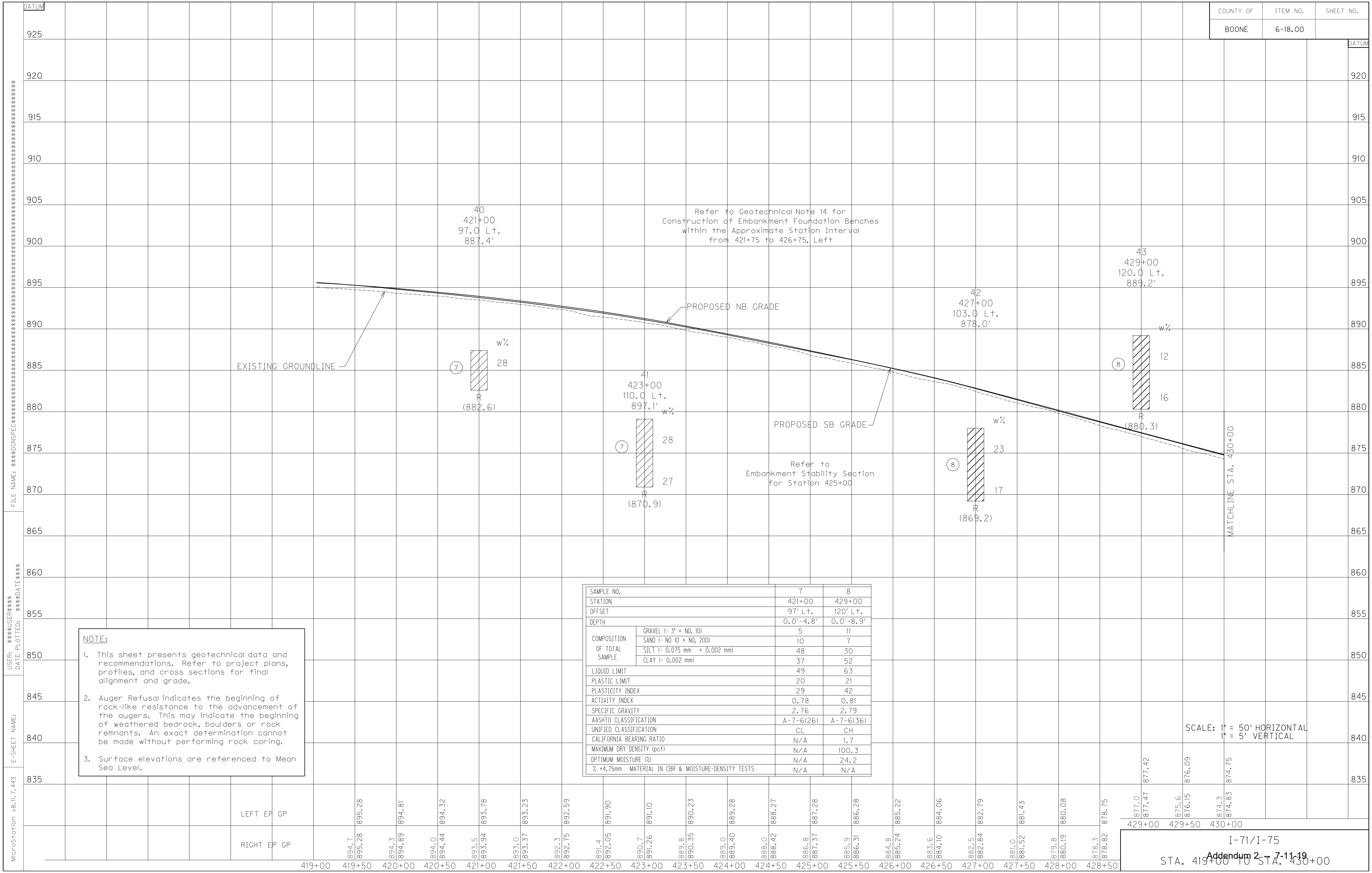
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 338
STA. 88+00 TO STA. 92+60

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 421+75 to 426+75, Left

Refer to Embankment Stability Section for Station 425+00

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		7	8
STATION		421+00	429+00
OFFSET		97′ Lt.	120′ Lt.
DEPTH		0.0′-4.8′	0.0′-8.9′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5	11
	SAND (- NO 10 + NO. 200)	10	7
	SILT (- 0.075 mm + 0.002 mm)	48	30
	CLAY (- 0.002 mm)	37	52
LIQUID LIMIT		49	63
PLASTIC LIMIT		20	21
PLASTICITY INDEX		29	42
ACTIVITY INDEX		0.78	0.81
SPECIFIC GRAVITY		2.76	2.79
AASHTO CLASSIFICATION		A-7-6(26)	A-7-6(36)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		N/A	1.7
MAXIMUM DRY DENSITY (pcf)		N/A	100.3
OPTIMUM MOISTURE (%)		N/A	24.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

I-71/I-75
STA. 419+00 TO STA. 430+00

Addendum 2 - 7-11-19

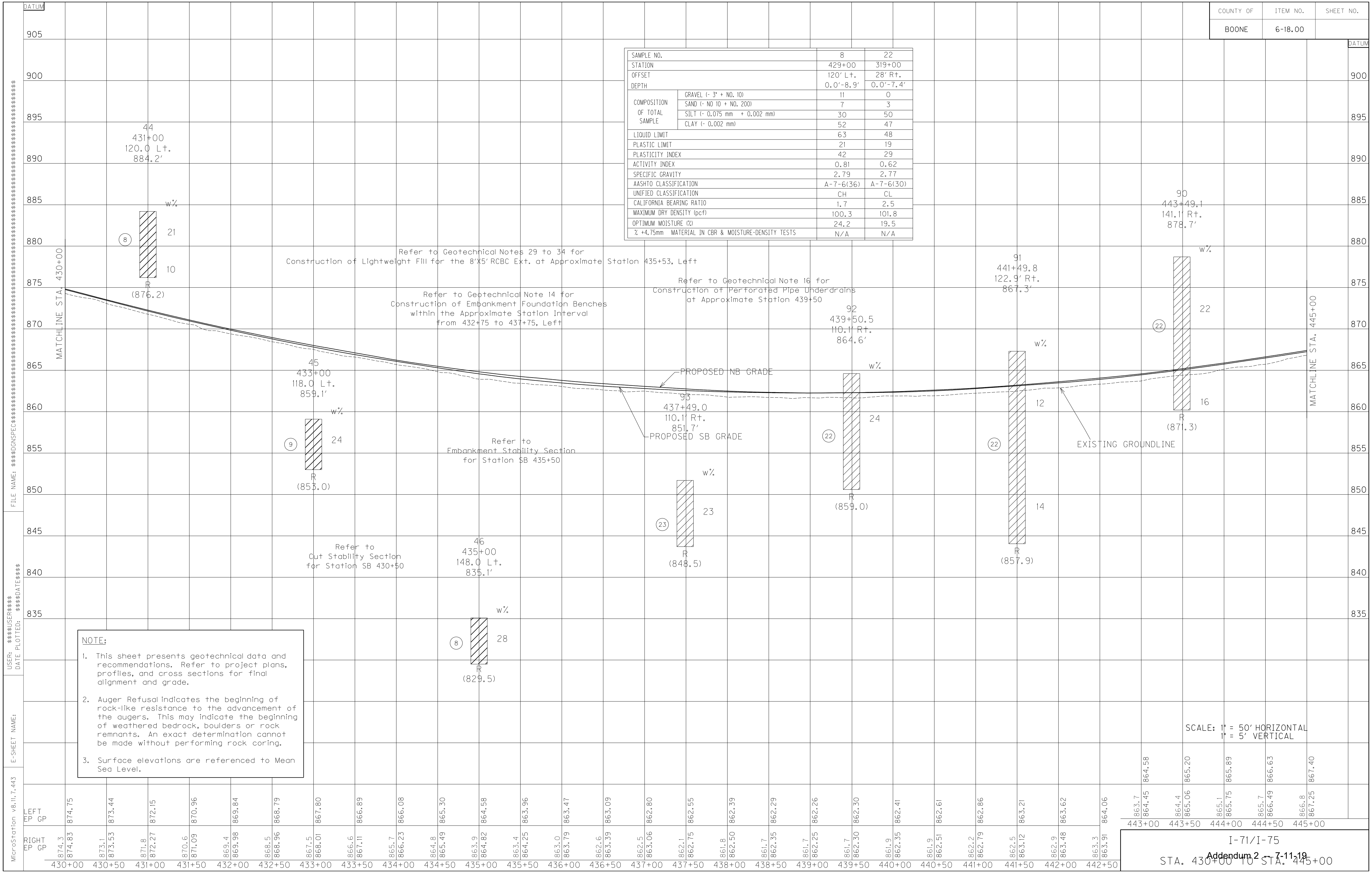
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		8	22
STATION		429+00	319+00
OFFSET		120' Lt.	28' Rt.
DEPTH		0.0'-8.9'	0.0'-7.4'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	11	0
	SAND (- NO 10 + NO. 200)	7	3
	SILT (- 0.075 mm + 0.002 mm)	30	50
	CLAY (- 0.002 mm)	52	47
LIQUID LIMIT		63	48
PLASTIC LIMIT		21	19
PLASTICITY INDEX		42	29
ACTIVITY INDEX		0.81	0.62
SPECIFIC GRAVITY		2.79	2.77
AASHTO CLASSIFICATION		A-7-6(36)	A-7-6(30)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		1.7	2.5
MAXIMUM DRY DENSITY (pcf)		100.3	101.8
OPTIMUM MOISTURE (%)		24.2	19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

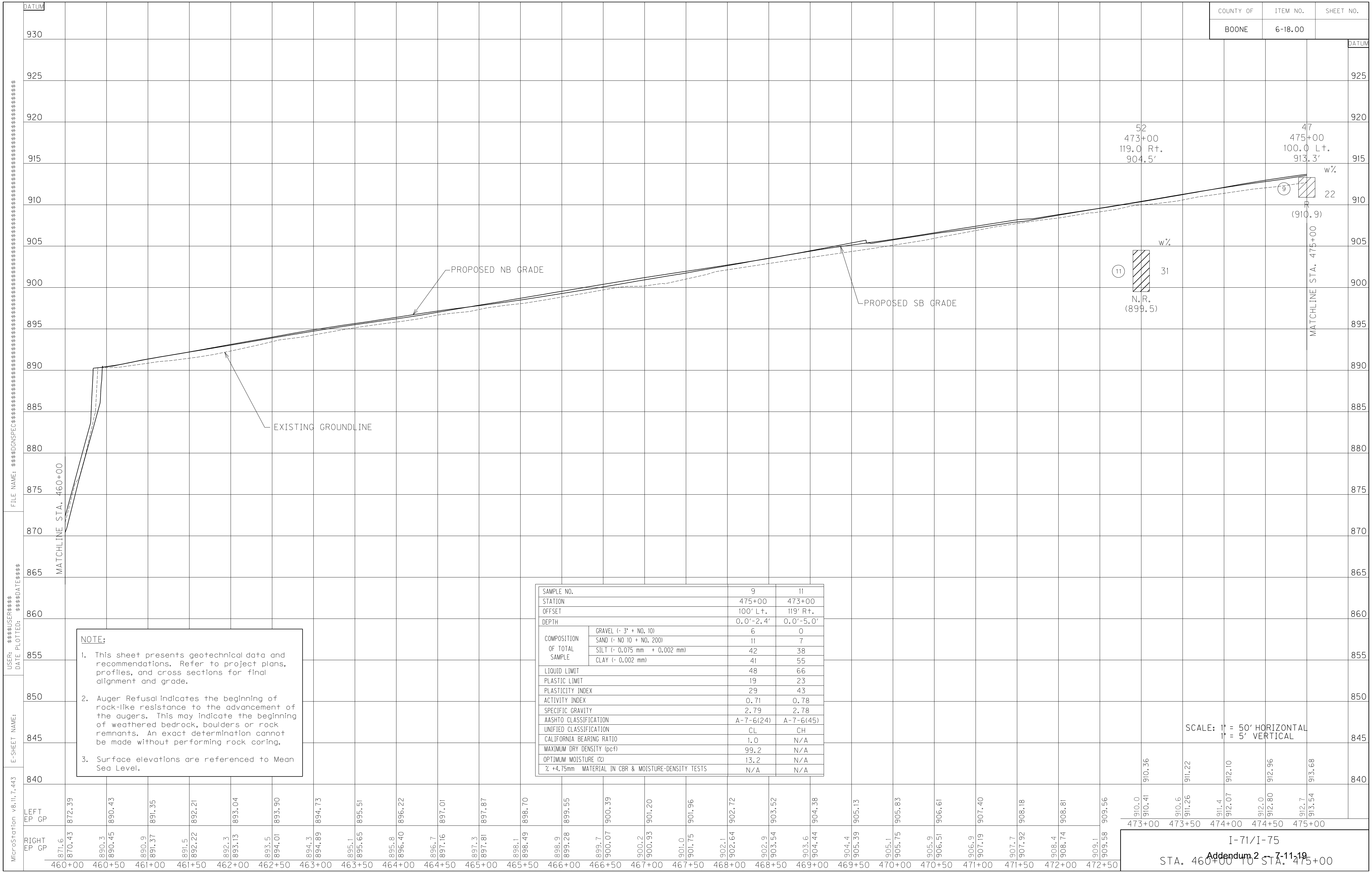
SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

I-71/I-75
STA. 430+00 TO STA. 445+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
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SAMPLE NO.		9	11
STATION		475+00	473+00
OFFSET		100' Lt.	119' Rt.
DEPTH		0.0'-2.4'	0.0'-5.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	0
	SAND (- NO 10 + NO. 200)	11	7
	SILT (- 0.075 mm + 0.002 mm)	42	38
	CLAY (- 0.002 mm)	41	55
LIQUID LIMIT		48	66
PLASTIC LIMIT		19	23
PLASTICITY INDEX		29	43
ACTIVITY INDEX		0.71	0.78
SPECIFIC GRAVITY		2.79	2.78
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(45)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		1.0	N/A
MAXIMUM DRY DENSITY (pcf)		99.2	N/A
OPTIMUM MOISTURE (%)		13.2	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

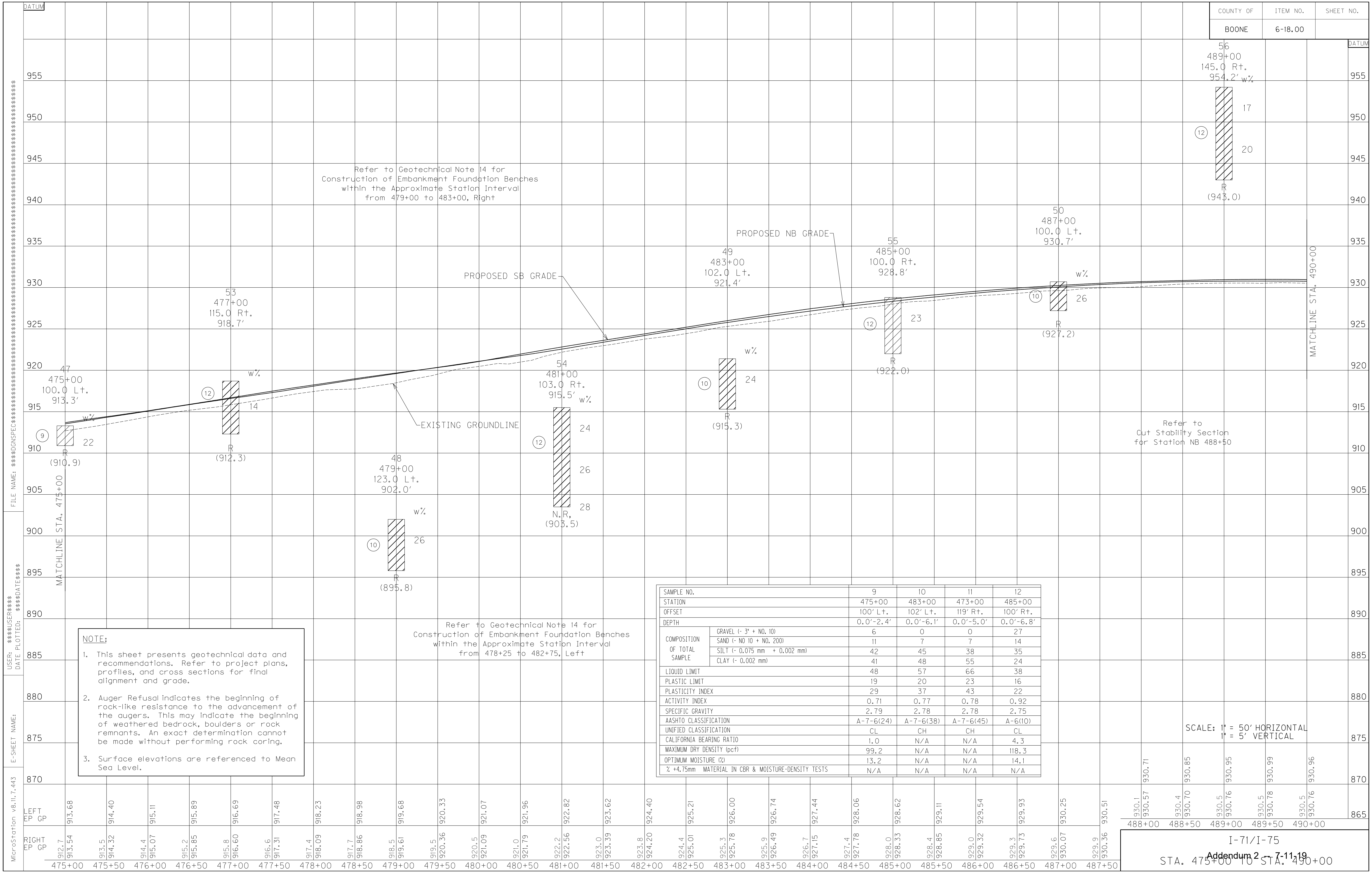
STATION	LEFT EP	LEFT GP	RIGHT EP	RIGHT GP
460+00		872.39	871.6	870.43
460+50		890.43	890.3	890.45
461+00		891.35	890.9	891.37
461+50		892.21	891.5	892.22
462+00		893.04	892.3	893.13
462+50		893.90	893.5	894.01
463+00		894.73	894.3	894.89
463+50		895.51	895.1	895.65
464+00		896.22	895.8	896.40
464+50		897.01	896.7	897.16
465+00		897.87	897.3	897.81
465+50		898.70	898.1	898.49
466+00		899.55	898.9	899.28
466+50		900.39	899.7	900.07
467+00		901.20	900.2	900.93
467+50		901.96	901.0	901.75
468+00		902.72	902.1	902.64
468+50		903.52	902.9	903.54
469+00		904.38	903.6	904.44
469+50		905.13	904.4	905.39
470+00		905.83	905.1	905.75
470+50		906.61	905.9	906.51
471+00		907.40	906.9	907.19
471+50		908.18	907.7	907.92
472+00		908.81	908.4	908.74
472+50		909.56	909.1	909.58
473+00	910.0	910.41		910.36
473+50	910.6	911.26		911.22
474+00	911.4	912.07		912.10
474+50	912.0	912.80		912.96
475+00	912.7	913.54		913.68

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

I-71/I-75
STA. 460+00 TO STA. 475+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 479+00 to 483+00, Right

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 478+25 to 482+75, Left

Refer to Cut Stability Section for Station NB 488+50

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		9	10	11	12
STATION		475+00	483+00	473+00	485+00
OFFSET		100′ Lt.	102′ Lt.	119′ Rt.	100′ Rt.
DEPTH		0.0′-2.4′	0.0′-6.1′	0.0′-5.0′	0.0′-6.8′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	0	0	27
	SAND (- NO 10 + NO. 200)	11	7	7	14
	SILT (- 0.075 mm + 0.002 mm)	42	45	38	35
	CLAY (- 0.002 mm)	41	48	55	24
LIQUID LIMIT		48	57	66	38
PLASTIC LIMIT		19	20	23	16
PLASTICITY INDEX		29	37	43	22
ACTIVITY INDEX		0.71	0.77	0.78	0.92
SPECIFIC GRAVITY		2.79	2.78	2.78	2.75
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(38)	A-7-6(45)	A-6(10)
UNIFIED CLASSIFICATION		CL	CH	CH	CL
CALIFORNIA BEARING RATIO		1.0	N/A	N/A	4.3
MAXIMUM DRY DENSITY (pcf)		99.2	N/A	N/A	118.3
OPTIMUM MOISTURE (%)		13.2	N/A	N/A	14.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A	N/A	N/A

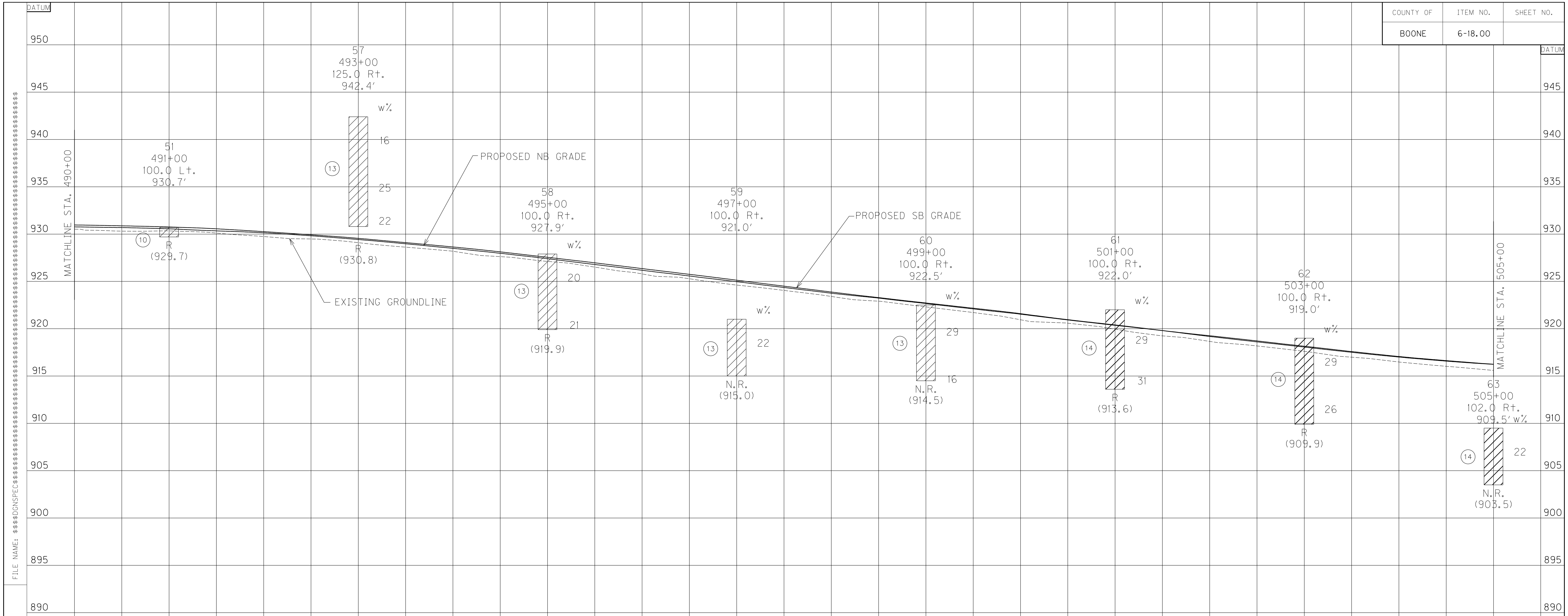
SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

I-71/I-75
STA. 475+00 TO STA. 490+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		13	14
STATION		495+00	505+00
OFFSET		100' Rt.	102' Rt.
DEPTH		0.0'-8.0'	0.0'-6.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1	0
	SAND (- NO 10 + NO. 200)	8	6
	SILT (- 0.075 mm + 0.002 mm)	57	45
	CLAY (- 0.002 mm)	34	49
LIQUID LIMIT		44	55
PLASTIC LIMIT		16	19
PLASTICITY INDEX		28	36
ACTIVITY INDEX		0.82	0.73
SPECIFIC GRAVITY		2.73	2.78
AASHTO CLASSIFICATION		A-7-6(26)	A-7-6(36)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		3.8	N/A
MAXIMUM DRY DENSITY (pcf)		107.6	N/A
OPTIMUM MOISTURE (%)		18.6	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

885
880
875
870
865

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

	LEFT EP GP	RIGHT EP GP
490+00	930.96	930.5 930.76
490+50	930.87	930.3 930.69
491+00	930.75	930.3 930.55
491+50	930.55	930.1 930.34
492+00	930.26	929.7 930.13
492+50	929.93	929.5 929.82
493+00	929.55	929.1 929.42
493+50	929.10	928.6 928.98
494+00	928.64	928.2 928.49
494+50	928.12	927.6 927.97
495+00	927.55	927.1 927.40
495+50	926.96	926.5 926.79
496+00	926.36	925.8 926.18
496+50	925.75	925.3 925.57
497+00	925.13	924.6 924.97
497+50	924.50	924.0 924.36
498+00	923.88	923.4 923.75
498+50	923.29	922.9 923.24
499+00	922.72	922.3 922.66
499+50	922.17	921.7 922.09
500+00	921.59	920.9 921.54
500+50	920.96	920.6 920.93
501+00	920.40	920.0 920.36
501+50	919.80	919.2 919.81
502+00	919.18	918.7 919.26
502+50	918.61	918.2 918.71
503+00	918.06	917.6 918.15
503+50	917.51	917.0 917.59
504+00	917.01	916.5 917.07
504+50	916.58	916.0 916.63
505+00	916.24	915.6 916.25

I-71/I-75

STA. 490+00 TO STA. 505+00

Addendum 2 -- 7-11-19

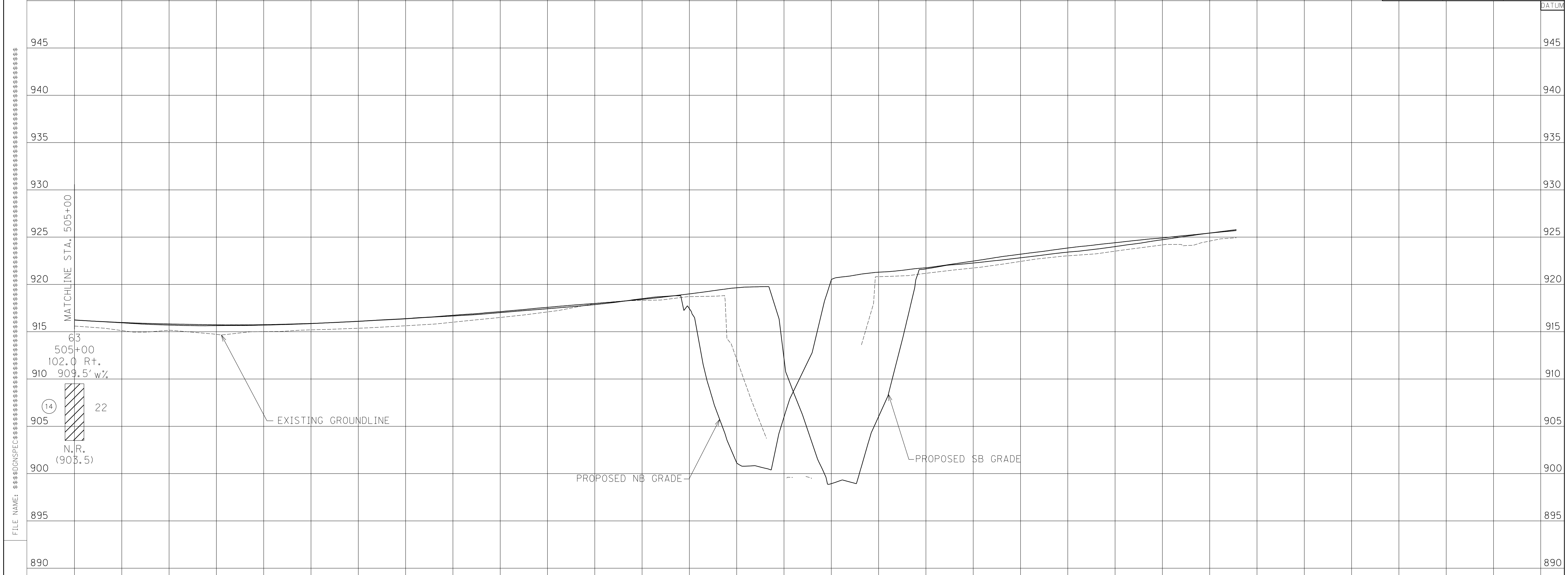
FILE NAME: $$$$DGNSPEC$$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		14
STATION		505+00
OFFSET		102' Rt.
DEPTH		0.0'-6.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	45
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		55
PLASTIC LIMIT		19
PLASTICITY INDEX		36
ACTIVITY INDEX		0.73
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(36)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

	505+00	505+50	506+00	506+50	507+00	507+50	508+00	508+50	509+00	509+50	510+00	510+50	511+00	511+50	512+00	512+50	513+00	513+50	514+00	514+50	515+00	515+50	516+00	516+50	517+00
LEFT EP GP	916.24	915.98	915.82	915.73	915.75	915.88	916.11	916.39	916.74	917.12	917.58	917.99	918.42	919.00	919.65	912.15	898.94	906.03	921.64	922.26	922.82	923.42	924.00	924.73	925.43
RIGHT EP GP	915.6 916.25	915.1 915.95	915.2 915.71	914.7 915.65	915.0 915.70	915.2 915.86	915.4 916.10	915.6 916.37	916.0 916.67	916.5 917.02	917.1 917.43	918.0 917.87	918.3 918.50	918.7 917.43	912.1 901.14	905.97	920.49	920.8 921.30	921.2 921.76	921.7 922.47	922.4 923.20	923.0 923.85	923.5 924.41	924.2 924.91	924.6 925.43

I-71/I-75
STA. 505+00 TO END CONSTRUCTION

Addendum 2 -- 7-11-19

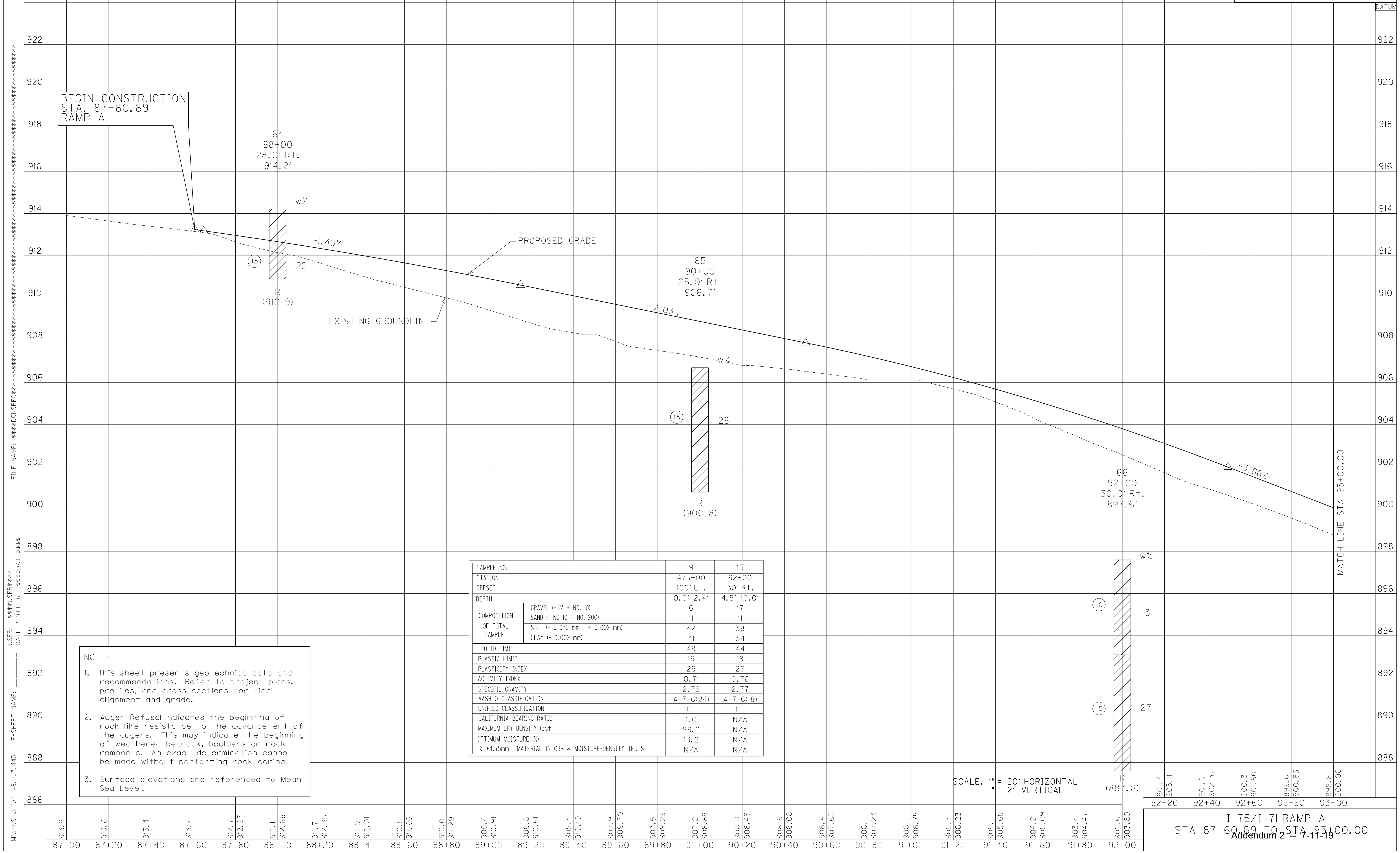
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		9	15
STATION		475+00	92+00
OFFSET		100′ Lt.	30′ Rt.
DEPTH		0.0′-2.4′	4.5′-10.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	17
	SAND (- NO 10 + NO. 200)	11	11
	SILT (- 0.075 mm + 0.002 mm)	42	38
	CLAY (- 0.002 mm)	41	34
LIQUID LIMIT		48	44
PLASTIC LIMIT		19	18
PLASTICITY INDEX		29	26
ACTIVITY INDEX		0.71	0.76
SPECIFIC GRAVITY		2.79	2.77
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(18)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	N/A
MAXIMUM DRY DENSITY (pcf)		99.2	N/A
OPTIMUM MOISTURE (%)		13.2	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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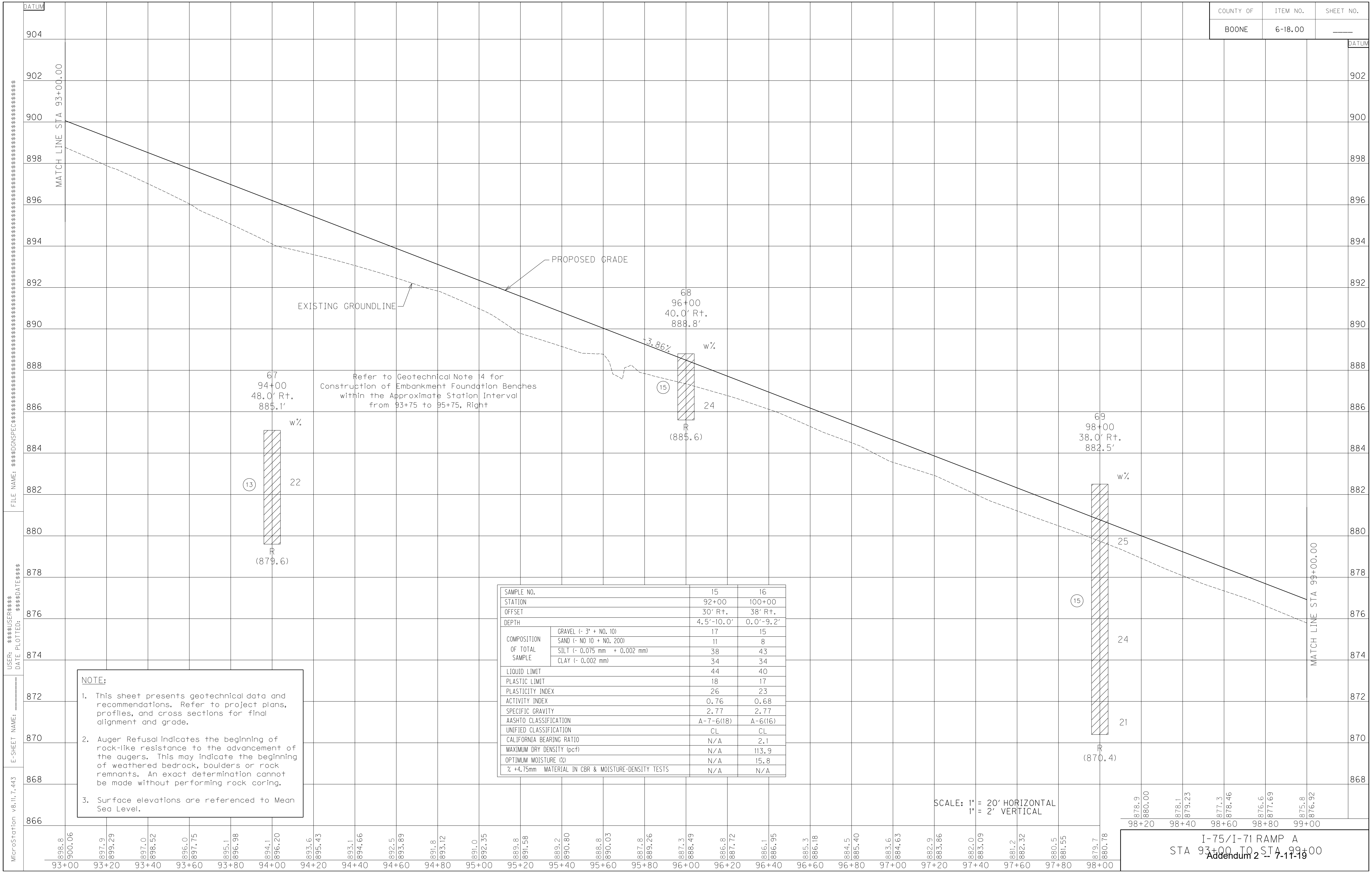
3. Surface elevations are referenced to Mean Sea Level.

I-75/I-71 RAMP A
STA 87+60.69 TO STA 93+00.00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		15	16
STATION		92+00	100+00
OFFSET		30' Rt.	38' Rt.
DEPTH		4.5'-10.0'	0.0'-9.2'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	17	15
	SAND (- NO 10 + NO. 200)	11	8
	SILT (- 0.075 mm + 0.002 mm)	38	43
	CLAY (- 0.002 mm)	34	34
LIQUID LIMIT		44	40
PLASTIC LIMIT		18	17
PLASTICITY INDEX		26	23
ACTIVITY INDEX		0.76	0.68
SPECIFIC GRAVITY		2.77	2.77
AASHTO CLASSIFICATION		A-7-6(18)	A-6(16)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		N/A	2.1
MAXIMUM DRY DENSITY (pcf)		N/A	113.9
OPTIMUM MOISTURE (%)		N/A	15.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

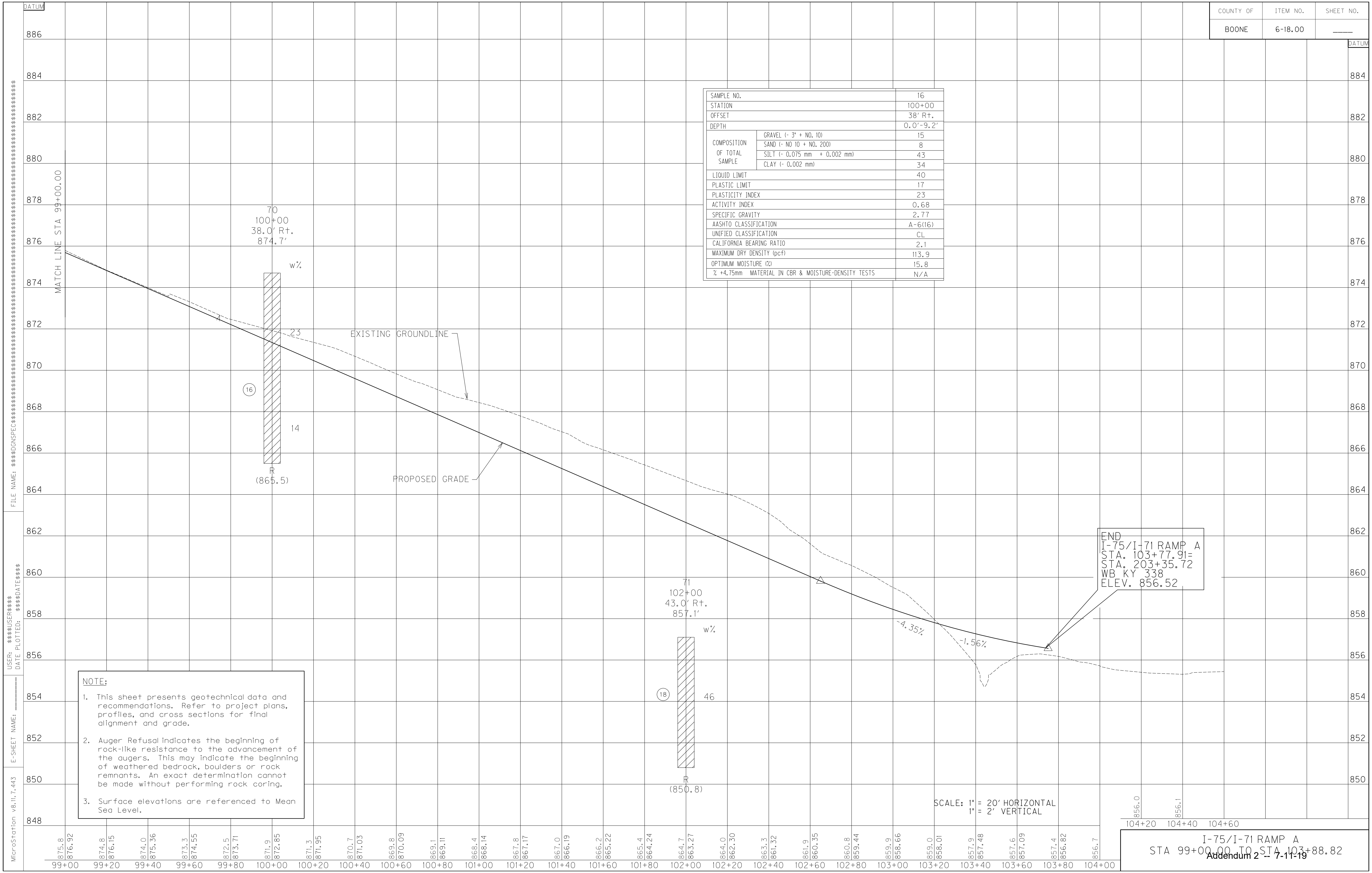
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

93+00	898.8	900.06
93+20	897.9	899.29
93+40	897.0	898.52
93+60	896.0	897.75
93+80	895.1	896.98
94+00	894.1	896.20
94+20	893.6	895.43
94+40	893.1	894.66
94+60	892.5	893.89
94+80	891.8	893.12
95+00	891.0	892.35
95+20	889.8	891.58
95+40	889.2	890.80
95+60	888.8	890.03
95+80	887.8	889.26
96+00	887.3	888.49
96+20	886.8	887.72
96+40	886.1	886.95
96+60	885.3	886.18
96+80	884.5	885.40
97+00	883.6	884.63
97+20	882.9	883.86
97+40	882.0	883.09
97+60	881.2	882.32
97+80	880.5	881.55
98+00	879.7	880.78
98+20	878.9	880.00
98+40	878.1	879.23
98+60	877.3	878.46
98+80	876.6	877.69
99+00	875.8	876.92

I-75/I-71 RAMP A
STA 93+00 TO STA 99+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		16
STATION		100+00
OFFSET		38′ Rt.
DEPTH		0.0′-9.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	15
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	43
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		40
PLASTIC LIMIT		17
PLASTICITY INDEX		23
ACTIVITY INDEX		0.68
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-6(16)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.1
MAXIMUM DRY DENSITY (pcf)		113.9
OPTIMUM MOISTURE (%)		15.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
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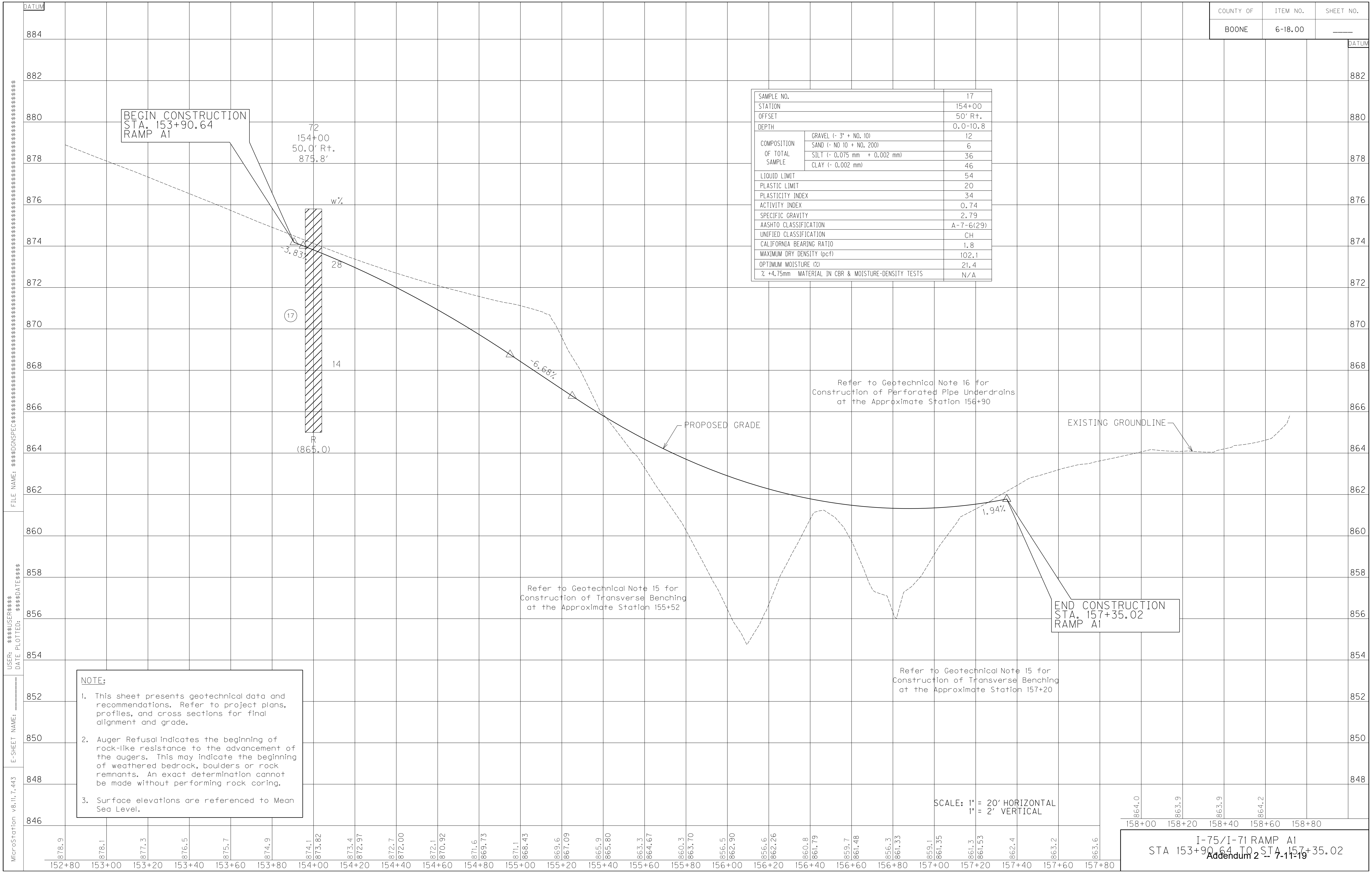
I-75/I-71 RAMP A
STA 99+00.00 TO STA 103+88.82

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		17
STATION		154+00
OFFSET		50' Rt.
DEPTH		0.0-10.8
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	12
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	36
	CLAY (- 0.002 mm)	46
LIQUID LIMIT		54
PLASTIC LIMIT		20
PLASTICITY INDEX		34
ACTIVITY INDEX		0.74
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(29)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.8
MAXIMUM DRY DENSITY (pcf)		102.1
OPTIMUM MOISTURE (%)		21.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 156+90

Refer to Geotechnical Note 15 for Construction of Transverse Benching at the Approximate Station 155+52

Refer to Geotechnical Note 15 for Construction of Transverse Benching at the Approximate Station 157+20

NOTE:

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SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

I-75/I-71 RAMP A1
STA 153+90.64 TO STA 157+35.02

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$

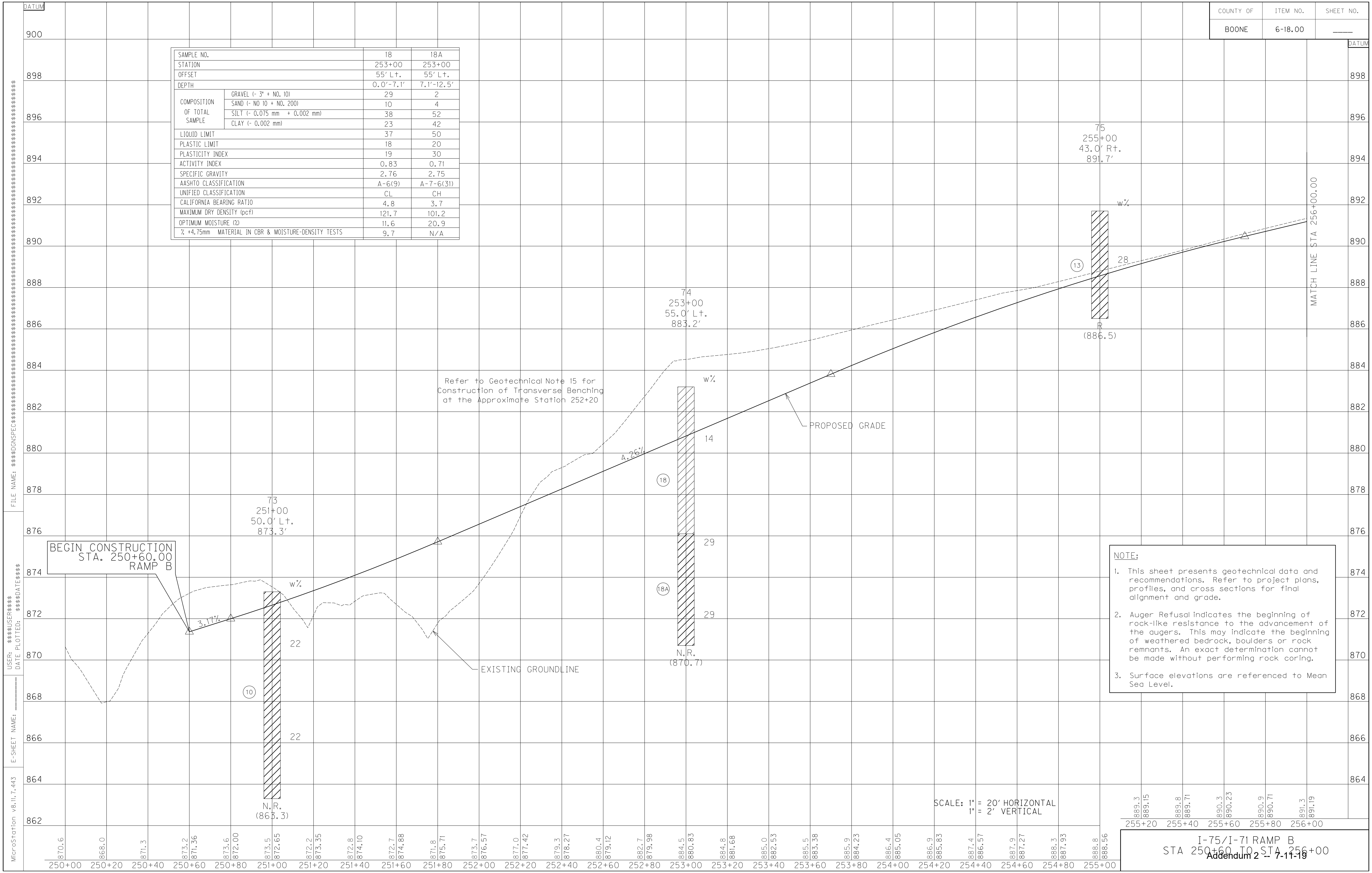
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ________

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		18	18A
STATION		253+00	253+00
OFFSET		55′ Lt.	55′ Lt.
DEPTH		0.0′-7.1′	7.1′-12.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	29	2
	SAND (- NO 10 + NO. 200)	10	4
	SILT (- 0.075 mm + 0.002 mm)	38	52
	CLAY (- 0.002 mm)	23	42
LIQUID LIMIT		37	50
PLASTIC LIMIT		18	20
PLASTICITY INDEX		19	30
ACTIVITY INDEX		0.83	0.71
SPECIFIC GRAVITY		2.76	2.75
AASHTO CLASSIFICATION		A-6(9)	A-7-6(31)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		4.8	3.7
MAXIMUM DRY DENSITY (pcf)		121.7	101.2
OPTIMUM MOISTURE (%)		11.6	20.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		9.7	N/A



250+00	250+20	250+40	250+60	250+80	251+00	251+20	251+40	251+60	251+80	252+00	252+20	252+40	252+60	252+80	253+00
870.6	868.0	871.3	873.2	873.6	873.5	872.2	872.8	872.7	871.8	873.7	877.0	879.3	880.4	882.7	884.5
			871.36	872.00	872.65	873.35	874.10	874.88	875.71	876.57	877.42	878.27	879.12	879.98	880.83

253+20	253+40	253+60	253+80	254+00	254+20	254+40	254+60	254+80	255+00	255+20	255+40	255+60	255+80	256+00
884.8	885.0	885.5	885.9	886.4	886.9	887.4	887.9	888.3	888.8	889.3	889.8	890.3	890.9	891.3
881.68	882.53	883.38	884.23	885.05	885.83	886.57	887.27	887.93	888.56	889.15	889.71	890.23	890.71	891.19

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

I-75/I-71 RAMP B
STA 250+60 TO STA 256+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

NOTE:

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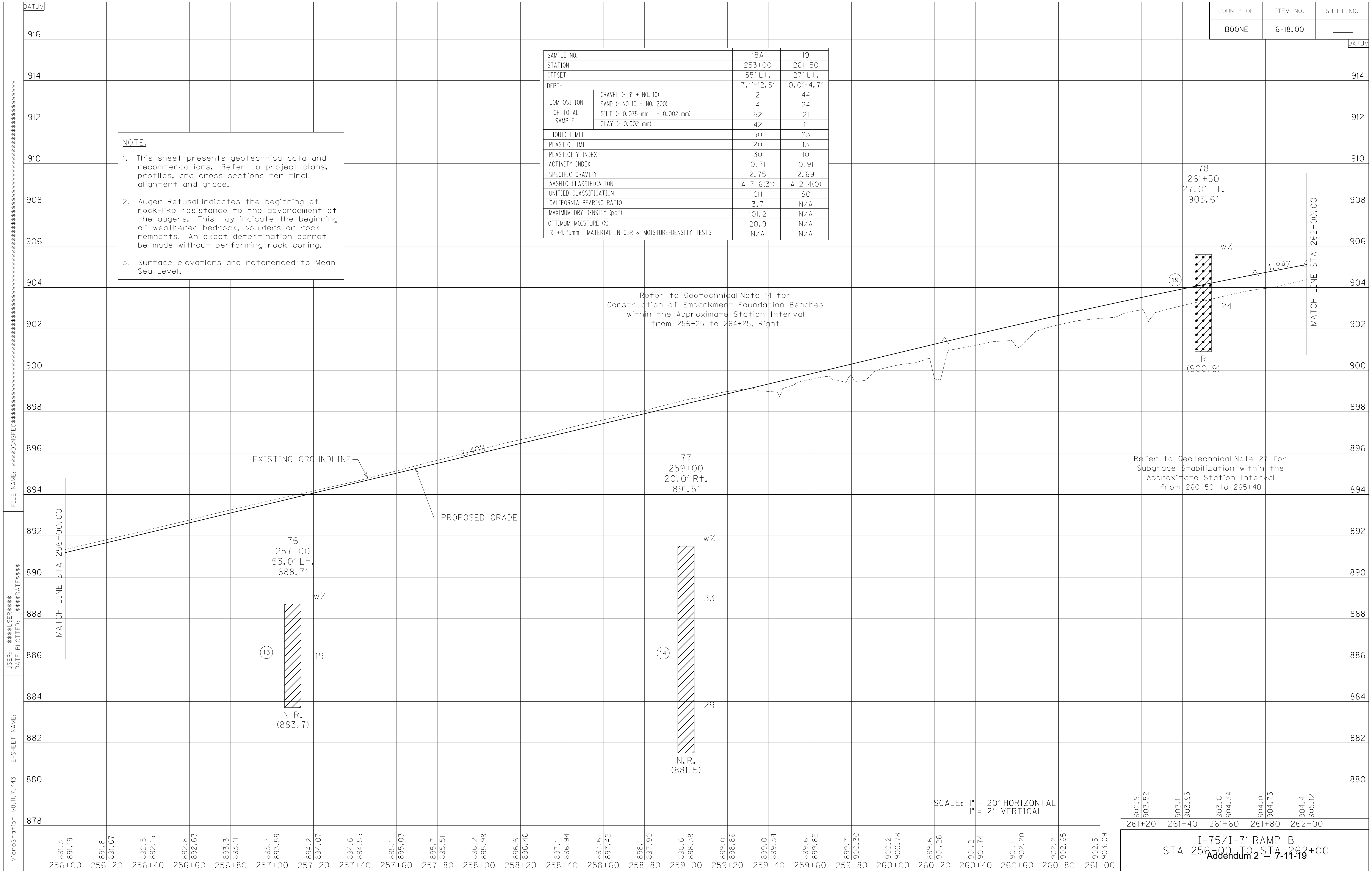
SAMPLE NO.		18A	19
STATION		253+00	261+50
OFFSET		55′ Lt.	27′ Lt.
DEPTH		7.1′-12.5′	0.0′-4.7′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2	44
	SAND (- NO 10 + NO. 200)	4	24
	SILT (- 0.075 mm + 0.002 mm)	52	21
	CLAY (- 0.002 mm)	42	11
LIQUID LIMIT		50	23
PLASTIC LIMIT		20	13
PLASTICITY INDEX		30	10
ACTIVITY INDEX		0.71	0.91
SPECIFIC GRAVITY		2.75	2.69
AASHTO CLASSIFICATION		A-7-6(31)	A-2-4(0)
UNIFIED CLASSIFICATION		CH	SC
CALIFORNIA BEARING RATIO		3.7	N/A
MAXIMUM DRY DENSITY (pcf)		101.2	N/A
OPTIMUM MOISTURE (%)		20.9	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 256+25 to 264+25, Right

Refer to Geotechnical Note 27 for Subgrade Stabilization within the Approximate Station Interval from 260+50 to 265+40

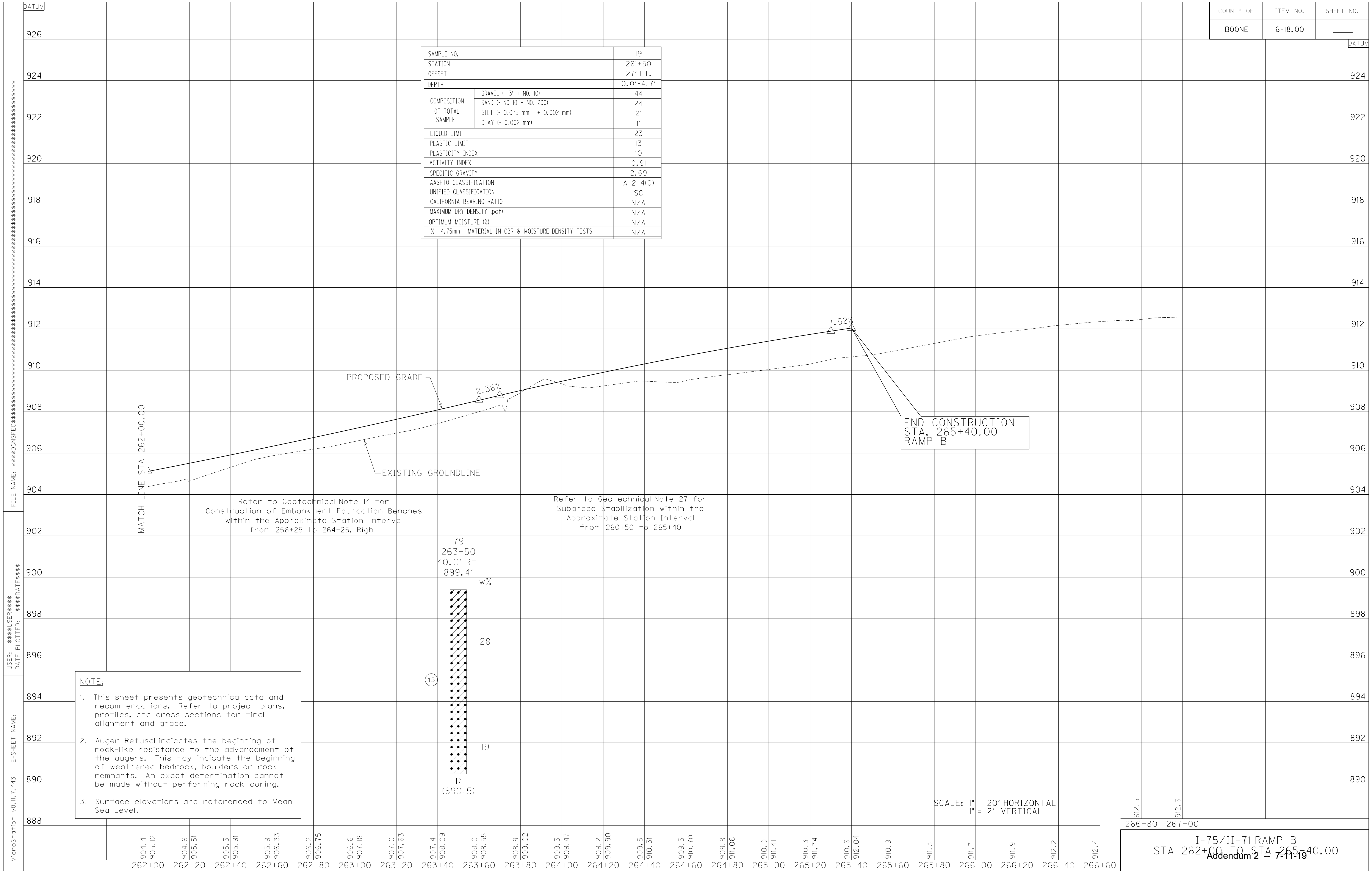
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/I-71 RAMP B
STA 256+00 TO STA 262+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		19
STATION		261+50
OFFSET		27′ Lt.
DEPTH		0.0′-4.7′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	44
	SAND (- NO 10 + NO. 200)	24
	SILT (- 0.075 mm + 0.002 mm)	21
	CLAY (- 0.002 mm)	11
LIQUID LIMIT		23
PLASTIC LIMIT		13
PLASTICITY INDEX		10
ACTIVITY INDEX		0.91
SPECIFIC GRAVITY		2.69
AASHTO CLASSIFICATION		A-2-4(0)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/II-71 RAMP B
STA 262+00 TO STA 265+40.00

Addendum 2 -- 7-11-19

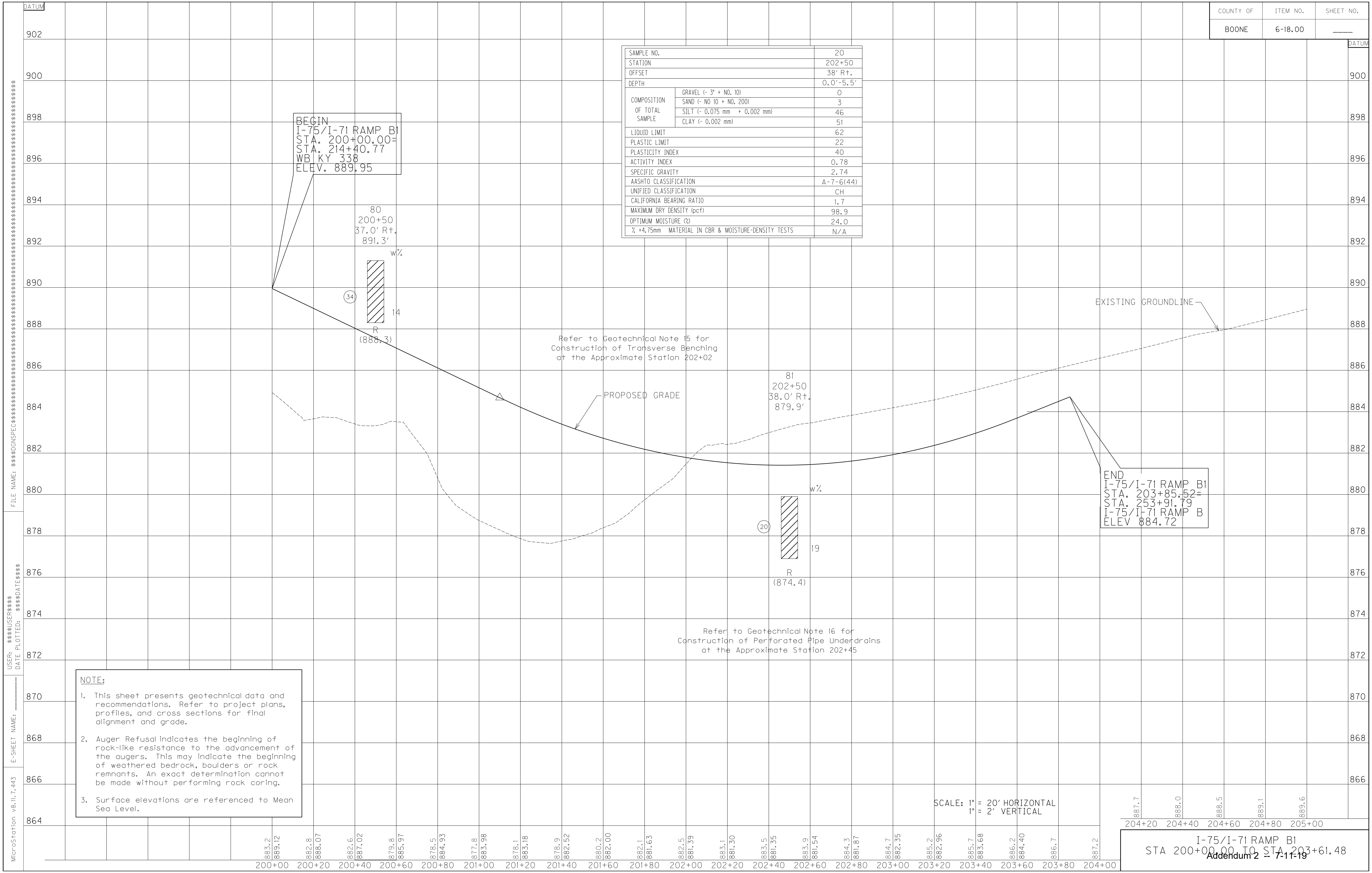
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ____

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		20
STATION		202+50
OFFSET		38' Rt.
DEPTH		0.0'-5.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	51
LIQUID LIMIT		62
PLASTIC LIMIT		22
PLASTICITY INDEX		40
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(44)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		98.9
OPTIMUM MOISTURE (%)		24.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

883.2	889.12	200+00
882.8	888.07	200+20
882.6	887.02	200+40
879.8	885.97	200+60
878.5	884.93	200+80
877.8	883.98	201+00
878.1	883.18	201+20
878.9	882.52	201+40
880.2	882.00	201+60
882.1	881.63	201+80
882.5	881.39	202+00
883.1	881.30	202+20
883.5	881.35	202+40
883.9	881.54	202+60
884.3	881.87	202+80
884.7	882.35	203+00
885.2	882.96	203+20
885.7	883.68	203+40
886.2	884.40	203+60
886.7		203+80
887.2		204+00
887.7		204+20
888.0		204+40
888.5		204+60
889.1		204+80
889.6		205+00

I-75/I-71 RAMP B1
STA 200+00.00 TO STA 203+61.48

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

NOTE:

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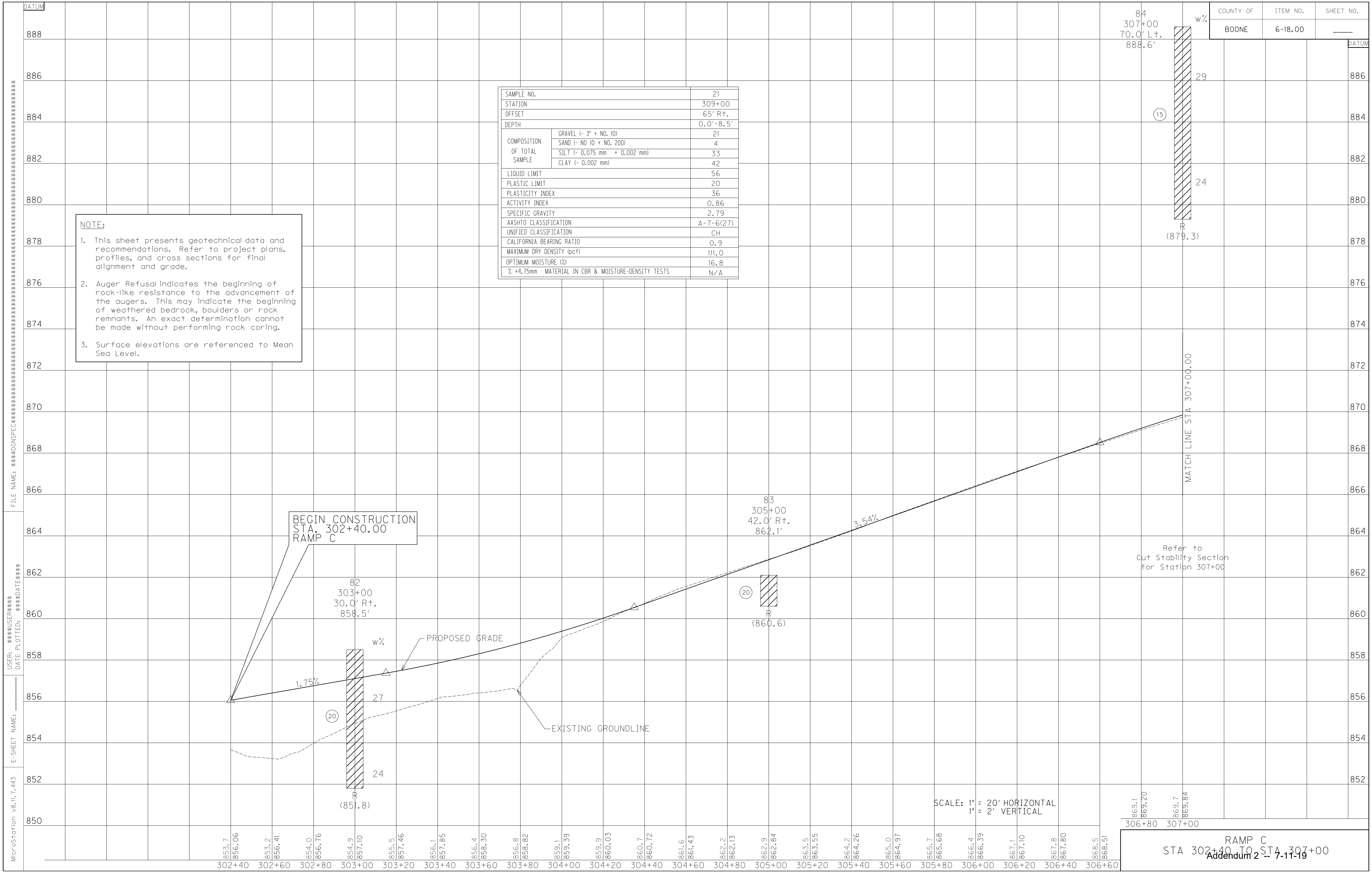
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		21
STATION		309+00
OFFSET		65′ Rt.
DEPTH		0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	33
	CLAY (- 0.002 mm)	42
LIQUID LIMIT		56
PLASTIC LIMIT		20
PLASTICITY INDEX		36
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		0.9
MAXIMUM DRY DENSITY (pcf)		111.0
OPTIMUM MOISTURE (%)		16.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



RAMP C
STA 302+40 TO STA 307+00

Addendum 2 -- 7-11-19

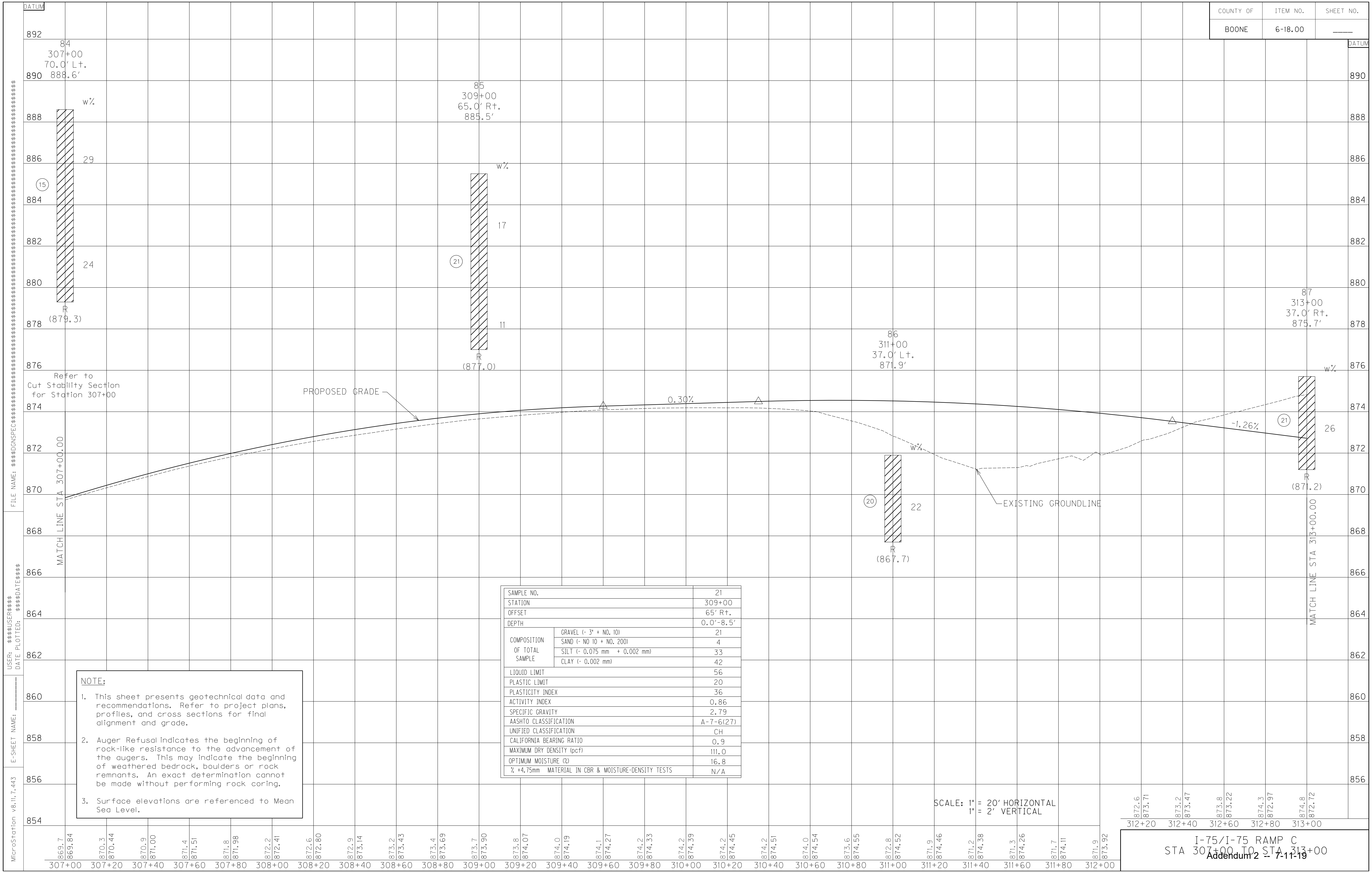
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ____

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



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3. Surface elevations are referenced to Mean Sea Level.

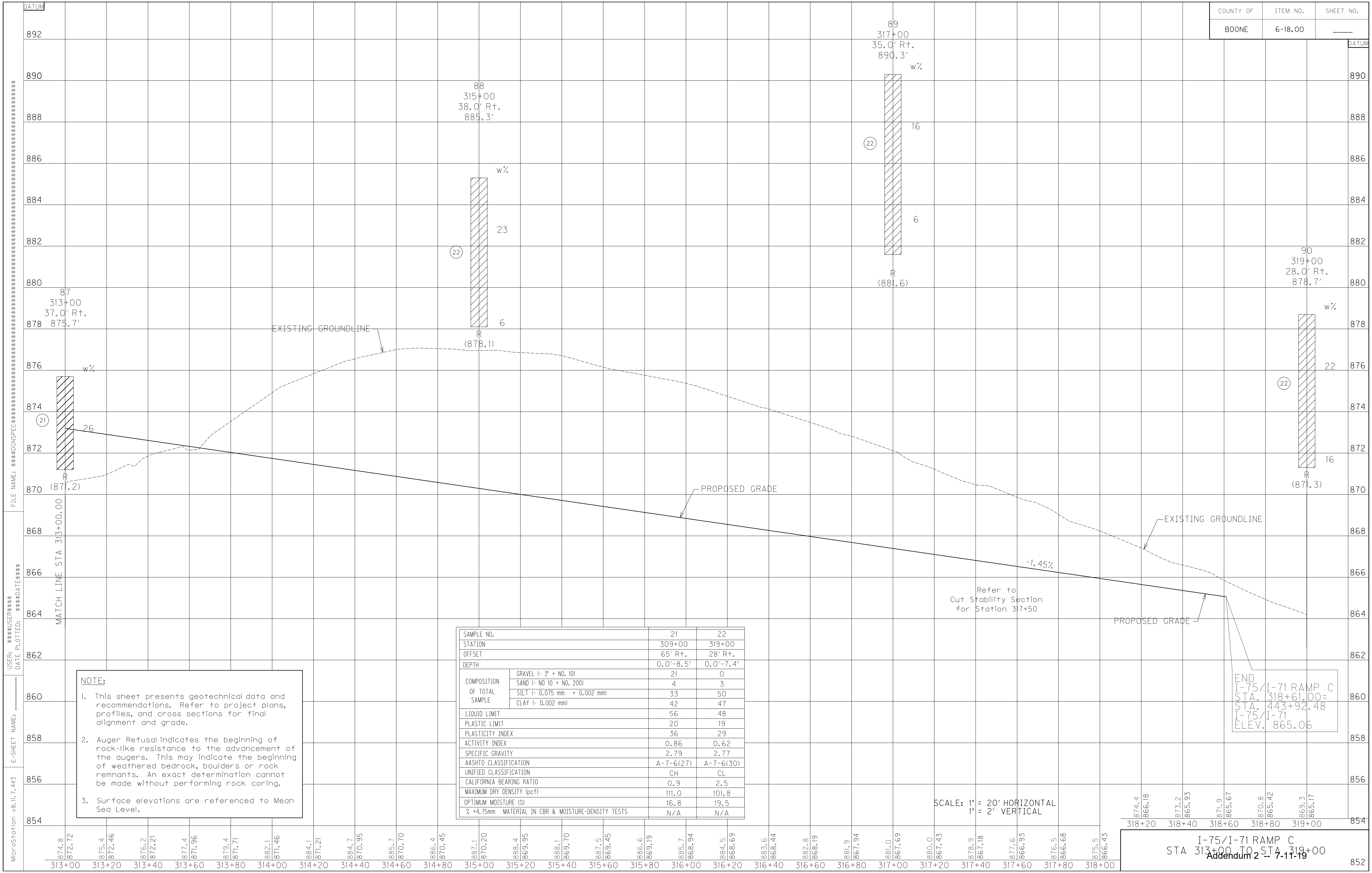
SAMPLE NO.		21
STATION		309+00
OFFSET		65' Rt.
DEPTH		0.0'-8.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	33
	CLAY (- 0.002 mm)	42
LIQUID LIMIT		56
PLASTIC LIMIT		20
PLASTICITY INDEX		36
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		0.9
MAXIMUM DRY DENSITY (pcf)		111.0
OPTIMUM MOISTURE (%)		16.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

I-75/I-75 RAMP C
STA 307+00 TO STA 313+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME: ____
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		21	22
STATION		309+00	319+00
OFFSET		65′ Rt.	28′ Rt.
DEPTH		0.0′-8.5′	0.0′-7.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21	0
	SAND (- NO 10 + NO. 200)	4	3
	SILT (- 0.075 mm + 0.002 mm)	33	50
	CLAY (- 0.002 mm)	42	47
LIQUID LIMIT		56	48
PLASTIC LIMIT		20	19
PLASTICITY INDEX		36	29
ACTIVITY INDEX		0.86	0.62
SPECIFIC GRAVITY		2.79	2.77
AASHTO CLASSIFICATION		A-7-6(27)	A-7-6(30)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		0.9	2.5
MAXIMUM DRY DENSITY (pcf)		111.0	101.8
OPTIMUM MOISTURE (%)		16.8	19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

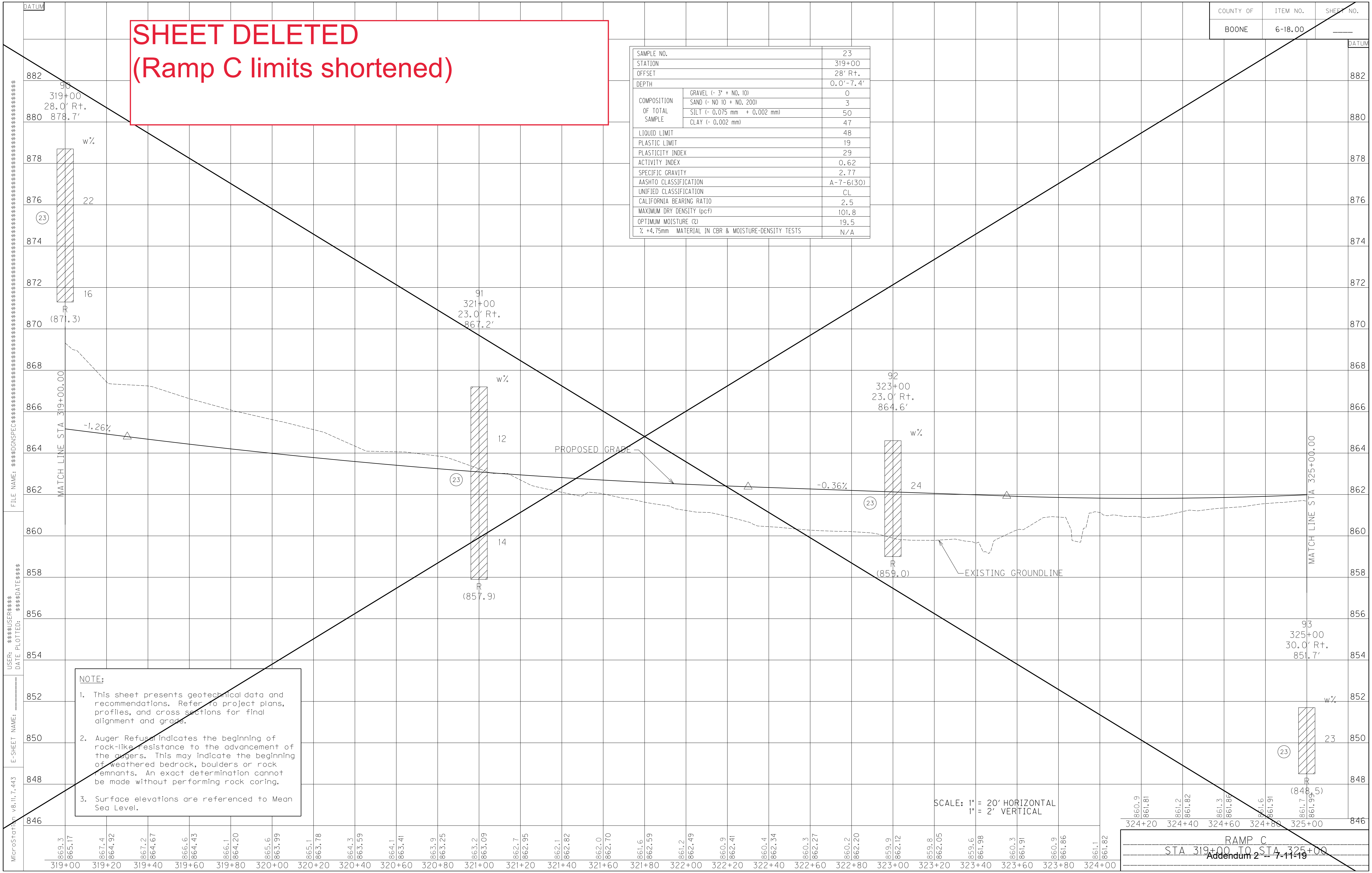
I-75/I-71 RAMP C
STA 313+00 TO STA 319+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SHEET DELETED
(Ramp C limits shortened)

SAMPLE NO.		23
STATION		319+00
OFFSET		28′ Rt.
DEPTH		0.0′-7.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	50
	CLAY (- 0.002 mm)	47
LIQUID LIMIT		48
PLASTIC LIMIT		19
PLASTICITY INDEX		29
ACTIVITY INDEX		0.62
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-7-6(30)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		101.8
OPTIMUM MOISTURE (%)		19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



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3. Surface elevations are referenced to Mean Sea Level.

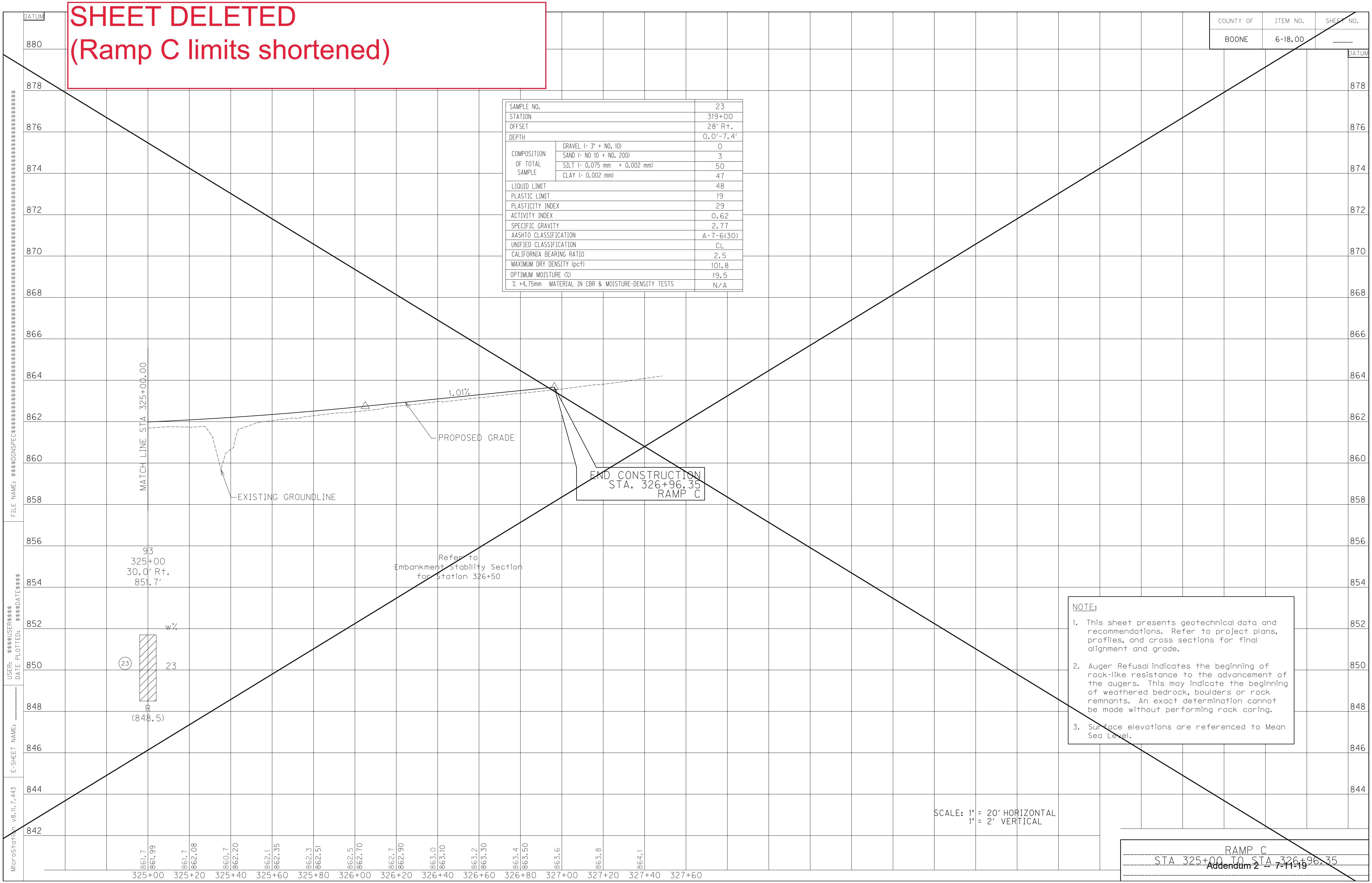
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP C
STA 319+00 TO STA 325+00

Addendum 2 -- 7-11-19

SHEET DELETED
(Ramp C limits shortened)

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		23
STATION		319+00
OFFSET		28′ Rt.
DEPTH		0.0′-7.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	50
	CLAY (- 0.002 mm)	47
LIQUID LIMIT		48
PLASTIC LIMIT		19
PLASTICITY INDEX		29
ACTIVITY INDEX		0.62
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-7-6(30)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		101.8
OPTIMUM MOISTURE (%)		19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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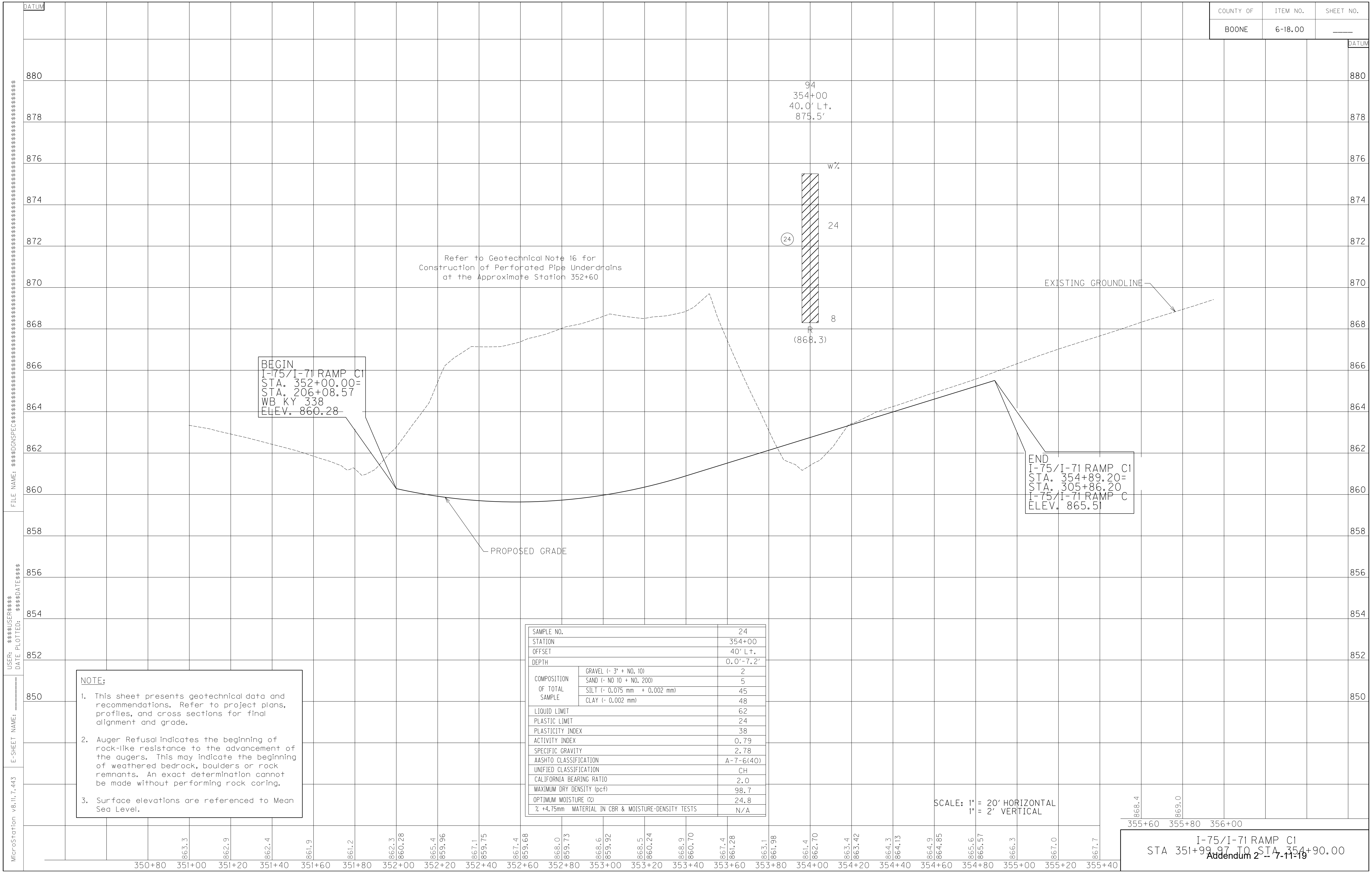
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP C
STA 325+00 TO STA 326+96.35

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



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SAMPLE NO.		24
STATION		354+00
OFFSET		40′ Lt.
DEPTH		0.0′-7.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	45
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		62
PLASTIC LIMIT		24
PLASTICITY INDEX		38
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		24.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

I-75/I-71 RAMP C1
STA 351+99.97 TO STA 354+90.00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		22
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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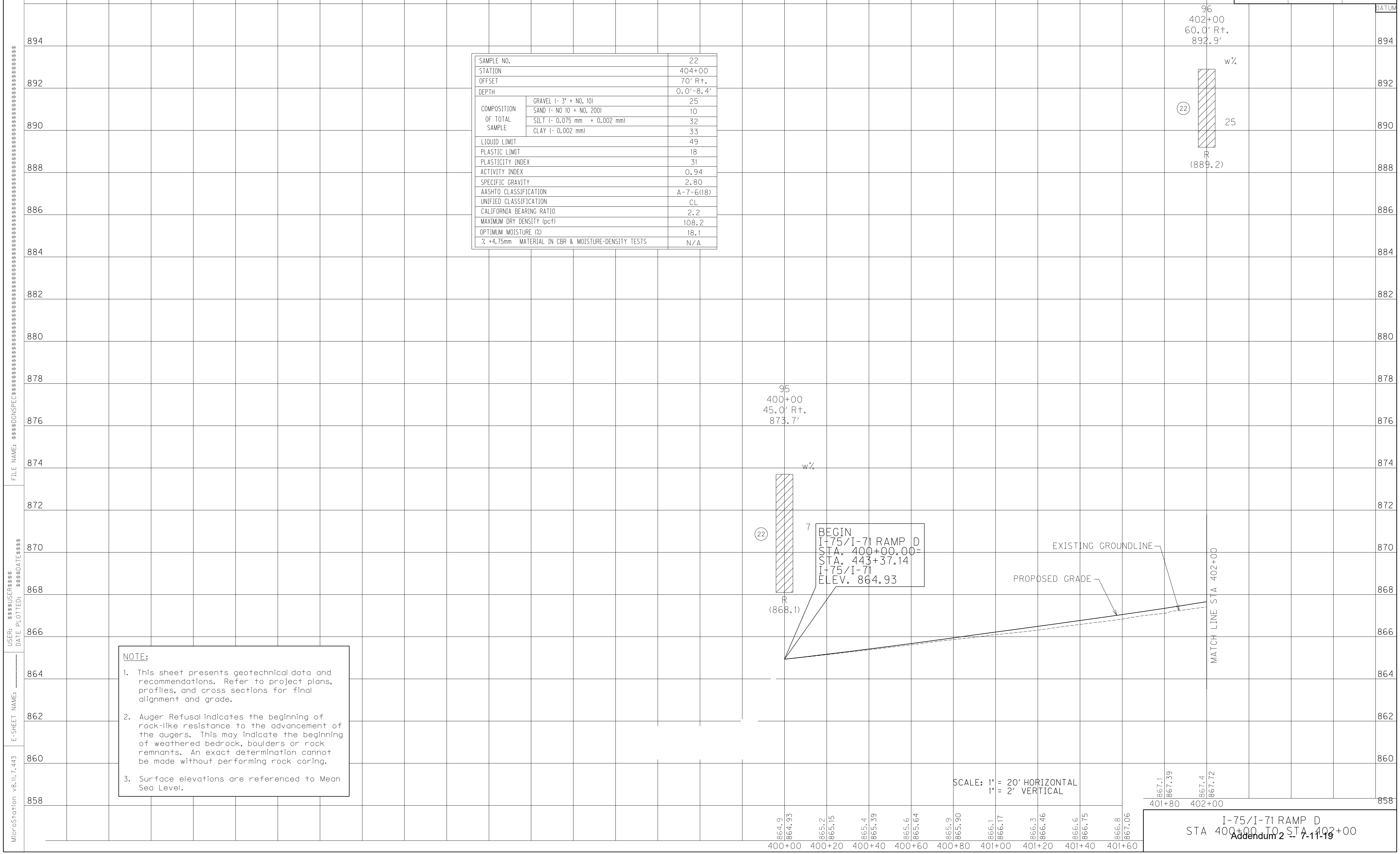
3. Surface elevations are referenced to Mean Sea Level.

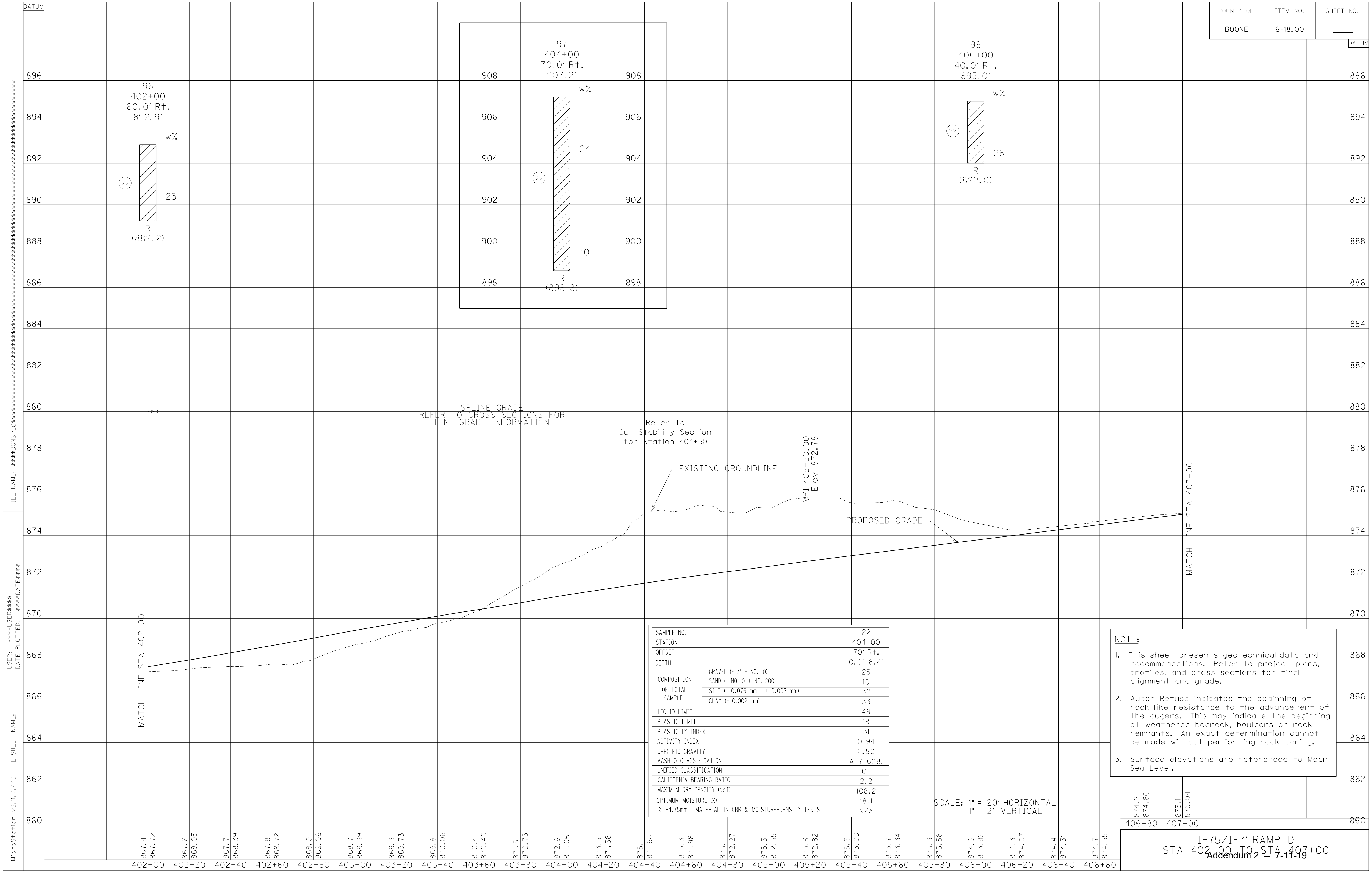


SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/I-71 RAMP D
STA 400+00 TO STA 402+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		22
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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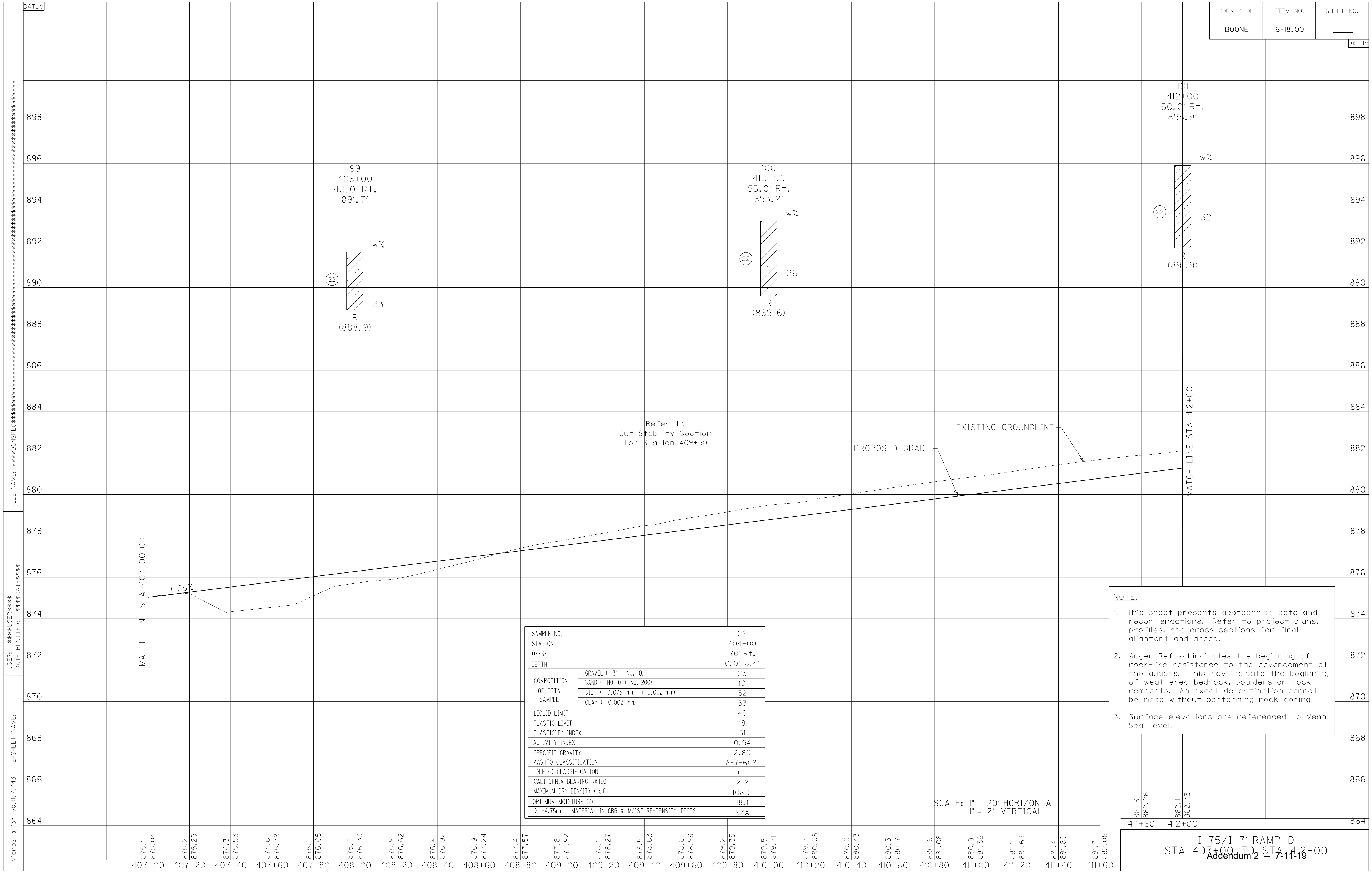
I-75/I-71 RAMP D
STA 402+00 TO STA 407+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



407+00	875.1	875.04
407+20	875.2	875.29
407+40	874.3	875.53
407+60	874.6	875.78
407+80	875.1	876.05
408+00	875.7	876.33
408+20	875.9	876.62
408+40	876.4	876.92
408+60	876.9	877.24
408+80	877.4	877.57
409+00	877.8	877.92
409+20	878.1	878.27
409+40	878.5	878.63
409+60	878.8	878.99
409+80	879.2	879.35
410+00	879.5	879.71
410+20	879.7	880.08
410+40	880.0	880.43
410+60	880.3	880.77
410+80	880.6	881.08
411+00	880.9	881.36
411+20	881.1	881.63
411+40	881.4	881.86
411+60	881.7	882.08
411+80	881.9	882.26
412+00	882.1	882.43

SAMPLE NO.		22
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

I-75/I-71 RAMP D
STA 407+00 TO STA 412+00

Addendum 2 -- 7-11-19

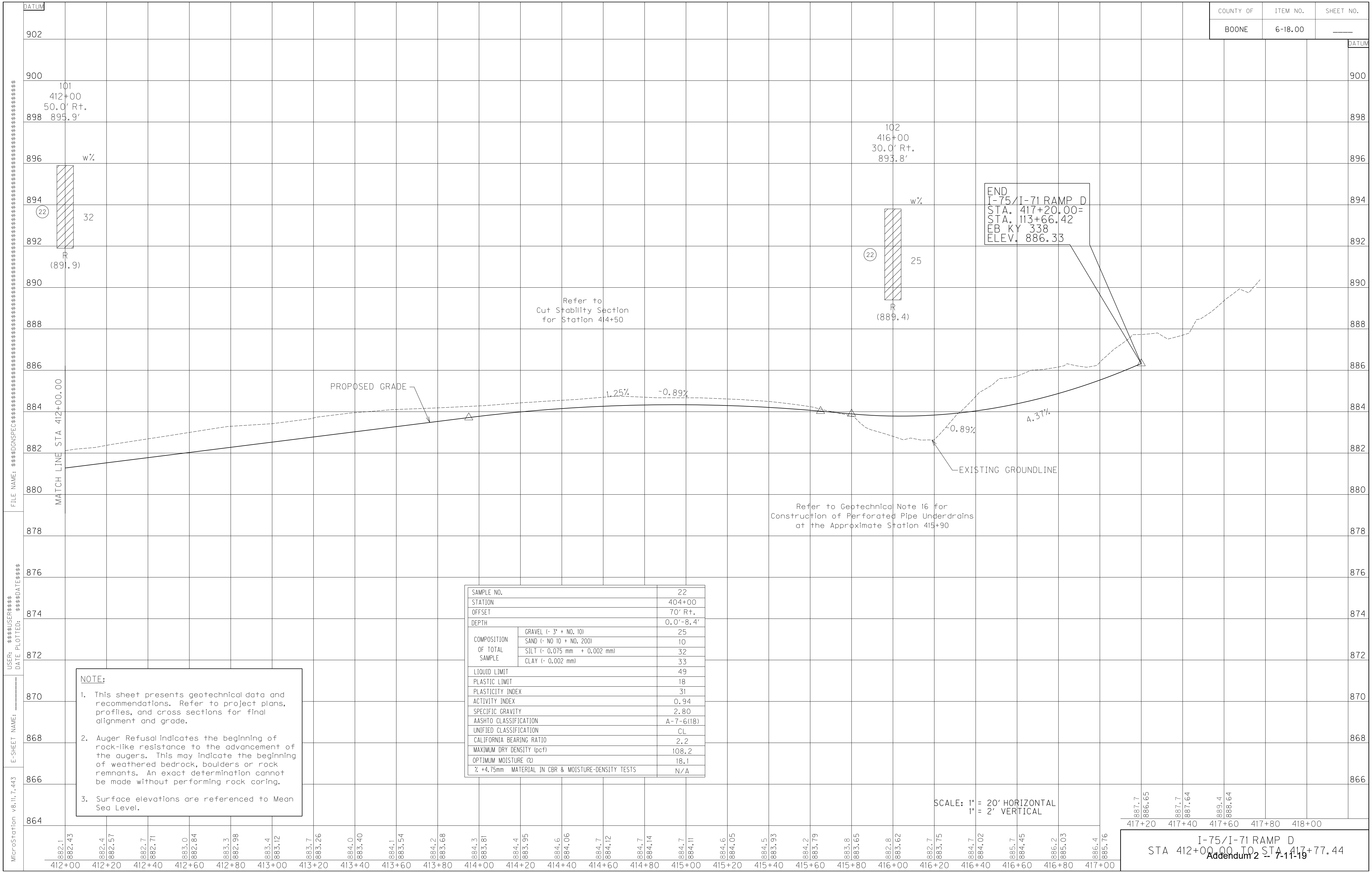
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ______

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



412+00	882.1	882.43
412+20	882.4	882.57
412+40	882.7	882.71
412+60	883.0	882.84
412+80	883.3	882.98
413+00	883.4	883.12
413+20	883.7	883.26
413+40	884.0	883.40
413+60	884.1	883.54
413+80	884.2	883.68
414+00	884.3	883.81
414+20	884.4	883.95
414+40	884.6	884.06
414+60	884.7	884.12
414+80	884.7	884.14
415+00	884.7	884.11
415+20	884.6	884.05
415+40	884.5	883.93
415+60	884.2	883.79
415+80	883.8	883.65
416+00	882.8	883.62
416+20	882.7	883.75
416+40	884.7	884.02
416+60	885.7	884.45
416+80	886.2	885.03
417+00	886.4	885.76
417+20	887.7	886.65
417+40	887.7	887.64
417+60	889.4	888.64
417+80		
418+00		

SAMPLE NO.		22
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

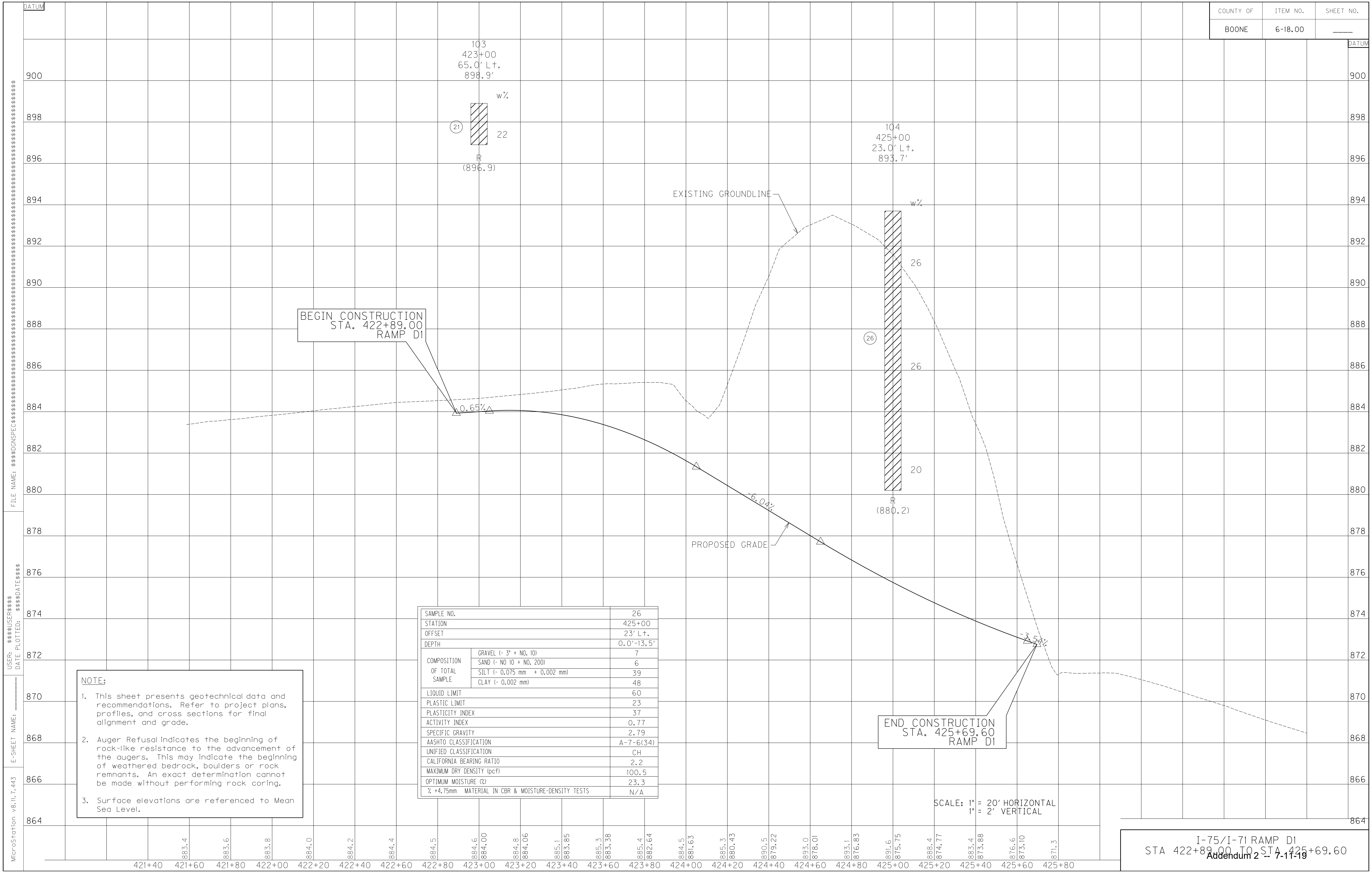
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/I-71 RAMP D
STA 412+00.00 TO STA 417+77.44

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
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SAMPLE NO.		26
STATION		425+00
OFFSET		23′ Lt.
DEPTH		0.0′-13.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	39
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		60
PLASTIC LIMIT		23
PLASTICITY INDEX		37
ACTIVITY INDEX		0.77
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(34)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		100.5
OPTIMUM MOISTURE (%)		23.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

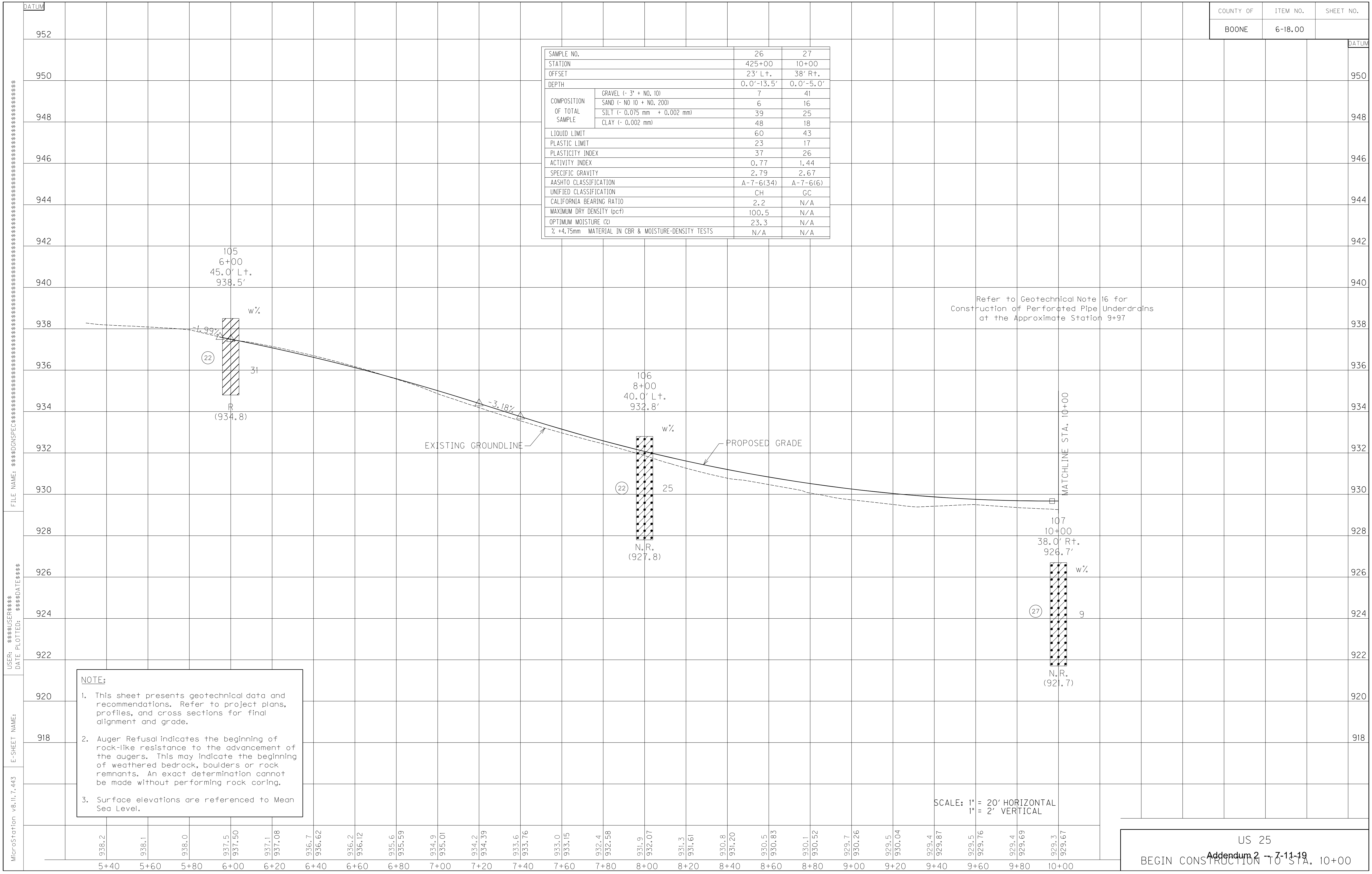
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/I-71 RAMP D1
STA 422+89.00 TO STA 425+69.60

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		26	27
STATION		425+00	10+00
OFFSET		23′ Lt.	38′ Rt.
DEPTH		0.0′-13.5′	0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7	41
	SAND (- NO 10 + NO. 200)	6	16
	SILT (- 0.075 mm + 0.002 mm)	39	25
	CLAY (- 0.002 mm)	48	18
LIQUID LIMIT		60	43
PLASTIC LIMIT		23	17
PLASTICITY INDEX		37	26
ACTIVITY INDEX		0.77	1.44
SPECIFIC GRAVITY		2.79	2.67
AASHTO CLASSIFICATION		A-7-6(34)	A-7-6(6)
UNIFIED CLASSIFICATION		CH	GC
CALIFORNIA BEARING RATIO		2.2	N/A
MAXIMUM DRY DENSITY (pcf)		100.5	N/A
OPTIMUM MOISTURE (%)		23.3	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 9+97

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

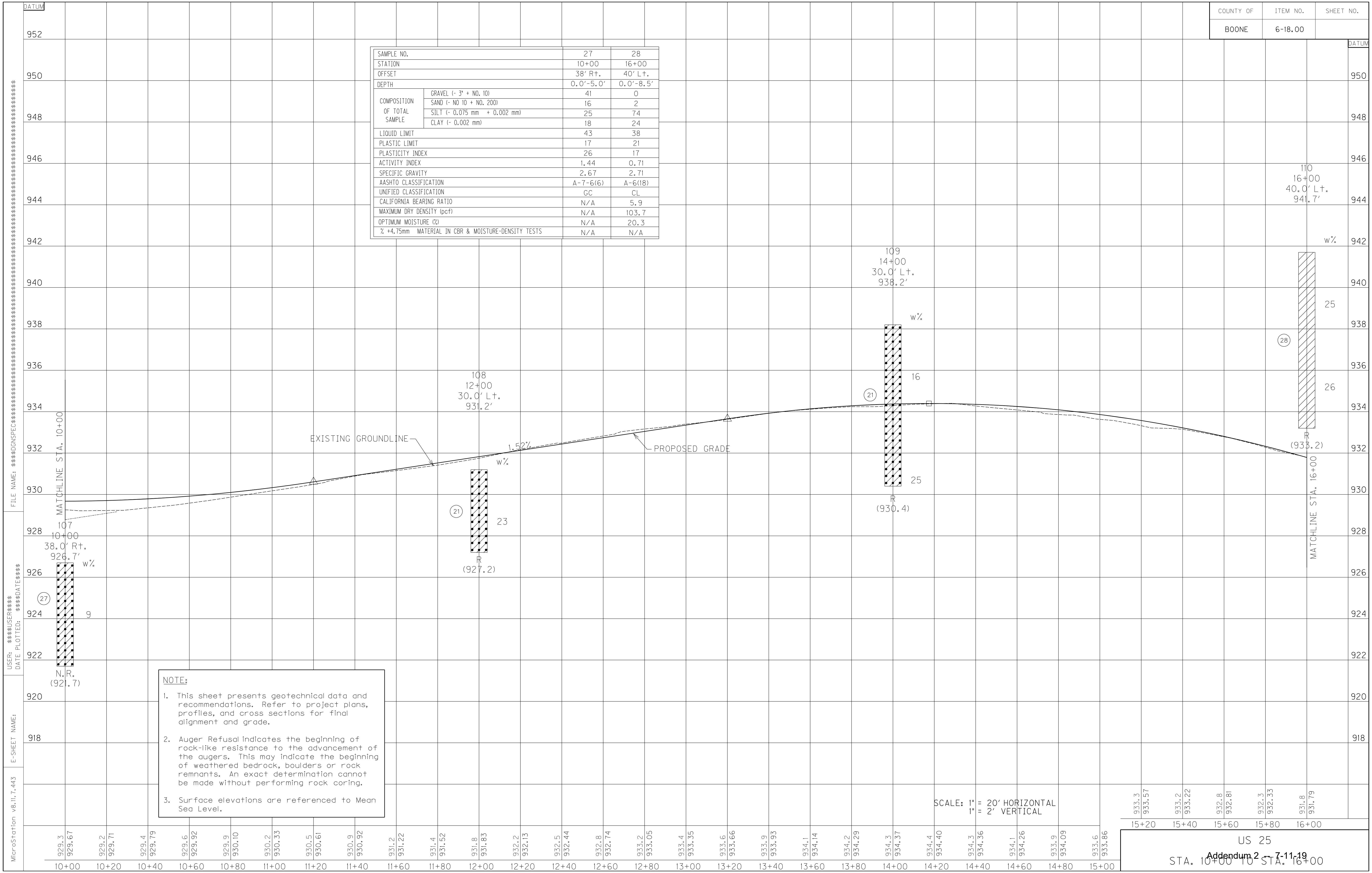
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

5+40	938.2	
5+60	938.1	
5+80	938.0	
6+00	937.5	937.50
6+20	937.1	937.08
6+40	936.7	936.62
6+60	936.2	936.12
6+80	935.6	935.59
7+00	934.9	935.01
7+20	934.2	934.39
7+40	933.6	933.76
7+60	933.0	933.15
7+80	932.4	932.58
8+00	931.9	932.07
8+20	931.3	931.61
8+40	930.8	931.20
8+60	930.5	930.83
8+80	930.1	930.52
9+00	929.7	930.26
9+20	929.5	930.04
9+40	929.4	929.87
9+60	929.5	929.76
9+80	929.4	929.69
10+00	929.3	929.67

US 25
BEGIN CONSTRUCTION TO STA. 10+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		27	28
STATION		10+00	16+00
OFFSET		38′ Rt.	40′ Lt.
DEPTH		0.0′-5.0′	0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	41	0
	SAND (- NO 10 + NO. 200)	16	2
	SILT (- 0.075 mm + 0.002 mm)	25	74
	CLAY (- 0.002 mm)	18	24
LIQUID LIMIT		43	38
PLASTIC LIMIT		17	21
PLASTICITY INDEX		26	17
ACTIVITY INDEX		1.44	0.71
SPECIFIC GRAVITY		2.67	2.71
AASHTO CLASSIFICATION		A-7-6(6)	A-6(18)
UNIFIED CLASSIFICATION		GC	CL
CALIFORNIA BEARING RATIO		N/A	5.9
MAXIMUM DRY DENSITY (pcf)		N/A	103.7
OPTIMUM MOISTURE (%)		N/A	20.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

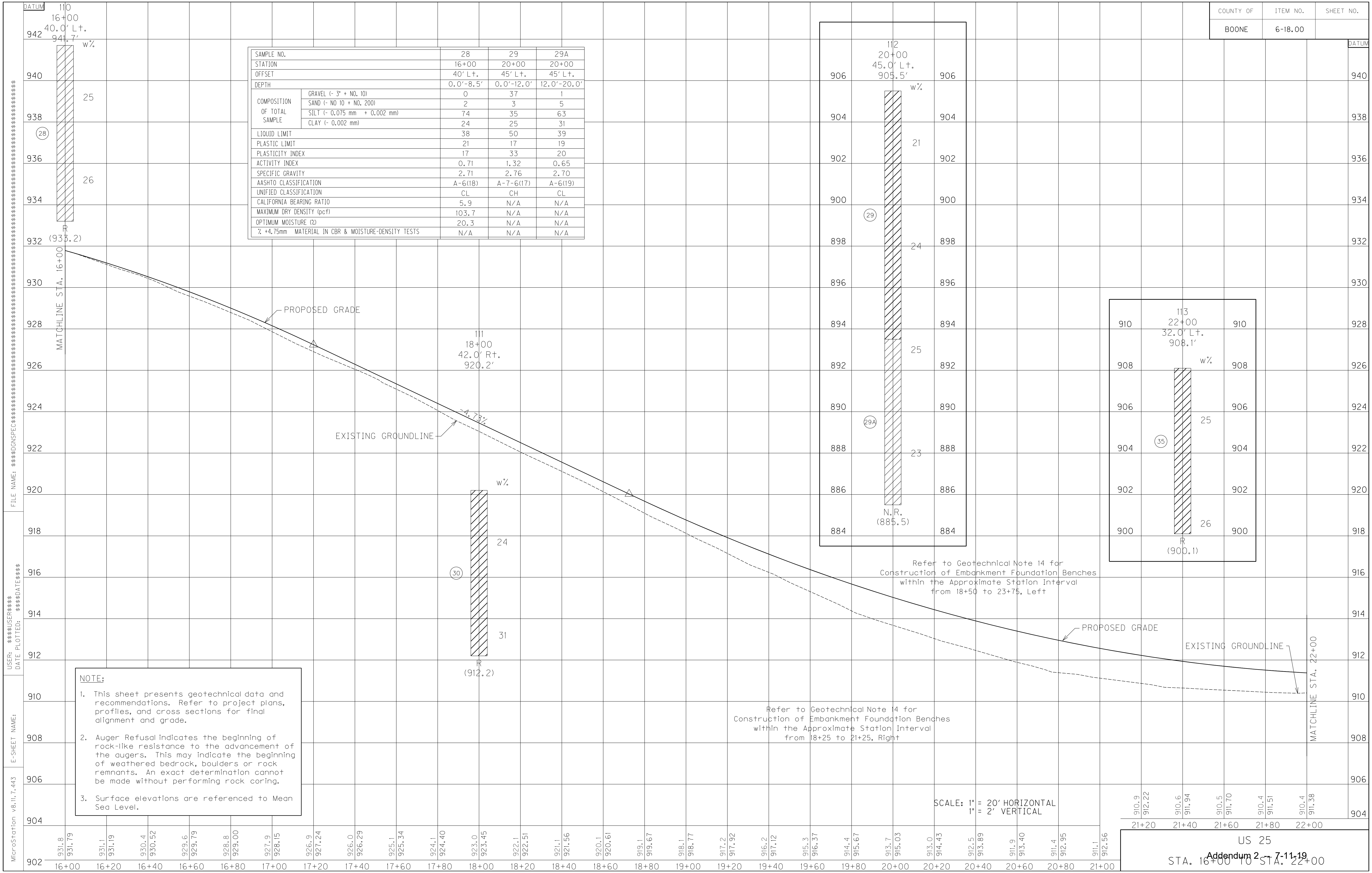
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 10+00 TO STA. 16+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		28	29	29A
STATION		16+00	20+00	20+00
OFFSET		40′ Lt.	45′ Lt.	45′ Lt.
DEPTH		0.0′-8.5′	0.0′-12.0′	12.0′-20.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	37	1
	SAND (- NO 10 + NO. 200)	2	3	5
	SILT (- 0.075 mm + 0.002 mm)	74	35	63
	CLAY (- 0.002 mm)	24	25	31
LIQUID LIMIT		38	50	39
PLASTIC LIMIT		21	17	19
PLASTICITY INDEX		17	33	20
ACTIVITY INDEX		0.71	1.32	0.65
SPECIFIC GRAVITY		2.71	2.76	2.70
AASHTO CLASSIFICATION		A-6(18)	A-7-6(17)	A-6(19)
UNIFIED CLASSIFICATION		CL	CH	CL
CALIFORNIA BEARING RATIO		5.9	N/A	N/A
MAXIMUM DRY DENSITY (pcf)		103.7	N/A	N/A
OPTIMUM MOISTURE (%)		20.3	N/A	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A	N/A



Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 18+50 to 23+75, Left

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 18+25 to 21+25, Right

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

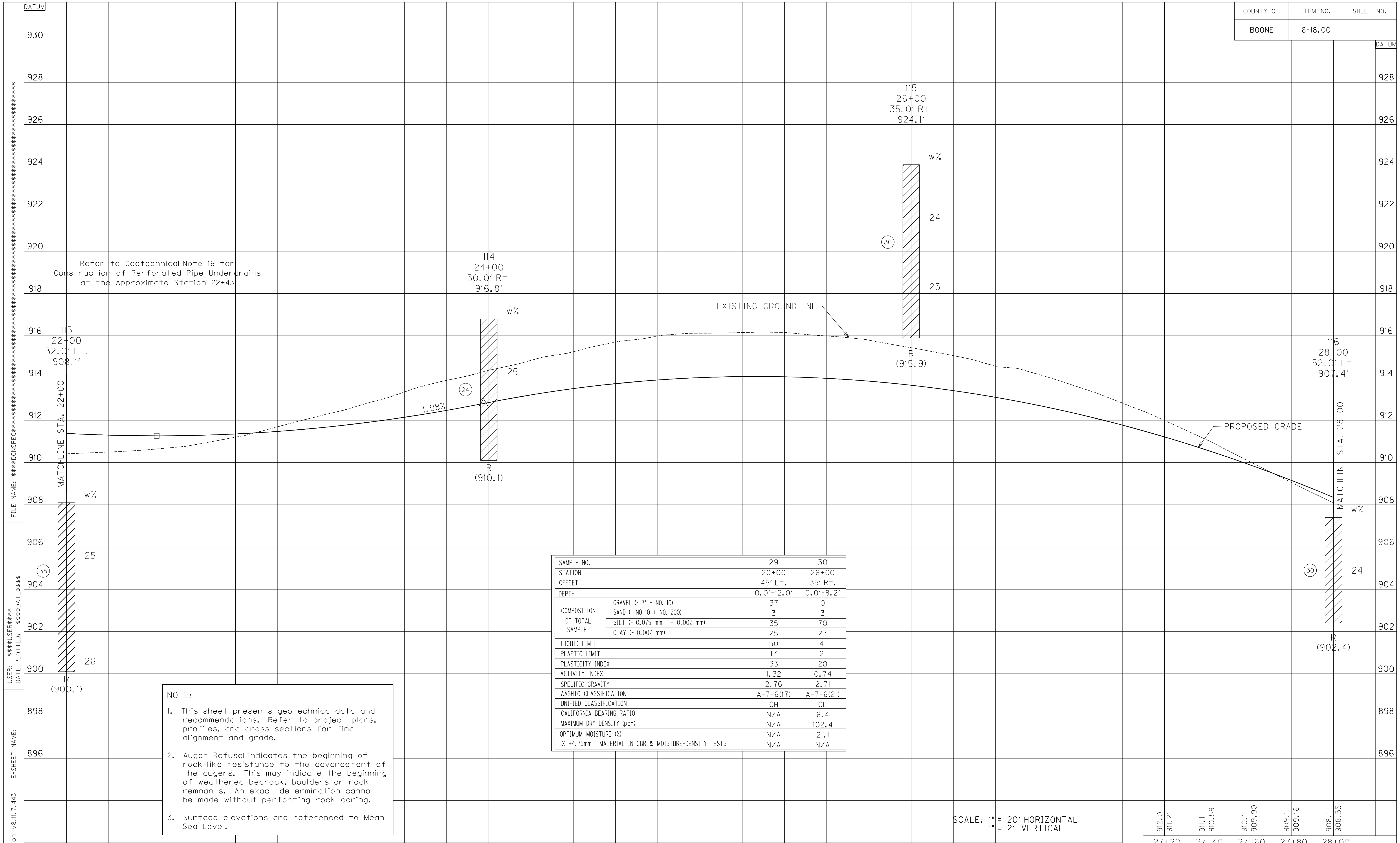
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

FILE NAME: $$$$DGNSPEC$$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

US 25
STA. 16+00 TO STA. 22+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		29	30
STATION		20+00	26+00
OFFSET		45′ Lt.	35′ Rt.
DEPTH		0.0′-12.0′	0.0′-8.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	37	0
	SAND (- NO 10 + NO. 200)	3	3
	SILT (- 0.075 mm + 0.002 mm)	35	70
	CLAY (- 0.002 mm)	25	27
LIQUID LIMIT		50	41
PLASTIC LIMIT		17	21
PLASTICITY INDEX		33	20
ACTIVITY INDEX		1.32	0.74
SPECIFIC GRAVITY		2.76	2.71
AASHTO CLASSIFICATION		A-7-6(17)	A-7-6(21)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		N/A	6.4
MAXIMUM DRY DENSITY (pcf)		N/A	102.4
OPTIMUM MOISTURE (%)		N/A	21.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

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22+00	910.4	911.38
22+20	910.5	911.30
22+40	910.6	911.26
22+60	910.8	911.28
22+80	911.2	911.35
23+00	911.7	911.47
23+20	912.2	911.64
23+40	912.7	911.87
23+60	913.3	912.14
23+80	913.9	912.47
24+00	914.4	912.84
24+20	914.8	913.20
24+40	915.2	913.50
24+60	915.7	913.73
24+80	916.0	913.91
25+00	916.1	914.02
25+20	916.2	914.07
25+40	916.2	914.06
25+60	916.0	913.99
25+80	915.8	913.86
26+00	915.4	913.66
26+20	915.1	913.41
26+40	914.6	913.09
26+60	914.2	912.71
26+80	913.5	912.27
27+00	912.8	911.77
27+20	912.0	911.21
27+40	911.1	910.59
27+60	910.1	909.90
27+80	909.1	909.16
28+00	908.1	908.35

US 25

STA. 22+00 TO STA. 28+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$

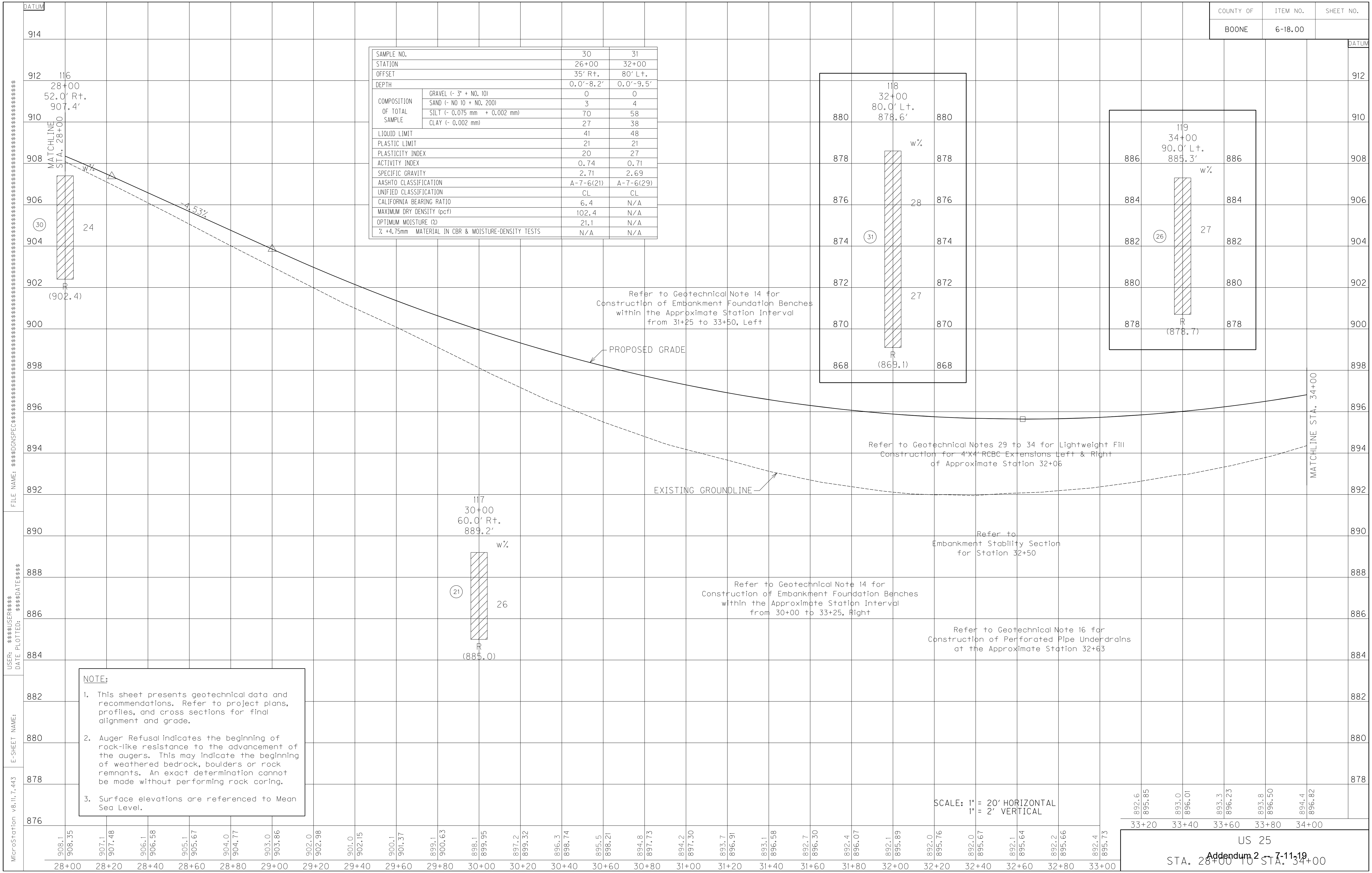
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		30	31
STATION		26+00	32+00
OFFSET		35′ Rt.	80′ Lt.
DEPTH		0.0′-8.2′	0.0′-9.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0
	SAND (- NO 10 + NO. 200)	3	4
	SILT (- 0.075 mm + 0.002 mm)	70	58
	CLAY (- 0.002 mm)	27	38
LIQUID LIMIT		41	48
PLASTIC LIMIT		21	21
PLASTICITY INDEX		20	27
ACTIVITY INDEX		0.74	0.71
SPECIFIC GRAVITY		2.71	2.69
AASHTO CLASSIFICATION		A-7-6(21)	A-7-6(29)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		6.4	N/A
MAXIMUM DRY DENSITY (pcf)		102.4	N/A
OPTIMUM MOISTURE (%)		21.1	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

NOTE:

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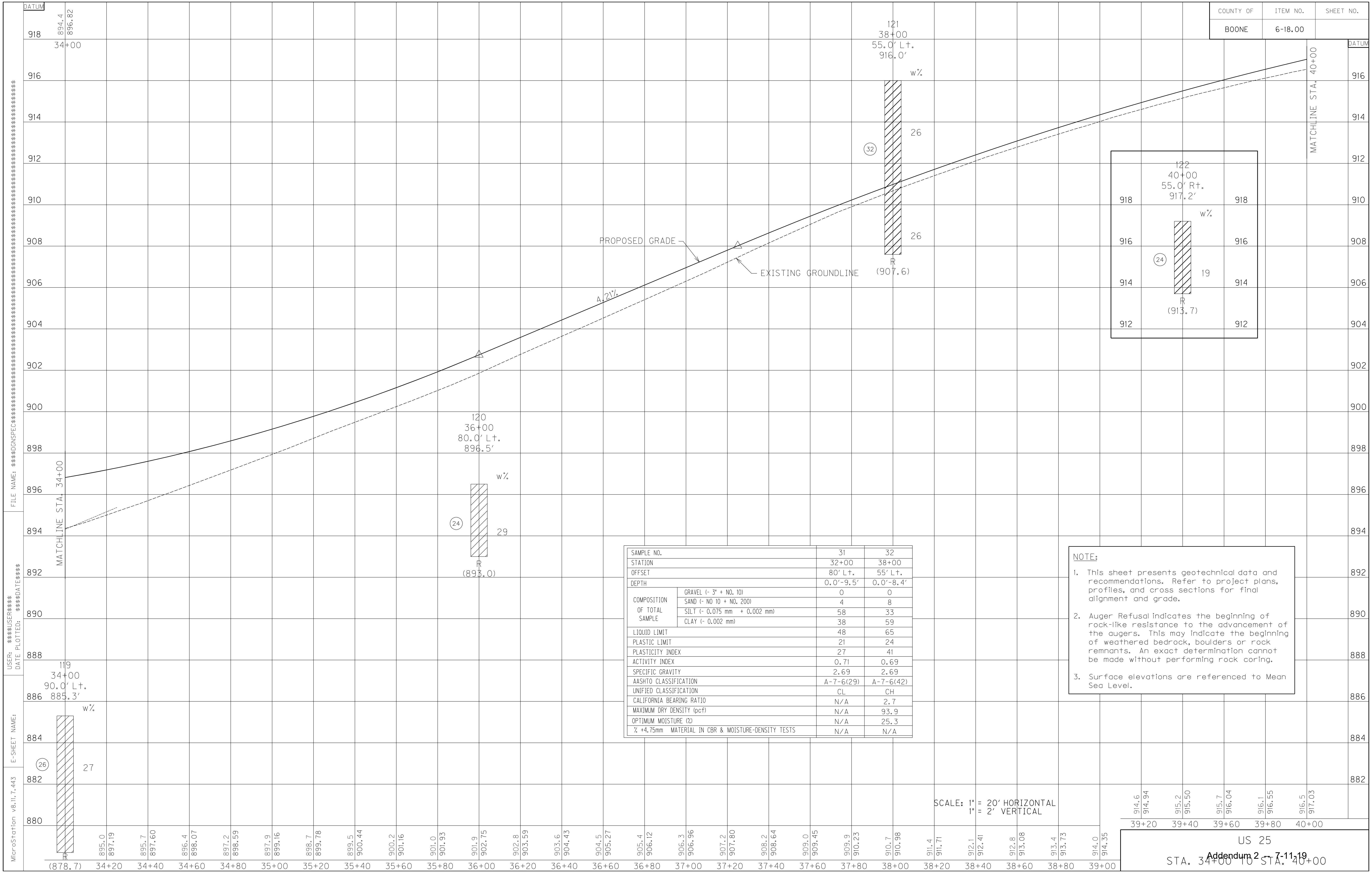
US 25

STA. 28+00 TO STA. 34+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		31	32
STATION		32+00	38+00
OFFSET		80' Lt.	55' Lt.
DEPTH		0.0'-9.5'	0.0'-8.4'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0
	SAND (- NO 10 + NO. 200)	4	8
	SILT (- 0.075 mm + 0.002 mm)	58	33
	CLAY (- 0.002 mm)	38	59
LIQUID LIMIT		48	65
PLASTIC LIMIT		21	24
PLASTICITY INDEX		27	41
ACTIVITY INDEX		0.71	0.69
SPECIFIC GRAVITY		2.69	2.69
AASHTO CLASSIFICATION		A-7-6(29)	A-7-6(42)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		N/A	2.7
MAXIMUM DRY DENSITY (pcf)		N/A	93.9
OPTIMUM MOISTURE (%)		N/A	25.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

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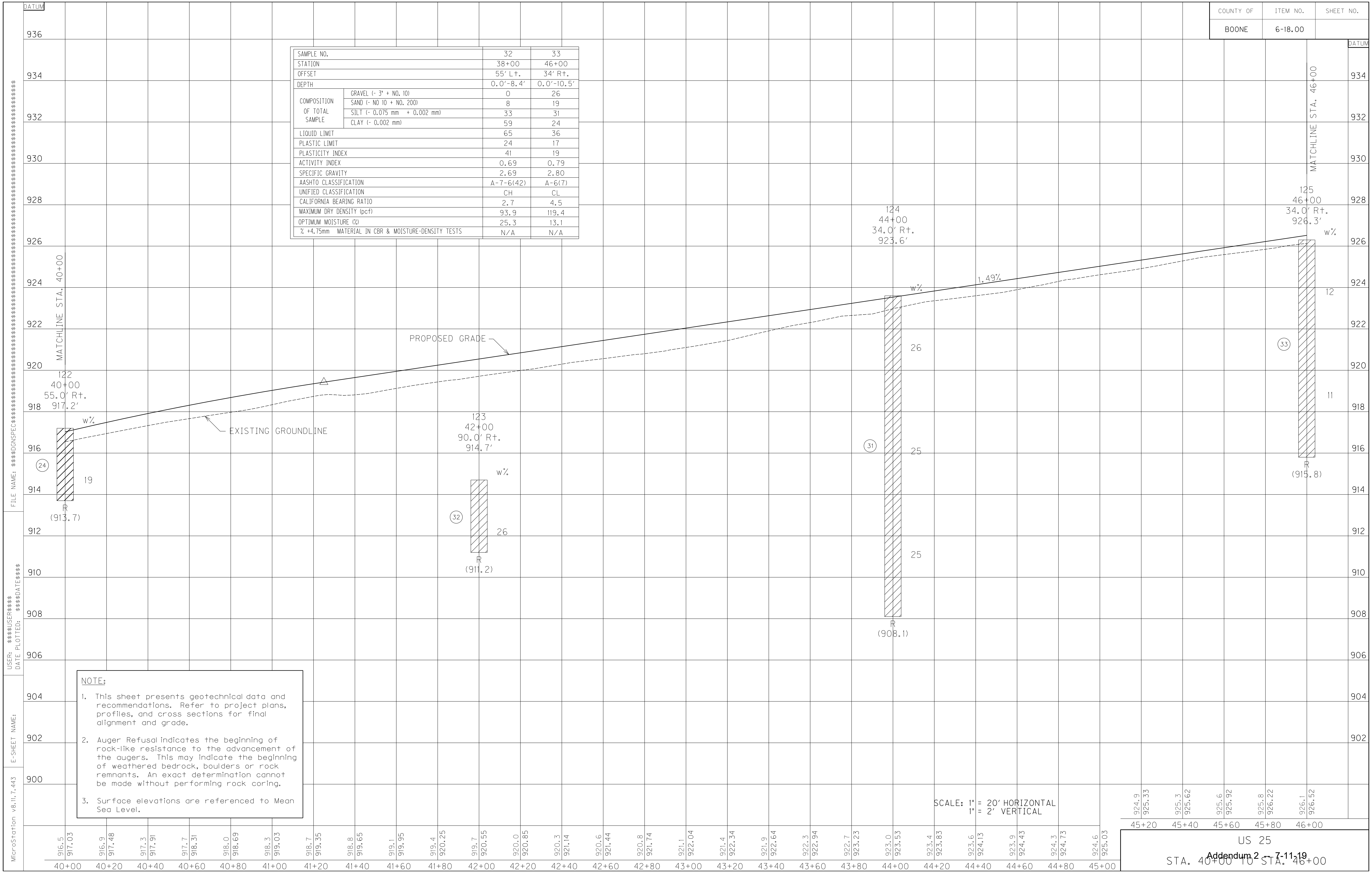
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25
STA. 34+00 TO STA. 40+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		32	33
STATION		38+00	46+00
OFFSET		55' Lt.	34' Rt.
DEPTH		0.0'-8.4'	0.0'-10.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	26
	SAND (- NO 10 + NO. 200)	8	19
	SILT (- 0.075 mm + 0.002 mm)	33	31
	CLAY (- 0.002 mm)	59	24
LIQUID LIMIT		65	36
PLASTIC LIMIT		24	17
PLASTICITY INDEX		41	19
ACTIVITY INDEX		0.69	0.79
SPECIFIC GRAVITY		2.69	2.80
AASHTO CLASSIFICATION		A-7-6(42)	A-6(7)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		2.7	4.5
MAXIMUM DRY DENSITY (pcf)		93.9	119.4
OPTIMUM MOISTURE (%)		25.3	13.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25
STA. 40+00 TO STA. 46+00

Addendum 2 -- 7-11-19

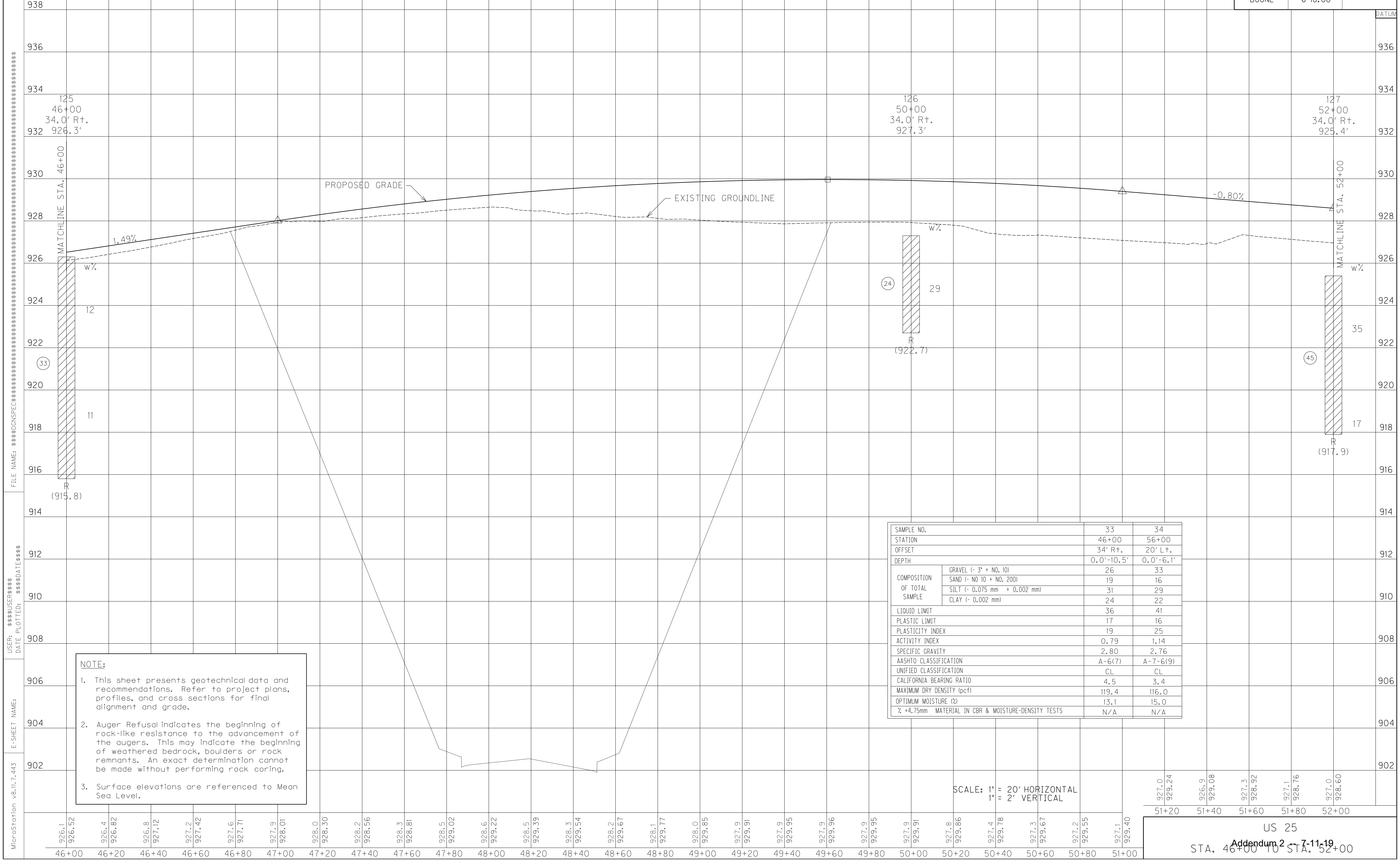
FILE NAME: $$$$DGNSPEC$$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



46+00	926.1	926.52
46+20	926.4	926.82
46+40	926.8	927.12
46+60	927.2	927.42
46+80	927.6	927.71
47+00	927.9	928.01
47+20	928.0	928.30
47+40	928.2	928.56
47+60	928.3	928.81
47+80	928.5	929.02
48+00	928.6	929.22
48+20	928.5	929.39
48+40	928.3	929.54
48+60	928.2	929.67
48+80	928.1	929.77
49+00	928.0	929.85
49+20	927.9	929.91
49+40	927.9	929.95
49+60	927.9	929.96
49+80	927.9	929.95
50+00	927.9	929.91
50+20	927.8	929.86
50+40	927.4	929.78
50+60	927.3	929.67
50+80	927.2	929.55
51+00	927.1	929.40
51+20	927.0	929.24
51+40	926.9	929.08
51+60	927.3	928.92
51+80	927.1	928.76
52+00	927.0	928.60

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		33	34
STATION		46+00	56+00
OFFSET		34′ Rt.	20′ Lt.
DEPTH		0.0′-10.5′	0.0′-6.1′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	26	33
	SAND (- NO 10 + NO. 200)	19	16
	SILT (- 0.075 mm + 0.002 mm)	31	29
	CLAY (- 0.002 mm)	24	22
LIQUID LIMIT		36	41
PLASTIC LIMIT		17	16
PLASTICITY INDEX		19	25
ACTIVITY INDEX		0.79	1.14
SPECIFIC GRAVITY		2.80	2.76
AASHTO CLASSIFICATION		A-6(7)	A-7-6(9)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		4.5	3.4
MAXIMUM DRY DENSITY (pcf)		119.4	116.0
OPTIMUM MOISTURE (%)		13.1	15.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

US 25

STA. 46+00 TO STA. 52+00

Addendum 2 -- 7-11-19

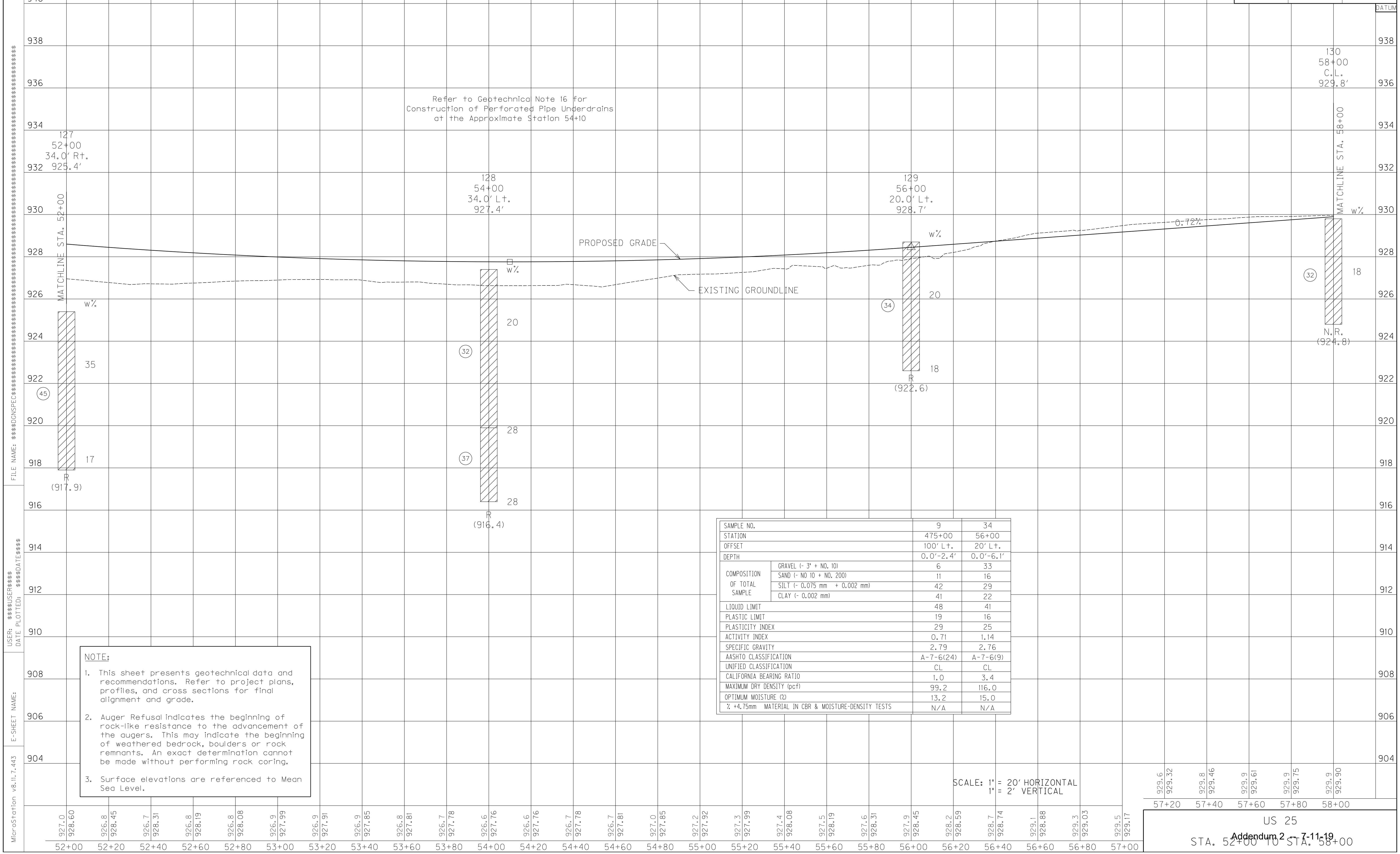
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		9	34
STATION		475+00	56+00
OFFSET		100′ Lt.	20′ Lt.
DEPTH		0.0′-2.4′	0.0′-6.1′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	33
	SAND (- NO 10 + NO. 200)	11	16
	SILT (- 0.075 mm + 0.002 mm)	42	29
	CLAY (- 0.002 mm)	41	22
LIQUID LIMIT		48	41
PLASTIC LIMIT		19	16
PLASTICITY INDEX		29	25
ACTIVITY INDEX		0.71	1.14
SPECIFIC GRAVITY		2.79	2.76
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(9)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	3.4
MAXIMUM DRY DENSITY (pcf)		99.2	116.0
OPTIMUM MOISTURE (%)		13.2	15.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

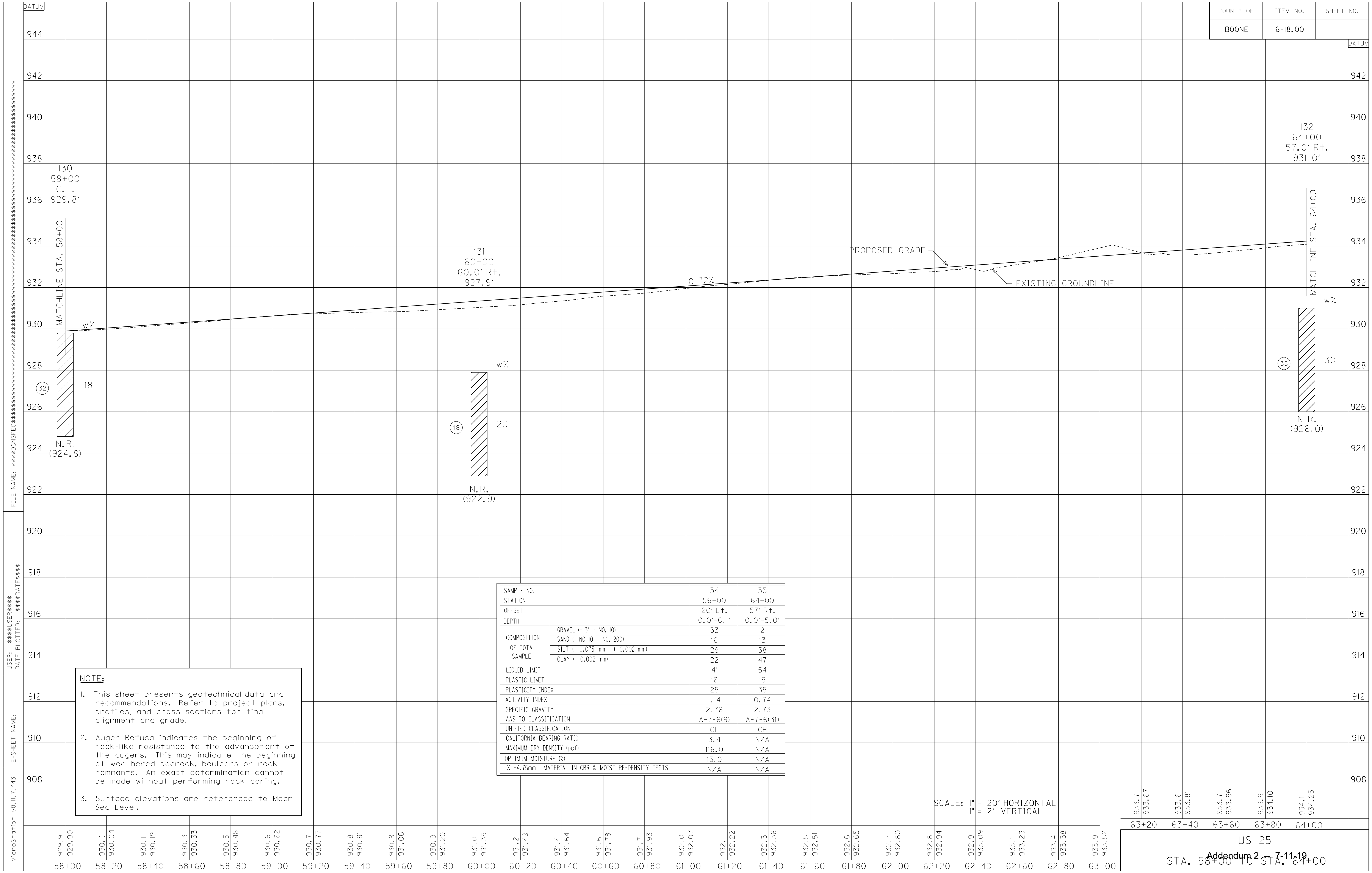
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

US 25

STA. 52+00 TO STA. 58+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



58+00	929.9	929.90
58+20	930.0	930.04
58+40	930.1	930.19
58+60	930.3	930.33
58+80	930.5	930.48
59+00	930.6	930.62
59+20	930.7	930.77
59+40	930.8	930.91
59+60	930.8	931.06
59+80	930.9	931.20
60+00	931.0	931.35
60+20	931.2	931.49
60+40	931.4	931.64
60+60	931.6	931.78
60+80	931.7	931.93
61+00	932.0	932.07
61+20	932.1	932.22
61+40	932.3	932.36
61+60	932.5	932.51
61+80	932.6	932.65
62+00	932.7	932.80
62+20	932.8	932.94
62+40	932.9	933.09
62+60	933.1	933.23
62+80	933.4	933.38
63+00	933.9	933.52
63+20	933.7	933.67
63+40	933.6	933.81
63+60	933.7	933.96
63+80	933.9	934.10
64+00	934.1	934.25

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		34	35
STATION		56+00	64+00
OFFSET		20′ Lt.	57′ Rt.
DEPTH		0.0′-6.1′	0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	33	2
	SAND (- NO 10 + NO. 200)	16	13
	SILT (- 0.075 mm + 0.002 mm)	29	38
	CLAY (- 0.002 mm)	22	47
LIQUID LIMIT		41	54
PLASTIC LIMIT		16	19
PLASTICITY INDEX		25	35
ACTIVITY INDEX		1.14	0.74
SPECIFIC GRAVITY		2.76	2.73
AASHTO CLASSIFICATION		A-7-6(9)	A-7-6(31)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		3.4	N/A
MAXIMUM DRY DENSITY (pcf)		116.0	N/A
OPTIMUM MOISTURE (%)		15.0	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

US 25

STA. 58+00 TO STA. 64+00

Addendum 2 -- 7-11-19

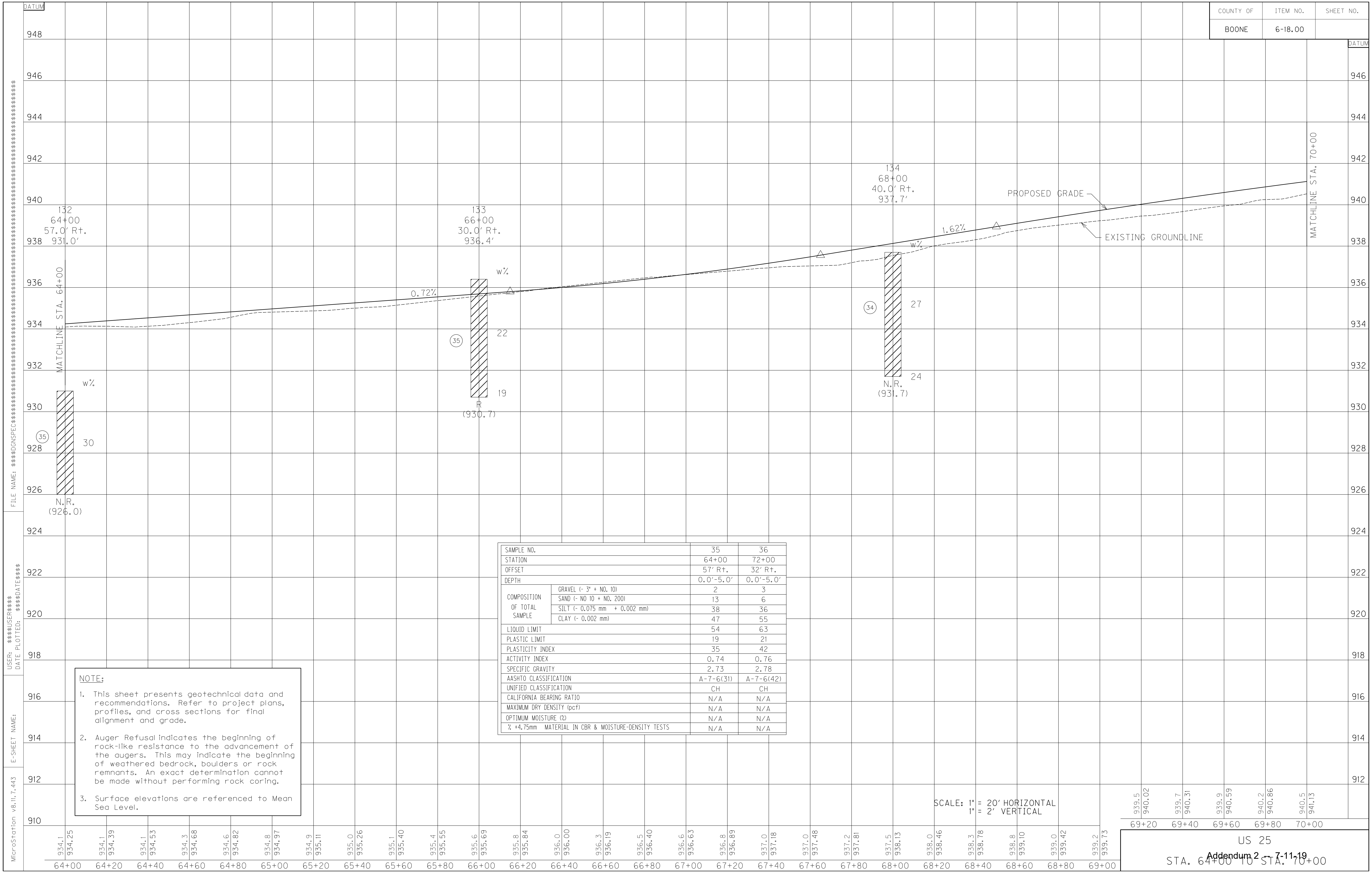
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		35	36
STATION		64+00	72+00
OFFSET		57' Rt.	32' Rt.
DEPTH		0.0'-5.0'	0.0'-5.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2	3
	SAND (- NO 10 + NO. 200)	13	6
	SILT (- 0.075 mm + 0.002 mm)	38	36
	CLAY (- 0.002 mm)	47	55
LIQUID LIMIT		54	63
PLASTIC LIMIT		19	21
PLASTICITY INDEX		35	42
ACTIVITY INDEX		0.74	0.76
SPECIFIC GRAVITY		2.73	2.78
AASHTO CLASSIFICATION		A-7-6(31)	A-7-6(42)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		N/A	N/A
MAXIMUM DRY DENSITY (pcf)		N/A	N/A
OPTIMUM MOISTURE (%)		N/A	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

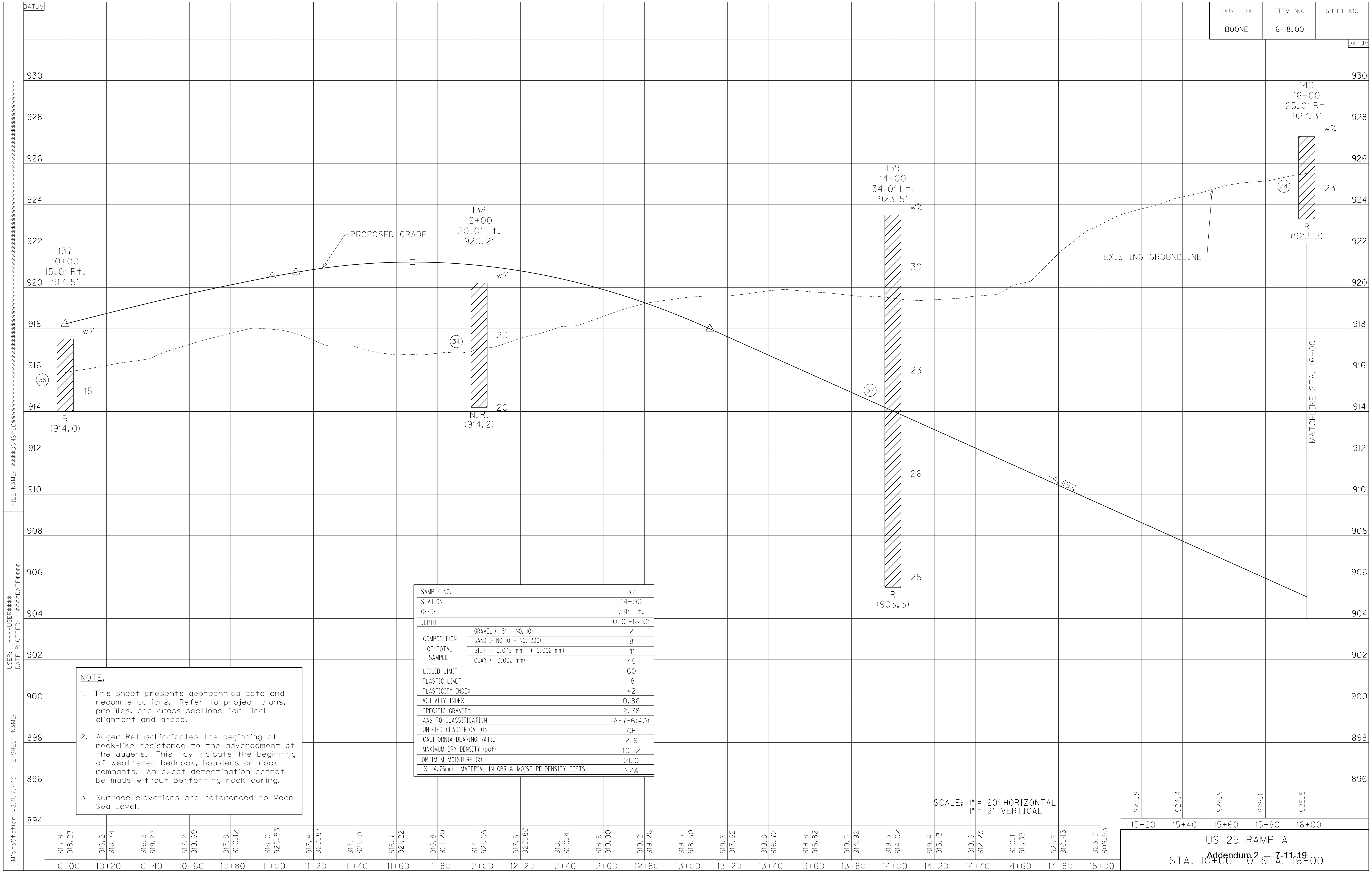
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25
STA. 64+00 TO STA. 70+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		37
STATION		14+00
OFFSET		34′ Lt.
DEPTH		0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	41
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		60
PLASTIC LIMIT		18
PLASTICITY INDEX		42
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.6
MAXIMUM DRY DENSITY (pcf)		101.2
OPTIMUM MOISTURE (%)		21.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP A
STA. 10+00 TO STA. 16+00

Addendum 2 -- 7-11-19

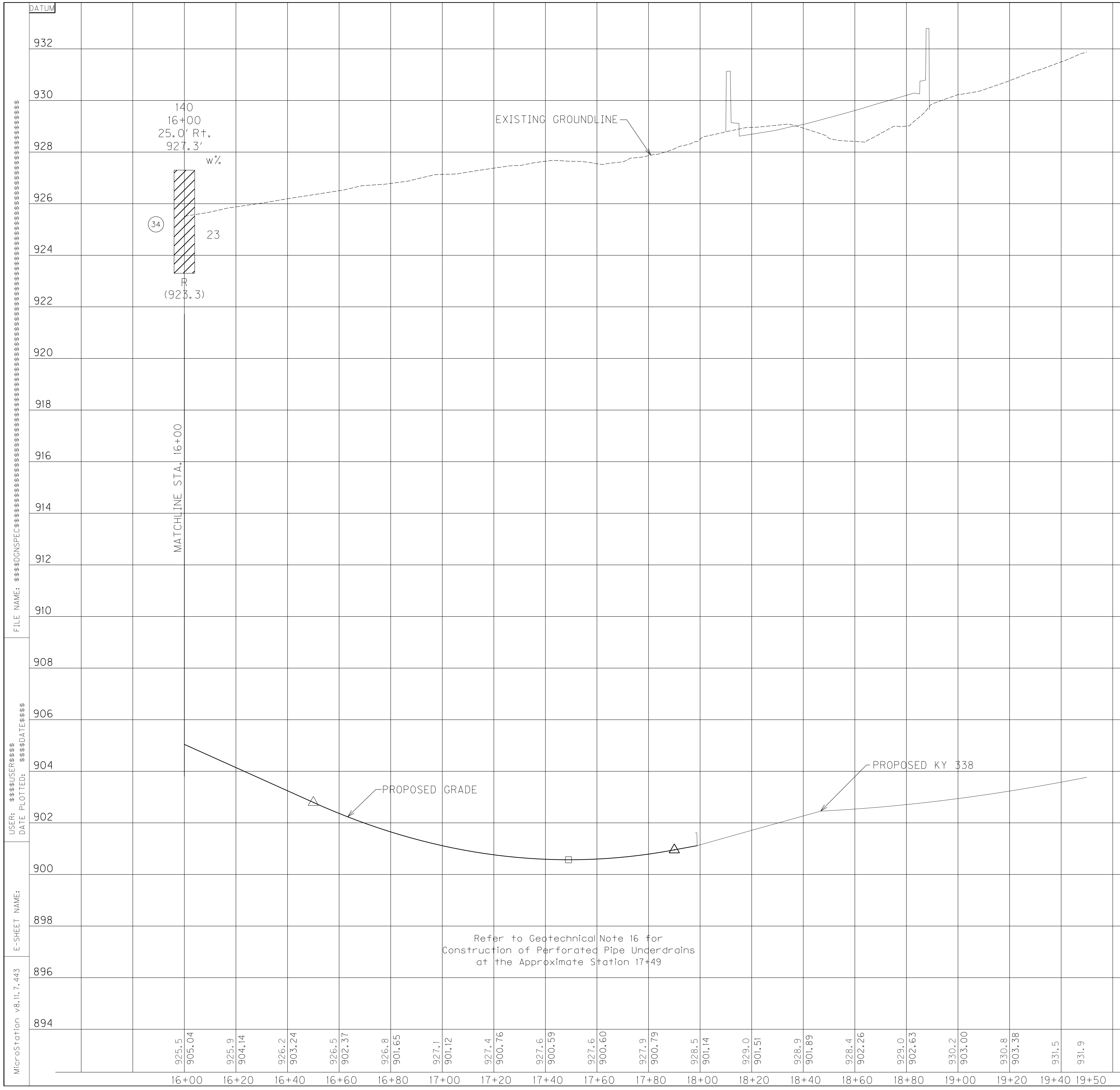
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 17+49

SAMPLE NO.		37
STATION		14+00
OFFSET		34′ Lt.
DEPTH		0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	41
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		60
PLASTIC LIMIT		18
PLASTICITY INDEX		42
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.6
MAXIMUM DRY DENSITY (pcf)		101.2
OPTIMUM MOISTURE (%)		21.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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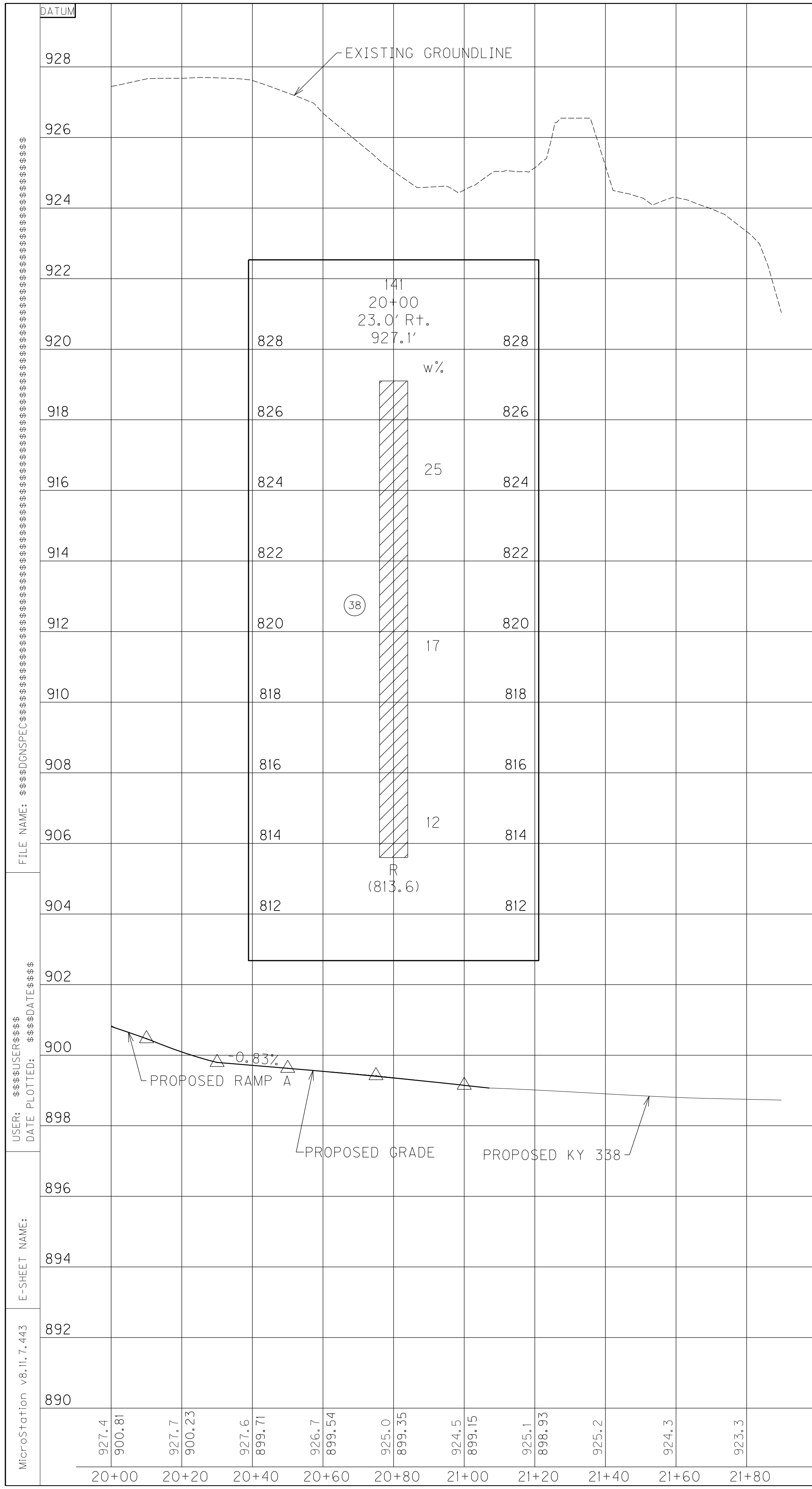
3. Surface elevations are referenced to Mean Sea Level.

DATUM
930
928
926
924
922
920
918
916
914
912
910
908
906
904
902
900
898
896

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP A
Addendum 2 -- 7-11-19
STA. 16+00 TO STA. 19+50

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		38
STATION		20+00
OFFSET		23′ Rt.
DEPTH		0.0′-13.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	14
	SAND (- NO 10 + NO. 200)	12
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		42
PLASTIC LIMIT		18
PLASTICITY INDEX		24
ACTIVITY INDEX		0.71
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(16)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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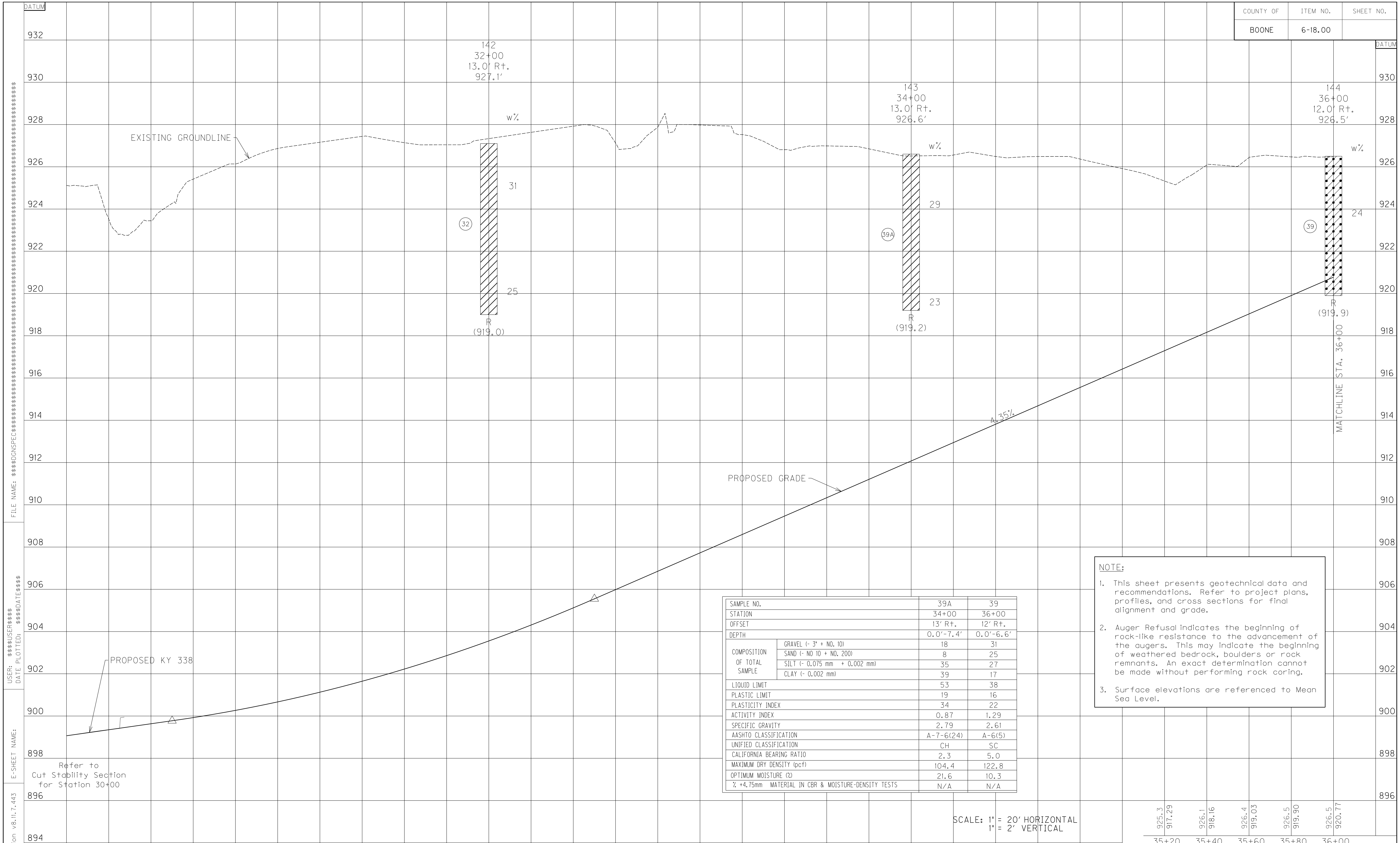
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP B
STA. 20+00 TO STA. 21+37.04

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		39A	39
STATION		34+00	36+00
OFFSET		13' Rt.	12' Rt.
DEPTH		0.0'-7.4'	0.0'-6.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	18	31
	SAND (- NO 10 + NO. 200)	8	25
	SILT (- 0.075 mm + 0.002 mm)	35	27
	CLAY (- 0.002 mm)	39	17
LIQUID LIMIT		53	38
PLASTIC LIMIT		19	16
PLASTICITY INDEX		34	22
ACTIVITY INDEX		0.87	1.29
SPECIFIC GRAVITY		2.79	2.61
AASHTO CLASSIFICATION		A-7-6(24)	A-6(5)
UNIFIED CLASSIFICATION		CH	SC
CALIFORNIA BEARING RATIO		2.3	5.0
MAXIMUM DRY DENSITY (pcf)		104.4	122.8
OPTIMUM MOISTURE (%)		21.6	10.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

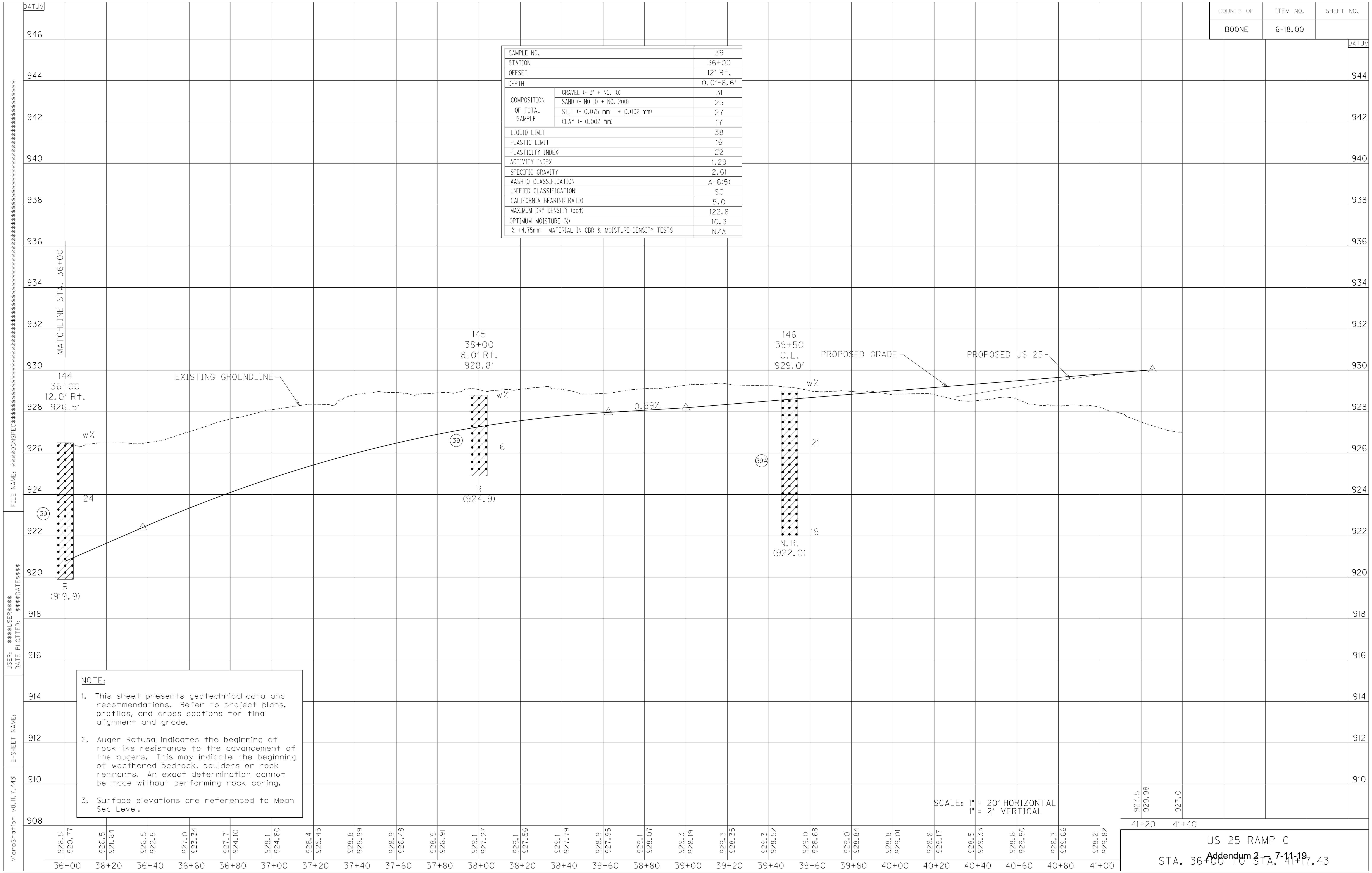
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

30+00	925.1	899.07
30+20	923.5	899.35
30+40	923.4	899.63
30+60	925.4	899.93
30+80	926.1	900.27
31+00	926.9	900.67
31+20	927.2	901.13
31+40	927.4	901.65
31+60	927.1	902.23
31+80	927.0	902.86
32+00	927.3	903.56
32+20	927.6	904.31
32+40	927.9	905.12
32+60	927.1	905.98
32+80	927.9	906.85
33+00	928.0	907.72
33+20	927.5	908.59
33+40	926.8	909.46
33+60	927.0	910.33
33+80	926.8	911.20
34+00	926.5	912.07
34+20	926.6	912.94
34+40	926.5	913.81
34+60	926.5	914.68
34+80	926.4	915.55
35+00	925.9	916.42
35+20	925.3	917.29
35+40	926.1	918.16
35+60	926.4	919.03
35+80	926.5	919.90
36+00	926.5	920.77

US 25 RAMP C
STA. 30+00 TO STA. 36+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		39
STATION		36+00
OFFSET		12' Rt.
DEPTH		0.0'-6.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	31
	SAND (- NO 10 + NO. 200)	25
	SILT (- 0.075 mm + 0.002 mm)	27
	CLAY (- 0.002 mm)	17
LIQUID LIMIT		38
PLASTIC LIMIT		16
PLASTICITY INDEX		22
ACTIVITY INDEX		1.29
SPECIFIC GRAVITY		2.61
AASHTO CLASSIFICATION		A-6(5)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		5.0
MAXIMUM DRY DENSITY (pcf)		122.8
OPTIMUM MOISTURE (%)		10.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

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3. Surface elevations are referenced to Mean Sea Level.

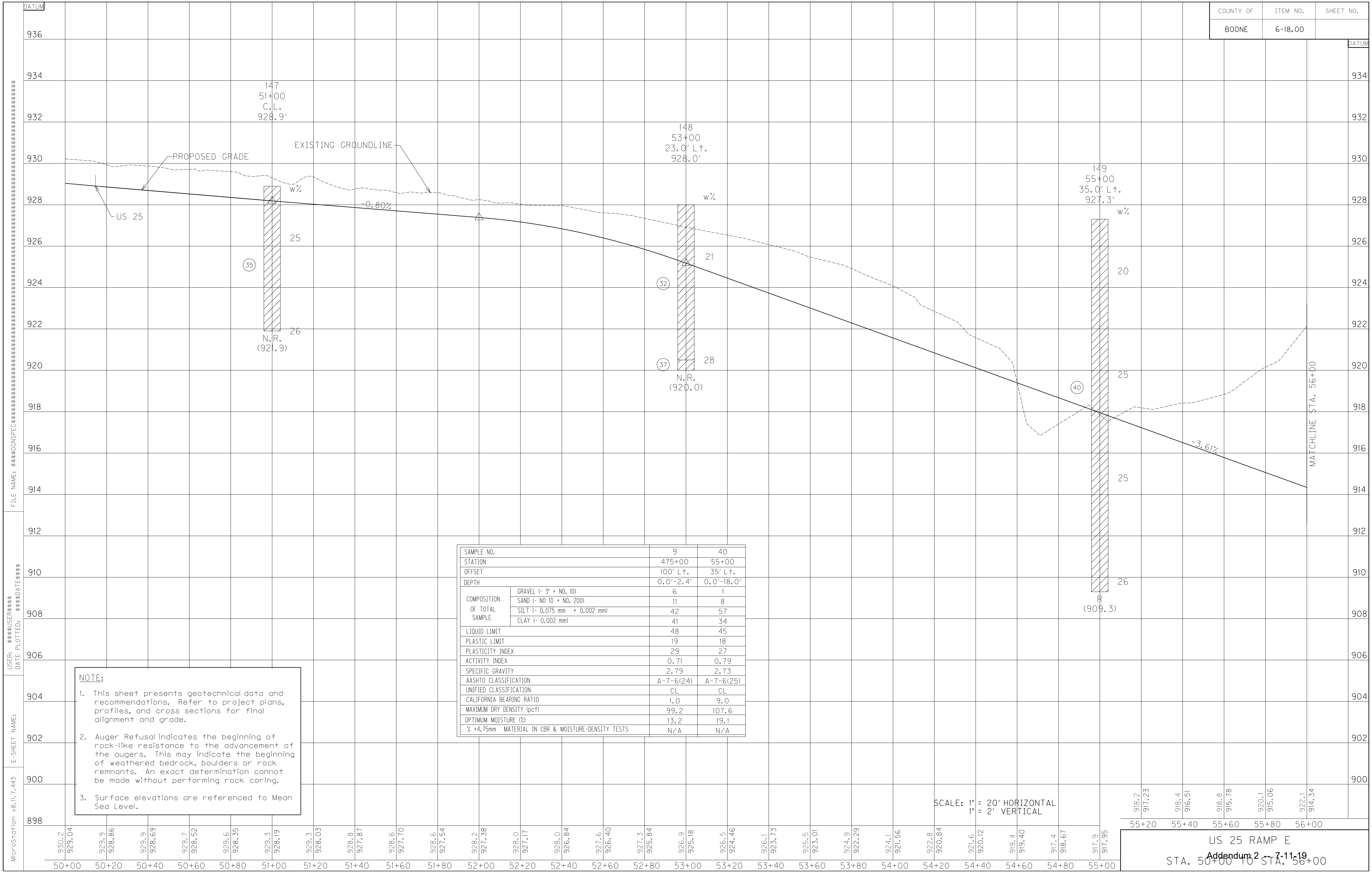
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25 RAMP C

STA. 36+00 TO STA. 41+17.43

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		9	40
STATION		475+00	55+00
OFFSET		100′ Lt.	35′ Lt.
DEPTH		0.0′-2.4′	0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	1
	SAND (- NO 10 + NO. 200)	11	8
	SILT (- 0.075 mm + 0.002 mm)	42	57
	CLAY (- 0.002 mm)	41	34
LIQUID LIMIT		48	45
PLASTIC LIMIT		19	18
PLASTICITY INDEX		29	27
ACTIVITY INDEX		0.71	0.79
SPECIFIC GRAVITY		2.79	2.73
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(25)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	9.0
MAXIMUM DRY DENSITY (pcf)		99.2	107.6
OPTIMUM MOISTURE (%)		13.2	19.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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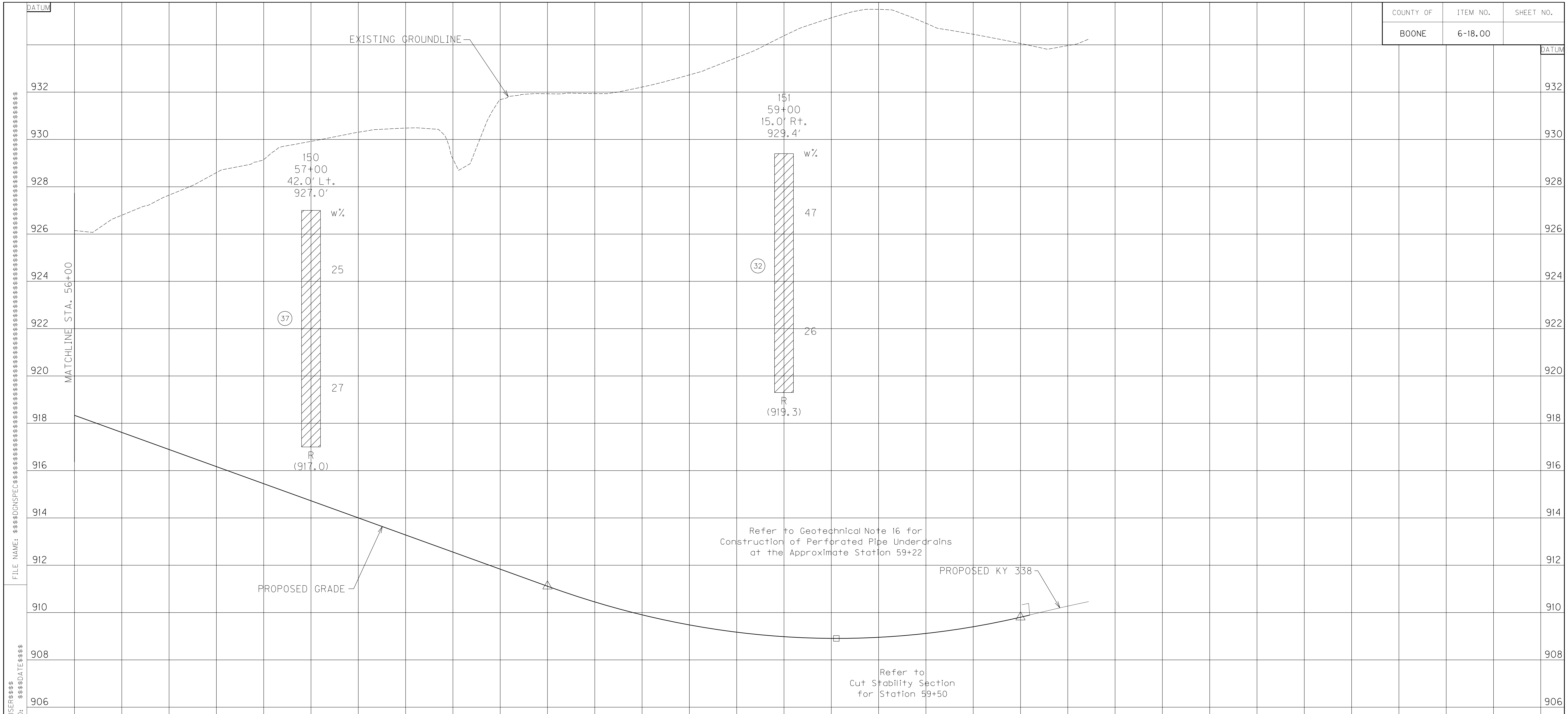
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP E
STA. 50+00 TO STA. 56+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		40
STATION		55+00
OFFSET		35' Lt.
DEPTH		0.0'-18.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	57
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		45
PLASTIC LIMIT		18
PLASTICITY INDEX		27
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.73
AASHTO CLASSIFICATION		A-7-6(25)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		9.0
MAXIMUM DRY DENSITY (pcf)		107.6
OPTIMUM MOISTURE (%)		19.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

904
902
900
898
896

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

922.1	922.8	923.6	924.6	925.1	925.9	926.3	926.5	925.2	927.7	927.9	927.9	928.2	928.7	929.5	930.4	931.1	931.5	930.9	930.4	930.1	930.0
914.34	913.62	912.89	912.17	911.45	910.73	910.00	909.28	908.56	907.84	907.11	906.45	905.90	905.48	905.17	904.98	904.91	904.95	905.12	905.40	905.80	906.26
56+00	56+20	56+40	56+60	56+80	57+00	57+20	57+40	57+60	57+80	58+00	58+20	58+40	58+60	58+80	59+00	59+20	59+40	59+60	59+80	60+00	60+20

US 25 RAMP E
STA. 56+00 TO STA. 60+28.81

Addendum 2 - 7-11-19

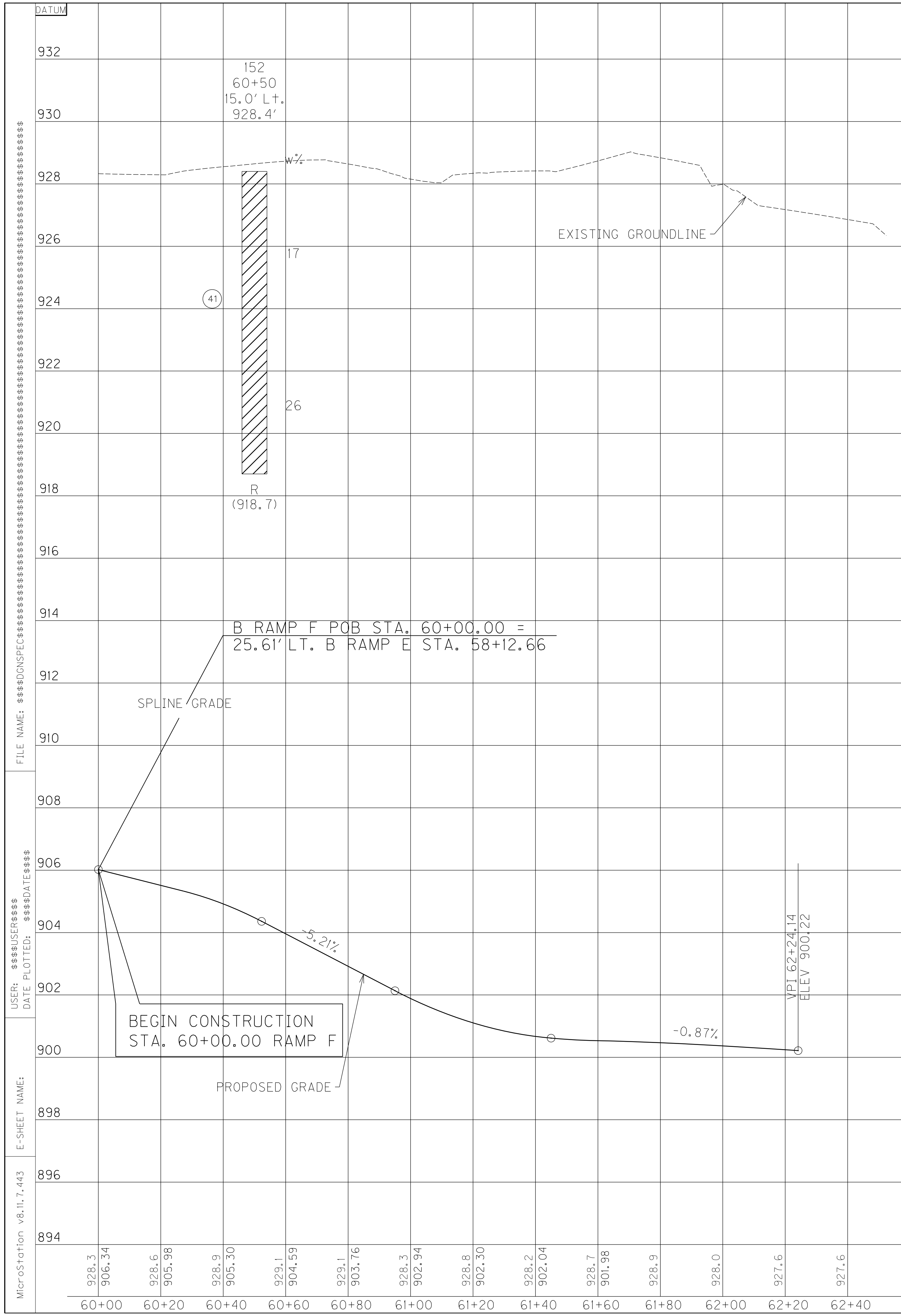
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		41
STATION		60+50
OFFSET		15′ Lt.
DEPTH		0.0′-9.7′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		63
PLASTIC LIMIT		23
PLASTICITY INDEX		40
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.83
AASHTO CLASSIFICATION		A-7-6(39)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.9
MAXIMUM DRY DENSITY (pcf)		96.6
OPTIMUM MOISTURE (%)		25.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

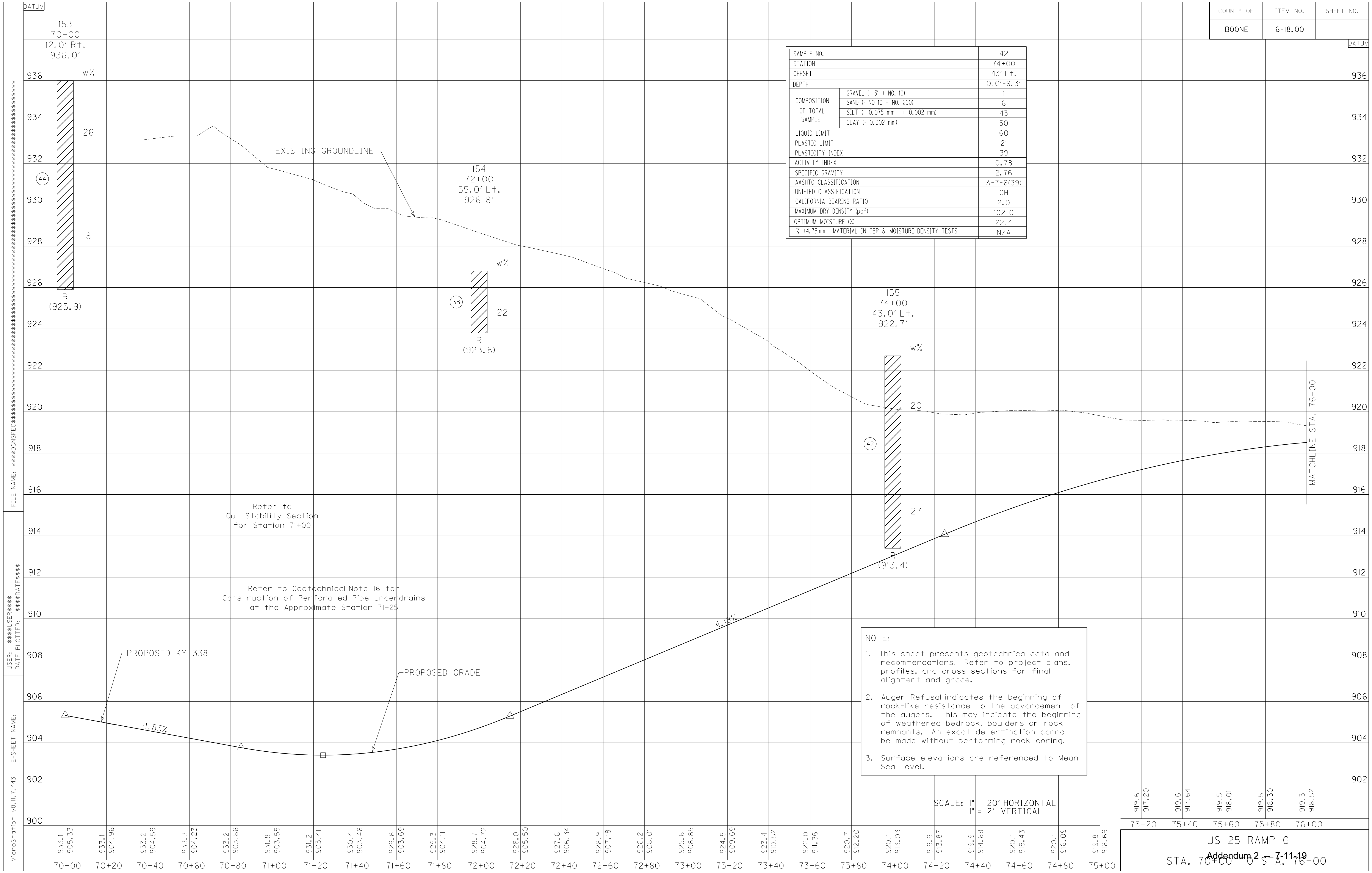
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP F
STA. 60+00 TO STA. 62+76.49

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		42
STATION		74+00
OFFSET		43' Lt.
DEPTH		0.0'-9.3'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	43
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		60
PLASTIC LIMIT		21
PLASTICITY INDEX		39
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(39)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		102.0
OPTIMUM MOISTURE (%)		22.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Refer to Cut Stability Section for Station 71+00

Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 71+25

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

933.1	905.33	70+00
933.1	904.96	70+20
933.2	904.59	70+40
933.3	904.23	70+60
933.2	903.86	70+80
931.8	903.55	71+00
931.2	903.41	71+20
930.4	903.46	71+40
929.6	903.69	71+60
929.3	904.11	71+80
928.7	904.72	72+00
928.0	905.50	72+20
927.6	906.34	72+40
926.9	907.18	72+60
926.2	908.01	72+80
925.6	908.85	73+00
924.5	909.69	73+20
923.4	910.52	73+40
922.0	911.36	73+60
920.7	912.20	73+80
920.1	913.03	74+00
919.9	913.87	74+20
919.9	914.68	74+40
920.1	915.43	74+60
920.1	916.09	74+80
919.8	916.69	75+00
919.6	917.20	75+20
919.6	917.64	75+40
919.5	918.01	75+60
919.5	918.30	75+80
919.3	918.52	76+00

US 25 RAMP G

STA. 70+00 TO STA. 76+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$

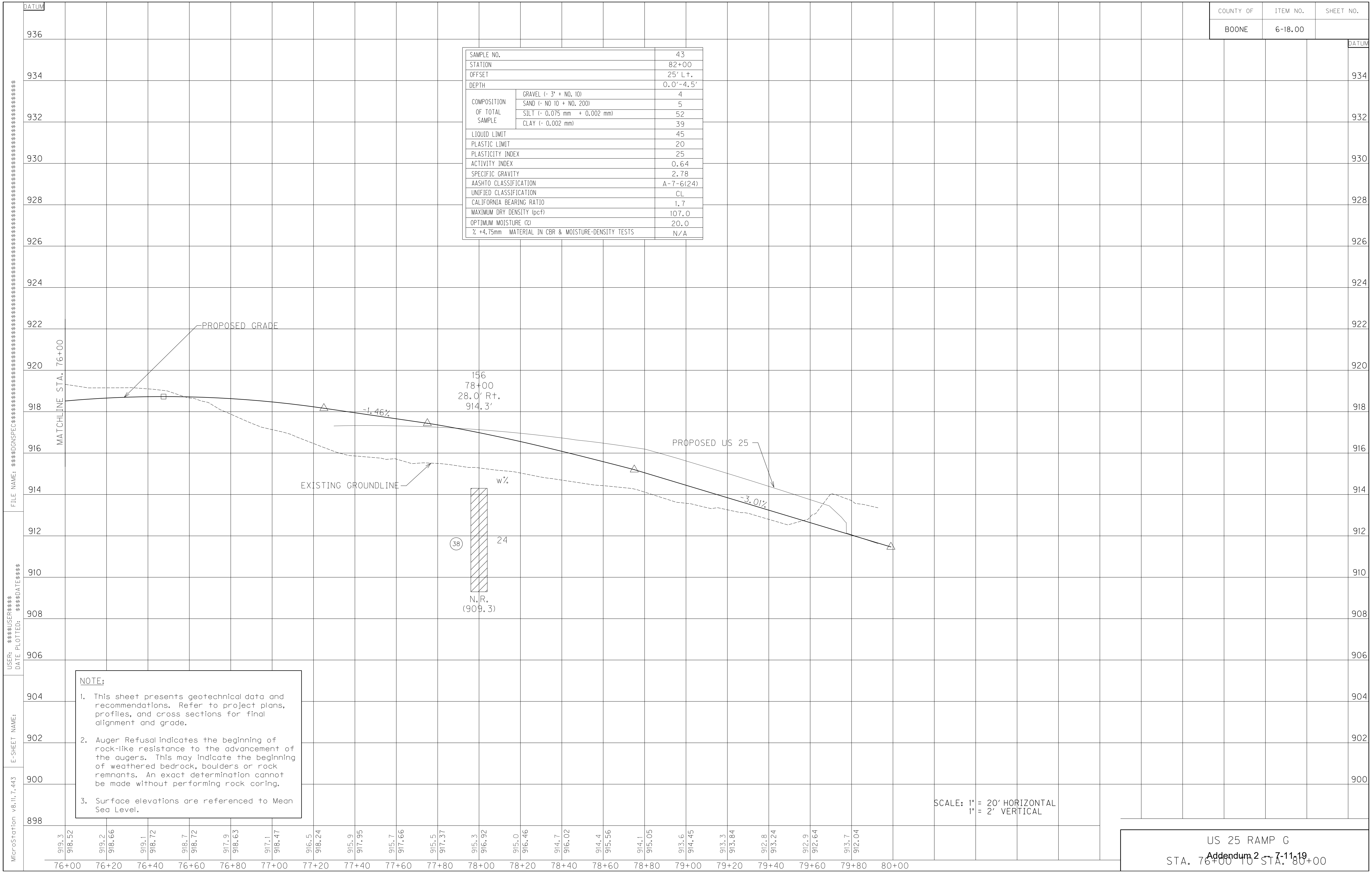
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		43
STATION		82+00
OFFSET		25' Lt.
DEPTH		0.0'-4.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	39
LIQUID LIMIT		45
PLASTIC LIMIT		20
PLASTICITY INDEX		25
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(24)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		107.0
OPTIMUM MOISTURE (%)		20.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



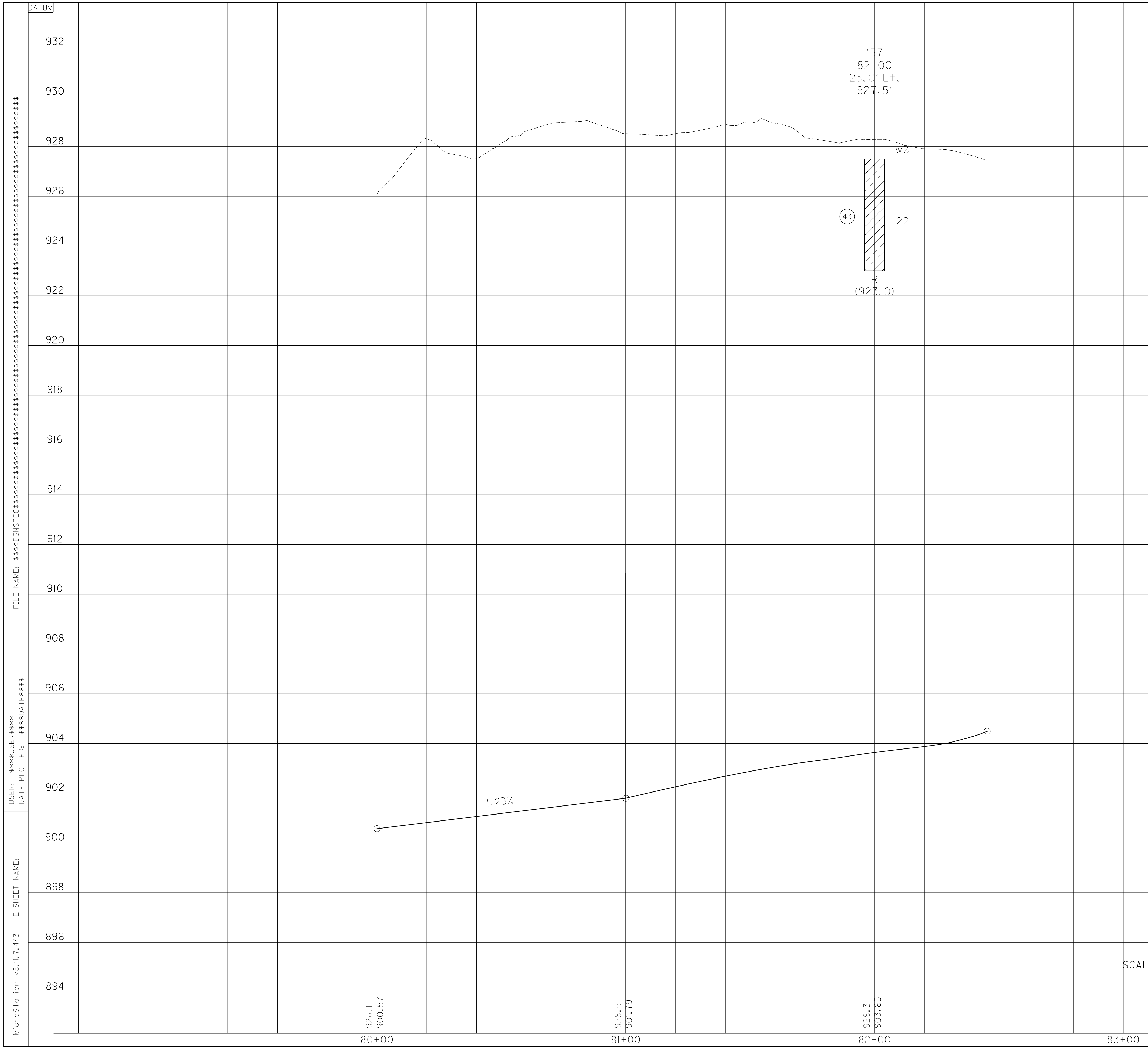
NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25 RAMP G
Addendum 2 -- 7-11-19
STA. 76+00 TO STA. 80+00

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		43
STATION		82+00
OFFSET		25' Lt.
DEPTH		0.0'-4.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	39
LIQUID LIMIT		45
PLASTIC LIMIT		20
PLASTICITY INDEX		25
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(24)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		107.0
OPTIMUM MOISTURE (%)		20.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

DATUM
930
928
926
924
922
920
918
916
914
912
910
908
906
904
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900
898
896

SOIL PROFILE SHEET
RAMP H
STA. 80+00 TO STA. 83+00

Addendum 2 -- 7-11-19

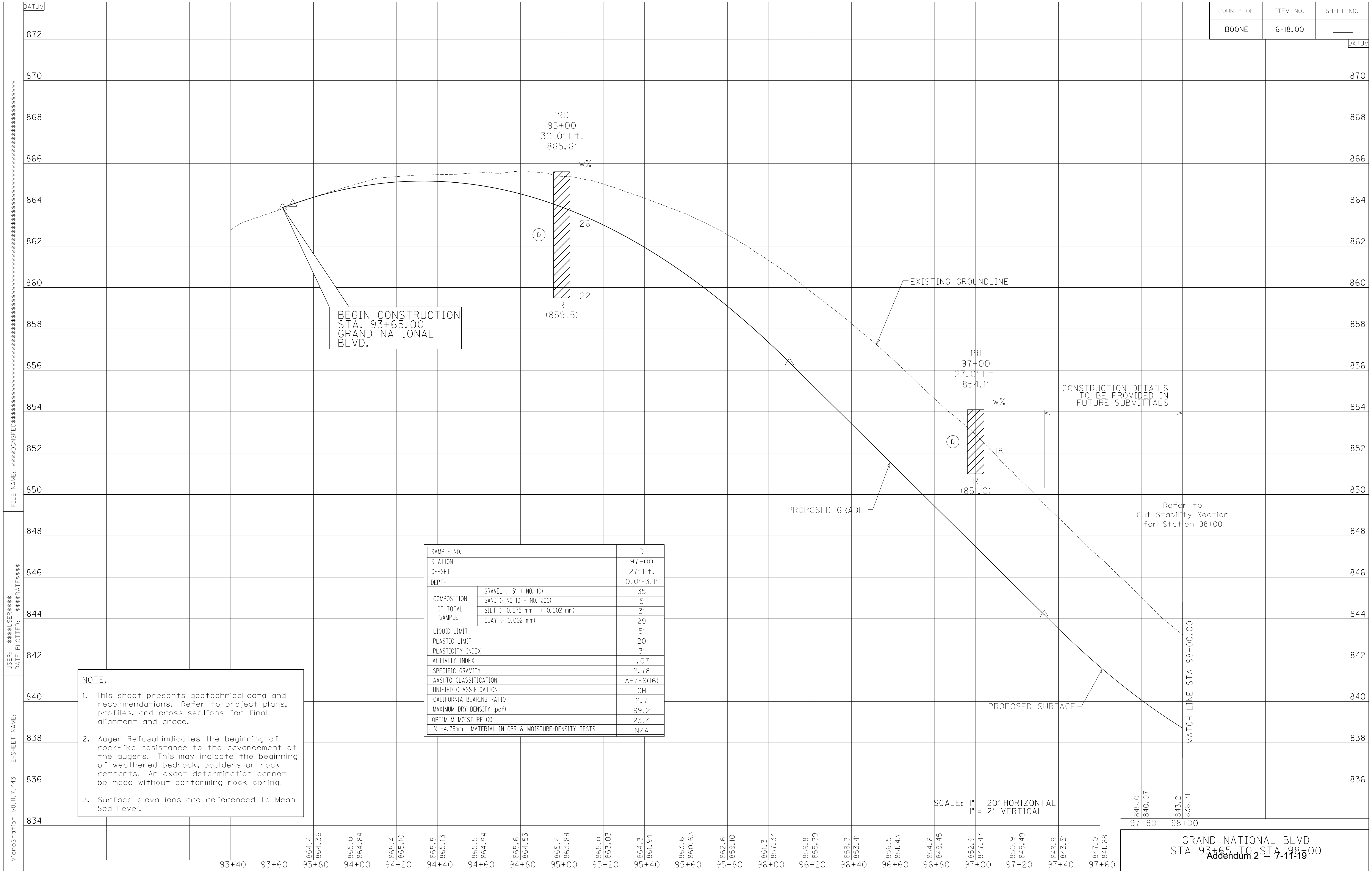
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		D
STATION		97+00
OFFSET		27' Lt.
DEPTH		0.0'-3.1'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	35
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	31
	CLAY (- 0.002 mm)	29
LIQUID LIMIT		51
PLASTIC LIMIT		20
PLASTICITY INDEX		31
ACTIVITY INDEX		1.07
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(16)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.7
MAXIMUM DRY DENSITY (pcf)		99.2
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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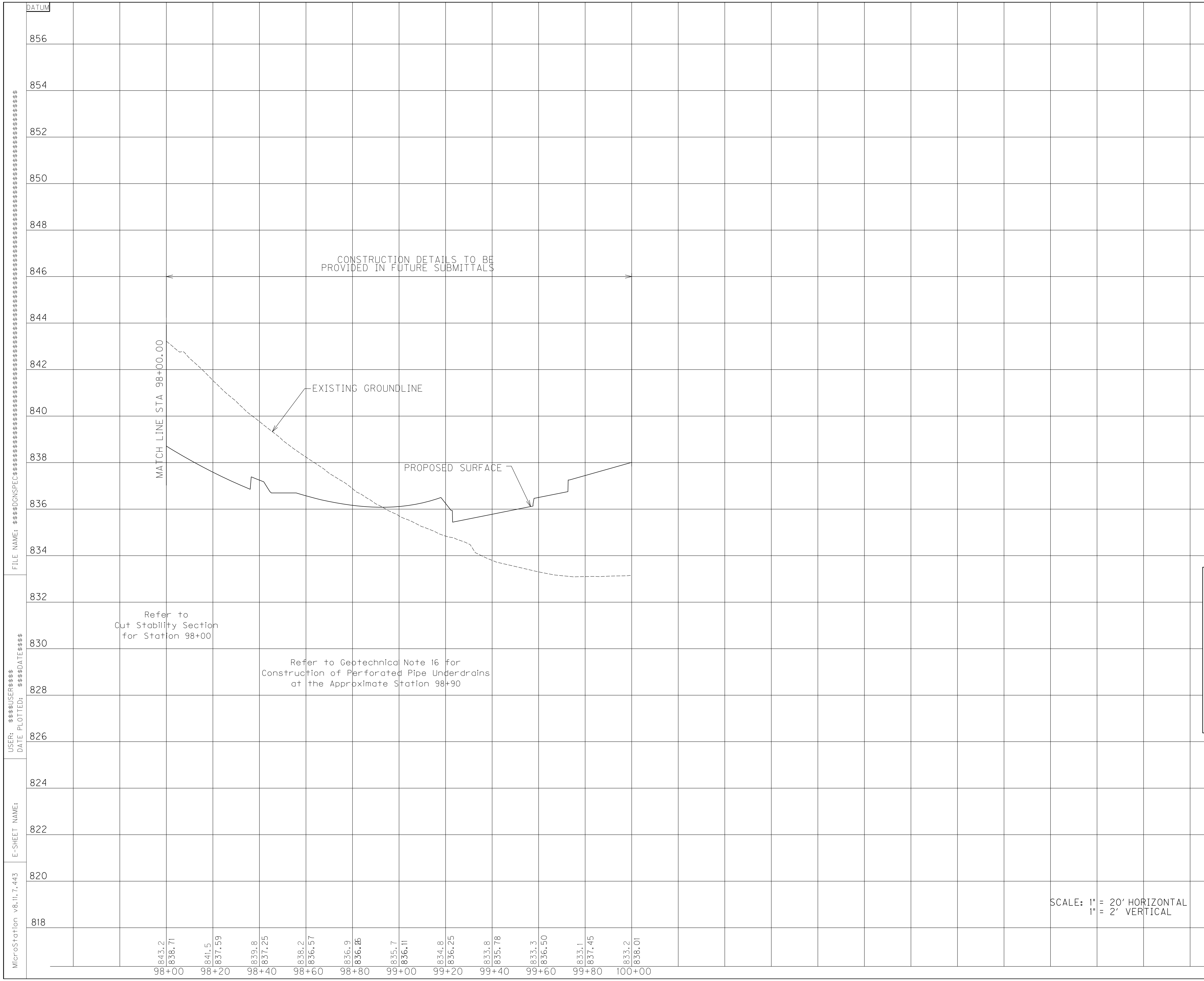
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

GRAND NATIONAL BLVD
STA 93+65 TO STA 98+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

GRAND NATIONAL BLVD
STA 98+00 TO STA 100+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$

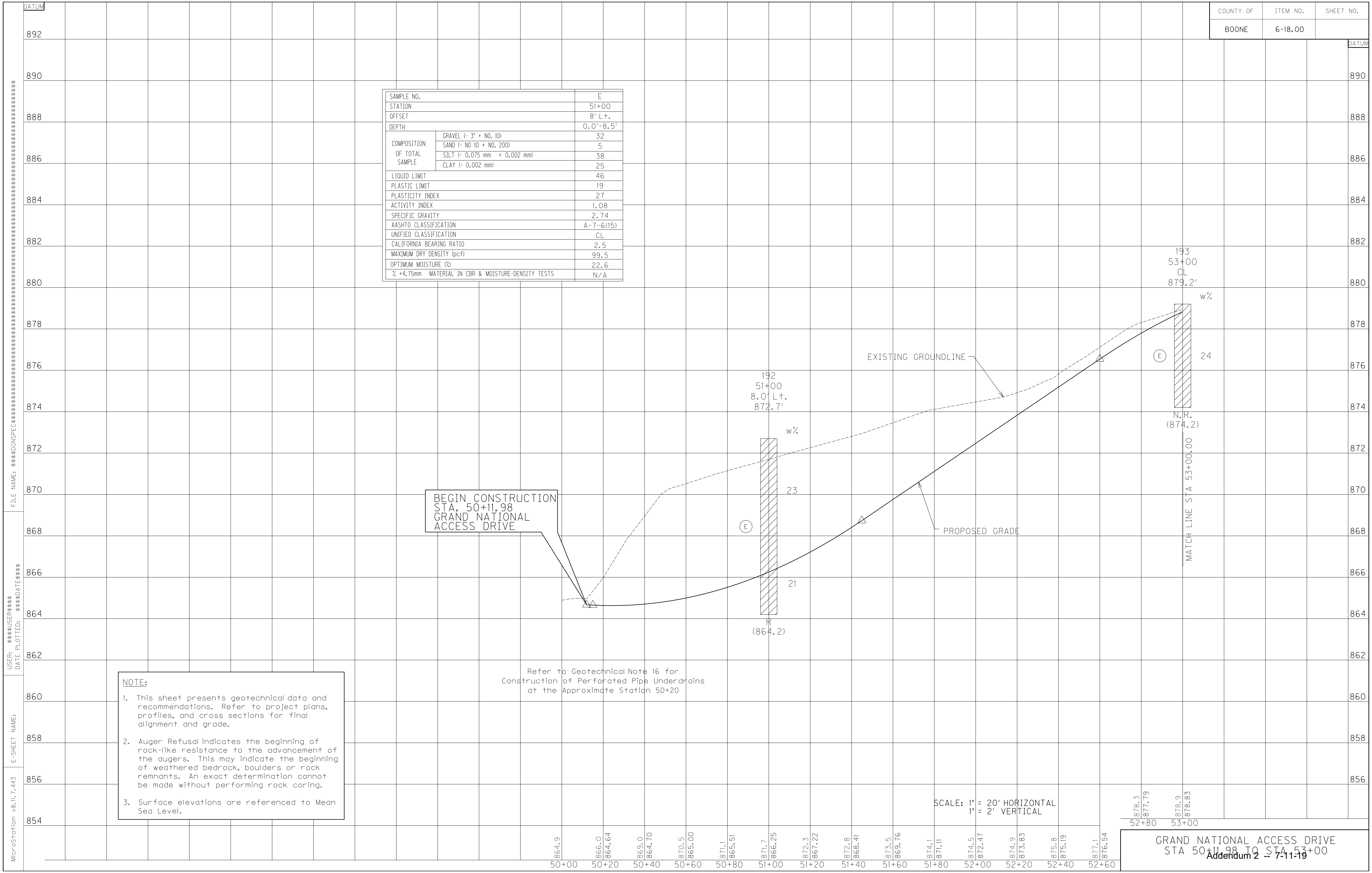
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		E
STATION		51+00
OFFSET		8′ Lt.
DEPTH		0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	32
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	25
LIQUID LIMIT		46
PLASTIC LIMIT		19
PLASTICITY INDEX		27
ACTIVITY INDEX		1.08
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(15)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		99.5
OPTIMUM MOISTURE (%)		22.6
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 50+20

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

GRAND NATIONAL ACCESS DRIVE
STA 50+11.98 TO STA 53+00

Addendum 2 -- 7-11-19

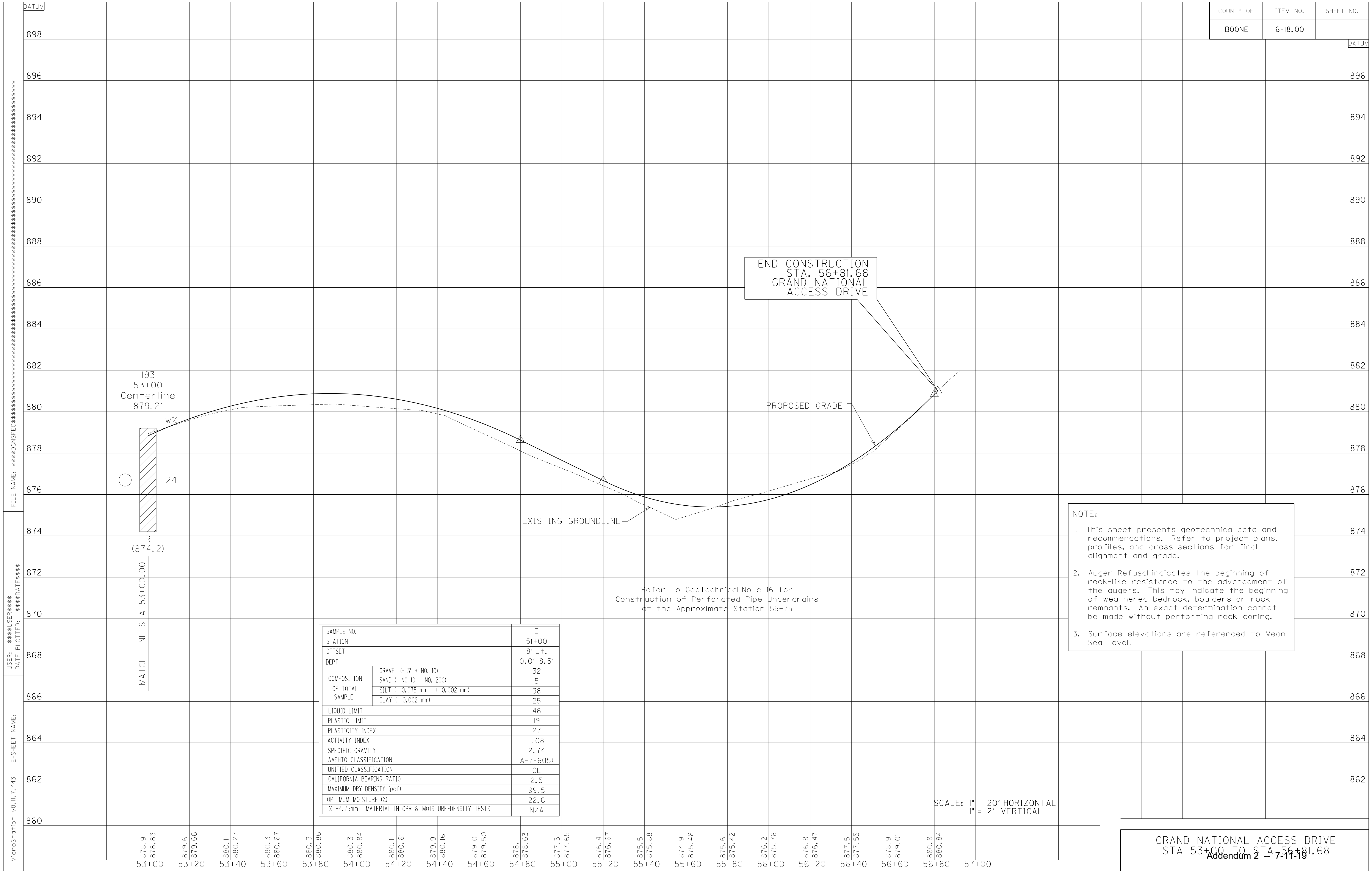
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 16 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 55+75

SAMPLE NO.		E
STATION		51+00
OFFSET		8' Lt.
DEPTH		0.0'-8.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	32
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	25
LIQUID LIMIT		46
PLASTIC LIMIT		19
PLASTICITY INDEX		27
ACTIVITY INDEX		1.08
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(15)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		99.5
OPTIMUM MOISTURE (%)		22.6
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

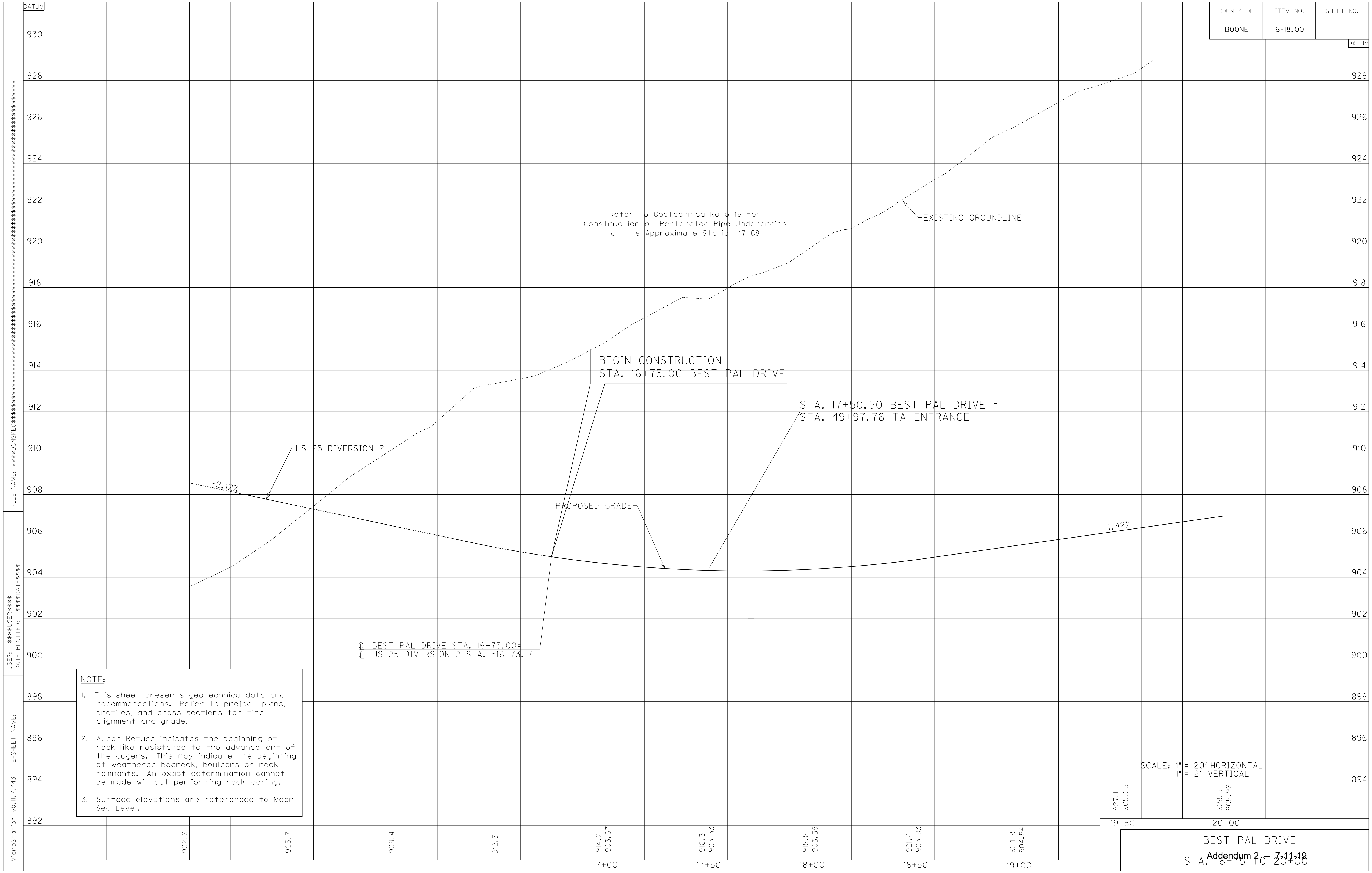
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

GRAND NATIONAL ACCESS DRIVE
STA 53+00 TO STA 56+81.68

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

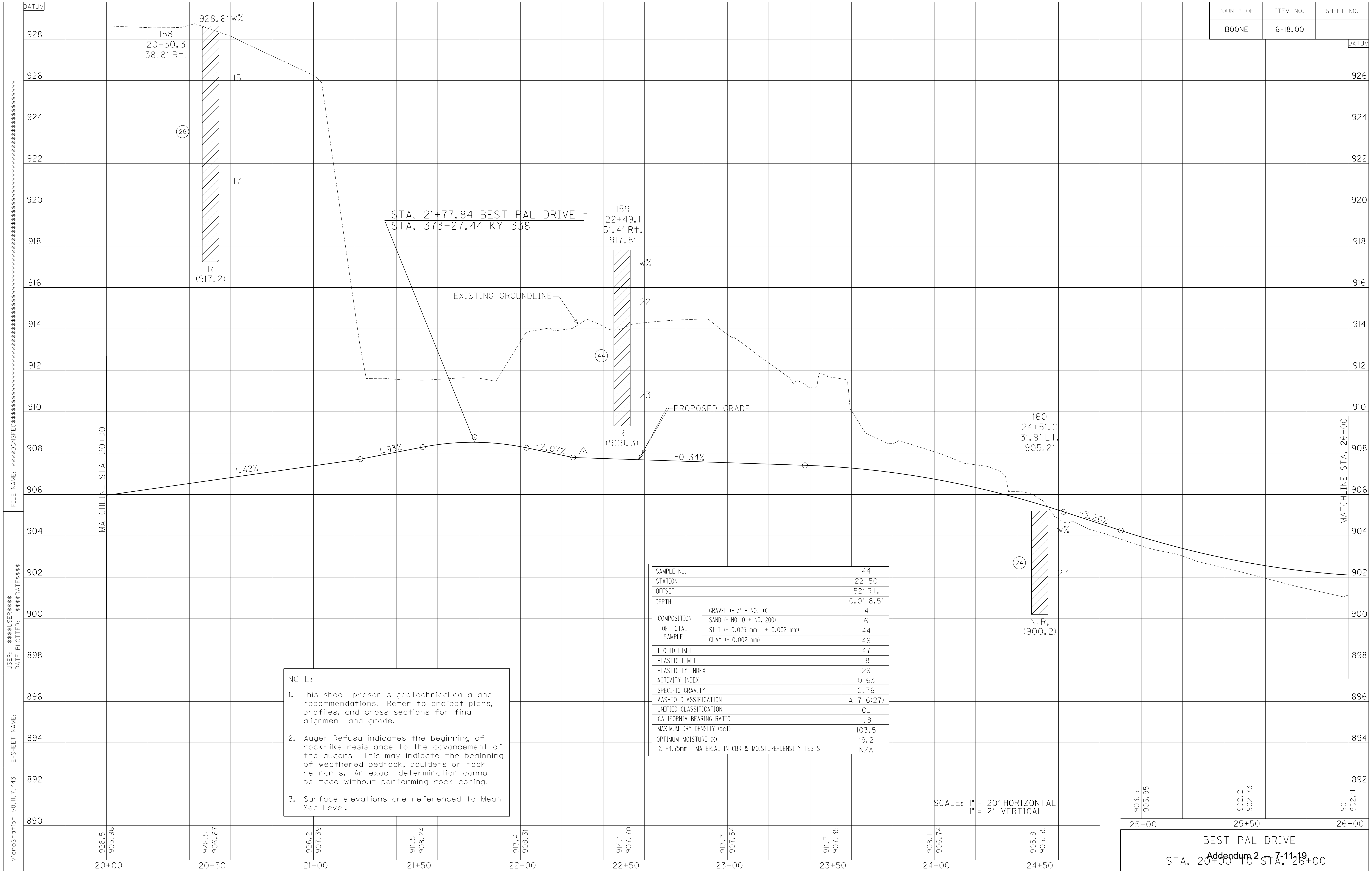
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

BEST PAL DRIVE
STA. 16+75 TO 20+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		44
STATION		22+50
OFFSET		52′ Rt.
DEPTH		0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	44
	CLAY (- 0.002 mm)	46
LIQUID LIMIT		47
PLASTIC LIMIT		18
PLASTICITY INDEX		29
ACTIVITY INDEX		0.63
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.8
MAXIMUM DRY DENSITY (pcf)		103.5
OPTIMUM MOISTURE (%)		19.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

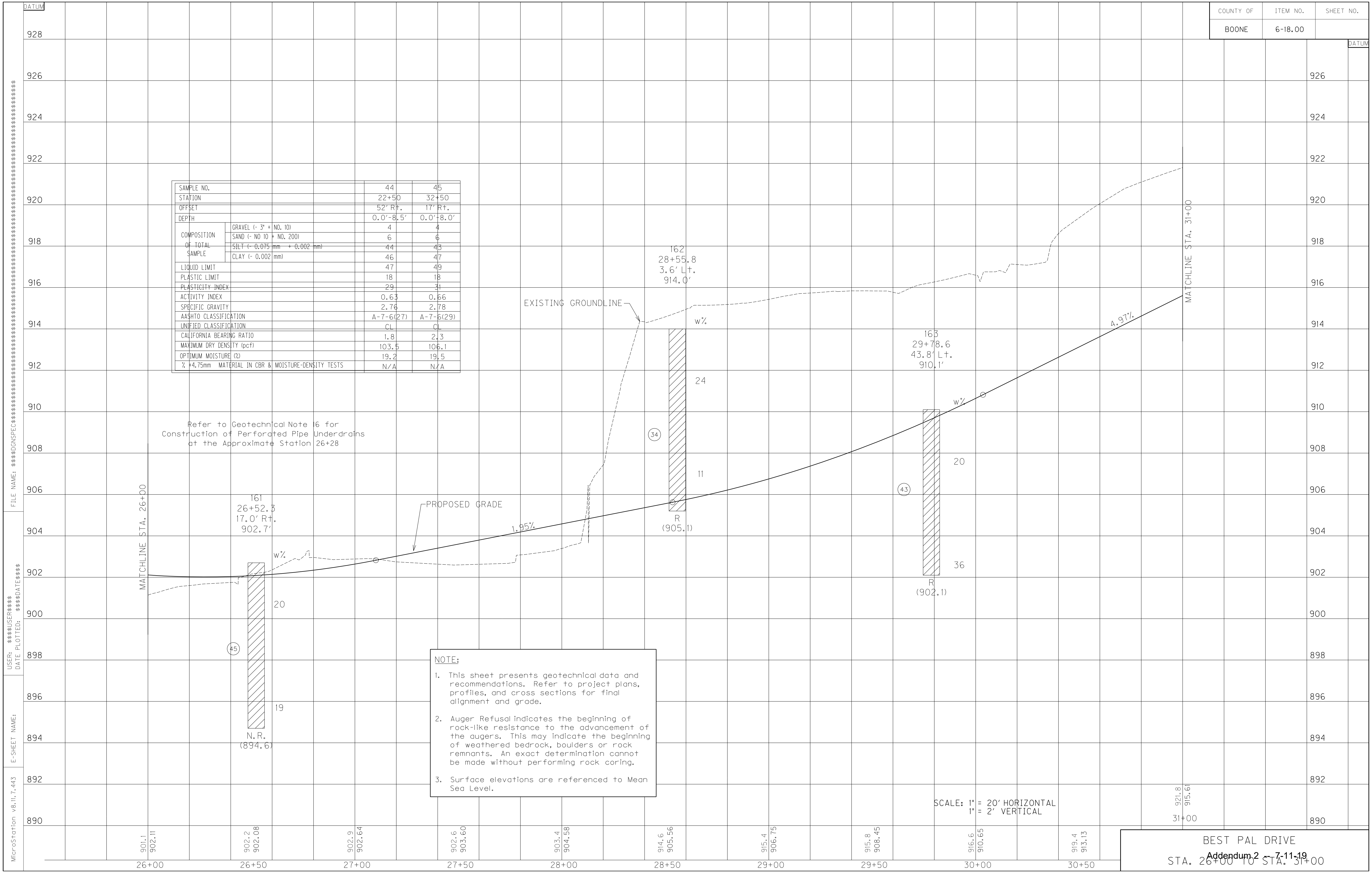
E-SHEET NAME:

MicroStation v8.11.7.443

BEST PAL DRIVE
STA. 20+00 TO STA. 26+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		44	45
STATION		22+50	32+50
OFFSET		52' Rt.	17' Rt.
DEPTH		0.0'-8.5'	0.0'-8.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4	4
	SAND (- NO 10 + NO. 200)	6	6
	SILT (- 0.075 mm + 0.002 mm)	44	43
	CLAY (- 0.002 mm)	46	47
LIQUID LIMIT		47	49
PLASTIC LIMIT		18	18
PLASTICITY INDEX		29	31
ACTIVITY INDEX		0.63	0.66
SPECIFIC GRAVITY		2.76	2.78
AASHTO CLASSIFICATION		A-7-6(27)	A-7-6(29)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.8	2.3
MAXIMUM DRY DENSITY (pcf)		103.5	106.1
OPTIMUM MOISTURE (%)		19.2	19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

Refer to Geotechnical Note 6 for Construction of Perforated Pipe Underdrains at the Approximate Station 26+28

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

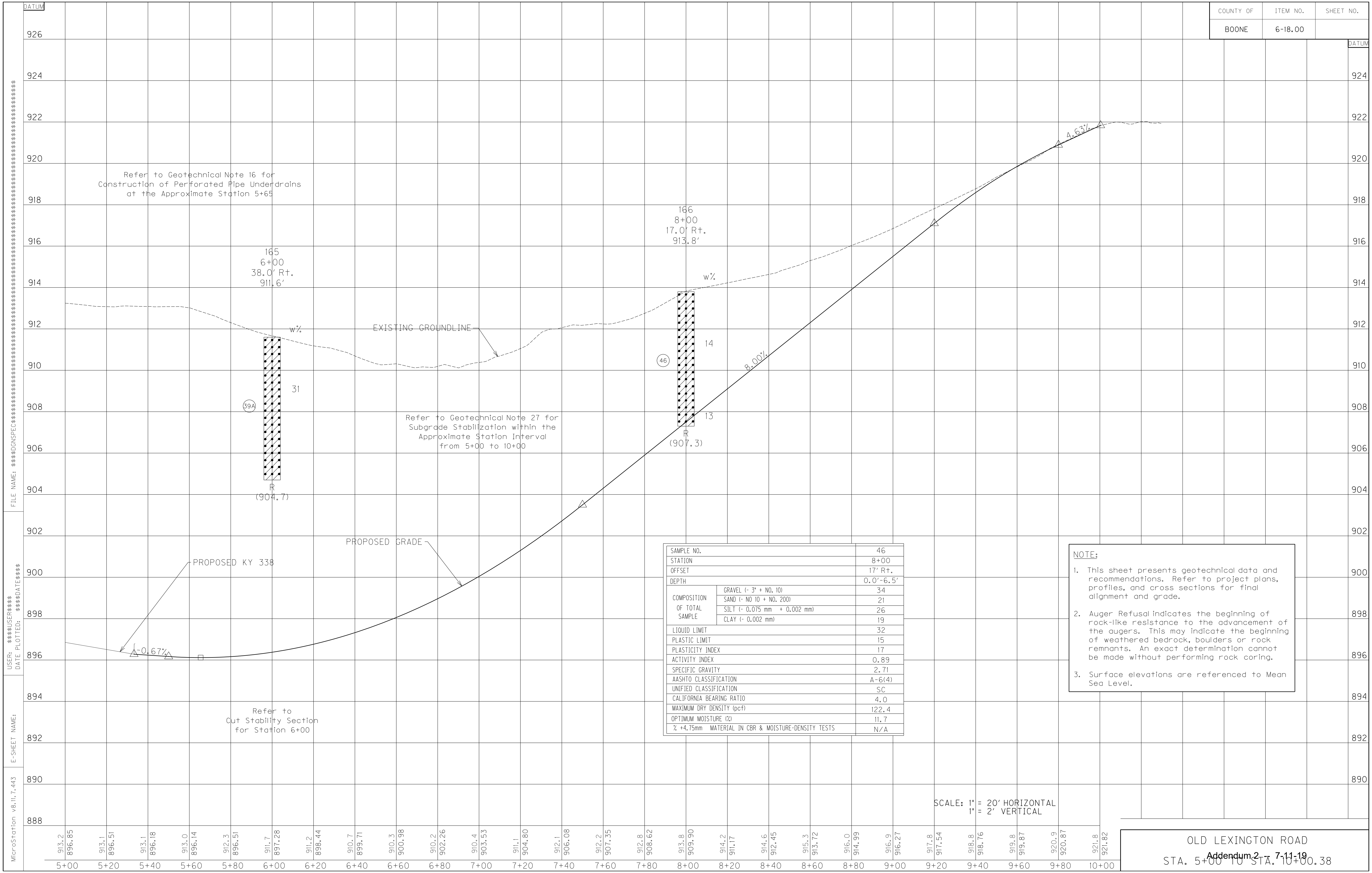
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

BEST PAL DRIVE
STA. 26+00 TO STA. 31+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		46
STATION		8+00
OFFSET		17' Rt.
DEPTH		0.0'-6.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	34
	SAND (- NO 10 + NO. 200)	21
	SILT (- 0.075 mm + 0.002 mm)	26
	CLAY (- 0.002 mm)	19
LIQUID LIMIT		32
PLASTIC LIMIT		15
PLASTICITY INDEX		17
ACTIVITY INDEX		0.89
SPECIFIC GRAVITY		2.71
AASHTO CLASSIFICATION		A-6(4)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		4.0
MAXIMUM DRY DENSITY (pcf)		122.4
OPTIMUM MOISTURE (%)		11.7
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

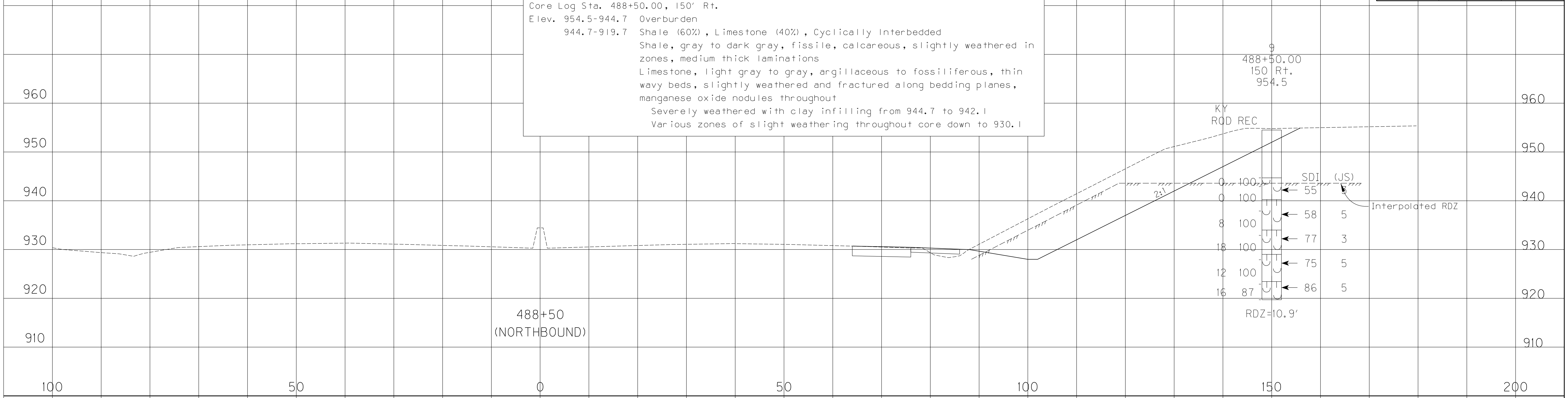
NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

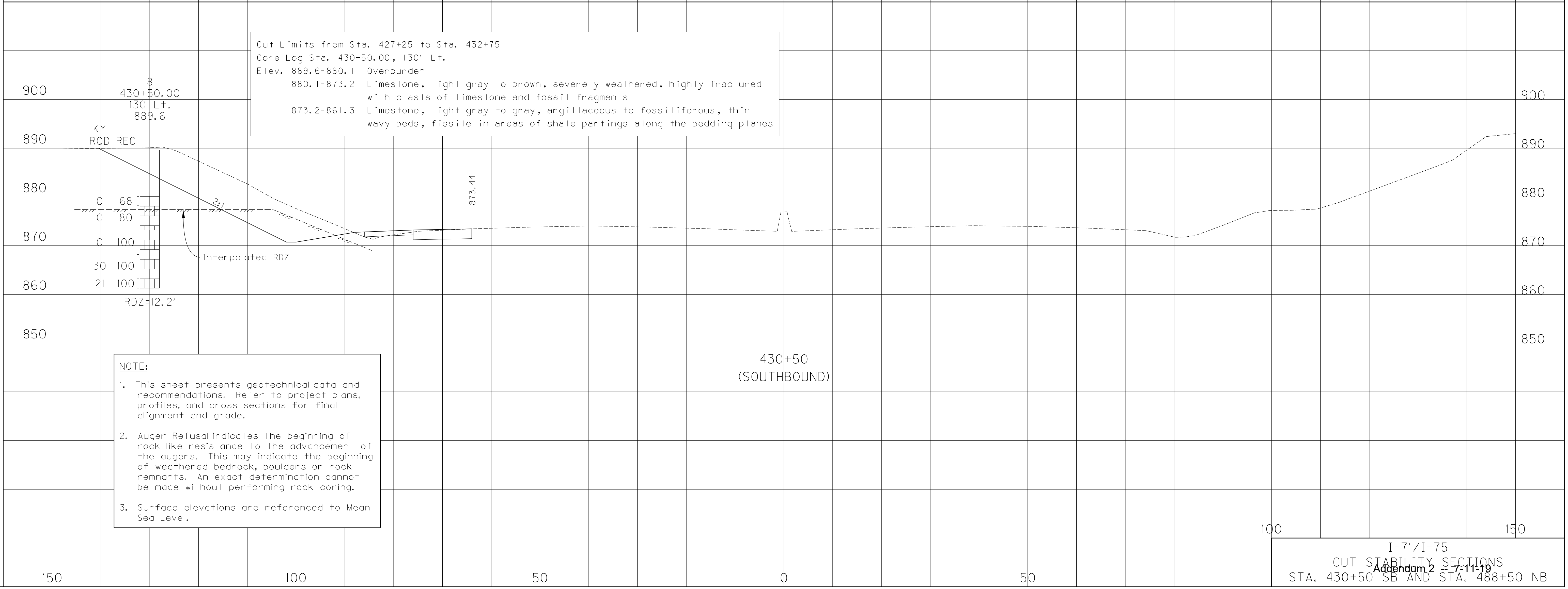
OLD LEXINGTON ROAD
STA. 5+00 TO STA. 10+00.38

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Cut Limits from Sta. 482+25 to Sta. 497+25
Core Log Sta. 488+50.00, 150' Rt.
Elev. 954.5-944.7 Overburden
944.7-919.7 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Severely weathered with clay infilling from 944.7 to 942.1
Various zones of slight weathering throughout core down to 930.1



Cut Limits from Sta. 427+25 to Sta. 432+75
Core Log Sta. 430+50.00, 130' Lt.
Elev. 889.6-880.1 Overburden
880.1-873.2 Limestone, light gray to brown, severely weathered, highly fractured with clasts of limestone and fossil fragments
873.2-861.3 Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, fissile in areas of shale partings along the bedding planes

NOTE:

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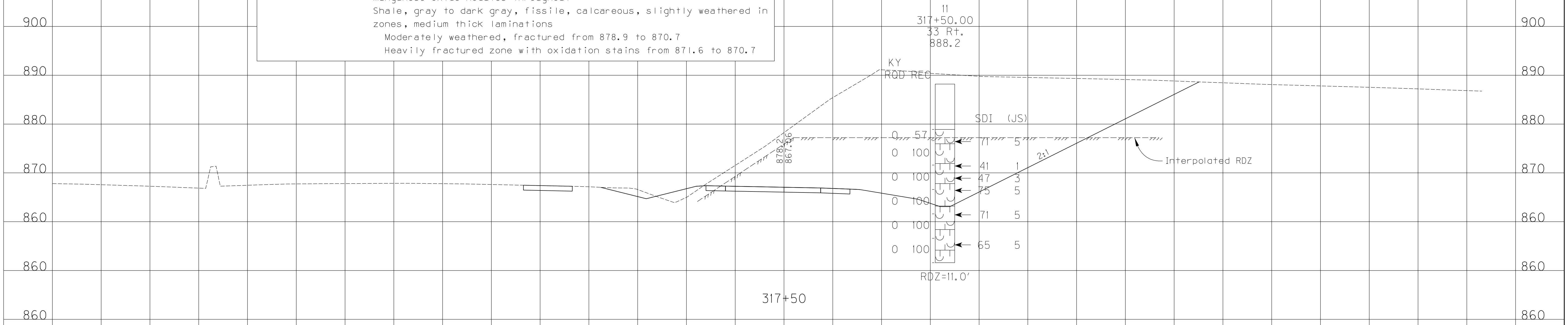
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-71/I-75
CUT STABILITY SECTIONS
STA. 430+50 SB AND STA. 488+50 NB

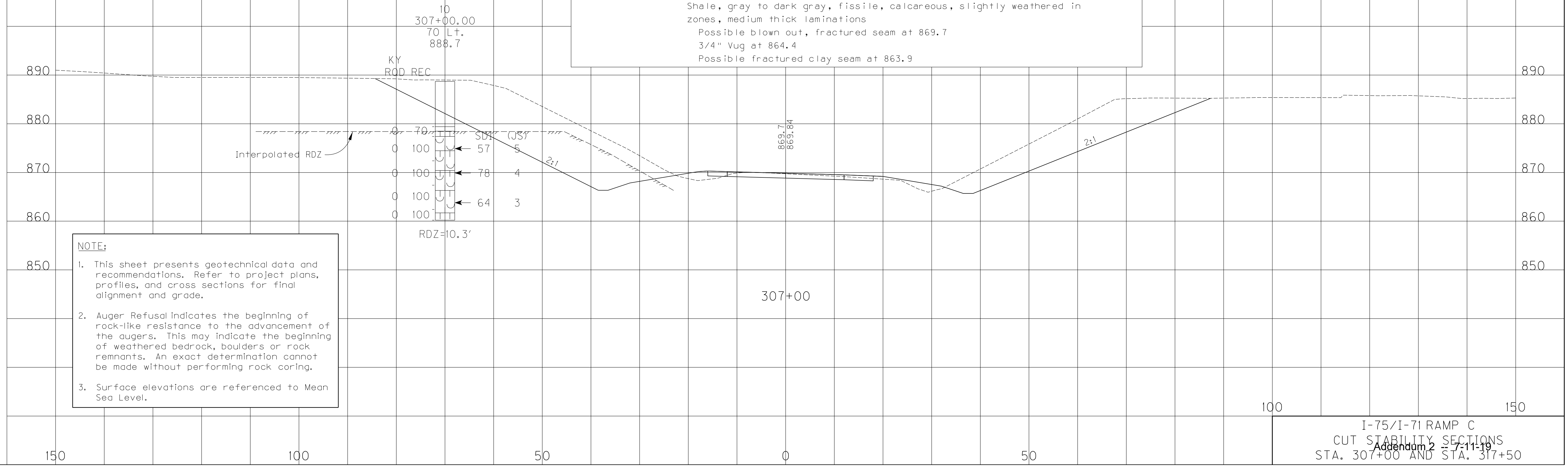
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 311+75 to Sta. 324+25
Core Log Sta. 317+50.00, 33' Rt.
Elev. 888.2-878.9 Overburden
878.9-851.6 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Moderately weathered, fractured from 878.9 to 870.7
Heavily fractured zone with oxidation stains from 871.6 to 870.7



Cut Limits from Sta. 302+50 to Sta. 310+00
Core Log Sta. 307+00.00, 70' Lt.
Elev. 888.7-879.4 Overburden
879.4-877.4 Limestone, gray, moderately weathered, slightly fractured with clay infilling
877.4-860.2 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Possible blown out, fractured seam at 869.7
3/4" Vug at 864.4
Possible fractured clay seam at 863.9



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-75/I-71 RAMP C
CUT STABILITY SECTIONS
STA. 307+00 AND STA. 317+50

Addendum 2 - 7-11-19

FILE NAME: $$$$DGNSPEC$$

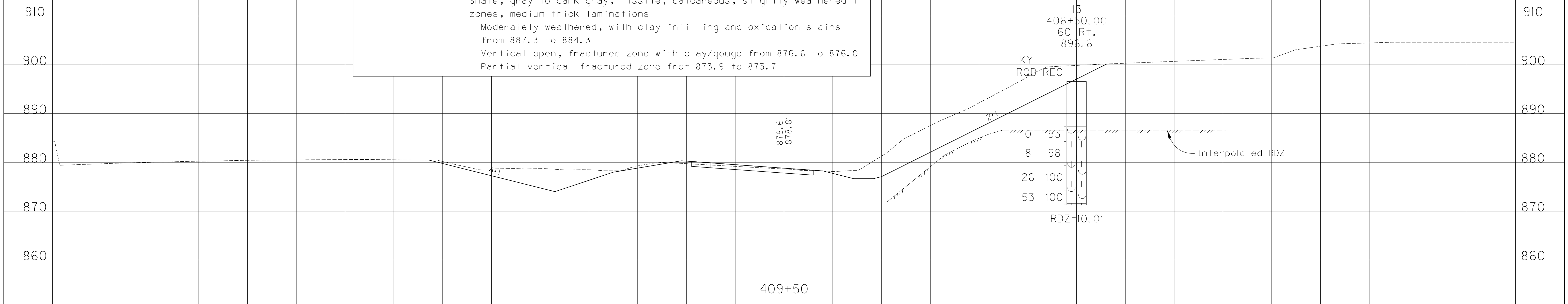
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

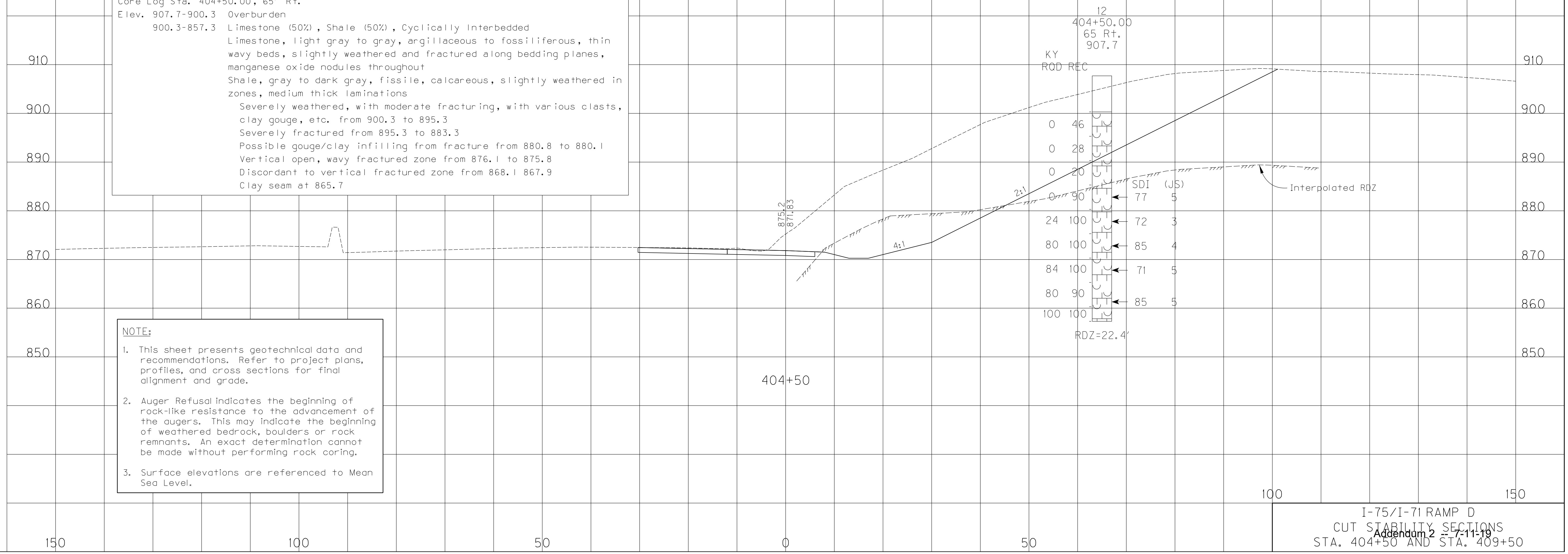
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 406+50.00, 60′ Rt.
Elev. 896.6-887.3 Overburden
887.3-871.3 Limestone (60%), Shale (40%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Moderately weathered, with clay infilling and oxidation stains from 887.3 to 884.3
Vertical open, fractured zone with clay/gouge from 876.6 to 876.0
Partial vertical fractured zone from 873.9 to 873.7



Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 404+50.00, 65′ Rt.
Elev. 907.7-900.3 Overburden
900.3-857.3 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Severely weathered, with moderate fracturing, with various clasts, clay gouge, etc. from 900.3 to 895.3
Severely fractured from 895.3 to 883.3
Possible gouge/clay infilling from fracture from 880.8 to 880.1
Vertical open, wavy fractured zone from 876.1 to 875.8
Discordant to vertical fractured zone from 868.1 867.9
Clay seam at 865.7



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-75/I-71 RAMP D
CUT STABILITY SECTIONS
STA. 404+50 AND STA. 409+50

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

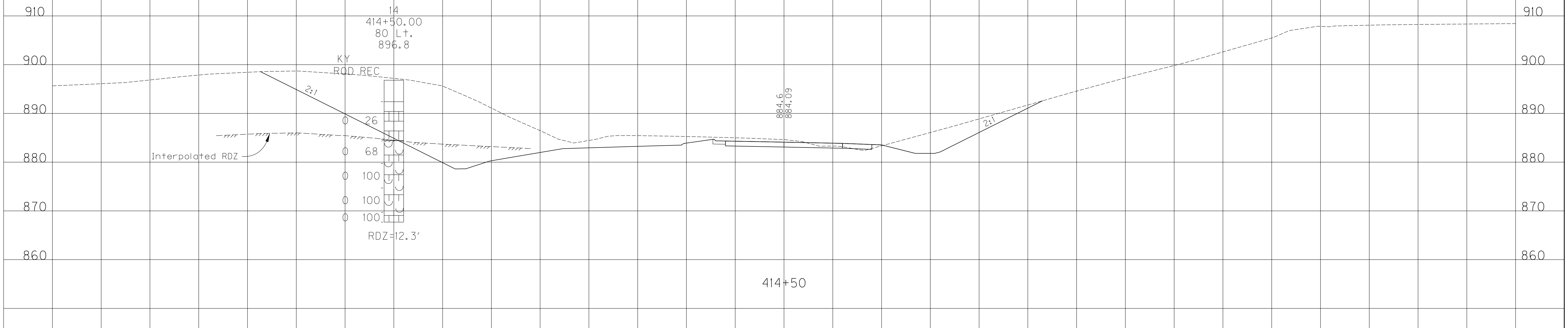
E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 414+50.00, 80' Lt.

Elev.	896.8-892.4	Overburden
	892.4-884.4	Limestone, light gray to gray, finely crystalline to slightly fossiliferous, thin wavy bedding, slightly weathered, moderately to severely fractured/fragmented with clay infilling
	884.4-867.7	Limestone (55%), Shale (45%), Cyclically Interbedded Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations, Open fractured zone from 880.0 to 879.7 3/4" Vug at 873.4 Large clay seam from 872.2 to 871.9 Partial open fracture at 869.5



414+50

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

100 150

150 100 50 0 50

I-75/I-71 RAMP D
CUT STABILITY SECTION
STA. 414+50

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$

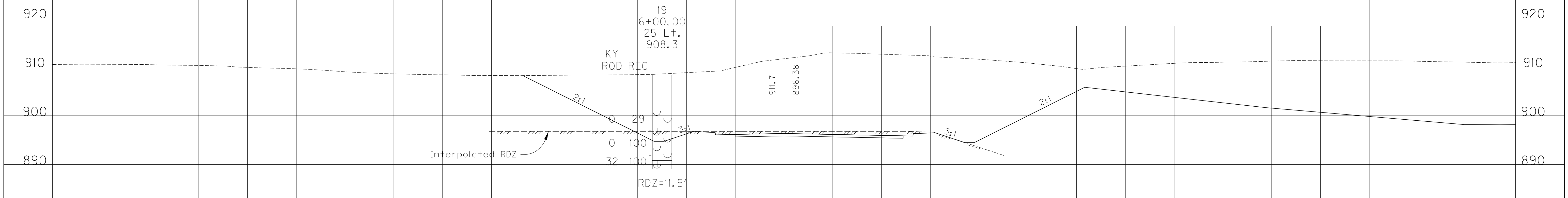
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

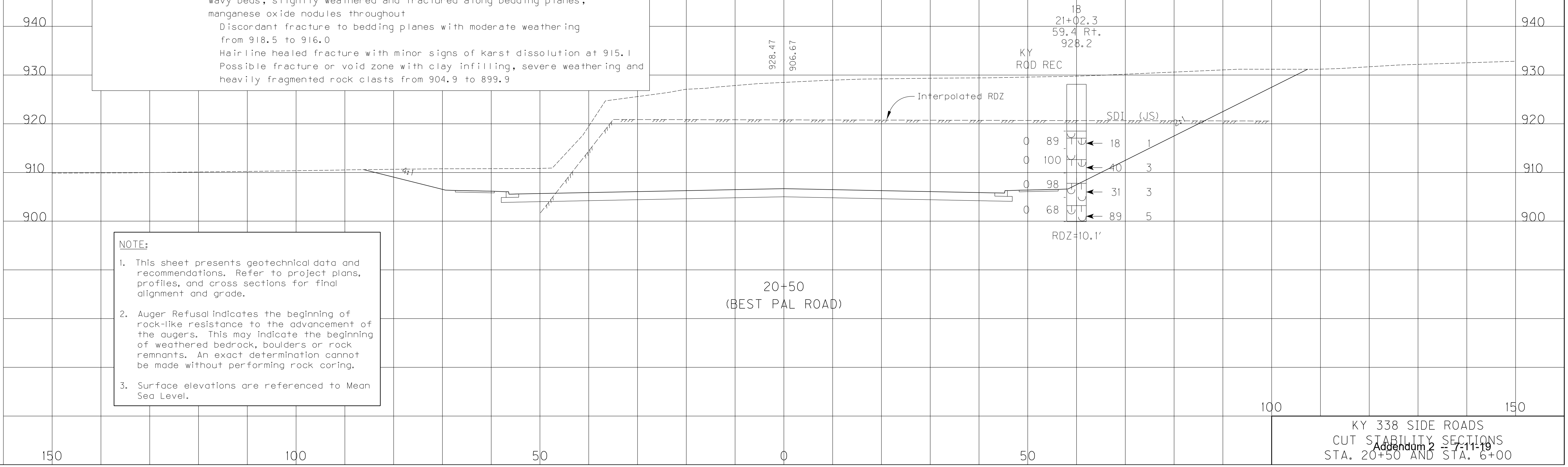
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 5+25 to Sta. 10+00
Core Log Sta. 6+00.00, 25' Lt.
Elev. 908.3-901.4 Overburden
901.4-889.1 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Slight to moderate weathering with clay infilling and minor karst dissolution from 901.4 to 896.8
Large clay filled void from 896.3 to 895.6
Oxidation stains along bedding the planes from 894.5 to 894.3
Vertical, open fractured zone with slight weathering and oxidation stains from 892.6 to 892.4 and 890.9 to 890.6



6+00
(OLD LEXINGTON ROAD)

Cut Limits from Sta. 20+50 to Sta. 24+25
Core Log Sta. 21+02.3, 59.4' Rt.
Elev. 928.1-918.5 Overburden
918.5-889.9 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Discordant fracture to bedding planes with moderate weathering from 918.5 to 916.0
Hairline healed fracture with minor signs of karst dissolution at 915.1
Possible fracture or void zone with clay infilling, severe weathering and heavily fragmented rock clasts from 904.9 to 899.9



20+50
(BEST PAL ROAD)

NOTE:

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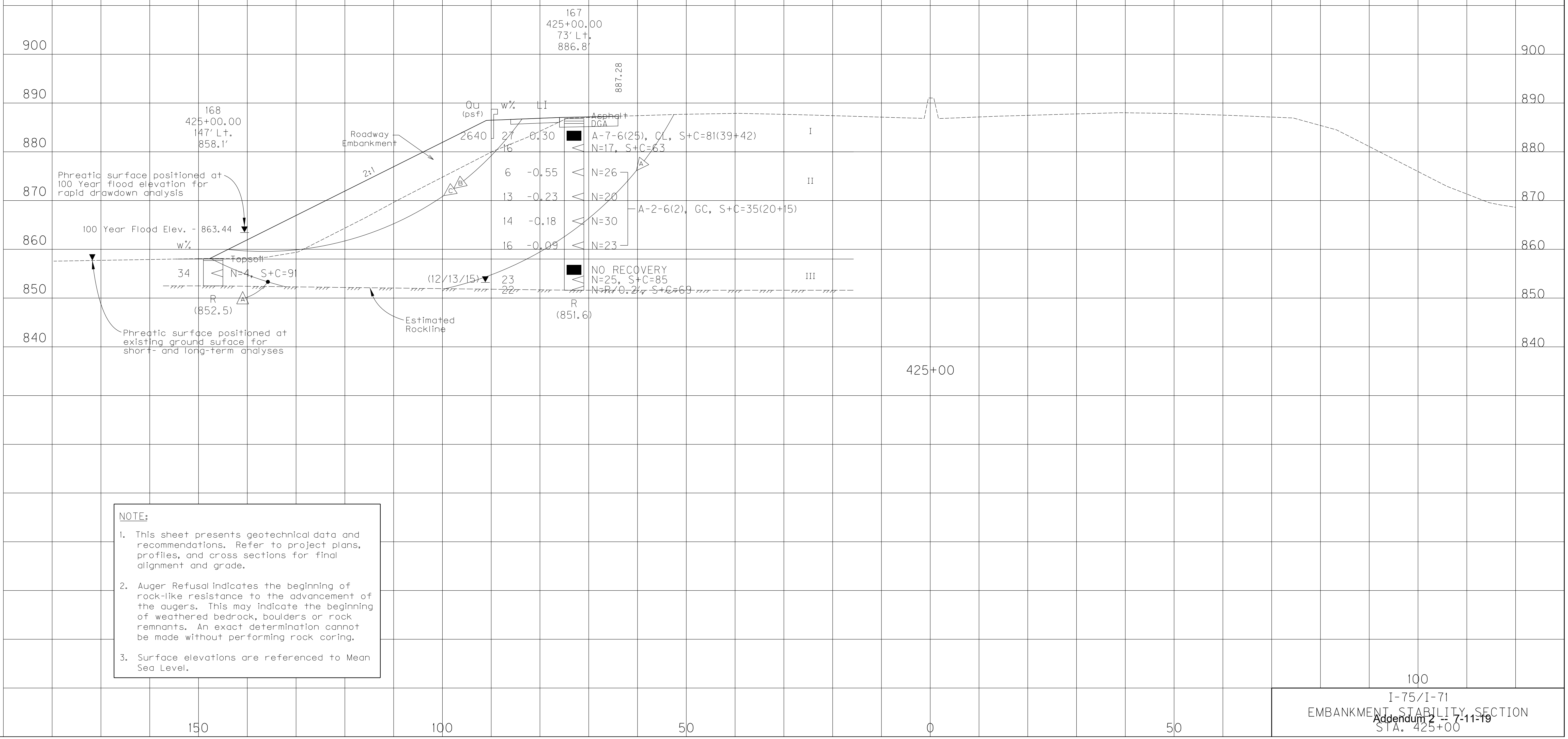
3. Surface elevations are referenced to Mean Sea Level.

KY 338 SIDE ROADS
CUT STABILITY SECTIONS
STA. 20+50 AND STA. 6+00
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

ESTIMATED SOIL STRENGTH PARAMETERS				
SOIL	I	II	III	ROADWAY EMBANKMENT
SHORT TERM	γ = 120 pcf c = 1300 psf ø = 0°	γ = 133 pcf c = 0 psf ø = 34°	γ = 120 pcf c = 600 psf ø = 0°	γ = 125 pcf c = 1000 psf ø = 0°
LONG TERM AND RAPID DRAWDOWN	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{ø}$ = 28°	γ = 133 pcf $\bar{c}$ = 0 psf $\bar{ø}$ = 34°	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{ø}$ = 28°	γ = 125 pcf $\bar{c}$ = 150 psf $\bar{ø}$ = 25°

FACTORS OF SAFETY		
SHORT TERM	A	1.2
LONG TERM	B	1.5
RAPID DRAWDOWN	C	1.4



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

I-75/I-71
EMBANKMENT STABILITY SECTION
STA. 425+00

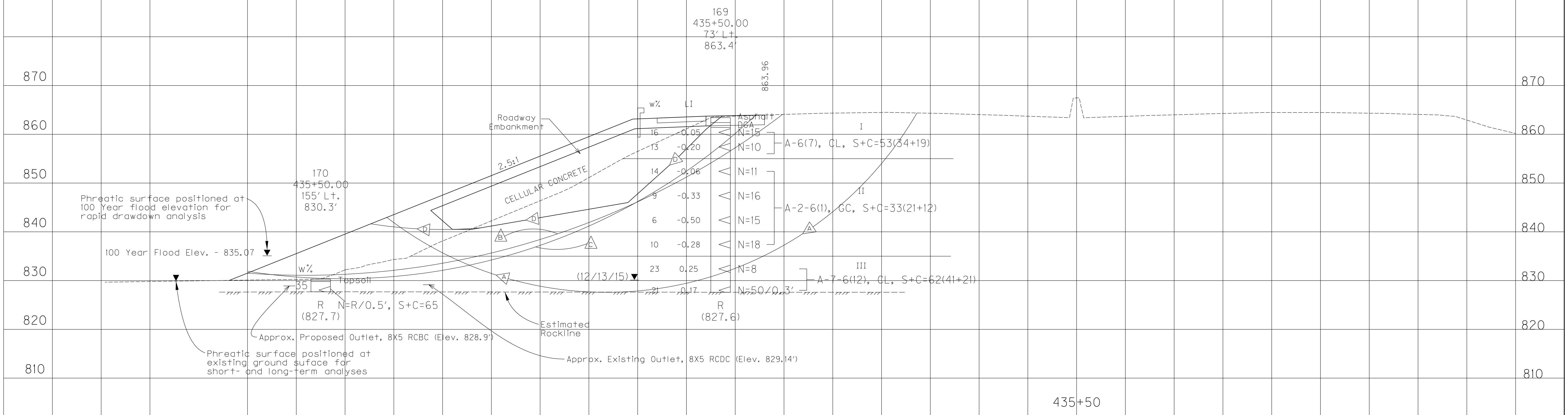
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

ESTIMATED SOIL STRENGTH PARAMETERS						
SOIL	I	II	III	ROADWAY EMBANKMENT	CELLULAR CONCRETE	EPS GEOFOAM
SHORT TERM	γ = 120 pcf c = 1300 psf ø = 0°	γ = 133 pcf c = 0 psf ø = 34°	γ = 120 pcf c = 600 psf ø = 0°	γ = 125 pcf c = 1000 psf ø = 0°	γ = 36 pcf c = 2880 psf ø = 0°	γ = 3.2 pcf c = 1650 psf ø = 0°
LONG TERM AND RAPID DRAWDOWN	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{ø}$ = 28°	γ = 133 pcf $\bar{c}$ = 0 psf $\bar{ø}$ = 34°	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{ø}$ = 28°	γ = 125 pcf $\bar{c}$ = 150 psf $\bar{ø}$ = 25°	γ = 36 pcf $\bar{c}$ = 2880 psf $\bar{ø}$ = 0°	γ = 3.2 pcf $\bar{c}$ = 1650 psf $\bar{ø}$ = 0°

FACTORS OF SAFETY	NORMAL FILL	EPS GEOFOAM	CELLULAR CONCRETE
SHORT TERM	1.4	2.3	2.2 △A*
LONG TERM	1.7	2.2	2.5 △B*
RAPID DRAWDOWN	1.7	2.2	2.4 △C*
SLIDING		1.7	1.4 △D*

*See failure surface on cross-section below.
Normal fill and Geofoam configuration failure surfaces not shown.



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-71/75
EMBANKMENT STABILITY SECTION
STA. 435+50

Addendum 2 -- 7-11-19

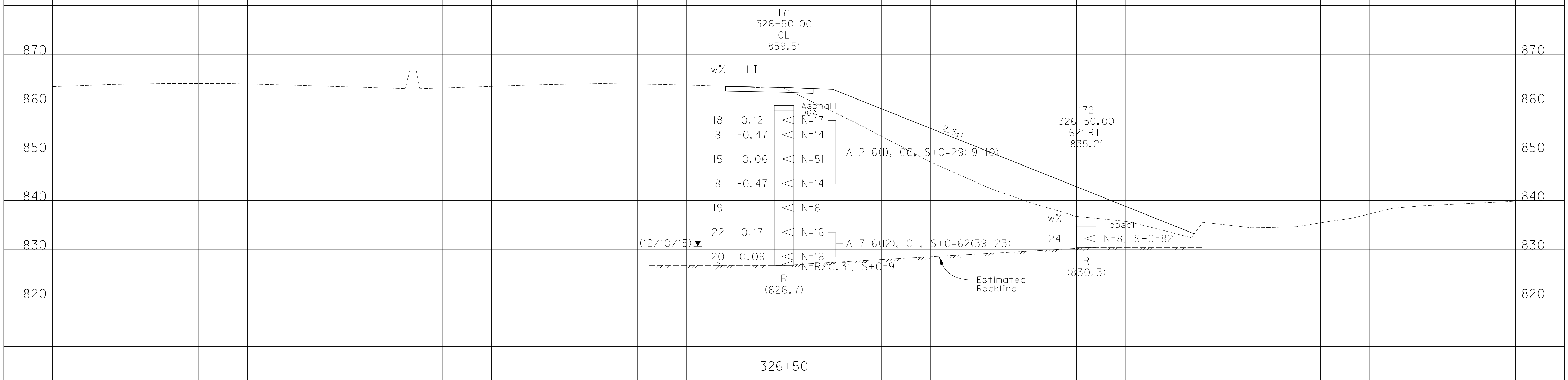
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

NOTE:

This section is outside of the project limits but is still included for completeness. For stability analyses information, refer to SB I-71\I-75 Aux. Entrance Lane Embankment Stability Section Sta. 435+50, as this is the same section.

I-75/I-71 RAMP C
EMBANKMENT STABILITY SECTION
STA. 326+50

Addendum 2 -- 7-11-19

Attachment #2

New Geotechnical Drawings

GEOTECHNICAL NOTES

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

LIGHTWEIGHT FILL FOR CULVERT EXTENSIONS @ I-75/I-71 STA 435+53, US 25 STA 32+06:

29. Place lightweight fill material as shown in the plans and in accordance with the Special Note for Cellular Concrete Fill OR the Special Note for EPS Foam Block Embankments, and the appropriate Lightweight Fill Detail Sheet. These documents provide additional detail on the construction of the lightweight fill. The fill shall extend perpendicular to the culvert to the minimum limits shown on the detail sheets.

30. Lightweight fill shall be covered with a minimum two (2)-foot of soil cap when it is not directly beneath pavement and base aggregate. The soil shall consist of clay classified as either CL or CH in the Unified Soil Classification System (USCS) and placed and compacted in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction.

31. When EPS geofoam fill is within five (5) feet of the proposed road grade, a concrete load distributor is required above the top layer of geofoam blocks. The Special Note for EPS Foam Block Embankments provides details for the concrete load distributor.

32. Temporary sheeting or shoring may be required for construction of the lightweight fill. The specific designs for any necessary sheeting and shoring shall be performed by the Contractor and approved by the Engineer. Construction and stability of temporary slopes required for lightweight fill placement are the responsibility of the Contractor. Caution should be used with sheeting/shoring or temporary slopes adjacent to existing roadways. The time any temporary cut slopes are left open should be minimized to reduce the likely of slope instability.

33. Any changes in lightweight fill configuration and material type from the applicable Lightweight Fill Detail Sheet and Special Note will require additional design and analysis by the Contractor or Supplier, meeting the approval of the Engineer.

34. A proposed soundwall will be constructed in the area of the 8X5 culvert extension at I-75/I-71 Station 435+53. Drilled shaft soundwall foundations should be considered prior to lightweight fill placement to prevent negative impact to the lightweight fill materials. For any drilled shafts within the lightweight fill zone, drilling should not be performed through geofoam materials. Drilled shaft side capacity should be neglected in lightweight fill materials, unless updated designs are provided by the Contractor and approved by the Department.

DESIGNED BY:
DATE SUBMITTED:

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS: FD52 008 0075 175-176

GEOTECHNICAL NOTES
Addendum 2 -- 7-11-19

EPS GEOFOAM FILL DETAILS (GENERAL CONFIGURATION) 8X5 RCBC CULVERT EXTENSION STA 435+53.9 I-71 / I-75

NOTE: THIS IS ONLY A TYPICAL EPS GEOFOAM FILL CONFIGURATION. ALL MEASUREMENTS AND SLOPES EXPLICITLY GIVEN ON THIS SHEET MUST BE FOLLOWED AND THE INDICATED MINIMUM LIGHTWEIGHT FILL VOLUME MUST BE MAINTAINED.

NOTES:

1) EXCAVATING THE EMBANKMENT FOR THE EPS GEOFOAM FILL INSTALLATION WILL INVOLVE SOME RISK. THEREFORE, TO PREVENT POTENTIAL DAMAGE TO THE ROADWAY, THE CONTRACTOR WILL BE ALLOWED 21 CONTINUOUS DAYS FROM BEGINNING OF THE REMOVAL OF THE EMBANKMENT SLOPE TO REPLACING THE EMBANKMENT SLOPE ON THE PROPOSED FINAL RECOMMENDED SLOPE. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE SOIL CUT DURING CONSTRUCTION. SHEETING AND SHORING MAY BE REQUIRED TO EXCAVATE AND CONSTRUCT THE EPS GEOFOAM FILL. THE DESIGNS OF ANY REQUIRED SHEETING OR SHORING SHALL BE PERFORMED BY THE CONTRACTOR'S ENGINEER.

2) PRIOR TO GEOFOAM BLOCK PLACEMENT CONSTRUCT A SAND LEVELING PAD MEETING ALL REQUIREMENTS OF THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS. A GEOMEMBRANE SHALL BE PLACED OVER THE TOP AND SIDES OF THE OUTER BLOCKS. THE GEOMEMBRANE MATERIAL PROPERTIES AND PLACEMENT SHALL BE IN ACCORDANCE WITH THE THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS. THE MATERIAL COST AND PLACEMENT OF THE SAND LEVELING PAD AND GEOMEBRANE WILL BE INCIDENTAL TO THE UNIT BID PRICE FOR "EPS FOAM BLOCK".

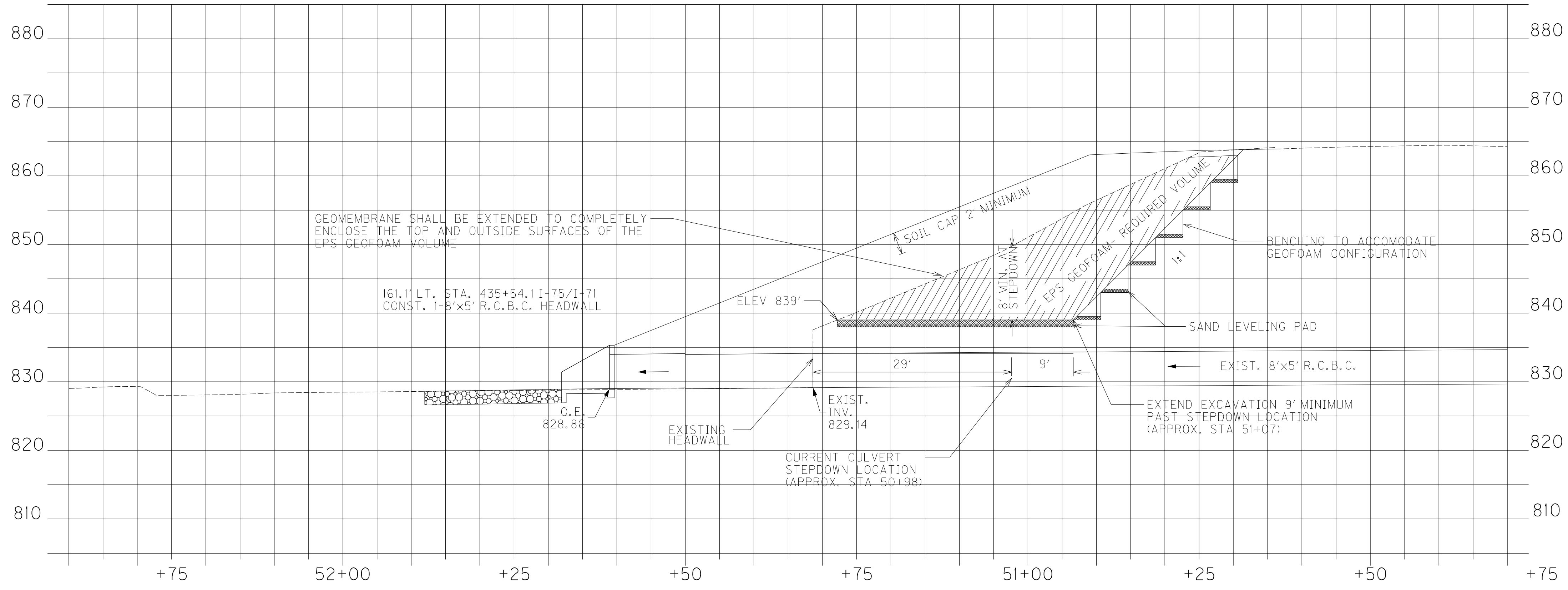
3) PLACE THE EPS GEOFOAM FILL MATERIAL AS SHOWN IN THE PLANS AND IN ACCORDANCE WITH THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS.

4) A PROPOSED SOUNDWALL WILL BE CONSTRUCTED IN THE AREA OF THE CULVERT EXTENSION. DRILLED SHAFT SOUNDWALL FOUNDATIONS SHOULD BE CONSIDERED PRIOR TO LIGHTWEIGHT FILL PLACEMENT TO PREVENT NEGATIVE IMPACT TO THE LIGHTWEIGHT FILL. DRILLING FOR THE DRILLED SHAFTS SHOULD NOT BE PERFORMED THROUGH GEOFOAM MATERIALS. DRILLED SHAFT SIDE CAPACITY SHOULD BE NEGLECTED IN LIGHTWEIGHT FILL MATERIALS, UNLESS UPDATED DESIGNS ARE PROVIDED BY THE CONTRACTOR AND APPROVED BY THE DEPARTMENT.

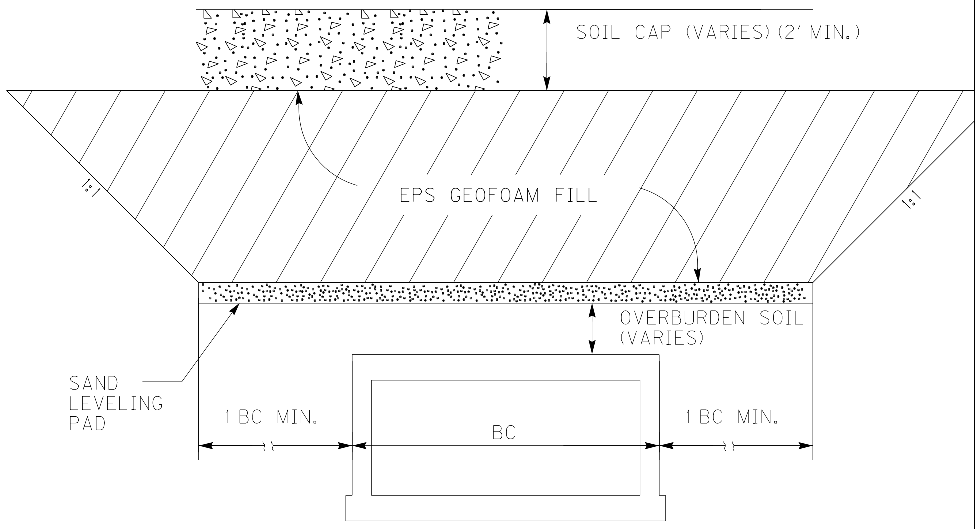
5) PAYMENT FOR THE EPS GEOFOAM FILL WILL BE MADE ON THE BASIS OF THE PLAN QUANTITIES. NO SEPARATE FIELD MEASUREMENT FOR EPS FOAM BLOCK SHALL BE MADE. THE FINAL QUANITIES WILL BE THE DESIGN PLAN QUANTITIES INCREASED OR DECREASED BY AUTHORIZED CHANGES. THE UNIT PRICE BID FOR "EPS FOAM BLOCK" SHALL BE FULL COMPENSATION FOR ALL ENGINEERING, MATERIALS, LABOR AND INCIDENTAL ITEMS NECESSARY TO CONSTRUCT THE EPS GEOFOAM FILL IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS.

6) EPS GEOFOAM FILL SHALL BE CONSTRUCTED OF MATERIAL APPROVED FOR USE BY THE KENTUCKY TRANSPORTATION CABINET. DETAILS SHOWN IN THESE PLANS FOR EPS GEOFOAM FILL REPRESENT LIMITS OF FILL WHERE THE DESIRED WEIGHT (PRESSURE) REDUCTION IS REQUIRED. IF THE CONTRACTOR PROPOSES TO USE THE UNIT WEIGHT SPECIFIED IN THE PLANS, A MATERIAL DATA SHEET WILL BE SUFFICIENT FOR VERIFICATION OF THE PROPOSED MATERIAL (NO ADDITIONAL CALCULATIONS WILL BE REQUIRED UNLESS REQUESTED BY THE ENGINEER). IF THE CONTRACTOR PROPOSES TO USE A UNIT WEIGHT DIFFERENT THAN WHAT WAS USED IN THE INITIAL CONFIGURATION, CONSTRUCTION DETAILS AND SEALED ENGINEERING CALCULATIONS SHOWING MATERIALS, METHODS AND MEANS PROPOSED TO PRODUCE THE DESIRED WEIGHT REDUCTION ON THE EXISTING CULVERT USING "EPS FOAM BLOCK" SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS SUBMISSION SHALL BE MADE 30 DAYS PRIOR TO ORDERING MATERIAL OR BEGINNING EXCAVATION FOR PLACEMENT OF EPS GEOFOAM FILL.

7) PROVIDE A GEOFOAM BLOCK WITH A UNIT WEIGHT OF 2.85 LBS/CUBIC FOOT OR LESS. SEE SECTION 2 OF THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS.



CULVERT PIPE PROFILE



TYPICAL CULVERT SECTION SHOWING MINIMUM LATERAL LIMITS OF LIGHTWEIGHT FILL

DATE: 3-MARCH-2019
CHECKED BY
DESIGNED BY: ______________
DETAILED BY: M. Carpenter
E. Scott

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–71 / I–75
CROSSING
EPS GEOFOAM EMBANKMENT DETAIL

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH
Addendum 2 - 7-11-19

SHEET NO.

DRAWING NO.
00000

ITEM NUMBER
06–0018.00

LIGHTWEIGHT CELLULAR CONCRETE FILL DETAILS (GENERAL CONFIGURATION) 8X5 RCBC CULVERT EXTENSION STA 435+53.9 I-71 / I-75

Note: This is only a typical Lightweight Cellular Concrete fill configuration. All measurements and slopes explicitly given on this sheet must be followed and the indicated minium lightweight fill volume must be maintained.

NOTES:

1) EXCAVATING THE EMBANKMENT FOR THE LIGHTWEIGHT CELLULAR CONCRETE FILL INSTALLATION WILL INVOLVE SOME RISK. THEREFORE, TO PREVENT POTENTIAL DAMAGE TO THE ROADWAY, THE CONTRACTOR WILL BE ALLOWED 21 CONTINUOUS DAYS FROM BEGINNING OF THE REMOVAL OF THE EMBANKMENT SLOPE TO REPLACING THE EMBANKMENT SLOPE ON THE PROPOSED FINAL RECOMMENDED SLOPE. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE SOIL CUT DURING CONSTRUCTION. TEMPORARY BACK SLOPE EXCAVATION LIMITS. SHEETING AND SHORING MAY BE REQUIRED TO EXCAVATE AND CONSTRUCT THE LIGHTWEIGHT CELLULAR CONCRETE FILL. THE DESIGNS OF ANY REQUIRED SHEETING OR SHORING SHALL BE PERFORMED BY THE CONTRACTOR'S ENGINEER.

2) A ONE-FOOT COARSE AGGREGATE ROCK DRAINAGE BLANKET, IN ACCORDANCE WITH SECTION 805 OF THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SHALL BE PLACED ON THE EXCAVATED EMBANKMENT SIDE SLOPE FOR A DRAINAGE BLANKET. THE DRAINAGE BLANKET SHALL BE WRAPPED WITH TYPE IV GEOTEXTILE FABRIC IN ACCORDANCE WITH SECTIONS 214 AND 843 OF THE CURRENT STANDARDS SPECIFICATIONS. THE DRAINAGE BLANKET CONSTRUCTION WILL BE INCIDENTAL TO THE UNIT BID PRICE FOR "CELLULAR CONCRETE FILL".

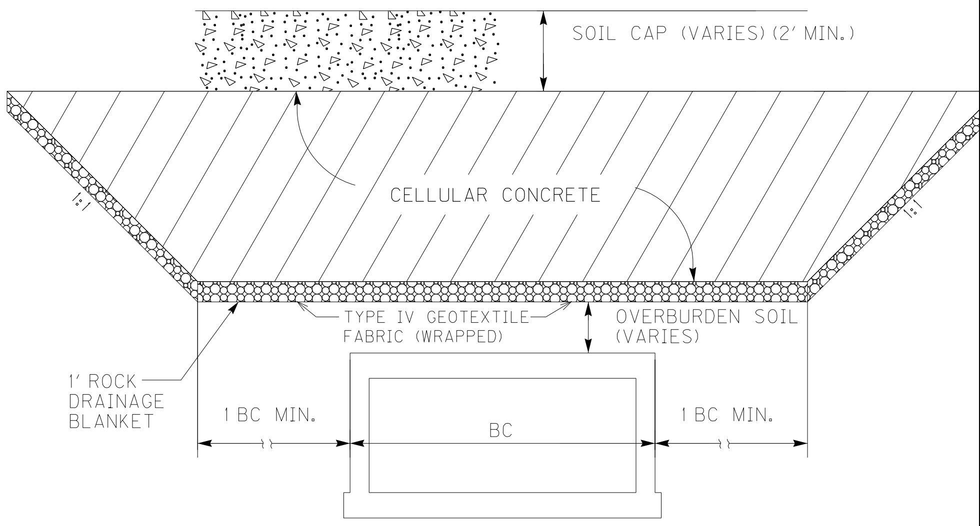
3) PLACE THE CELLULAR CONCRETE FILL MATERIAL AS SHOWN IN THE PLANS AND IN ACCORDANCE WITH THE SPECIAL NOTE FOR CELLULAR CONCRETE FILL.

4) A PROPOSED SOUNDWALL WILL BE CONSTRUCTED IN THE AREA OF THE CULVERT EXTENSION. DRILLED SHAFT SOUNDWALL FOUNDATIONS SHOULD BE CONSIDERED PRIOR TO LIGHTWEIGHT FILL PLACEMENT TO PREVENT NEGATIVE IMPACT TO THE LIGHTWEIGHT FILL. DRILLED SHAFT SIDE CAPACITY SHOULD BE NEGLECTED IN LIGHTWEIGHT FILL MATERIALS, UNLESS UPDATED DESIGNS ARE PROVIDED BY THE CONTRACTOR AND APPROVED BY THE DEPARTMENT.

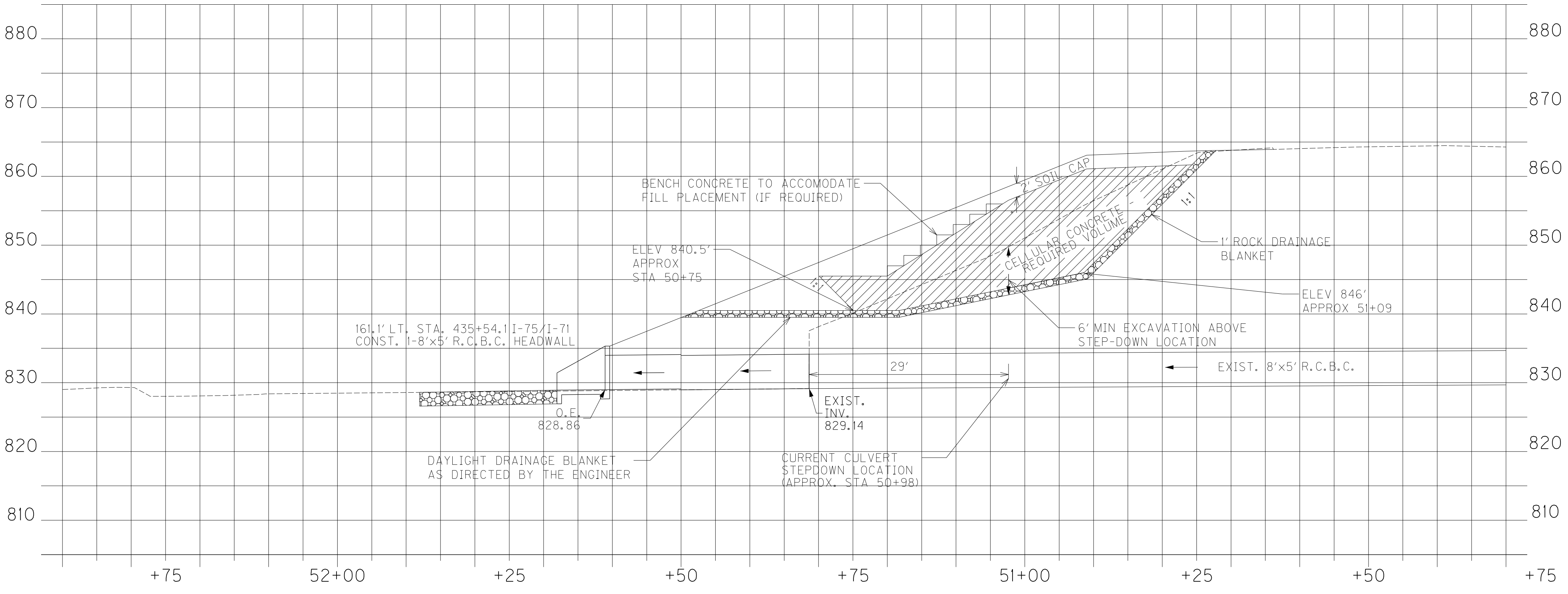
5) PAYMENT FOR THE CELLULAR CONCRETE FILL WILL BE MADE ON THE BASIS OF THE PLAN QUANTITIES. NO SEPARATE FIELD MEASUREMENT FOR CELLULAR CONCRETE FILL SHALL BE MADE. THE FINAL QUANTITIES WILL BE THE DESIGN PLAN QUANTITIES INCREASED OR DECREASED BY AUTHORIZED CHANGES. THE UNIT PRICE BID FOR "CELLULAR CONCRETE FILL" SHALL BE FULL COMPENSATION FOR ALL ENGINEERING, MATERIALS, LABOR AND INCIDENTAL ITEMS NECESSARY TO CONSTRUCT THE LIGHTWEIGHT CELLULAR CONCRETE FILL IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS.

6) CELLULAR CONCRETE SHALL BE CONSTRUCTED OF MATERIAL APPROVED FOR USE BY THE KENTUCKY TRANSPORTATION CABINET. DETAILS SHOWN IN THESE PLANS FOR CELLULAR CONCRETE FILL REPRESENT LIMITS OF FILL WHERE THE DESIRED WEIGHT (PRESSURE) REDUCTION IS REQUIRED. IF THE CONTRACTOR PROPOSES TO USE THE UNIT WEIGHT SPECIFIED IN THE PLANS, A MATERIAL DATA SHEET WILL BE SUFFICIENT FOR VERIFICATION OF THE PROPOSED MATERIAL (NO ADDITIONAL CALCULATIONS WILL BE REQUIRED UNLESS REQUESTED BY THE ENGINEER). IF THE CONTRACTOR USES A DIFFERENT UNIT WEIGHT, CONSTRUCTION DETAILS AND SEALED ENGINEERING CALCULATIONS SHOWING MATERIALS, METHODS AND MEANS PROPOSED TO PRODUCE THE DESIRED WEIGHT REDUCTION ON THE EXISTING CULVERT USING "CELLULAR CONCRETE FILL" SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS SUBMISSION SHALL BE MADE 30 DAYS PRIOR TO ORDERING MATERIAL OR BEGINNING EXCAVATION FOR PLACEMENT OF LIGHTWEIGHT CELLULAR CONCRETE FILL.

7) PROVIDE A MATERIAL WITH A CAST UNIT WEIGHT OF 40 LBS/CUBIC FOOT OR LESS.



TYPICAL CULVERT SECTION SHOWING MINIMUM LATERAL LIMITS OF LIGHTWEIGHT FILL



CULVERT PIPE PROFILE

DATE: 3-MARCH-2019
CHECKED BY
DESIGNED BY: ______
DETAILED BY: M. Carpenter
E. Scott

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–71 / I–75

CROSSING
CELLULAR CONCRETE FILL DETAIL

SUBSURFACE DATA

ITEM NUMBER
06–0018.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

Addendum 2 - 7-31-19

SHEET NO.
____

DRAWING NO.
00000

EPS GEOFOAM FILL DETAILS (GENERAL CONFIGURATION) 4X4 RCBC EXTENSION LT & RT OF US 25 STA 32+06.4

NOTE: THIS IS ONLY A TYPICAL EPS GEOFOAM FILL CONFIGURATION. ALL MEASUREMENTS AND SLOPES EXPLICITLY GIVEN ON THIS SHEET MUST BE FOLLOWED AND THE INDICATED MINIMUM LIGHTWEIGHT FILL VOLUME MUST BE MAINTAINED.

NOTES:

1) EXCAVATING THE EMBANKMENT FOR THE EPS GEOFOAM FILL INSTALLATION WILL INVOLVE SOME RISK. THEREFORE, TO PREVENT POTENTIAL DAMAGE TO THE ROADWAY, THE CONTRACTOR WILL BE ALLOWED 21 CONTINUOUS DAYS FROM BEGINNING OF THE REMOVAL OF THE EMBANKMENT SLOPE TO REPLACING THE EMBANKMENT SLOPE ON THE PROPOSED FINAL RECOMMENDED SLOPE. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE SOIL CUT DURING CONSTRUCTION. SHEETING AND SHORING MAY BE REQUIRED TO EXCAVATE AND CONSTRUCT THE EPS GEOFOAM FILL. THE DESIGNS OF ANY REQUIRED SHEETING OR SHORING SHALL BE PERFORMED BY THE CONTRACTOR'S ENGINEER.

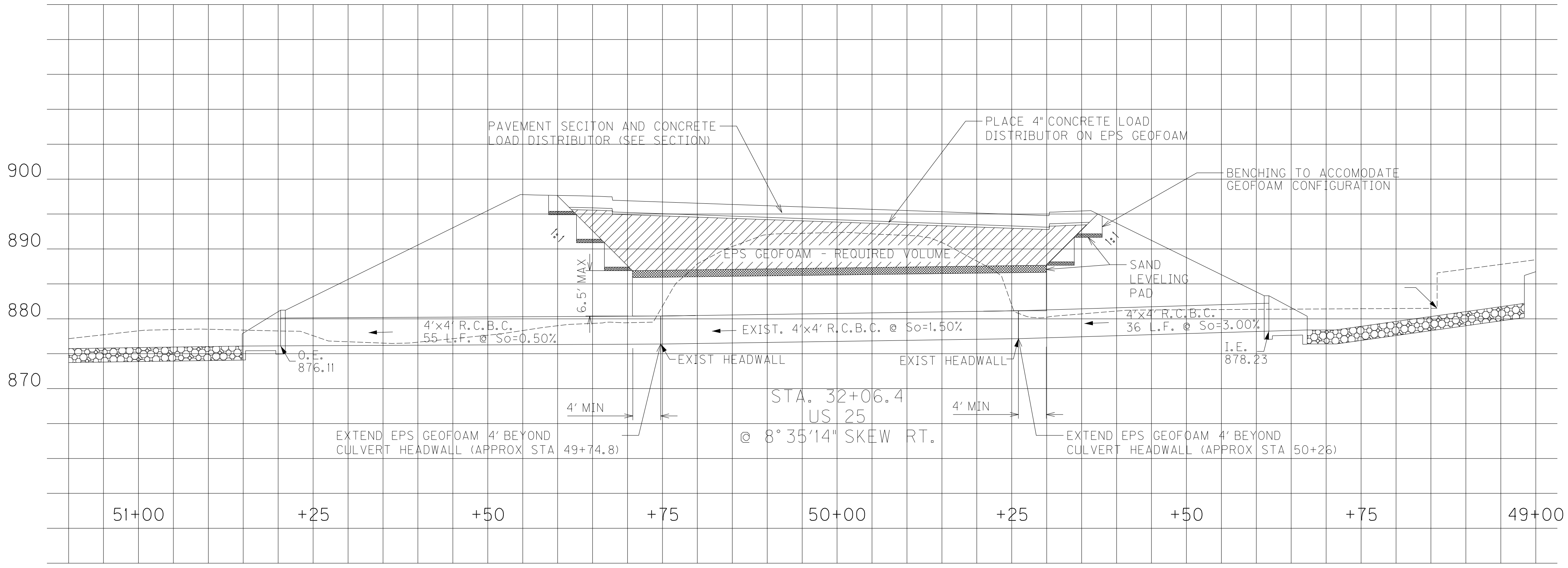
2) PRIOR TO GEOFOAM BLOCK PLACEMENT CONSTRUCT A SAND LEVELING PAD MEETING ALL REQUIREMENTS OF THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS. A GEOMEMBRANE SHALL BE PLACED OVER THE TOP AND SIDES OF THE OUTER BLOCKS. THE GEOMEMBRANE MATERIAL PROPERTIES AND PLACEMENT SHALL BE IN ACCORDANCE WITH THE THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS. THE MATERIAL COST AND PLACEMENT OF THE SAND LEVELING PAD AND GEOMEBRANE WILL BE INCIDENTAL TO THE UNIT BID PRICE FOR "EPS FOAM BLOCK".

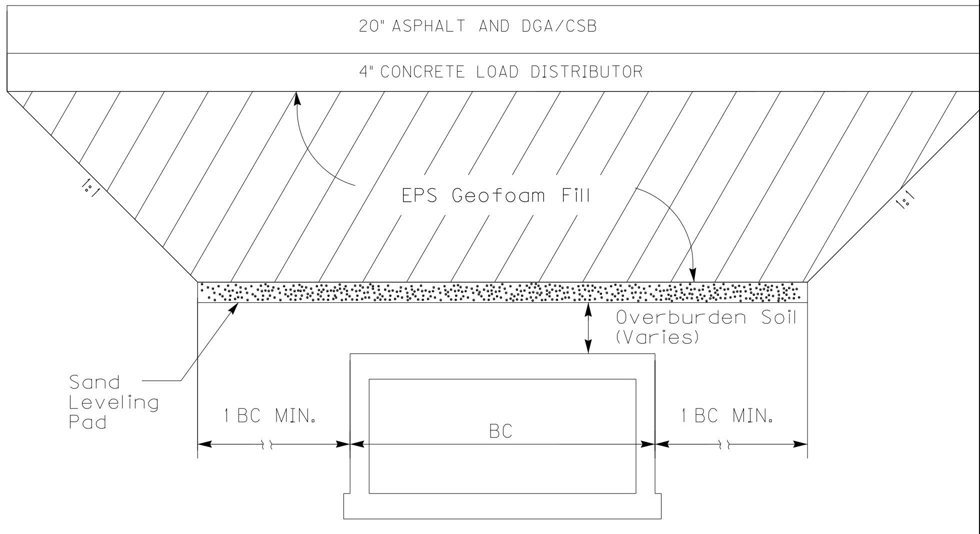
3) PLACE THE EPS GEOFOAM FILL MATERIAL AS SHOWN IN THE PLANS AND IN ACCORDANCE WITH THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS.

4) PAYMENT FOR THE EPS GEOFOAM FILL WILL BE MADE ON THE BASIS OF THE PLAN QUANTITIES. NO SEPARATE FIELD MEASUREMENT FOR EPS FOAM BLOCK SHALL BE MADE. THE FINAL QUANITIES WILL BE THE DESIGN PLAN QUANTITIES INCREASED OR DECREASED BY AUTHORIZED CHANGES. THE UNIT PRICE BID FOR "EPS FOAM BLOCK" SHALL BE FULL COMPENSATION FOR ALL ENGINEERING, MATERIALS, LABOR AND INCIDENTAL ITEMS NECESSARY TO CONSTRUCT THE EPS GEOFOAM FILL IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS.

5) EPS GEOFOAM FILL SHALL BE CONSTRUCTED OF MATERIAL APPROVED FOR USE BY THE KENTUCKY TRANSPORTATION CABINET. DETAILS SHOWN IN THESE PLANS FOR EPS GEOFOAM FILL REPRESENT LIMITS OF FILL WHERE THE DESIRED WEIGHT (PRESSURE) REDUCTION IS REQUIRED. IF THE CONTRACTOR PROPOSES TO USE THE UNIT WEIGHT SPECIFIED IN THE PLANS, A MATERIAL DATA SHEET WILL BE SUFFICIENT FOR VERIFICATION OF THE PROPOSED MATERIAL (NO ADDITIONAL CALCULATIONS WILL BE REQUIRED UNLESS REQUESTED BY THE ENGINEER). IF THE CONTRACTOR PROPOSES TO USE A UNIT WEIGHT DIFFERENT THAN WHAT WAS USED IN THE INITIAL CONFIGURATION, CONSTRUCTION DETAILS AND SEALED ENGINEERING CALCULATIONS SHOWING MATERIALS, METHODS AND MEANS PROPOSED TO PRODUCE THE DESIRED WEIGHT REDUCTION ON THE EXISTING CULVERT USING "EPS FOAM BLOCK" SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS SUBMISSION SHALL BE MADE 30 DAYS PRIOR TO ORDERING MATERIAL OR BEGINNING EXCAVATION FOR PLACEMENT OF EPS GEOFOAM FILL.

6) PROVIDE A GEOFOAM BLOCK WITH A UNIT WEIGHT OF 2.85 LBS/CUBIC FOOT OR LESS. SEE SECTION 2 OF THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS.





TYPICAL CULVERT SECTION SHOWING MINIMUM LATERAL LIMITS OF LIGHTWEIGHT FILL

DATE: 3-MARCH-2019	CHECKED BY
DESIGNED BY: ____________	____________
DETAILED BY: M. Carpenter	E. Scott

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US-25

CROSSING
EPS GEOFOAM EMBANKMENT DETAIL

SUBSURFACE DATA

ITEM NUMBER
06-0018.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

Addendum 2 - 7-31-19

SHEET NO.
____

DRAWING NO.
00000

LIGHTWEIGHT CELLULAR CONCRETE FILL DETAILS (GENERAL CONFIGURATION) 4X4 RCBC EXTENSION LT & RT OF US 25 STA 32+06.4

Note: This is only a typical Lightweight Cellular Concrete fill configuration. All measurements and slopes explicitly given on this sheet must be followed and the indicated minium lightweight fill volume must be maintained.

NOTES:

1) EXCAVATING THE EMBANKMENT FOR THE LIGHTWEIGHT CELLULAR CONCRETE FILL INSTALLATION WILL INVOLVE SOME RISK. THEREFORE, TO PREVENT POTENTIAL DAMAGE TO THE ROADWAY, THE CONTRACTOR WILL BE ALLOWED 21 CONTINUOUS DAYS FROM BEGINNING OF THE REMOVAL OF THE EMBANKMENT SLOPE TO REPLACING THE EMBANKMENT SLOPE ON THE PROPOSED FINAL RECOMMENDED SLOPE. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE SOIL CUT DURING CONSTRUCTION. TEMPORARY BACK SLOPE EXCAVATION LIMITS. SHEETING AND SHORING MAY BE REQUIRED TO EXCAVATE AND CONSTRUCT THE LIGHTWEIGHT CELLULAR CONCRETE FILL. THE DESIGNS OF ANY REQUIRED SHEETING OR SHORING SHALL BE PERFORMED BY THE CONTRACTOR'S ENGINEER.

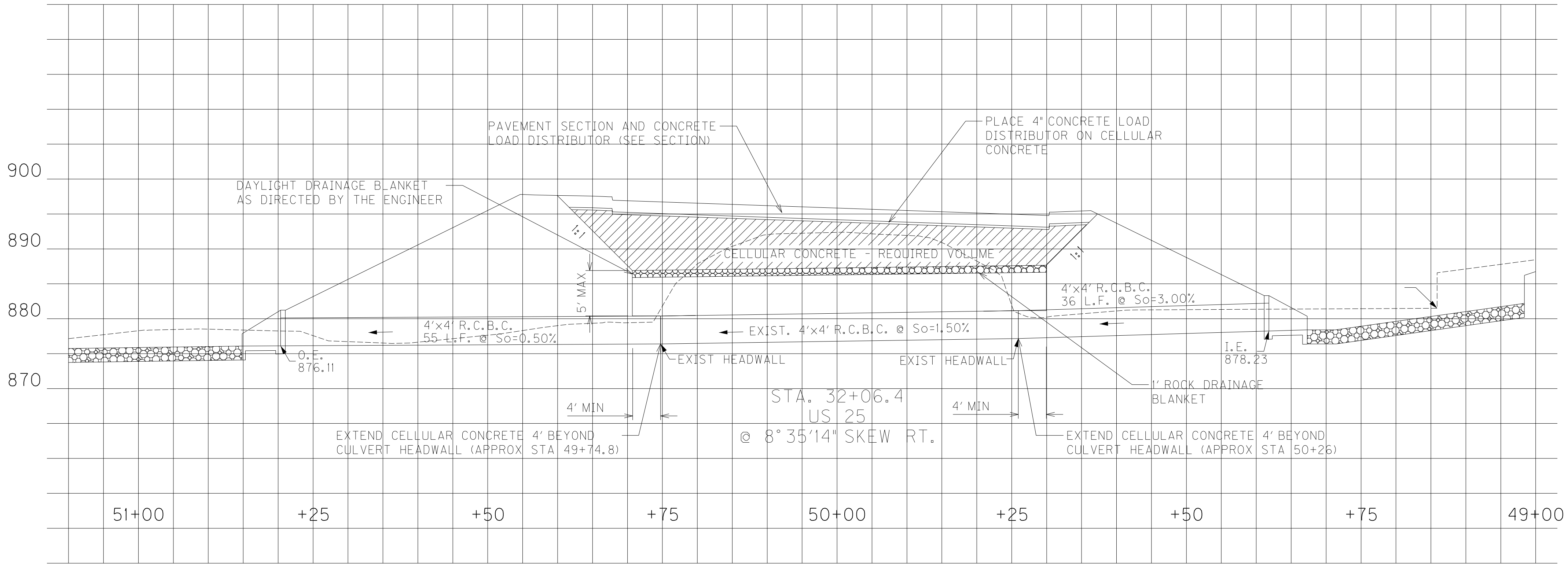
2) A ONE-FOOT COARSE AGGREGATE ROCK DRAINAGE BLANKET, IN ACCORDANCE WITH SECTION 805 OF THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SHALL BE PLACED ON THE EXCAVATED EMBANKMENT SIDE SLOPE FOR A DRAINAGE BLANKET. THE DRAINAGE BLANKET SHALL BE WRAPPED WITH TYPE IV GEOTEXTILE FABRIC IN ACCORDANCE WITH SECTIONS 214 AND 843 OF THE CURRENT STANDARDS SPECIFICATIONS. THE DRAINAGE BLANKET CONSTRUCTION WILL BE INCIDENTAL TO THE UNIT BID PRICE FOR "CELLULAR CONCRETE FILL".

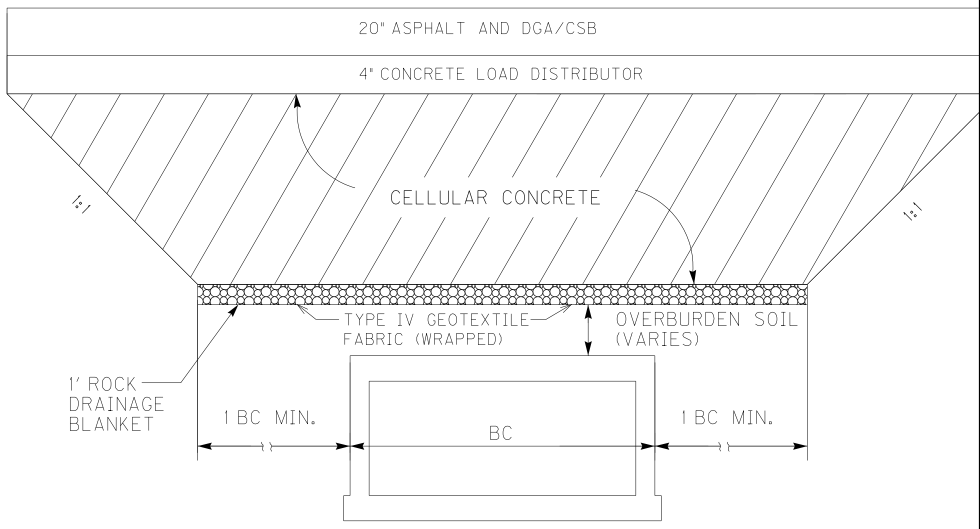
3) PLACE THE CELLULAR CONCRETE FILL MATERIAL AS SHOWN IN THE PLANS AND IN ACCORDANCE WITH THE SPECIAL NOTE FOR CELLULAR CONCRETE FILL.

4) PAYMENT FOR THE CELLULAR CONCRETE FILL WILL BE MADE ON THE BASIS OF THE PLAN QUANTITIES. NO SEPARATE FIELD MEASUREMENT FOR CELLULAR CONCRETE FILL SHALL BE MADE. THE FINAL QUANITIES WILL BE THE DESIGN PLAN QUANTITIES INCREASED OR DECREASED BY AUTHORIZED CHANGES. THE UNIT PRICE BID FOR "CELLULAR CONCRETE FILL" SHALL BE FULL COMPENSATION FOR ALL ENGINEERING, MATERIALS, LABOR AND INCIDENTAL ITEMS NECESSARY TO CONSTRUCT THE LIGHTWEIGHT CELLULAR CONCRETE FILL IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS.

5) CELLULAR CONCRETE SHALL BE CONSTRUCTED OF MATERIAL APPROVED FOR USE BY THE KENTUCKY TRANSPORTATION CABINET. DETAILS SHOWN IN THESE PLANS FOR CELLULAR CONCRETE FILL REPRESENT LIMITS OF FILL WHERE THE DESIRED WEIGHT (PRESSURE) REDUCTION IS REQUIRED. IF THE CONTRACTOR PROPOSES TO USE THE UNIT WEIGHT SPECIFIED IN THE PLANS, A MATERIAL DATA SHEET WILL BE SUFFICIENT FOR VERIFICATION OF THE PROPOSED MATERIAL (NO ADDITIONAL CALCULATIONS WILL BE REQUIRED UNLESS REQUESTED BY THE ENGINEER). IF THE CONTRACTOR USES A DIFFERENT UNIT WEIGHT, CONSTRUCTION DETAILS AND SEALED ENGINEERING CALCULATIONS SHOWING MATERIALS, METHODS AND MEANS PROPOSED TO PRODUCE THE DESIRED WEIGHT REDUCTION ON THE EXISTING CULVERT USING "CELLULAR CONCRETE FILL" SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS SUBMISSION SHALL BE MADE 30 DAYS PRIOR TO ORDERING MATERIAL OR BEGINNING EXCAVATION FOR PLACEMENT OF LIGHTWEIGHT CELLULAR CONCRETE FILL.

6) PROVIDE A MATERIAL WITH A CAST UNIT WEIGHT OF 40 LBS/CUBIC FOOT OR LESS.





TYPICAL CULVERT SECTION
SHOWING MINIMUM LATERAL LIMITS
OF LIGHTWEIGHT FILL

DATE: 3-MARCH-2019
CHECKED BY
DESIGNED BY: ________________
DETAILED BY: M. Carpenter
E. Scott

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US–25
CROSSING
CELLULAR CONCRETE FILL DETAIL

SUBSURFACE DATA

ITEM NUMBER
06–0018.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH
Addendum 2 - 7-31-19

SHEET NO.
_____
DRAWING NO.
00000

Attachment #3

Revised Coordinate Data Sheet

(updated boring locations)

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date 4/2/2019

Road Number I-71/75 Richwood

Survey Crew / Consultant

Contact Person

Item #

Mars #

Project #

Notes: Updated Stations/Offsets for Best Pal Road realignment.

(circle one)

Elevation Datum [✓ NAVD88] Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	OLD STATION	OLD OFFSET	ELEVATION (ft)	NEW STATION	NEW OFFSET
18	38.917891736N	84.625250001W	18	21+00	60 R	928.158	21+02.28	59.38 R
158	38.917747684N	84.625292161W	158	20+50	40 R	928.641	20+50.26	38.75 R
159	38.918304938N	84.625361262W	159	22+50	52 R	917.811	22+49.08	51.42 R
160	38.918593836N	84.626075491W	160	24+50	33 L	905.203	24+50.95	31.88 L
161	38.919155505N	84.626281244W	161	26+50	17 R	902.655	26+52.30	17.00 R
162	38.919676840N	84.626539425W	162	28+50	17 R	913.989	28+55.76	3.61 L
163	38.920067555N	84.626543319W	163	30+50	17 R	910.055	29+78.57	43.75 L
164	38.920402534N	84.625986324W	164	32+50	17 R	920.734	*	*

* Beyond new construction limits

COORDINATE DATA SUBMISSION FORM

KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date 4/2/2019

Road Number I-71/75 Richwood

Survey Crew / Consultant

Contact Person

Item #

Mars #

Project #

Notes: Updated Stations/Offsets for old Ramp C borings now on I-75/I-71.

(circle one)

Elevation Datum [✓ NAVD88] Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	OLD STATION	OLD OFFSET	ELEVATION (ft)	NEW STATION	NEW OFFSET
90	38.913172712N	84.629015382W	90	319+00	28.0' Rt.	878.731	443+49.1	141.1' Rt.
91	38.912627523N	84.628920521W	91	321+00	23.0' Rt.	867.263	441+49.8	122.9' Rt.
92	38.912083467N	84.628848322W	92	323+00	23.0' Rt.	864.604	439+50.5	110.1' Rt.
93	38.911534963N	84.628812465W	93	325+00	30.0' Rt.	851.739	437+49.0	108.4' Rt.

MEMORANDUM **RA-004-2019**

TO: **Randy Turner, PE**
Project Management Coordinator
Division of Highway Design

FROM: **Michael Carpenter, PE**
Geotechnical Branch Manager
Division of Structural Design

BY: **Erik Scott, PE**
Geotechnical Branch

DATE: **May 9, 2019**

SUBJECT: **Boone County**
FD04 008 0075 175-176
Reconstruction of I-75 / I-71 & KY 338 (Richwood Road) Interchange
KY 338 (Richwood Road) Station 99+00.00 to 392+43.78
US 25 (Dixie Highway) Station 5+83.94 to 77+00.00
I-75/71 Station 419+03.64 to 506+17.60
I-75 Milepoints 175.217 to 175.622
Item No. 6-18.00
Mars No. 8433801D
Geotechnical Engineering Roadway Report Addendum

The addendum geotechnical engineering roadway report for the subject project (RA-002-2019) was issued April 4, 2019. Since that time, minor revisions of the geotechnical sheets were required. First, the retaining wall limits referenced in Geotechnical Note No. 7.24 were updated as noted below. Second, the last soil profile sheet for Best Pal Drive was omitted previously, and has been added. The revised geotechnical sheets are attached, and have been provided to HDR, Inc. in DGN format, for inclusion in the roadway plans.

REVISED GEOTECHNICAL NOTE:

7.24 The retaining walls at the following locations will affect the cut slope and embankment construction. For these areas, please refer to the structural plans for specific instructions for cut slope and embankment construction.

Approximate Station Limits

<u>KY 338</u>
Retaining Wall No. 1: 103+90 to 106+51.34, Left
Retaining Wall No. 1A: 107+91.78 to 108+25.45, Left
Retaining Wall No. 2: 113+80 to 114+70, Left

WB KY 338
Retaining Wall No. 3: 201+13 to 202+74, Left
Retaining Wall No. 15: 207+80 to 209+45, Right

EB KY 338
Retaining Wall No. 14: 107+30 to 109+86, Left

Best Pal Drive
Retaining Wall No. 4: 23+00 to 24+48, Right

US 25
Retaining Wall No. 7: 42+00 to 46+69.89, Left
Retaining Wall No. 8: 49+51.06 to 55+25, Left
Retaining Wall No. 9: 42+25 to 46+68.87, Right
Retaining Wall No. 10: 49+53.69 to 54+25, Right

US 25: Ramp A / Ramp B
Retaining Wall No. 11: 13+49.80 to 17+14.09, Right

US 25: Ramp C
Retaining Wall No. 12: 30+80.02 to 31+60.23, Right

I-75/I-71
Retaining Wall No. 13: 489+85 to 490+25, Right

cc: **Division of Design (Plan Processing Section)**
TEBM for Project Development (District 6)
Project Manager (District 6)
HMB, Inc.
HDR, Inc.

Attachments:

GEOTECHNICAL NOTES

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

19. In areas where the chemical stabilization is not feasible (such as cross-overs, tie-ins, narrow widenings, etc.) the subgrade shall be constructed with either eight (8) additional inches of Crushed Stone Base (CSB) underlain with geogrid or six (6) additional inches of Crushed Stone Base (CSB) underlain with high-strength fabric. Geogrid, if used, shall be underlain with Geotextile Fabric, in accordance with Sections 214 & 843 of the current Standard Specifications. Contrary to the Standard Specifications, Type IV Geotextile Fabric shall be used in lieu of Type III Fabric. The subgrade material properties and installation shall be in accordance with the Special Note for Spot Subgrade Stabilization (Alternatives C or D only) and the current Standard Specifications for Road and Bridge Construction. The aggregate shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction.

20. Where shale (or limestone) bedrock is encountered at the top of subgrade in the cuts, the roadbed shall be undercut one foot below the proposed grade and the limits of the roadbed excavation shall be extended to the ditchlines. The refill shall consist of soil and shall be constructed as specified in Section 204 of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, current edition. Shale cannot be used in the top one foot of the subgrade. For Roadway Excavation projects, the placement of soil refill shall be incidental. For Embankment-in-Place projects, the placement of soil refill shall be paid at the unit bid price for Embankment-in-Place and the excavation of the bedrock material shall be incidental. For either case, no compensation shall be made for the incidental portions of this work.

21. Pile cores shall be constructed at the bridge approach embankments in accordance with Kentucky Standard Drawings RGX-100 and RGX-105, meeting the material requirements of the current edition of Special Provision 69.

22. As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and backfilled with suitable subgrade material in accordance with Section 207 of the current Standard Specifications.

Approximate Station Limits

KY 338
99+00 to 124+07
370+20 to 371+50
388+50 to 392+00

EB KY 338
100+00 to 105+00
112+00 to 116+07

WB KY 338
205+00 to 216+22

SB I-71/I-75 AUX. ENTRANCE RAMP
419+04 to 443+50
475+00 to 506+18

I-75/I-71 Ramp A
87+60 to 97+00

I-75/I-71 Ramp B
255+50 to 265+40

I-75/I-71 Ramp C
304+50 to 313+50

I-75/I-71 Ramp D
400+00 to 410+50
415+50 to 416+00

US 25
5+84 to 22+90
27+60 to 30+80
34+00 to 77+00

Triple Crown Blvd
50+00 to 53+14

Paddock Drive
201+00 to 203+40

Best Pal Drive
24+25 to 28+25

Frogtown Connector
601+50 to 602+50

Old Lexington Road
9+50 to 11+50

Richwood Road
19+00 to 21+00

23. As directed by the Engineer, existing bituminous concrete at the following approximate locations that is positioned within the limits of new roadway embankments and positioned at a distance greater than three feet below proposed subgrade elevation, shall be scarified or broken until all cleavage planes are destroyed, or the pavement shall be removed entirely as conditions demand in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Subgrade materials remaining after removal of pavements may need to be stabilized prior to placement of new pavement sections, as directed by the Engineer.

Approximate Station Limits
US 25
30+80 to 34+00

24. The retaining walls at the following locations will affect the cut slope and embankment construction. For these areas, please refer to the structural plans for specific instructions for cut slope and embankment construction.

Approximate Station Limits

KY 338
Retaining Wall No. 1: 103+90 to 106+51.34, Left
Retaining Wall No. 1A: 107+91.78 to 108+25.45, Left
Retaining Wall No. 2: 113+80 to 114+70, Left

EB KY 338
Retaining Wall No. 14: 107+30 to 109+86, Left

WB KY 338
Retaining Wall No. 3: 201+13 to 202+74, Left
Retaining Wall No. 15: 207+80 to 209+45, Right

US 25
Retaining Wall No. 7: 42+00 to 46+69.89, Left
Retaining Wall No. 8: 49+51.06 to 55+25, Left
Retaining Wall No. 9: 42+25 to 46+68.87, Right
Retaining Wall No. 10: 49+53.69 to 54+25, Right

US 25 Ramp A / Ramp B
Retaining Wall No. 11: 13+49.80 to 17+14.09, Right

US 25 Ramp C
Retaining Wall No. 12: 30+80.02 to 31+60.23, Right

I-75/I-71
Retaining Wall No. 13: 489+85 to 490+25, Right

25. Embankment slopes at the following location will need to be flatter than a 2:1 (H:V) to maintain minimum factor of safety requirements for slope stability. The fill limitsand required sections show the flattened slopes and results of the stability analysis.

Approximate Station Limits	Steepest Allowable Slope
I-75/I-71: 434+80 to 436+20	2.5:1 (H:V)

26. All embankment construction using non-durable shale will be in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction, "Embankment Principally of Non-Durable Shale".

27. Some areas of the project may contain silts or sands at subgrade. Lime may not be effective in stabilizing these materials. If such soils are encountered cement should be more effective. The Stabilization Contractor shall adjust the stabilization techniques, as directed by the Engineer. Based on boring information, these soils may be encountered at the following locations. Geotechnical Branch personnel are available to assist in identifying these soil types and providing alternative treatment recommendations, if needed. The original lime stabilization bid items will be used for payment for any such changes.

Approximate Station Limits
RAMP B
260+50 to 265+40

OLD LEXINGTON PIKE
5+00 to 10+00

28. Soil borings were performed near the reinforced concrete pipe culverts (RCPs) at the following locations. See the Geotechnical Profile Sheets for rockline information.

Approximate Station Limits
EB KY 338
100+00
105+91

Triple Crown Blvd
51+00

DESIGNED BY:
DATE SUBMITTED:

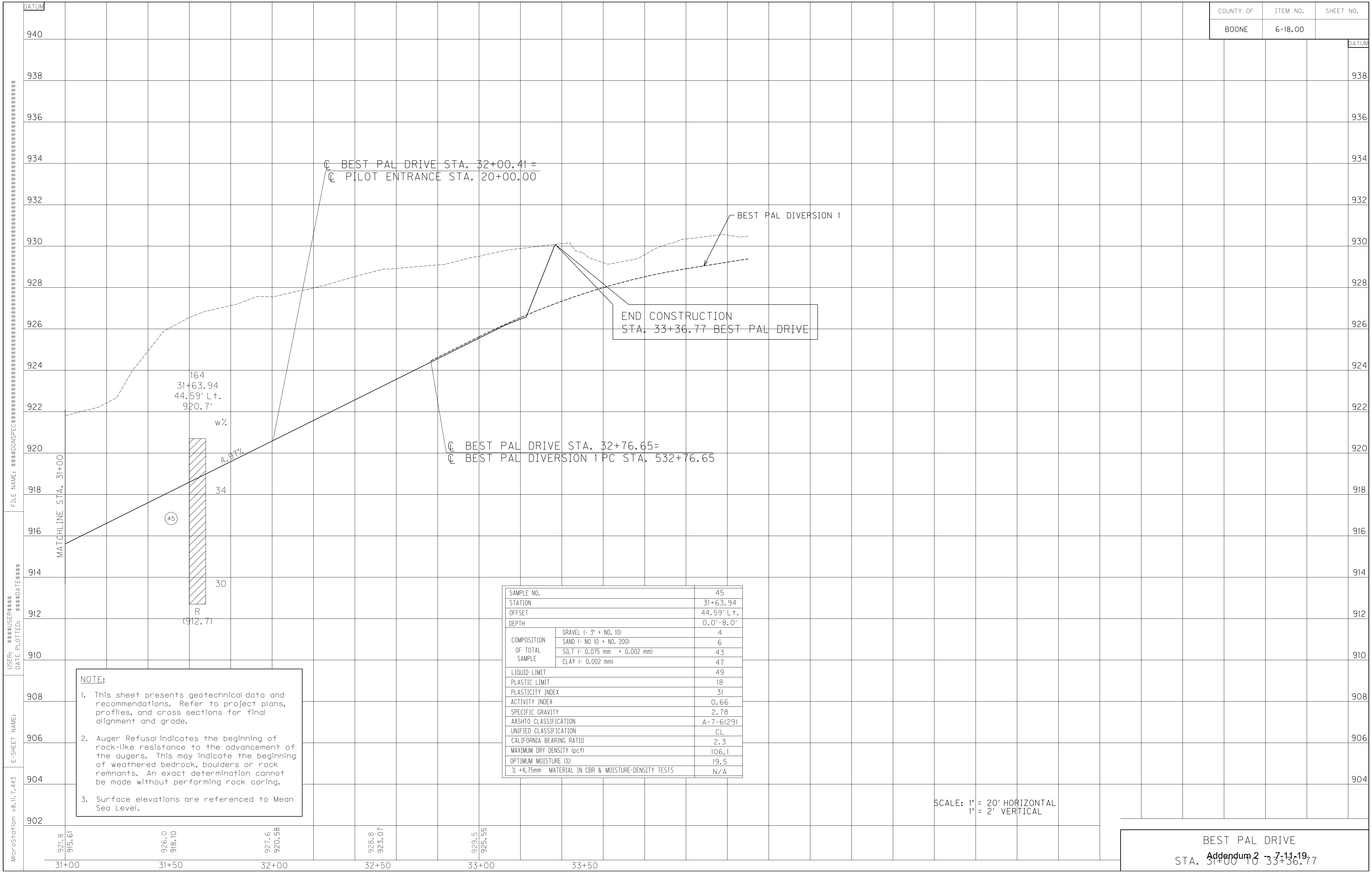
Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS: FD52 008 0075 175-176

GEOTECHNICAL NOTES

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		45
STATION		31+63.94
OFFSET		44.59' Lt.
DEPTH		0.0'-8.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	43
	CLAY (- 0.002 mm)	47
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.66
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(29)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.3
MAXIMUM DRY DENSITY (pcf)		106.1
OPTIMUM MOISTURE (%)		19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

BEST PAL DRIVE
STA. 31+00 TO 33+36.77

Addendum 2 -- 7-11-19

COORDINATE DATA SUBMISSION FORM

KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date 4/2/2019

(revised 5-7-19 for Hole #164)

Road Number I-71/75 Richwood

Survey Crew / Consultant

Contact Person

Item #

Mars #

Project #

Notes: Updated Stations/Offsets for Best Pal Road realignment.

(circle one)

Elevation Datum [✓ NAVD88] Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	OLD STATION	OLD OFFSET	ELEVATION (ft)	NEW STATION	NEW OFFSET
18	38.917891736N	84.625250001W	18	21+00	60 R	928.158	21+02.28	59.38 R
158	38.917747684N	84.625292161W	158	20+50	40 R	928.641	20+50.26	38.75 R
159	38.918304938N	84.625361262W	159	22+50	52 R	917.811	22+49.08	51.42 R
160	38.918593836N	84.626075491W	160	24+50	33 L	905.203	24+50.95	31.88 L
161	38.919155505N	84.626281244W	161	26+50	17 R	902.655	26+52.30	17.00 R
162	38.919676840N	84.626539425W	162	28+50	17 R	913.989	28+55.76	3.61 L
163	38.920067555N	84.626543319W	163	30+50	17 R	910.055	29+78.57	43.75 L
164	38.920402534N	84.625986324W	164	32+50	17 R	920.734	31+63.94	44.59 L

Appendix H4 -- KY 338 (Item No. 6-18) Geotechnical Reports (Structures)

For Reference Only

6-18 Geotechnical Reports for Roadway + Structures Summary

Last Update: 6-7-19, v.3

Structure Type	Number	Structure	Alignment	Begin	End	Length	Offset	Average Height Approx.	Wall Type	Structure Number	Report Date	Company	Page #
Bridges	1	US25 over KY 338 Bridge over - SPUI	US 25	46+66.40	49+71.84	305				S-065-2018	01-02-19	HDR	
	2	Norfolk Southern Railway Bridge over KY 338	Rail	19+73.82	20+96.82	123				S-066-2018	12-04-18	HDR	
		Addendum								SA-002-2019	04-03-19	HDR	
Box Culverts / Culverts	1	4' x 4' RCBC Extension	US 25	32+06.40	NA					S-080-2018	11-21-18	HDR	R77
	2	8' x 5' RCBC Extension at Outlet	I-75 / I-71	435+53.90	NA					S-081-2018	11-21-18	HDR	R29
	3	72" Pipe Culvert Extension	Triple Crown Blvd.	119+45	EB 106+45~					RA-002-2019		Parsons	R113
Retaining Walls	1	Retaining Wall #1, KY 338 at Triple Crown Blvd	KY 338	103+88	106+60	225	LT	9	Gravity	S-074-2018	12-12-18	Parsons	R3A, R5
		Addendum: Wall 1								SA-003-2019	03-15-19		
		Addendum: Wall 1A								S-045-2019	03-20-19		
	2	Retaining Wall #2	KY 338	113+80	114+70	150	LT	6	Gravity	Std. Dwg.	N/A		R7, R9
	3	Retaining Wall #3, I-75/I-71 Ramp A to WB KY 338	WB KY 338	201+14	202+77	160	LT	10	Gravity	S-075-2018	03-20-19	Parsons	R13
	4	~~Retaining Wall #4, Best Pal Drive~~	~~Best Pal Drive~~	~~23+00~~	~~25+10~~	~~238~~	~~RT~~		~~Gravity~~	~~S-078-2018~~	~~12-26-18~~	~~HDR~~	~~R123~~
	5	~~Retaining Wall #5, Best Pal Drive~~	~~Best Pal Drive~~	~~27+18~~	~~27+86~~		~~RT~~		~~Gravity~~	~~eliminated?~~		~~HDR~~	~~R125~~
	7	Retaining Wall #7, KY 338 to SB US 25 Ramp G	US 25	42+00	46+75	475	LT	12	MSE wall	S-067-2018	01-07-19	HDR	R81, R83
	8	Retaining Wall #8, SB US 25 to KY 338 Ramp E	US 25	49+55	55+50	595	LT	12	MSE wall	S-070-2018	01-09-19	HDR	R83, R85
	9	Retaining Wall #9, NB US 25 to KY 338 Ramp A	US 25	41+50	46+70	520	RT	12	MSE wall	S-068-2018	01-09-19	HDR	R81, R83
	10	Retaining Wall #10, KY 338 to NB US 25 Ramp C	US 25	49+55	55+25	570	RT	12	MSE wall	S-071-2018	01-09-19	HDR	R83, R85
	11	Retaining Wall #11, US 25 North to KY 338 East	Ramp A	13+45	17+60	405	RT	10	Non-MSE	S-069-2018	12-11-19	HDR	R95, R97
	12	Retaining Wall #12, NS Bridge Wingwall on Ramp C	Ramp C	30+46	31+50	700	RT	10	Non-MSE	S-072-2018	12-11-18	HDR	R99
	13	Retaining Wall #13	I-75 / I-71	489+85	490+25	40	RT	5	Gravity	Std. Dwg.	N/A		R35, R37
	14	Retaining Wall #14, EB KY 338 under I-75/I-71	EB KY 338	107+85	109+58	165	LT	13	Soil-nail	S-077-2018	03-26-18	Parsons	R15
		Addendum							Soil-nail	SA-008-2019	04-15-19	Parsons	R15
	15	Retaining Wall #15, WB KY 338 under I-75/I-71	WB KY 338	207+80	209+45	175	RT	13	Soil-nail	S-076-2018	01-10-19	Parsons	R15
Noise Wall	1	Sound Wall Along I-75/I-71	I-75 / I-71	421+50	442+50	2100		14		S-073-2018	01-09-19	Parsons	R27, R29
Roadway Reports	**Number**	**Facility (ies) / Report Contents**	**Alignment**	**Begin**	**End**	**Length**	**Offset**	**Average Height**	**Wall Type**	**Report Number**	**Report Date**	**Company**	**Page #**
Roadway Report	N/A	KY 338, US 25, I-75	KY 338 US 25 I-75 I-75 Mile Points	99+00 5+84 419+04 175.217	392+44 77+00 506+18 175.622		N/A	N/A	N/A	R-049-2015	10-26-16		Overall Plans
Addendum	N/A	Norfolk Southern Rail Track Improvements (non-structural)	NS Track				N/A	N/A	N/A	RA-010-2018	03-27-19		
Roadway Addendum	N/A	Best Pal, Pilot "East" Entrance, Changes to Retaining Walls, Pipes > 54", Lightweight fill requirements for (2) box culverts, Geotechnical Notes & Special Notes					N/A	N/A	N/A	RA-002-2019	04-04-19		
Roadway Addendum	N/A	Geotechnical Note 7.24 for Retaining Walls, added soil profile for Best Pal Dr.					N/A	N/A	N/A	RA-004-2019	05-09-19		

MEMORANDUM **S-065-2018**

TO: Bart Asher, P.E.
Director
Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM
Geotechnical Branch

BY: Clayton S. Cook, P.E.
Geotechnical Branch

DATE: January 2, 2019

cc: J. Van Zee
C. Van Zee
M. Bezold (D-6)
R. Franxman (D-6)
E. Drury
R. Turner
B. Yeager
C. Callan-Ramler (D-6)
W. Hagerman (HDR)
K. Meyer (HDR)
K. Chism (Parsons)

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton;
US 25 Bridge Over KY 338 SPUI, 3 Span (86’, 131’, 71’), KY 338 Sta. 46+66.40
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed structure is planned to be either a three span bridge or single span bridge with the two middle piers removed. During development of this report the layout for the single span option had not been completed so the three span option was investigated and options given for the two middle piers of the three span option. The proposed bridge will be part of a Single Point Urban Interchange (SPUI) between US 25 and KY 338. The bridge will be carrying US 25 traffic over KY 338. Retaining walls will be connecting into each abutment as part of the overall interchange configuration. See geotechnical reports S-067-2018, S-068-2018, S-070-2018, and S-071-2018 for details on the MSE walls that will be adjacent to the two end bents of the bridge.

2.0 SITE GEOLOGIC CONDITIONS

The structure is located in the Union Quadrangle (GQ-779). The geologic mapping indicated that the bedrock in this location is part of the Bull Fork Formation. This formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

3.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of 11 sample and core holes were drilled for this structure. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples. Also, a three point consolidated undrained (CU) triaxial testing set was performed by HDR on samples extruded by the Branch's soil lab.

4.0 SUBSURFACE CONDITIONS

The soil encountered at the site included mostly lean clay with minor amounts of fat clay. The soil samples were designated as CL, CH, GC, and SC by the USCS, and A-7-6, A-6, and A-2-6. A large amount of limestone float rock was present in the overburden soil which resulted in high standard penetration testing (SPT) blow counts in areas that were above the start of bedrock. Soil CU triaxial testing was conducted on the lean clay and yielded an effective soil parameters of ϕ' = 14° and c' = 835 psf.

Top of weathered rock elevations ranged from 917.9 ft. to 909.3 ft. The bedrock layers at the structure location consisted of interbedded dark gray shale with limestone. Shale percentages were 85% to 58%, with the rest limestone, in the upper elevations which transitioned to 70% to 65% limestone in the 896 ft. to 886 ft. elevation range. The core recovered percentages were generally in the 90's, but the KY Rock Quality Designation (RQD) values ranged from 0 to 37. The SDI testing indicated that interbedded shale and limestone bedrock was non-durable. 27 rock unconfined tests were conducted with an average unconfined compressive strength of 916 psi.

5.0 ENGINEERING ANALYSIS & FOUNDATION RECOMMENDATIONS

5.1 **End Bent 1 & 2** - Use end bearing steel **H-Piles foundations** bearing on bedrock. Retaining Walls 7 and 9, S-067-2018 and S-068-2018 respectively, will be adjacent to End Bent #1 of the US 25 Bridge Spanning KY 338. Retaining Walls 8 and 10, S-070-2018 and S-071-2018 respectively, will be adjacent to End Bent #2. Retaining walls will be wrapping under the and in front of the end bent locations. H-Piles will need to be placed in pre-drilled holes, backfilled with sand or pea gravel, and then seated before the beginning of the MSE wall construction and corresponding backfill operations are started. As the internal backfill is being placed within the reinforced zone of the MSE Wall, the H-Piles shall be isolated from the internal backfill by installing cans as the wall is constructed. H-piles cannot be driven or drilled through the MSE reinforced zone. The annular space between the cans and the H-piles must be filled with sand or pea-gravel.

Pre-drilling will be required for installation of the piling and to insure their vertical placement. 24-inch diameter holes shall be drilled to a depth that ensure adequate lateral stability of the H-piles during construction of the MSE Wall. The holes shall be backfilled with sand or pea gravel once the pile is in place. Piles shall then be driven to refusal. Include the cost of all materials, labor and equipment needed for pre-dilling, backfilling the holes and driving the piles to refusal in the price per linear foot for "Pre-drilling for Piles".

A resistance factor (ϕ_c) of 0.5 is recommended to determine the maximum nominal resistance of the pile.

5.2 **Pier 1 & 2** – Use **spread footings** on competent unweathered bedrock. The estimated base of footing elevation is 887 feet. The spread footing shall be embedded a minimum of 2.0 feet into competent unweathered bedrock. Footings may be raised if competent unweathered bedrock is encountered at a higher elevation. (A minimum 2.0 feet of embedment must still be attained.) Size the footings at the service limit state using a presumptive factored bearing resistance of 16 ksf. Contact this branch for a more detailed analysis of the nominal bearing resistance if the strength or extreme limit states control the footing design.

5.3 **Embankment Analysis** – Settlement is not expected to be a concern since the structure will be bearing on bedrock**.** Horizontal stresses induced on the MSE wall by the H-Piles must be accounted for in the wall design. The information in regards to lateral pressure distribution from deep foundations on the face of the MSE Walls can be found in FHWA manual NHI-10-024 Volume 1, Chapter 6, Section 6.1.2.

Embankment stability at the end bent locations was not needed since the structure will be bearing on bedrock.

5.4 **Pile Driving** – A wave equation analysis was performed for this location. Based on this analyses it will be possible to set 12" or 14" H-piles to bedrock and practical refusal without encountering excessive blow counts or damaging the pile. The contractor shall submit the proposed pile driving system to the Department for approval prior to the installation of the first pile. Approval of the pile driving system by the Engineer will be subject to satisfactory field performance of the pile driving procedures. A hammer with a rated energy between **20** and **27** kip-ft will be required to drive the H-piles to practical refusal without encountering excessive blows counts or damaging the piles.

5.5 **MSE Walls** – Proposed MSE walls will be constructed that are adjacent to the proposed bridge end bents. Information in regard to recommendations to these MSE walls can be found in geotechnical reports S-067-2018, S-068-2018, S-070-2018, and S-071-2018.

6.0 PLAN NOTES

Add the following plan notes at the appropriate locations in the plans.

6.1 HAMMER CRITERIA: For H-piles, a hammer with a rated energy between 20 to 27 kip-ft will be required to drive the H-piles at End 1 and 2 to practical refusal without encountering excessive blow counts or damaging the piles. The contractor shall submit the proposed pile driving system to the Department for approval prior to the installation of the first pile. Approval of the pile system by the Engineer will be subject to satisfactory field performance of the pile driving procedure.

6.2 PRACTICAL REFUSAL: Drive bearing piles to practical refusal. For this project minimum blow requirements reached after total penetration becomes ½ inch or less for 10 consecutive blows, practical refusal is obtained after the pile is struck an additional 10 blows with total penetration of ½ inch or less. Immediately cease driving operations if the pile visibly yields or becomes damaged during driving. Drive additional production and test piles if directed by the Engineer.

6.3 Drive H-piles to refusal before beginning MSE Wall construction and corresponding backfill operations. As the internal back fill is being placed within the reinforced zone of the MSE wall, the H-piles shall be isolated from the internal backfill by using cans as the wall is constructed. H-piles cannot be driven or drilled through the MSE reinforced zone. The annular space between the cans and the H-piles must be filled with sand or pea-gravel.

6.4 Pre-drilling is necessary for pile installation, holes shall be drilled to elevation ###* for End Bent #1 and elevation ###* for End Bent #2. The holes shall be backfilled with sand or pea gravel once the pile is in place. A temporary casing may be required to prevent collapse of the hole. If used, the casing shall be removed, as the hole is being backfilled. Piles shall then be driven to refusal. Include the cost of all materials, labor and equipment needed to pre-drill, backfill the holes and drive the piles to refusal in the price per linear foot for "Pre-drilled for Piles".

* These elevations for Pre-drilled depths should be deep enough to ensure adequate lateral stability of the H-piles during construction of the MSE Wall.

6.5 Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

6.6 Solid rock excavation will be required for installation of this structures spread footings and wall.

6.7 If bedrock becomes softened at bearing elevation, the softened material should be undercut to unweathered material prior to placing the concrete. Seasonal groundwater fluctuations may cause groundwater infiltration into footing excavation, and a dewatering method may be necessary.

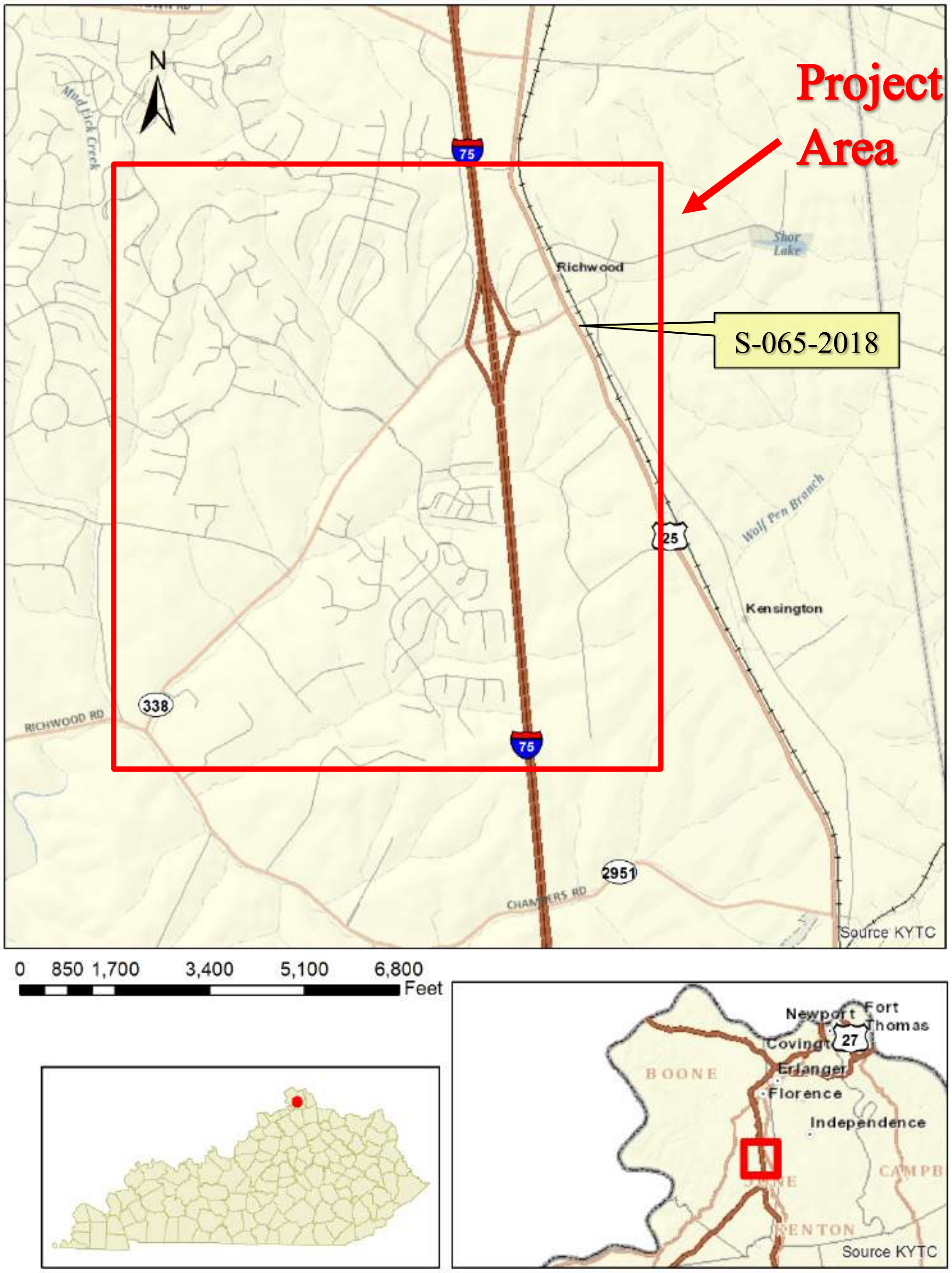
The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

If the single span bridge option is used the attached Subsurface sheets should be updated with the updated single span bridge configuration.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Coordinate Data Sheet**
- **S-065-2018 Rock Unconfined Data**
- **Bridge Profile Sheet**

Project Location Map



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FILE NAME: $$$$designfile$specification$$$$

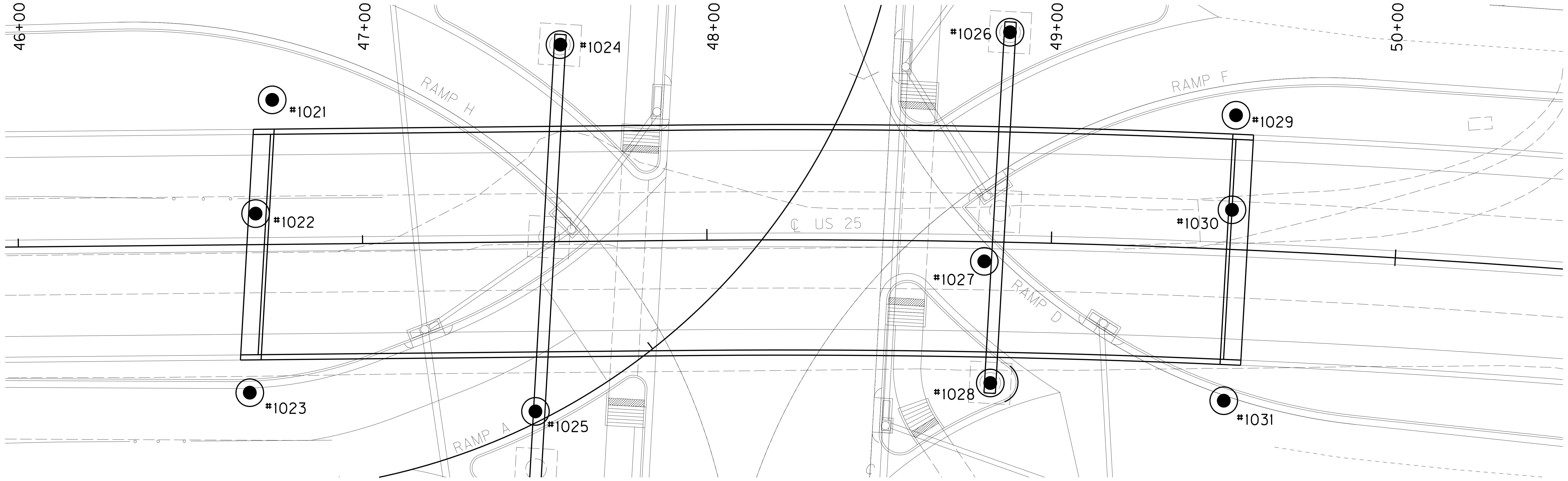
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

END BENT ONE

US 25 APPROXIMATE ROADWAY GRADE ELEV. = 927.50

Hole No.	1021	1022	1023
Station	46+74.15	46+69.00	46+66.80
Offset	42.00 ft. Lt.	9.00 ft. Lt.	43.00 ft. Rt.
Elev. (NAVD 88 datum)	927.00	926.00	926.90

1021

Shale:(68%) dark gray, silty, calcareous, interbedded w/Limestone (32%) light gray, medium & coarse grained, mostly even bedded, fossiliferous

Limestone:(65%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (35%) as laminations & partings

Top of rock elev.= 913.50
Base of weathered rock elev.= 912.70

1022

Cored Overburden: residular clay w/Limestone fragments

Shale:(75%) dark gray, silty, calcareous, interbedded w/Limestone (25%) light gray, medium & coarse grained, mostly even bedded, fossiliferous

Limestone:(70%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (30%) as laminations & partings

Top of rock elev.= 913.20
Base of weathered rock elev.= 912.90

1023

Shale:(65%) dark gray, silty, calcareous, interbedded w/Limestone (35%) light gray, medium & coarse grained, even bedded, fossiliferous

Limestone:(70%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (30%) as laminations & partings

Top of rock elev.= 913.40
Base of weathered rock elev.= 912.70

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE: **US 25**
CROSSING: **Bridge over KY 338**

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO. **00000**

S–065–18

ITEM NUMBER

6–18.00

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$$specification$$$$

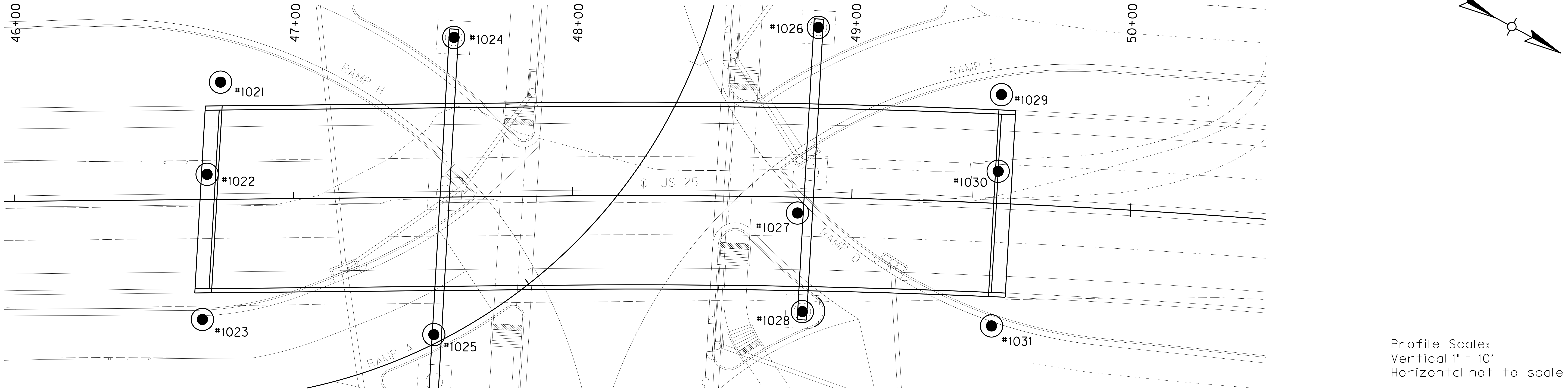
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.
Station
Offset
Elev.
(NAVD 88 datum)

1024
47+58.00
57.20 ft. Lt.
929.50

QU (psi)	D_{50} (mm)	w%	LI	
	0.455	16	-0.06	A-6(2),SC,S+C=41(25+16)
	0.007	22	-0.01	N=68/0.8, A-7-6(15),CL,S+C=80(45+35)
	0.044	7	-0.89	A-4(3),CL,S+C=56(39+17)
	0.018	15	-0.32	N=50/0.5, A-6(10),CL,S+C=65(37+28)

QU (psi)	KYRQD	REC	
174	0	100	53(2)
	0	93	SDI(JS) 88(4)
360	0	97	
	0	100	62(2)

Shale:(77%) dark gray, silty & clayey calcareous, interbedded w/Limestone (23%) light gray, medium & coarse grained, even bedded, fossiliferous

Top of rock elev.= 920.00
Base of weathered rock elev.= 919.00

1025
17+61.40
3.00 ft. Lt.
928.10

QU (psi)	D_{50} (mm)	w%	LI	
	0.003	32	0.32	A-7-6(24),CH,S+C=79(32+47)
	0.006	13	-0.33	A-6(15),CL,S+C=87(52+35)
	0.010	9	-0.58	N=47, A-6(10),CL,S+C=74(44+30)

QU (psi)	KYRQD	REC	
	0	71	88(4)
	0	66	SDI(JS) 62(2)
199	11	100	

Cored Overburden: residual stiff clay w/limestone fragments
Shale: brown, clayey, weathered, limestone partings
Shale:(75%) dark gray, silty & clayey calcareous, interbedded w/Limestone (25%) light gray, medium & coarse grained, even bedded, fossiliferous

Top of rock elev.= 916.80
Base of weathered rock elev.= 913.10

The Presumptive Factored Bearing Resistance at the Service Limit State is 16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE:	25-OCTOBER-2018	CHECKED BY
DESIGNED BY:		
DETAILED BY:	E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Bridge over KY 338

SUBSURFACE DATA

S–065–18

ITEM NUMBER

6–18.00

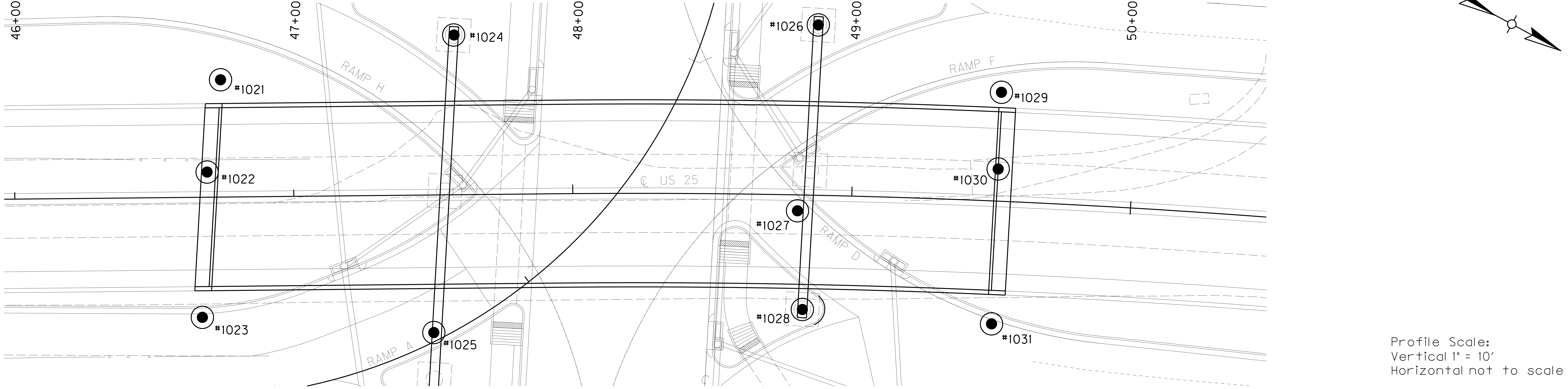
PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SUBSURFACE DATA



Hole No.
Station
Offset
Elev.
(NAVD 88 datum)

1026
48+86.70
61.00 ft. Lt.
929.90

QU (psi)	D_{50} (mm)	w%	LI	
	0.005	15	-0.34	A-7-6(19),CL,S+C=88(50+38)
	0.002	36	0.40	A-7-6(31),CH,S+C=91(39+52)

	KYRQD	REC	SDI(JS)
	13	90	57(2)
957	0	100	
	10	100	5(1)

Shale:(85%) dark gray, silty & clayey calcareous, interbedded w/Limestone (15%) light gray, medium & coarse grained, even bedded, fossiliferous

Top of rock elev.= 917.90
Base of weathered rock elev.= 917.30

1027
48+80.65
5.70 ft. Lt.
927.90

QU (psi)	D_{50} (mm)	w%	LI	
	0.009	19	-0.20	A-6(14),CL,S+C=81(53+28)
	0.002	17	-0.18	A-7-6(22),CL,S+C=89(40+49)
	0.010	13	-0.42	N=39, A-6(14),CL,S+C=76(46+30)

	KYRQD	REC	SDI(JS)
	0	97	48(2)
349	0	97	11(1)
	0	94	

Shale:(78%) dark gray, silty & clayey calcareous, interbedded w/Limestone (22%) light gray, medium & coarse grained, even bedded, fossiliferous

Top of rock elev.= 916.40
Base of weathered rock elev.= 915.50

1028
48+83.10
41.00 ft. Rt.
927.80

QU (psi)	D_{50} (mm)	w%	LI	
	0.006	26	0.24	A-6(17),CL,S+C=92(61+31)
	0.004	26	0.16	A-7-6(23),CL,S+C=89(49+40)
	0.009	26	0.55	A-6(10),CL,S+C=82(54+28)
	0.017	30	0.65	N=63/0.6, A-6(8),CL,S+C=66(39+27)
				N=50/0.1

	KYRQD	REC	SDI(JS)
	10	91	74(3)
577	13	100	
	0	87	60(2)

Shale:(58%) dark gray, silty & clayey calcareous, interbedded w/Limestone (42%) light gray, medium & coarse grained, even bedded, fossiliferous

Top of rock elev.= 909.30
Base of weathered rock elev.= 908.90

The Presumptive Factored Bearing Resistance at the Service Limit State is 16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Bridge over KY 338

SUBSURFACE DATA

S–065–18

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

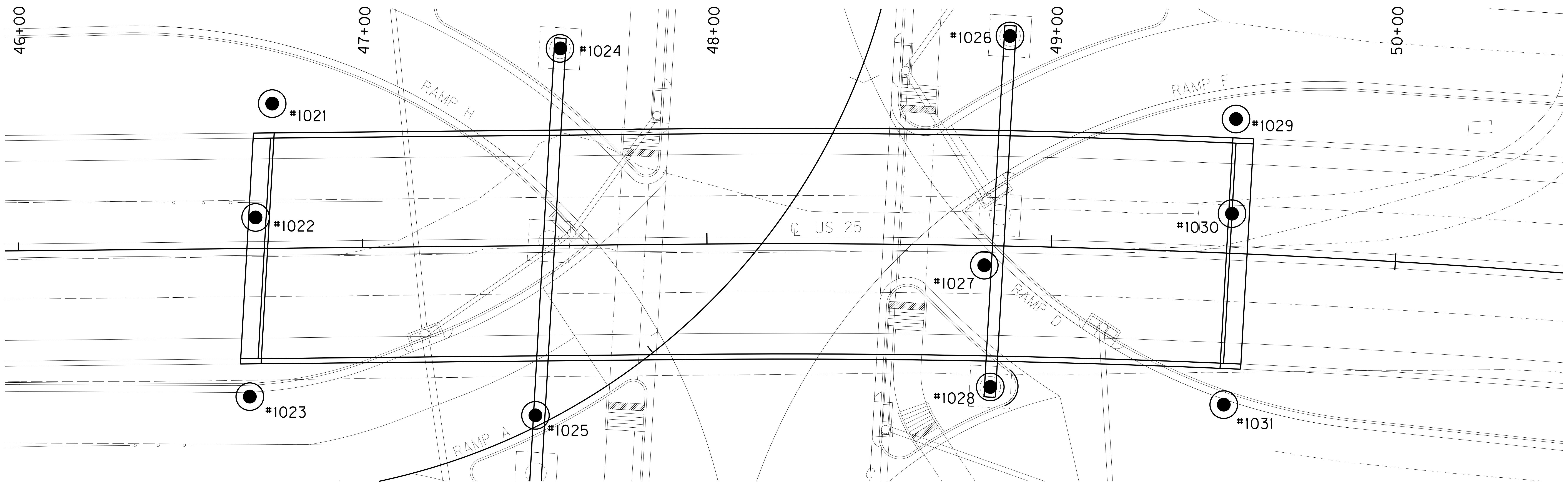
DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:
FILE NAME: $$$$design$file$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

END BENT TWO

US 25 APPROXIMATE ROADWAY GRADE ELEV. = 930.00

Hole No.	1029	1030	1031
Station	49+52.00	49+52.00	49+52.00
Offset	39.00 ft. Lt.	11.50 ft. Lt.	44.00 ft. Rt.
Elev. (NAVD 88 datum)	928.40	927.70	927.00

Hole 1029

QU (psi)	D50 (mm)	w%	LI	
	0.006	15	-0.43	A-6(16),CL,S+C=94(63+31)
	0.013	18	-0.21	A-6(10),CL,S+C=67(34+33)
	1.236	6	-0.84	N=65/0.9, A-2-6(1),GC,S+C=35(22+13)

QU (psi)	KYRQD	REC	
			SDI(JS)
	0	69	85(5)
1043	0	100	
	11	100	38(2)
	14	100	66(2)
	0	100	13(2)
598	10	100	
	0	97	85(4)
1413	13	100	84(4)
	20	100	
857	31	100	70(3)
	63	100	

Shale:(75%) dark gray, silty, calcareous, interbedded w/Limestone (25%) light gray, medium & coarse grained, even bedded, fossiliferous

Limestone:(65%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (35%) as laminations & partings

Top of rock elev.= 914.80
Base of weathered rock elev.= 914.00

Hole 1030

Qu (psf)	D50 (mm)	w%	LI	
2342	0.011	25	0.30	A-4(7),CL,S+C=88(71+17)
2313	0.005	24	0.09	A-6(16),CL,S+C=85(48+37)
	0.010	7	-0.97	N=50/0.2, A-6(8),CL,S+C=80(55+25)

QU (psi)	KYRQD	REC	
	0	97	83(4)
	0	100	SDI(JS)
	0	91	74(4)
	10	94	56(1)
747	11	100	91(3)
	0	100	
718	0	100	88(4)
3387	24	97	79(5)
	11	100	
	0	100	82(5)

Shale:(75%) dark gray, silty, calcareous, interbedded w/Limestone (25%) light gray, medium & coarse grained, even bedded, fossiliferous

Limestone:(65%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (35%) as laminations & partings

Top of rock elev.= 914.10
No weathered rock

Hole 1031

QU (psi)	D50 (mm)	w%	LI	
	0.003	18	-0.24	A-7-6(24),CL,S+C=88(42+46)
	0.016	28	0.21	N=7, A-7-6(15),CL,S+C=63(31+32)
	0.011	22	0.03	A-7-6(15),CL,S+C=69(36+33)
	0.009	20	-0.04	N=22, A-7-6(17),CL,S+C=73(40+33)
	0.010	12	-0.24	A-6(9),CL,S+C=74(42+31)
				N=50/0.1

QU (psi)	KYRQD	REC	
			59(2)
	0	91	SDI(JS)
	0	100	45(2)
	0	97	72(2)
	0	94	
	0	97	73(4)
	0	100	76(4)
584 719	0	97	
	0	100	93(5)
	0	100	68(3)
	0	100	

Shale:(75%) dark gray, silty, calcareous, interbedded w/Limestone (25%) light gray, medium & coarse grained, even bedded, fossiliferous

Limestone:(65%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (35%) as laminations & partings

Top of rock elev.= 914.00
Base of weathered rock elev.= 913.10

SHEET LOCATION:
FILE NAME: $$$$design$file$$specification$$$$
USERNAME: $$$USER$$$$
DATE: $$$DATE$$$$
E-SHEET NAME:

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
US 25	Bridge over KY 338

S–065–18

ITEM NUMBER
6–18.00

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-065-2018

Notes:

(circle one)

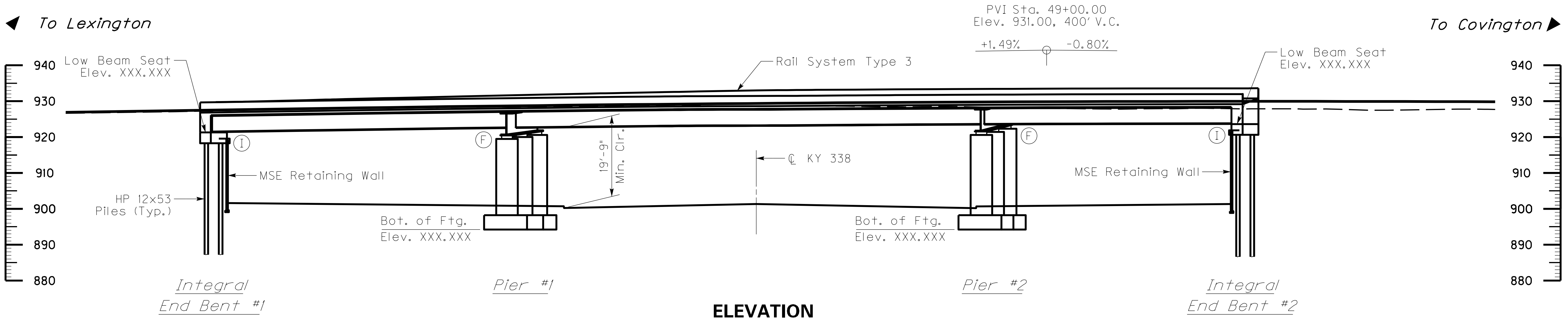
Elevation Datum **(NAVD88)** **Assumed**

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-065-2018						
1021	38.91793703	-84.62380630	1021	US 25 46+74.15	42' Lt.	926.96
1022	38.91796730	-84.62369550	1022	US 25 46+69	9' Lt.	925.98
1023	38.91802932	-84.62353072	1023	US 25 46+66.8	43' Rt.	926.87
1024	38.91812033	-84.62399240	1024	US 25 47+58	57.2' Lt.	930.82
1025	38.91823843	-84.62364959	1025	US 25 Ramp A 17+61.4	3.0' Lt.	927.64
1026	38.91843343	-84.62421606	1026	US 25 48+86.7	61' Lt.	929.90
1027	38.91848589	-84.62403258	1027	US 25 48+80.65	5.7' Lt.	927.82
1028	38.91854905	-84.62388933	1028	US 25 48+83.1	41' Rt.	927.33
1029	38.91862384	-84.62424774	1029	US 25 49+52	39' Lt.	928.41
1030	38.91865588	-84.62416023	1030	US 25 49+52	11.5' Lt.	927.70
1031	38.91872056	-84.62398363	1031	US 25 49+52	44' Rt.	927.01

Boone Co., Item No. 6-18.00
S-065-2018 Rock Testing Summary

Hole No.	Sample No.	Top Depth (ft)	Bottom Depth (ft)	Unconfined Compressive Strength (psi)	E (psi)	visual desc.
1021	1	14.9	15.5	345	8148	shale
1021	2	25.2	25.8	636	32620	mix
1021	3	36.2	36.6	917	69764	mix
1021	4	42	42.8	1194	115852	mix
1022	1	25.6	26.0	779	34919	shale
1022	2	32.6	33.1	330	25567	mix
1022	3	37.5	38.1	416	30536	mix
1022	4	45.8	46.5	967	105862	mix
1023	1	20.0	20.5	247	11233	shale
1023	2	23.3	24.0	3999	1098415	limestone
1023	3	28.4	29.1	1709	96016	shale
1023	4	40.2	40.7	521	48046	mix
1024	1	10.9	11.5	174	10248	mix
1024	2	18.8	19.4	360	10321	shale
1025	1	18.8	19.4	199	9895	mix
1026	1	16.2	16.9	957	68437	shale
1027	1	16.8	17.4	349	16478	mix
1028	1	21.3	21.7	577	12230	shale
1029	1	17.3	17.9	1043	76183	mix
1029	2	31	31.6	598	23980	shale
1029	3	38.9	39.5	1413	67025	shale
1029	4	45	45.5	857	101329	mix
1030	1	29.3	30.2	747	41013	mix
1030	2	35.3	35.9	718	31609	mix
1030	3	40.3	40.9	3387	919108	limestone
1031	1	36.2	36.7	584	28534	shale
1031	2	38.4	38.9	719	23764	shale

Total Data Points =	27	
Median Rock Unconfined =	718	psi
Mean Rock Unconfinned =	916	psi
Standard Deviation =	868	psi
Variance =	753237	psi
Mean -2 Standard Deviations =	2652	psi
Mean +2 Standard Deviations =	-819	psi
Used Data Points =	27	
Mean Youngs Modulus =	115449	psi



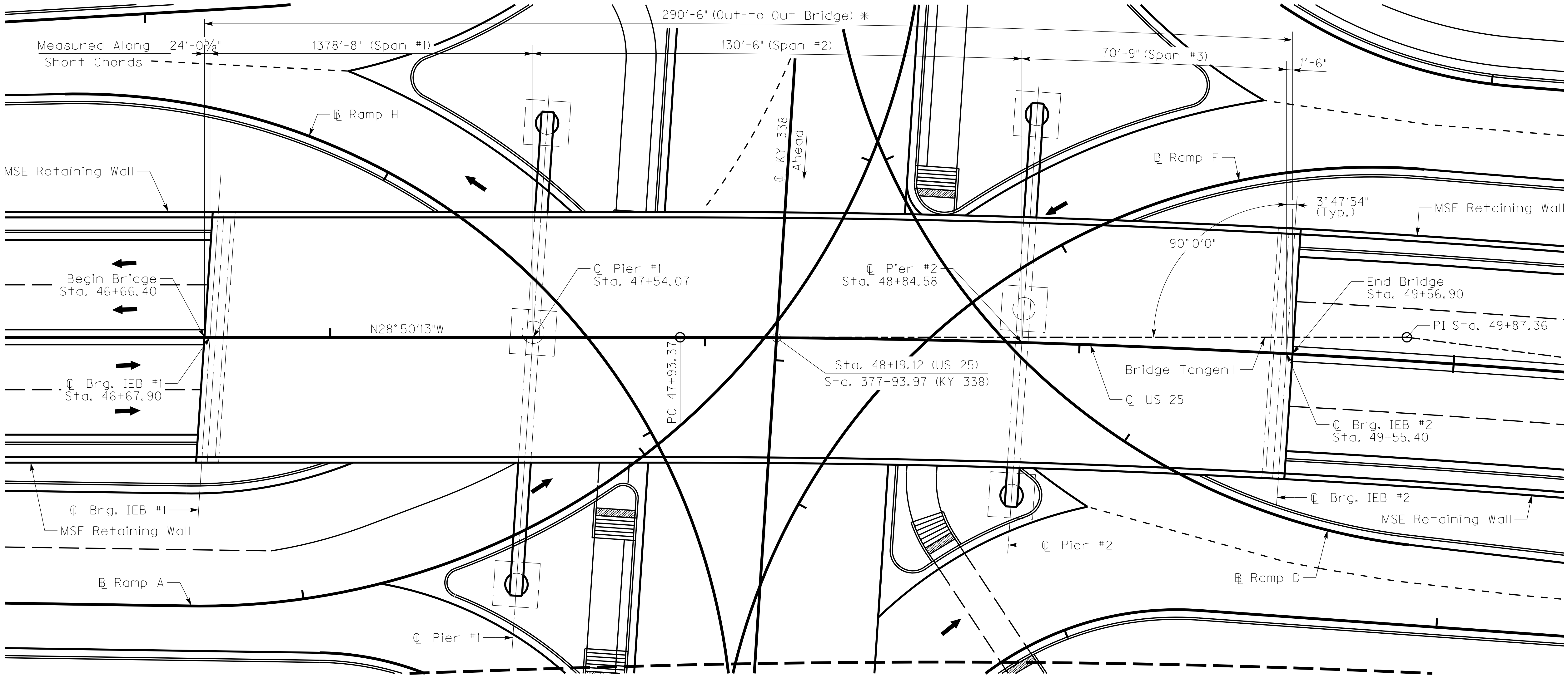
Ⓘ Integral

Ⓕ Fixed

ELEVATION

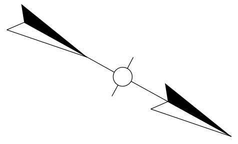
86'-2"x130'-6"x70'-9" WSPG ~ 3 Simple Spans

KY HL-93 Live Load ~ 3°47'54" Skew ~ 64'-0" Bridge Roadway Width



PLAN

∗ Measured Along ℄ US 25



US 25 HORIZONTAL CURVE DATA
PI 49+87.36
D = 07°23'58" Rt.
C = 1°54'35"
T = 193.99'
L = 387.44'
R = 3000.00'
E = 6.27'
e = 2.39%
Runoff = 81'
Runout = 67.78'

REVISION	DATE

DATE: June 2018	CHECKED BY
DESIGNED BY: W. Hagerman	L. Miller
DETAILED BY: J. Perry	L. Miller

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
US 25	KY 338

LAYOUT

PREPARED BY
HDR

Addendum 2 -- 7-11-19

SHEET NO.

DRAWING NO.

ITEM NUMBER

6-18.00

FILE NAME: N:\GEOTECH\2018-06-18 HDR FTP SITE\BRIDGES\US25_BRIDGE_PLAN AND PROFILE.DGN

USER: JGUINN
DATE PLOTTED: May 30, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

MEMORANDUM **S-066-2018**

TO: Bart Asher, P.E.
Director
Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM
Geotechnical Branch

BY: Clayton S. Cook, P.E.
Geotechnical Branch

DATE: December 4, 2018

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton
Norfolk Southern Railway Bridge Over KY 338
Single Span (123’), NSRR Sta. 19+73.82
Geotechnical Engineering Structure Foundation Report

cc: J. Van Zee
M. Bezold (D-6)
R. Franxman (D-6)
E. Drury
R. Turner
B. Yeager
C. Callan-Ramler (D-6)
W. Hagerman (HDR)
K. Meyer (HDR)

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed structure will be a single span bridge that will carry Norfolk Southern Railway traffic over KY 338. KY 338 will be lowered at this location in order to eliminate the existing at grade railroad crossing. Two proposed retaining walls will be connecting to the bridge from the west side. These are retaining wall number 11, US 25 north to KY 338 east, and retaining wall number 12, Norfolk Southern bridge wingwall on ramp C. See reports S-069-2018 and S-072-2018 for additional information on those structures.

2.0 SITE GEOLOGIC CONDITIONS

The structure is located in the Independence Quadrangle (GQ-785). The geologic mapping indicated that the bedrock in this location is part of the Bull Fork Formation. This formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

3.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of 6 sample and core holes were drilled for this structure. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples. Also, a two point consolidated undrained (CU) triaxial testing set was performed by HDR on samples extruded by the Branch's soil lab.

4.0 SUBSURFACE CONDITIONS

The soil encountered at the site included mostly lean clay with minor amounts of fat clay. The soil samples were designated as CL, CH, GC, ML and SC by the USCS, and A-7-6, A-6, and A-7-5 . A large amount of limestone float rock was present in the overburden soil which resulted in high standard penetration testing (SPT) blow counts in areas that were above the start of bedrock.

Soil strength testing included one CU Triaxial testing set and unconfined compression testing. Soil CU triaxial testing was conducted from lean clay samples in holes 1055 and 1056 and yielded effective soil parameters of ϕ' = 26° and c' = 374 psf. Three unconfined compression tests were conducted from holes 1051, 1052, and 1053 which resulted in unconfined values ranging from 1061 psf to 3751 psf.

Top of weathered rock elevations ranged from 900.6 to 911.5 ft. The bedrock layers at the structure location consisted of interbedded dark grey shale with limestone, with increasing percentages of limestone with increasing depth. There were 62% to 73% percent shale, with the rest limestone, in the upper elevations which transitioned to 65% limestone percentages in the 898 ft. to 890 ft. elevation range. The core recovered percentages were generally in the 90's, but the KY Rock Quality Designation (RQD) values ranged from 0 to 50. The SDI testing indicated that interbedded shale and limestone bedrock was non-durable. 30 rock unconfined tests were conducted. The design rock unconfined value was determined to be 750 psi. See S-066-2018 Rock Testing Summary in the attachments for more detail.

Observation well (OW) were not installed in any holes for the current structure, but OW's were installed for sounding holes for S-072-2018 and S-069-2018. Table 1 summarizes ground water levels taken around the bridge location.

Hole	7-Day Water Elevation (ft.)	Date
1045	921.4'	9/13/2018
1047	921.3'	9/13/2018
1049	923.4'	9/13/2018
1019	916.1'	8/10/2018
1015	913.2'	9/11/2018

5.0 ENGINEERING ANALYSIS

5.1 End Bent 1 and 2 – The proposed sequence of construction for the bridge decided at the team meeting held on July 5th, 2018 consisted of first moving the Norfolk Southern railroad traffic off of the current alignment. Once railroad traffic was moved drilled shafts could be installed for the substructure of the bridge. The superstructure could then be set on the shafts, train traffic would be moved onto the new bridge, and then the excavation for the KY 338 roadway underneath the bridge could be completed while train traffic was on top of the bridge.

This option would also remove the need for temporary shoring to support the temporary shoofly if the bridge substructure was a spread footing foundation with traditional excavation methods. The drilled shafts for the end bents will need to be extended into the wingwalls to support the railroad/mainline once the bridge is constructed and excavation starts around the bridge for KY 338, else temporary shoring will be needed to support the railroad mainline.

The installation of the shafts will require three different casing sizes as illustrated in **Figure 1**.

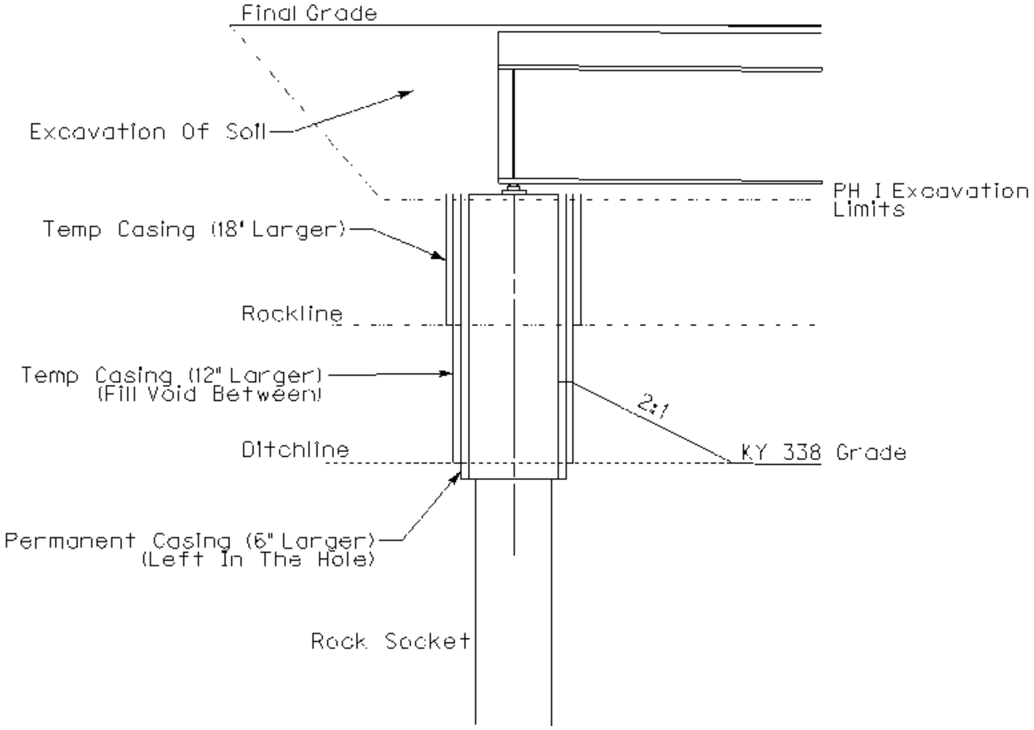


Figure 1. Proposed Installation for Drilled Shafts

Based on the bedrock rock being nondurable in this area, the excavation underneath the bridge once the drilled shafts are installed could be completed with hoe raming and there would be no need for blasting.

5.2 **Embankment Analysis** – Settlement is not expected to be a concern since the structure will be bearing on bedrock**.** Slope stability should be satisfied with extending of the drilled shafts into the wingwall areas to facilitate excavation of KY 338 beneath the bridge and to support the train traffic that will be utilizing the bridge.

Special considerations will need to be given to construction of the adjacent wingwall/retaining walls that are going to be adjacent to the bridge. The drilled shafts will need to be extended so that temporary shoring will not be needed to support the Norfolk Southern railroad. If temporary slopes steeper than a 2:1 are going to be utilized during any phase of construction this office should be contacted for further analysis of the proposed slopes.

Recommendations for geotechnical parameters for retaining walls 11 and 12 that connect to the Norfolk Southern bridge should be found in reports S-069-2018 and S-072-2018.

6.0 FOUNDATION RECOMMENDATIONS

6.1 End Bent 1 and 2

6.1.1 **End Bent 1 and 2** – Use drilled shafts with a top of rock socket 1 feet below proposed ditchline of the KY 338 excavation. Table 1 in section 6.2 contains relevant elevations needed to both complete the design and determine plan quantities for the drilled shafts. For Estimated Drilled Shaft Elevations in Table 1, ditchline was assumed to be 899 ft. Drilled shafts were evaluated for axial loading and the attached Drilled Shaft Capacity Charts tables provide the resulting capacities and resistances for Load & Resistance Factor Design (LRFD) methods.

6.1.2 Use drilled shafts constructed in accordance with Special Note For Drilled Shafts, current edition.

6.1.3 Use permanent casing that is 6 inches larger in diameter than the proposed shaft diameter to the "Bottom of Permanent Casing" elevations provided in Table 1. The permanent casing is incidental to "Drilled Shaft (Common)" or "Drilled Shaft (Solid Rock)" as applicable.

6.1.4 Use temporary casing for rock drilling that is 6 inches larger in diameter than the proposed permanent casing that extends to the top of shaft to the proposed ditch line elevation.

6.1.5 Use a temporary casing for soil drilling that is 6 inches larger in diameter then the proposed temporary casing for rock drilling that starts at ground elevation to top of weathered rock elevation.

6.1.6 If the drilled shaft are secant shafts the annulus between the temporary casing for rock drilling and permanent casing should be backfilled with sand, pea gravel, or other easily excavated material and will be incidental to "Drilled Shaft (Common)" or "Drilled Shaft (Solid Rock)" as applicable. This annulus shall be backfilled and temporary casing removed prior to placement of the reinforcing cage and concrete.

6.1.7 If the drilled shaft are not secant shafts the annulus between the temporary casing for rock drilling and permanent casing should be backfilled with flowable fill or low strength grout and will be incidental to "Drilled Shaft (Common)" or "Drilled Shaft (Solid Rock)" as applicable. This annulus shall be backfilled and temporary casing removed prior to placement of the reinforcing cage and concrete.

6.1.8 Require a 6 inch minimum rebar cover in the uncased rock sockets.

6.1.9 For Load & Resistance Factor Design (LRFD), evaluate the total factored axial resistance using only an end bearing value. The allowable capacities must equal or exceed the factored loads at the strength limit state. The side resistance in the shafts should be neglected due to the proposed use of tangent or secant shafts at the bridge end bent locations. If spacing of the drilled shafts becomes greater than one shaft diameter then contact this office for further analysis of drilled shaft axial capacity.

For sizing the shafts for axial resistance use a factored end bearing value of 16 ksf. For checking the strength and extreme limit states, the nominal end bearing resistance has been determined to be 48 ksf. Use a resistance factor of 0.45 for strength limit state analysis and a resistance factor of 1.0 for extreme limit state analysis.

6.1.10 Design the shafts neglecting any lateral resistance above the "Bottom of Permanent Casing" elevations provided in Table 1 and considering lateral resistance only in the uncased portions below the "Bottom of Permanent Casing" elevations. Perform lateral load analyses using the geotechnical parameters provided in the attached Idealized Soil and Bedrock Profile for End Bent 1 and 2. These parameters may be used to perform analyses using LPILE Plus or similar software. Some of the parameters may not be required to be input depending on the version or type of software being used.

Special considerations should be given for the reduction of lateral capacity of each drilled shaft due to group effects with the use of tangent or secant drilled shafts. The stress bulb that is developed in the rock due to the lateral stress from the drilled shaft should not overlap. It is recommended that group effects be negated by using every other drilled shaft for lateral capacity. If drilled shafts spacing needed for the lateral capacity of the end bents are tighter than one shaft diameter, this office should be contacted for further analysis.

6.1.11 The Contractor will be responsible for providing subsurface exploration drilling during construction to finalize the drilled shaft tip elevations.

Additional drilling will be required at every fourth drilled shaft location in accordance with the Special Note for Drilled Shafts, current edition. Estimates of the amount of Rockline Sounding may be made by taking the difference between the ground surface and the rockline at each shaft location. For estimating the amount of Rock Coring at this location, we recommend that the subsurface exploration extend a minimum depth of three (3) shaft diameters (but not less than 10 feet) below the bottom of the deepest anticipated tip elevation for any shaft of the bridge.

6.2 Estimated Drilled Shaft Elevations For End Bents

	Table 1			
	Elevations (ft.)[1]			
Substructure Unit	Est. Top of Rock	Est. Base of Weathered Rock	Ditchline	Bottom of Permanent Casing
End Bent 1	909 ft.[3]	908 ft.[3]	899 ft.	898 ft.
End Bent 2 (11 feet left of NSRR CL)[2]	910 ft.[3]	908 ft.[3]	899 ft.	898 ft.
End Bent 2 (40 feet right of NSRR CL)[2]	915 ft.	911 ft.	899 ft.	898 ft.

Notes:
1. Elevations will be verified after construction-phase has been performed. The final shaft tip elevations and quantities may be adjusted based on the actual conditions encountered in the field.
2. In order to estimate quantities: interpolate approximate elevations across End Bent 2
3. Interpreted elevations from drilled locations

6.3 Wingwalls (Extending Northeast of Bridge)

6.3.1 Use drilled shafts with a top of rock socket 1 feet below proposed ditchline of the KY 338 excavation. Table 2 in section 6.4 contains relevant elevations needed to both complete the design and determine plan quantities for the drilled shafts.

6.3.2 Design the shafts neglecting any lateral resistance above the "Bottom of Permanent Casing" elevations provided in Table 1 and considering lateral resistance only in the uncased portions below the "Bottom of Permanent Casing" elevations. Perform lateral load analyses using the geotechnical parameters provided in the attached Idealized Soil and Bedrock Profile for End Bent 1 and 2 Wingwalls. These parameters may be used to perform analyses using LPILE Plus or similar software. Some of the parameters may not be required to be input depending on the version or type of software being used.

Special considerations should be given for the reduction of lateral capacity of each drilled shaft due to group effects with the use of tangent or secant drilled shafts. The stress bulb that is developed in the rock due to the lateral stress from the drilled shaft should not overlap. It is recommended that group effects be negated by using every other drilled shaft for lateral capacity. If drilled shafts spacing needed for the lateral capacity of the end bents are tighter than one shaft diameter, this office should be contacted for further analysis.

6.3.3 Walls shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

6.4 Estimated Drilled Shaft Elevations For Wingwalls (Extending Northeast of Bridge)

	Table 2			
	Elevations (ft.)[1]			
Substructure Unit	Est. Top of Rock	Est. Base of Weathered Rock	Ditchline	Bottom of Permanent Casing
End Bent 1 Northeast Wingwall	909 ft. [3]	908 ft.[3]	899 ft.	898 ft.
End Bent #2 Northeast Wingwall Next to Bridge [2]	910 ft.[3]	908 ft.[3]	899 ft.	898 ft.
End Bent #2 Northeast Wingwall Furthest End From Bridge [2]	904 ft.[3]	903 ft.[3]	899 ft.	898 ft.

Notes:
1. Elevations will be verified after construction-phase has been performed. The final shaft tip elevations and quantities may be adjusted based on the actual conditions encountered in the field.
2. In order to estimate quantities: interpolate approximate elevations across Abutment #2 Wingwall
3. Interpreted elevations from drilled locations

7.0 PLAN NOTES

Add the following plan notes at the appropriate locations in the plans.

7.1 Temporary sheeting or shoring and a dewatering method may be required for installation of the subsurface foundations.

7.2 Use the elevations in Table 1 and Table 3 to determine plan quantities as follows:

- Drilled Shaft - *-inch (Common) - Groundline to Top of Rock
- Drilled Shaft -**-inches (Solid Rock) – Top of Rock to Ditchline
- Drilled Shaft -**-inches (Solid Rock) – Ditchline to One Foot Below Ditchline
- Drilled Shaft - ***-inch (Solid Rock) – One Foot Below Ditchline to Shaft Tip

* - Insert diameter 18-inches larger than shaft diameter chosen
** - Insert diameter 12-inch larger than shaft diameter chosen
*** - Insert diameter 6-inch larger than shaft diameter chosen
**** - Shaft diameter (Rock Socket diameter) chosen

The final shaft tip elevations and quantities may be adjusted based on the actual conditions encountered in the field.

7.3 Drilled shafts shall be constructed in accordance with the Special Note for Drilled Shafts. Include all costs (materials (including spiral and longitudinal reinforcement, reinforcement splices, and mechanical couplers, concrete, and temporary or permanent casing), labor, and equipment) associated with the drilled shafts in the unit price bid for Drilled Shaft, Common or Solid Rock, as applicable.

7.4 The Contractor will be responsible for providing subsurface exploration drilling during construction to finalize the drilled shaft tip elevations. Additional drilling will be required at each drilled shaft location in accordance with the Special Note for Drilled Shafts, current edition. For estimating the amount of Rock Coring at this location, we recommend that the subsurface exploration extend a minimum depth of three (3) shaft diameters (but not less than 10 feet) below the bottom of the anticipated tip elevation of each drilled shaft.

7.5 Excavation of bedrock in the vicinity of the drilled shafts cannot be performed until the concrete has met design strength.

7.6 Blasting in the area of the drilled shafts shall be prohibited after the drilled shafts are installed.

<u>If Shafts are Secant Shafts</u>

7.7 The annulus between the temporary casing for rock drilling and permanent casing should be backfilled with sand, pea gravel, or other easily excavated material and will be incidental to "Drilled Shaft (Common)" or "Drilled Shaft (Solid Rock)" as applicable. This annulus shall be backfilled and temporary casing removed prior to placement of the reinforcing cage and concrete.

If Shafts are Not Secant Shafts

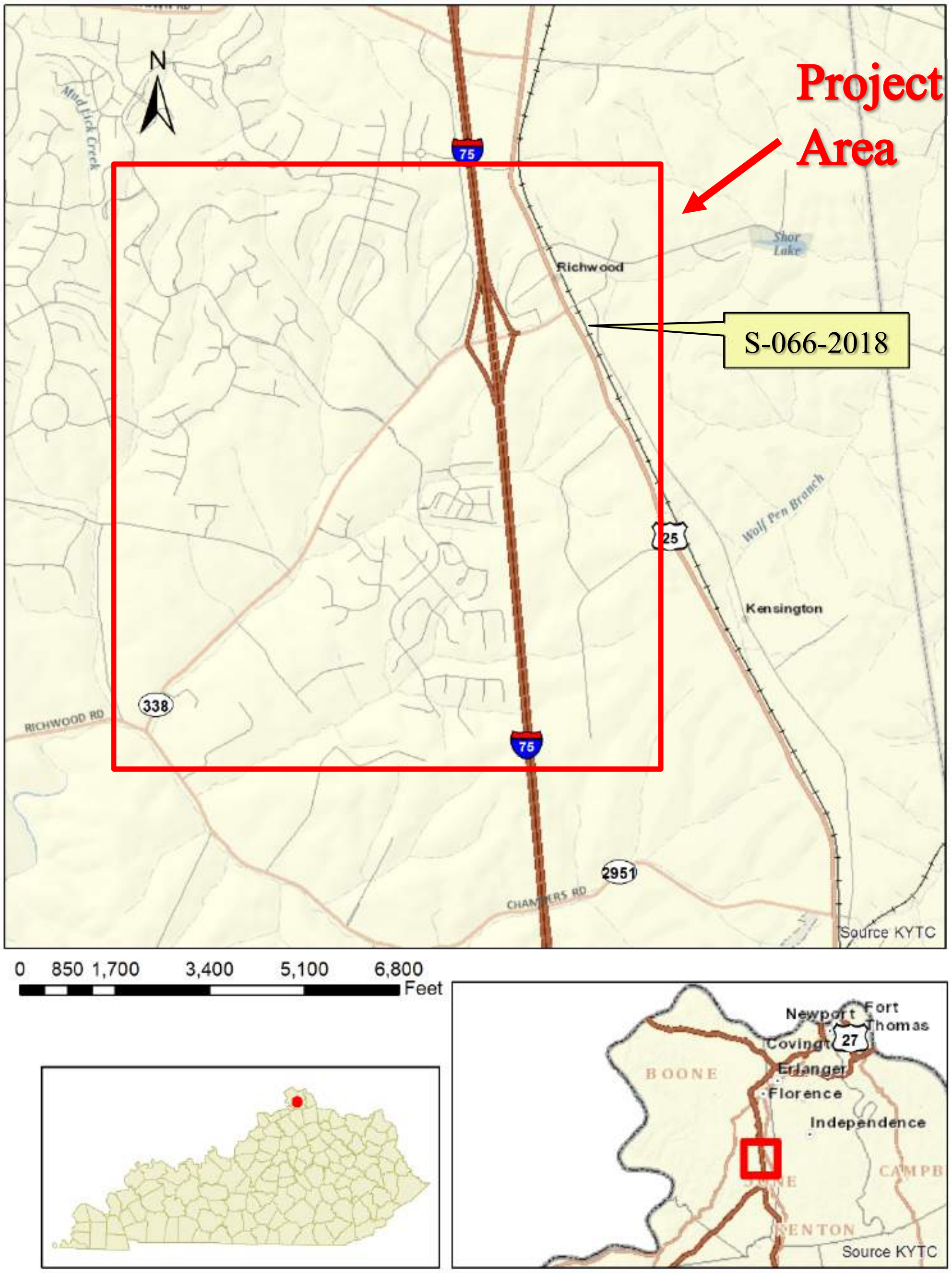
7.8 The annulus between the temporary casing for rock drilling and permanent casing should be backfilled with flowable fill or low strength grout and will be incidental to "Drilled Shaft (Common)" or "Drilled Shaft (Solid Rock)" as applicable. This annulus shall be filled and temporary casing removed prior to placement of the reinforcing cage and concrete.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

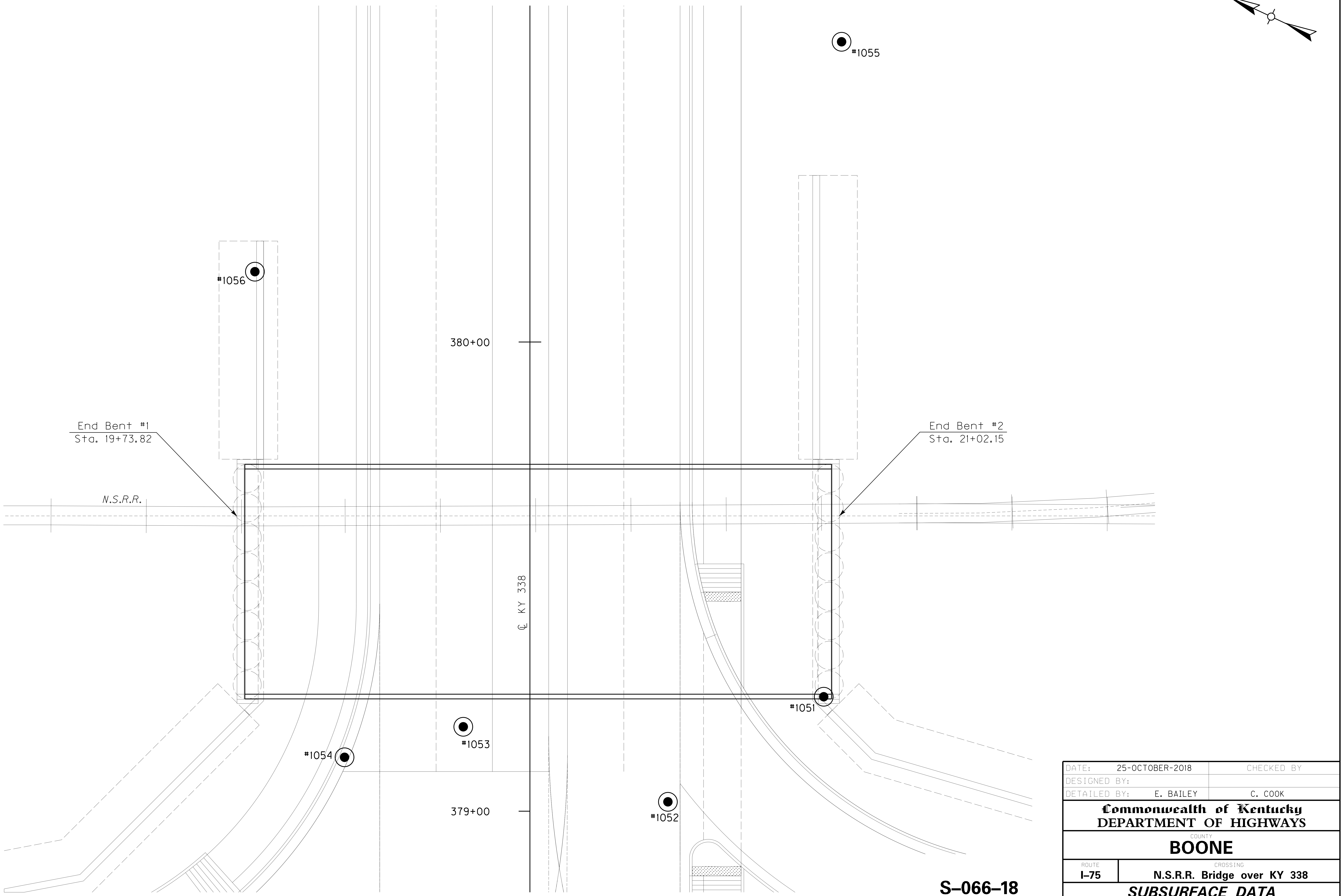
- **Project Location Map**
- **Subsurface Data Sheet**
- **Idealized Soil Profiles**
- **Coordinate Data Sheet**
- **Bridge Profile Sheet**
- **Rock Unconfined Data**
- **Elastic Modulus of Rock Mass (E_m) Calculation**

Project Location Map



SUBSURFACE DATA

Plan Scale 1" = 10'



SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
I–75	**N.S.R.R. Bridge over KY 338**

S–066–18

SUBSURFACE DATA

ITEM NUMBER

6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SUBSURFACE DATA

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

DATE: 25-OCTOBER-2018
CHECKED BY
DESIGNED BY:
DETAILED BY: E. BAILEY
C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–75
CROSSING
N.S.R.R. Bridge over KY 338

S–066–18

SUBSURFACE DATA

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole 1056:

Shale:(64%) dark gray, silty, calcareous, interbedded w/Limestone (36%) light gray, medium & coarse grained, mostly even bedded, fossiliferous

Limestone:(65%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (35%) as laminations & partings

Hole 1054:

Cored Overburden: No recovery

Shale:(69%) dark gray, silty, calcareous, interbedded w/Limestone (31%) light gray, medium & coarse grained, mostly even bedded, fossiliferous

Limestone:(65%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (35%) as laminations & partings

Hole 1053:

Cored Overburden: No recovery

Shale:(73%) dark gray, silty, calcareous, interbedded w/Limestone (27%) light gray, medium & coarse grained, mostly even bedded, fossiliferous

Limestone:(65%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (35%) as laminations & partings

DATE:	25-OCTOBER-2018	CHECKED BY
DESIGNED BY:		
DETAILED BY:	E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
I–75	N.S.R.R. Bridge over KY 338

S–066–18

ITEM NUMBER
6–18.00

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

IDEALIZED SOIL PROFILE

Boone Co., Item No 6-18.00
Norfolk Southern Railway Bridge Over KY 338, Single Span (123’)
End Bent 1

CSC 12/03/18

Strata **Parameters for Laterial Load Analysis**

Grade ↓

Elev.

927 ft Top of Railroad Bridge

Overburden, Neglect for Support
(Low Plasticity Clay)

Unit Weight γ (pcf): 120
∇ 920' **Undrained Cohesion: c (psf): 2250**
(Interpolated Water Elev.) **e50 = 0.005**
k_a = 0.472
Long Term Friction Angle ϕ': 21°
Long Term Cohesion c' (psf): 430
Backfill Slope Angle : 0°

908 ft

Shale/Limestone Bedrock
Parameters for Laterial Load Analysis
Unit Weight γ (pcf): 150
Initial Modulus of Rock Mass E (psi): 13,000
RQD : 70
Strain Factor (k rm): 0.0005
Compressive Strength qu (psi): 750

874 ft

Termination of Borings
Elevations are approximate

IDEALIZED SOIL PROFILE

Boone Co., Item No 6-18.00
Norfolk Southern Railway Bridge Over KY 338, Single Span (123’)
End Bent 2

CSC 12/03/18

Strata **Parameters for Laterial Load Analysis**

Grade ↓

Elev.

927 ft Top of Railroad Bridge

Overburden, Neglect for Support
(Low Plasticity Clay)

Unit Weight γ (pcf): 120
∇ 920' Undrained Cohesion: c (psf): 2250
(Interpolated Water Elev.) e50 = 0.005
$k_{a} =$ 0.472
Long Term Friction Angle ф': 21°
Long Term Cohesion c' (psf): 430
Backfill Slope Angle : 0°

911 to 908 ft West to East

Shale/Limestone Bedrock

Parameters for Laterial Load Analysis
Unit Weight γ (pcf): 150
Initial Modulus of Rock Mass E (psi): 13,000
RQD : 70
Strain Factor (k rm): 0.0005
Compressive Strength qu (psi): 750

874 ft

Termination of Borings
Elevations are approximate

IDEALIZED SOIL PROFILE

Boone Co., Item No 6-18.00
Norfolk Southern Railway Bridge Over KY 338, Single Span (123')
End Bent 1 Wingwall

CSC 12/03/18

Strata **Parameters for Laterial Load Analysis**

Grade Behind Wall ↓

Elev.
926 to 908 ft

Overburden, Neglect for Support
(Low Plasticity Clay)

∇ 920'
(Interpolated Water Elev.)

Unit Weight	γ (pcf):	120
Undrained Cohesion:	c (psf):	2250
	e50 =	0.005
	$k_{a\,=}$	0.472
Long Term Friction Angle	ф':	21°
Long Term Cohesion	c' (psf):	430

908 ft

Shale/Limestone Bedrock

Parameters for Laterial Load Analysis

Unit Weight	γ (pcf):	150
Initial Modulus of Rock Mass	E (psi):	13,000
RQD	:	70
Strain Factor	(k rm):	0.0005
Compressive Strength	qu (psi):	750

874 ft

Termination of Borings
Elevations are approximate

IDEALIZED SOIL PROFILE

Boone Co., Item No 6-18.00
Norfolk Southern Railway Bridge Over KY 338, Single Span (123’)
End Bent 2 Wingwall

CSC 12/03/18

Strata **Parameters for Laterial Load Analysis**

Grade Behind Wall ↓

Elev.
926 to 906 ft

Overburden, Neglect for Support
(Low Plasticity Clay)

Unit Weight γ (pcf): 120
▽ 920' Undrained Cohesion: c (psf): 2250
(Interpolated Water Elev.) e50 = 0.005
k_{a} = 0.472
Long Term Friction Angle ϕ': 21°
Long Term Cohesion c' (psf): 430

908 to 903 ft West to East

Shale/Limestone Bedrock
Parameters for Laterial Load Analysis
Unit Weight γ (pcf): 150
Initial Modulus of Rock Mass E (psi): 13,000
RQD : 70
Strain Factor (k rm): 0.0005
Compressive Strength qu (psi): 750

874 ft

Termination of Borings
Elevations are approximate

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-066-2018

Notes:

(circle one)

Elevation Datum (NAVD88) Assumed

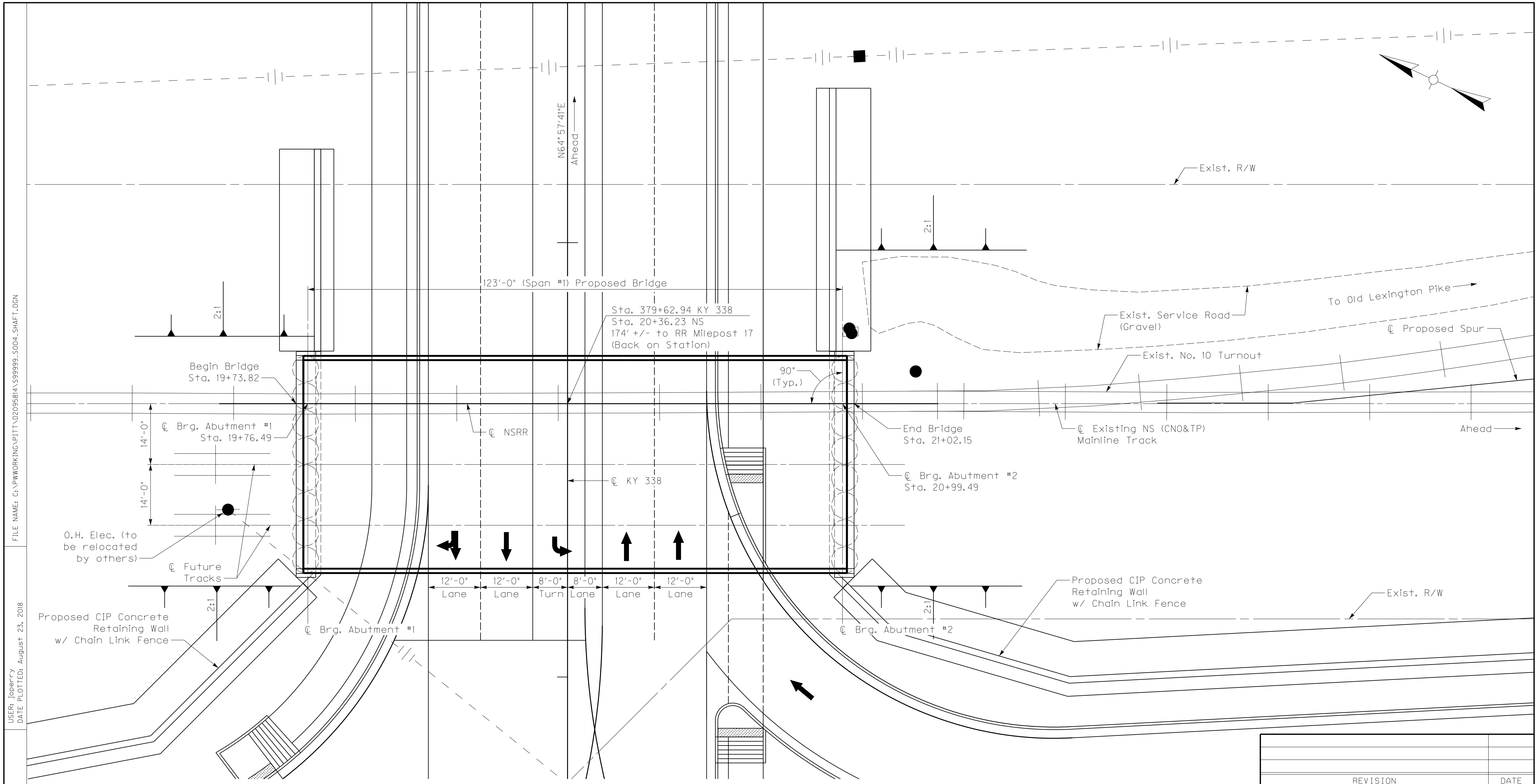
HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-066-2018						
1051	38.91833355	84.62340783	1051	KY 338 379+24.4	62.6 Rt.	924.50
1052	38.91839124	84.62352765	1052	KY 338 379+02	29.4' Rt.	924.56
1053	38.91851841	84.62353959	1053	KY 338 379+18	14.2' Lt.	924.90
1054	38.91864937	84.62364052	1054	KY 338 379+11.5	69.5 Lt.	924.03
1055	38.91848205	84.62295536	1055	KY 338 380+64	66.4' Rt.	910.69
1056	38.91874378	84.62328054	1056	KY 338 380+19	58.6' Lt.	922.57

FILE NAME: C:\PWWORKING\PITT\D2095814\S99999_S004_SHAFT.DGN

USER: joperry
DATE PLOTTED: August 23, 2018

E-SHEET NAME:

MicroStation v8.11.9.832



PLAN

123'-0" Single Span Welded Steel Plate Girder, No Skew
Cast In Place Concrete End Bent on Drilled Shaft Wall
Cooper E-80 / Alternative Live Load

PRELIMINARY

NOTES

Portions of existing track, turnout, switch hardware and switch control to be removed by Norfolk Southern forces to allow bridge construction while rail traffic is maintained on the shoo-fly and then reset in essentially the same location as existing.

REVISION	DATE

DATE: May 2018 | CHECKED BY
DESIGNED BY: M. Purcell | W. Hagerman
DETAILED BY: M. Purcell | W. Hagerman

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
NSRR

CROSSING
KY 338

LAYOUT (1 OF 2)

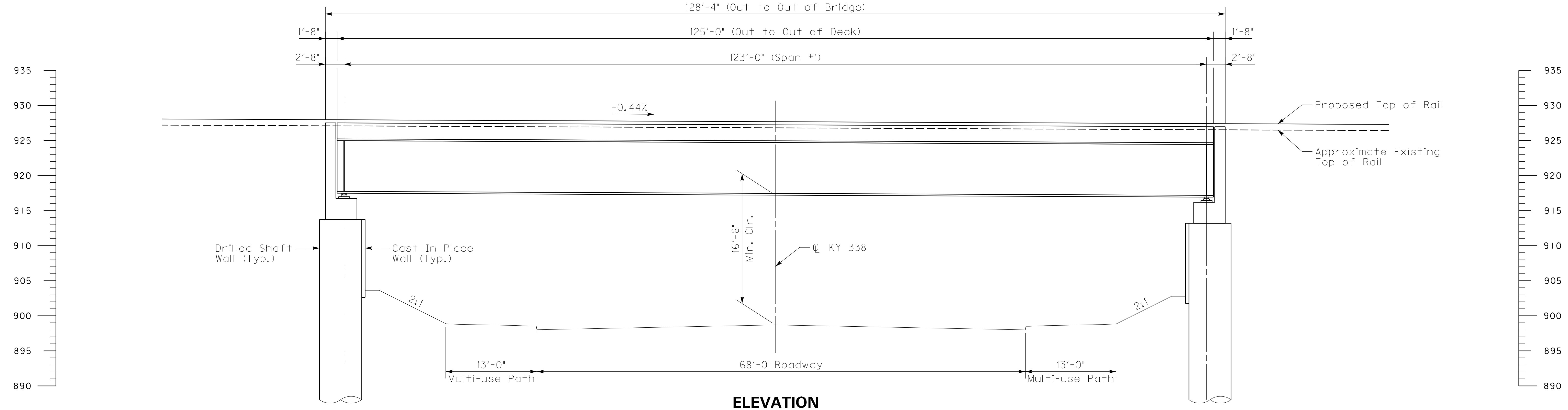
ITEM NUMBER
6-18.00

PREPARED BY
HDR
Addendum 2 -- 7-11-19

SHEET NO.
S1

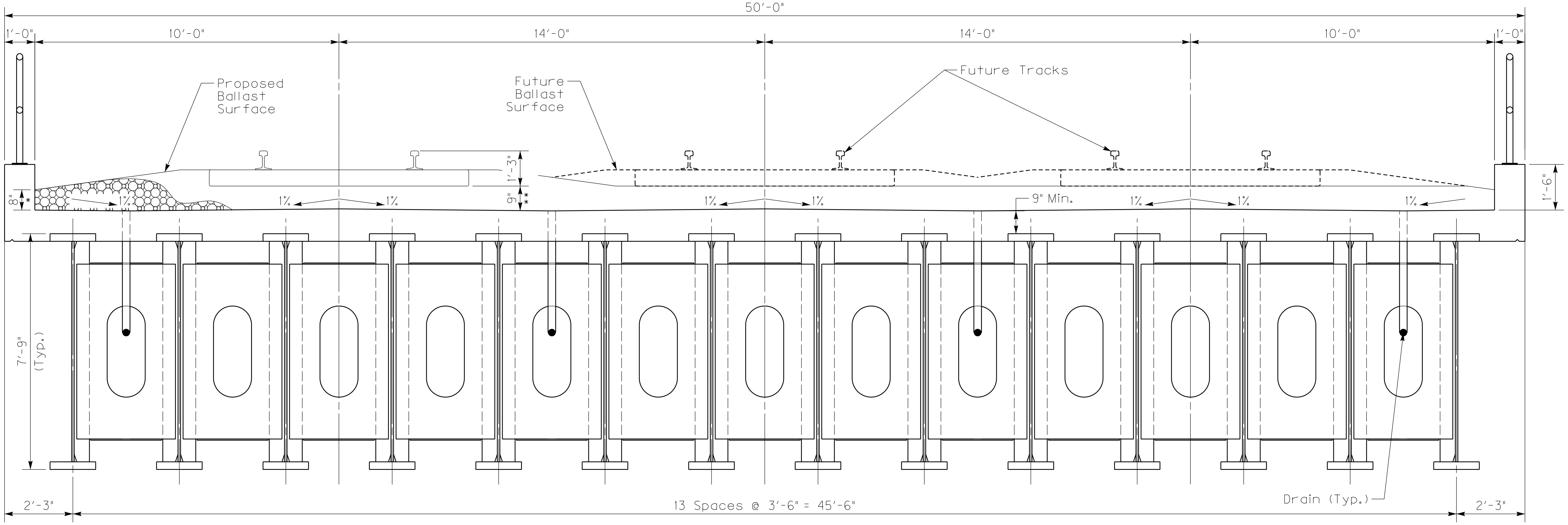
DRAWING NO.

FILE NAME: C:\PWWORKING\PITT\D2095814\S99999_S005_SHAFT.DGN
USER: joperry
DATE PLOTTED: July 9, 2018
E-SHEET NAME:
MicroStation v8.11.9.832



ELEVATION

(Looking KY 338 Station Ahead)
123'-0" Single Span Welded Steel Plate Girder
Cooper E-80 / Alternative Live Load ~ 50'-0" Out-to-Out Width @ Bridge



* Typical at curb face
** Typical under crossties

TYPICAL SECTION

Looking Ahead

Note: Deck drainage will be piped over to abutments

PRELIMINARY

REVISION	DATE

DATE: May 2018	CHECKED BY
DESIGNED BY: M. Purcell	W. Hagerman
DETAILED BY: M. Purcell	W. Hagerman

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
NSRR

CROSSING
KY 338

LAYOUT (2 OF 2)

PREPARED BY
HDR

Addendum 2 -- 7-11-19

SHEET NO.
S2

DRAWING NO.

NS PROJECT NUMBER
120–1–KY–BR0129396

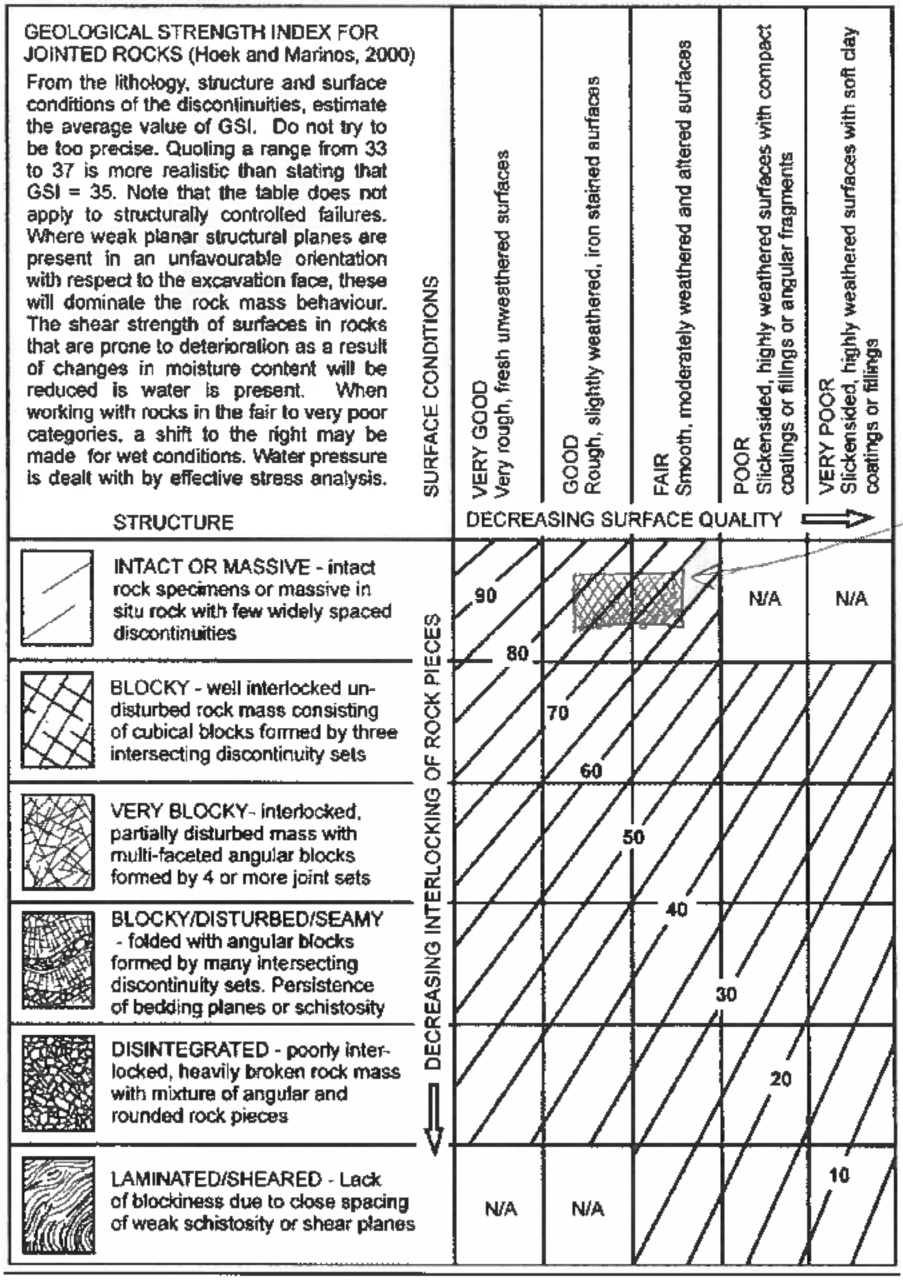
ITEM NUMBER
6–18.00

Boone Co., Item No. 6-18.00
S-066-2018 Rock Testing Summary

Hole No.	Sample No.	Top Depth (ft)	Bottom Depth (ft)	Unconfined Compressive Strength (psi)	E (psi)	visual desc.
1051	1	23.6	24.3	3877	1136384	limestone
1051	2	27.5	28	846	38248.73	shale
1051	3	34.8	35.5	875	91076.04	mix
1051	4	41	41.5	777	69223.94	mix
1051	5	48.1	48.7	1420	232899.5	mix
1052	1	22.7	23.3	441	19117.32	shale
1052	2	30.5	31.1	687	17858.51	shale
1052	3	33.8	34.4	987	109968.2	mix
1052	4	39.8	40.4	700	60098.14	mix
1052	5	43.9	44.6	645	84435	mix
1052	6	46.8	47.6	996	99330.12	mix
1053	1	31.7	32.3	721	29931.86	shale
1053	2	44.2	44.9	1187	132969.7	mix
1053	3	47.4	48	614	35164.96	mix
1054	1	30.3	31	851	44115.31	shale
1054	2	44.4	45.1	718	22863.49	mix
1054	3	49.5	50	752	64899.85	mix
1055	1	11.2	11.7	2827	733487.7	limestone
1055	2	17.9	18.5	334	6019.954	shale
1055	3	22.2	22.7	785	107052.8	mix
1055	4	28.2	28.8	741	46642.89	mix
1055	5	31.9	32.6	757	68528.53	mix
1055	6	36.1	36.6	676	41060.8	mix
1056	1	20.8	21.3	152	4152.958	shale
1056	2	23.9	24.5	3632	738886.3	limestone
1056	3	27.5	27.9	919	30693.34	shale
1056	4	31.3	31.9	610	16121.12	shale
1056	5	37.1	37.6	856	95412.44	mix
1056	6	41	41.7	781	88975.48	mix
1056	7	48.9	49.5	898	97442.6	mix

Total Data Points = 30
Median Rock Unconfined = 779 psi
Mean Rock Unconfinned = 1035 psi
Standard Deviation = 847 psi
Variance = 716602 psi
Mean -2 Standard Deviations = 2728 psi
Mean +2 Standard Deviations = -658 psi
Used Data Points = 27
Mean Rock Unconfined (No Limestone) = 768 psi
Mean Youngs Modulus (No Limestone) = 64974 psi
Used Rock Unconfinned Value = 750 psi
Used Youngs Modulus Value = 65000 psi

Elastic Modulus of Rock Mass (Em) Calculation



GEOLOGICAL STRENGTH INDEX FOR JOINTED ROCKS (Hoek and Marinos, 2000)

From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavourable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced is water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.

GSI Range: 82-65

Figure 10.4.6.4-1—Determination of *GSI* for Jointed Rock Mass (Hoek and Marinos, 2000)

considered. The correlation equations in Table 10.4.6.5-1 should then be used to evaluate modulus and its variation with depth. If pressuremeter tests are conducted, it is recommended that measured modulus values be calibrated to the values calculated using the relationships in Table 10.4.6.5-1.

Preliminary estimates of the elastic modulus of intact rock may be made from Table C10.4.6.5-1. Note that some of the rock types identified in the Table are not present in the U.S.

It is extremely important to use the elastic modulus of the rock mass for computation of displacements of rock materials under applied loads. Use of the intact modulus will result in unrealistic and unconservative estimates.

Table 10.4.6.5-1—Estimation of E_m Based on GSI

Expression	Notes/Remarks	Reference
$E_m(GPa) = \sqrt{\frac{q_u}{100}}10^{\frac{GSI-10}{40}}$ for $q_u \le 100$ MPa $E_m(GPa) = 10^{\frac{GSI-10}{40}}$ for $q_u > 100$ MPa	Accounts for rocks with $q_u < 100$ MPa; notes q_u in MPa	Hoek and Brown (1997); Hoek et al. (2002)
$E_m = \frac{E_R}{100} e^{GSI/21.7}$	Reduction factor on intact modulus, based on *GSI*	Yang (2006)

Notes: E_r = modulus of intact rock, E_m = equivalent rock mass modulus, *GSI* = geological strength index, q_u = uniaxial compressive strength, and 1 MPa = 20.9 ksf.

$E_R = 65{,}000$ psi

$$E_m = \frac{65000\text{ psi}}{100} e^{(65/21.7)} \approx \boxed{13{,}000\text{ psi}}$$

M E M O R A N D U M **SA-002-2019**

TO: Bart Asher, P.E.
Director
Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM
Geotechnical Branch

BY: Clayton S. Cook, P.E.
Geotechnical Branch

cc: J. Van Zee
M. Bezold (D-6)
R. Franxman (D-6)
E. Drury
R. Turner
B. Yeager
C. Callan-Ramler (D-6)
W. Hagerman (HDR)
K. Meyer (HDR)

DATE: April 3, 2019

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton
Norfolk Southern Railway Bridge Over KY 338
Single Span (123'), NSRR Sta. 19+73.82
Geotechnical Engineering Structure Foundation Addendum Report

INTRODUCTION

The geotechnical investigation for this structure was completed and discussed in Geotechnical Structure Foundation Report, S-066-2018 that was issued on December 4th, 2018. This addendum is being provided to address updated geotechnical recommendations for the proposed drilled shafts at End Bent 1 and 2 and the design criteria given for the extended wing walls of the original report. The recommendations outlined in this addendum supersedes the original recommendations in section 6.1.9, 6.3.3 and the second paragraph of 6.1.10 of S-066-2018.

ENGINEERING ANALYSIS

End Bent 1 and 2

For Allowable Stress Design (ASD), evaluate the allowable drilled shaft axial capacity using the attached drilled shaft axial capacity tables. The allowable capacities must equal or exceed the proposed loads. The side resistance in the shafts can be accounted for once the length of the shaft embedment into rock exceeds 10 feet. If need axial capacity exceeds the allowable axial capacities attached please contact this office.

In the S-066-2018 report it was stated that "Special considerations should be given for the reduction of lateral capacity of each drilled shaft due to group effects with the use of tangent or secant drilled shafts". Based on discussion with the bridge designer, reduction in lateral capacity from group effects within the rock socket was deemed unnecessary.

Wingwalls (Extending Northeast of Bridge)
Walls shall be designed in accordance with applicable AREMA Specifications.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project ASD Drilled Shaft Axial Capacity Table**

Allowable Stress Design (ASD)

DRILLED SHAFT AXIAL CAPACITY TABLE

Boone Co., Item No 6-18.00

Norfolk Southern Railway Bridge Over KY 338, End Bents 1 & 2

Rock Socket Diameter = 5.0 feet
Rock Socket Diameter = 60 inches
CSC 04/03/2019

Rock Socket Length (ft.)	Ultimate Unit Side Shear q_{ss} (ksf)	Ultimate Unit End Bearing q_{eb} (ksf)	Ultimate Side Shear Q_{ss} (kips)	Ultimate End Bearing Q_{eb} (kips)	Total Ultimate Axial Capacity Q_{ut} (kips)	Total Allowable Axial Capacity Q_{at} (kips)	Total Allowable Uplift Capacity Q_{up} (kips)
0.0							
1.0	0.00	48	0	942	942	377	0
2.0	0.00	48	0	942	942	377	0
3.0	0.00	48	0	942	942	377	0
4.0	0.00	48	0	942	942	377	0
5.0	0.00	48	0	942	942	377	0
6.0	0.00	48	0	942	942	377	0
7.0	0.00	48	0	942	942	377	0
8.0	0.00	48	0	942	942	377	0
9.0	0.00	48	0	942	942	377	0
10.0	0.00	48	0	942	942	377	0
>>> 11.0	5.67	48	89	942	1032	413	25
12.0	5.67	48	178	942	1121	448	50
13.0	5.67	48	267	942	1210	484	75
14.0	5.67	48	356	942	1299	519	100
15.0	5.67	48	445	942	1388	555	125
16.0	5.67	48	534	942	1477	591	150
17.0	5.67	48	623	942	1566	626	175
18.0	5.67	48	713	942	1655	662	200
19.0	5.67	48	802	942	1744	698	224
20.0	5.67	48	891	942	1833	733	249

>>> No Side Resistance Shale be accounted for until after 10 foot of embedment

D (ft.) = 5.0
FS = 2.5

Allowable Stress Design (ASD)

DRILLED SHAFT AXIAL CAPACITY TABLE

Boone Co., Item No 6-18.00

Norfolk Southern Railway Bridge Over KY 338, End Bents 1 & 2

Rock Socket Diameter = 6.0 feet

Rock Socket Diameter = 72 inches

CSC 04/03/2019

Rock Socket Length (ft.)	Ultimate Unit Side Shear q_{ss} (ksf)	Ultimate Unit End Bearing q_{eb} (ksf)	Ultimate Side Shear Q_{ss} (kips)	Ultimate End Bearing Q_{eb} (kips)	Total Ultimate Axial Capacity Q_{ut} (kips)	Total Allowable Axial Capacity Q_{at} (kips)	Total Allowable Uplift Capacity Q_{up} (kips)
0.0							
1.0	0.00	48	0	1357	1357	543	0
2.0	0.00	48	0	1357	1357	543	0
3.0	0.00	48	0	1357	1357	543	0
4.0	0.00	48	0	1357	1357	543	0
5.0	0.00	48	0	1357	1357	543	0
6.0	0.00	48	0	1357	1357	543	0
7.0	0.00	48	0	1357	1357	543	0
8.0	0.00	48	0	1357	1357	543	0
9.0	0.00	48	0	1357	1357	543	0
10.0	0.00	48	0	1357	1357	543	0
>>> 11.0	5.67	48	107	1357	1464	586	30
12.0	5.67	48	214	1357	1571	628	60
13.0	5.67	48	321	1357	1678	671	90
14.0	5.67	48	428	1357	1785	714	120
15.0	5.67	48	534	1357	1892	757	150
16.0	5.67	48	641	1357	1998	799	180
17.0	5.67	48	748	1357	2105	842	209
18.0	5.67	48	855	1357	2212	885	239
19.0	5.67	48	962	1357	2319	928	269
20.0	5.67	48	1069	1357	2426	970	299

>>> No Side Resistance Shale be accounted for until after 10 foot of embedment

D (ft.) = 6.0

FS = 2.5

M E M O R A N D U M

cc: J. Van Zee
M. Bezold
R. Franxman
R. Turner
D. Gesso
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundation Section

DATE: November 21, 2018

SUBJECT: **Boone County**
FD52 12F0 008 0075 175-176; IMSTP0757129
US 25
Mars #: 8433801D
4'x4' RCBC Extensions (90'Lt and 36'Rt.) at Sta. 32+06.4
Item #: 6-0018.00
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on Projectwise and through email for use in development of structure plans. The onsite geotechnical exploration for the project was performed by the consulting firm of Horn and Associates.

The proposed 4'x4' culvert extensions will be utilized as part of the proposed reconstruction of the interchange between KY 338 and I-71/75 in Boone County. The structure is located on US 25 at approximate M.P. 4.5. The project is in Richwood, KY.

2.0 SITE GEOLOGIC CONDITIONS

This structure is located in the Independence Geologic Quadrangle (GQ# 785). The geologic mapping indicates that the bedrock at this site consists primarily of the Bull Fork Formation.

3.0 FIELD INVESTIGATION

One (1) sample boring was taken at this structure's location as part of the structural geotechnical investigation. Two (2) sample borings and one (1) fill profile boring from the roadway geotechnical investigation report for this project, R-049-2015, were also used in the analysis of this structure. The soil samples were delivered to the KYTC Geotechnical Branch in Frankfort, KY where the Branch's lab conducted testing on the samples.

4.0 SUBSURFACE CONDITIONS

The soils encountered at the site were indicated to be low plasticity clays and low plasticity silts. The soil samples were designated as CL and ML by the Unified Soil Classification System. No rock core was taken at this site.

5.0 ENGINEERING ANALYSIS

As part of the roadway geotechnical investigation an embankment stability analysis was performed near this structure at station 32+50 and satisfactory factors of safety were found. Please refer to Geotechnical Engineering Roadway Report R-049-2015 for geotechnical information related to construction of the roadway embankments.

Due to the rock depths and the proposed flow line elevations the culvert should be designed for a **yielding** foundation.

6.0 FOUNDATION RECOMMENDATIONS:

6.1 Design this culvert for a **yielding** foundation on granular replacement material below the bottom of the footing.

6.2 Due to low soil strengths at this site, the overburden must be excavated and backfilled with “Granular Embankment”, non-erodible only, meeting the material requirements of section 805 in the current edition of the Standard Specifications for Road and Bridge Construction. Contrary to the Standard Specifications, the maximum size limit for “Granular Embankment” is 4”.

6.3 The depth of Granular Replacement below the footing and Nominal Bearing Pressure at the base of the footing should be determined and specified by the designer using the graph of *“Nominal Bearing Resistance at Bottom of Footing for Various Footing Sizes and Depths of Granular Replacement”* attached to this report.

6.4 Size the footings at a service limit state using a factored bearing resistance of 0.33 times the Nominal Bearing Pressure at the base of the footing found on the previously sited graph. Use resistance factors of 0.45 and 1.0 for the strength and extreme limit state analyses, respectively.

6.5 The culvert should be designed with a paved flowline. The paved flowline shall also include the inlet and outlet apron portions of the culvert’s flowline paved to the edges of the wingwalls. A toe-wall shall also be incorporated into the beginning of the inlet and outlet portions of the paved apron. These shall extend to a minimum depth equivalent to that of the base of the culvert barrel foundation.

6.6 The wingwall should be designed using Soil Type 3 of Exhibit 413 in the Division of Structural Design Guidance Manual. It should be noted that the backfill slope being referred to is that perpendicular to the wingwall.

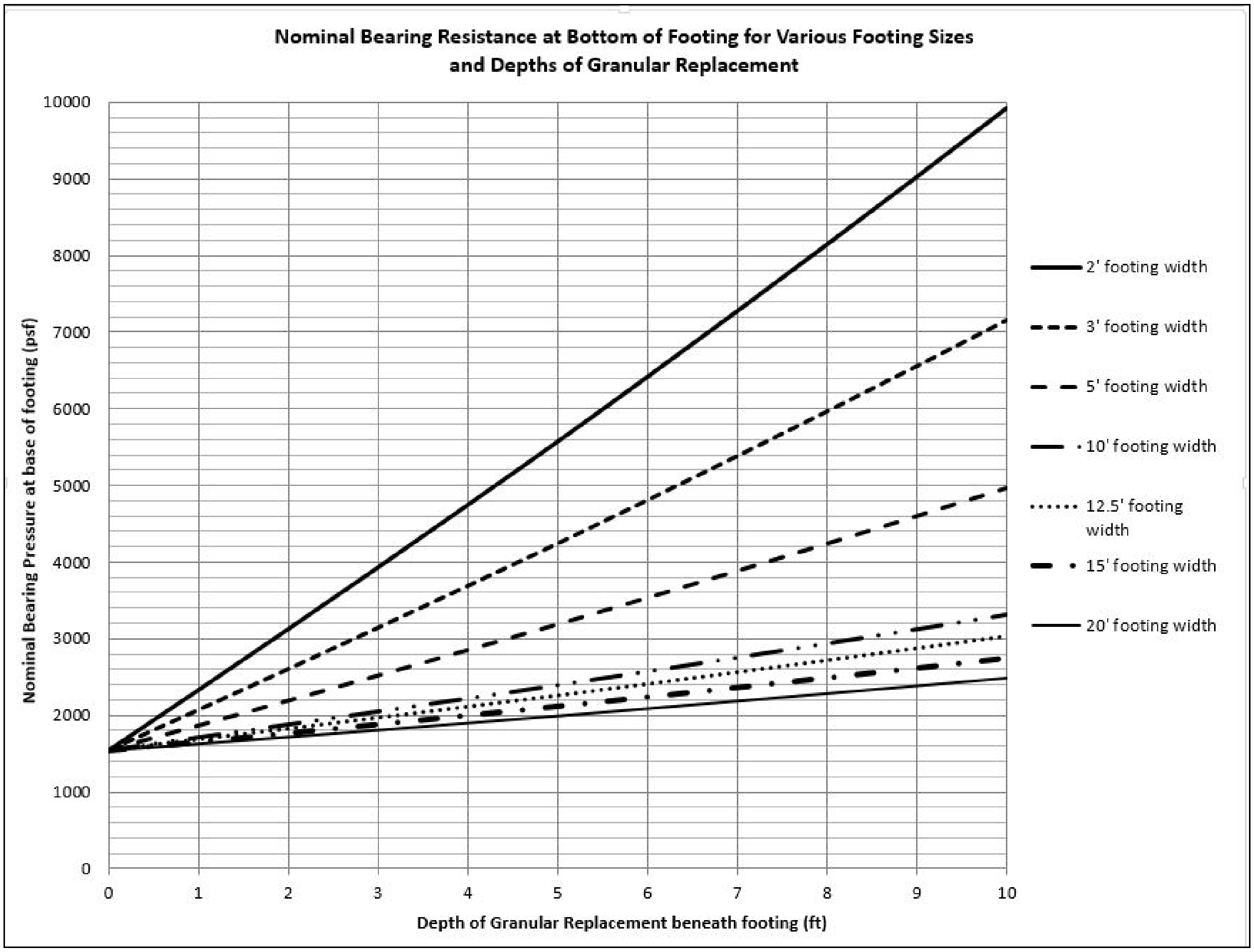
7.0 Plan Notes

(Include the notes below at appropriate locations in the Plans.)

7.1 Temporary sheeting or shoring and a dewatering method may be required for installation.

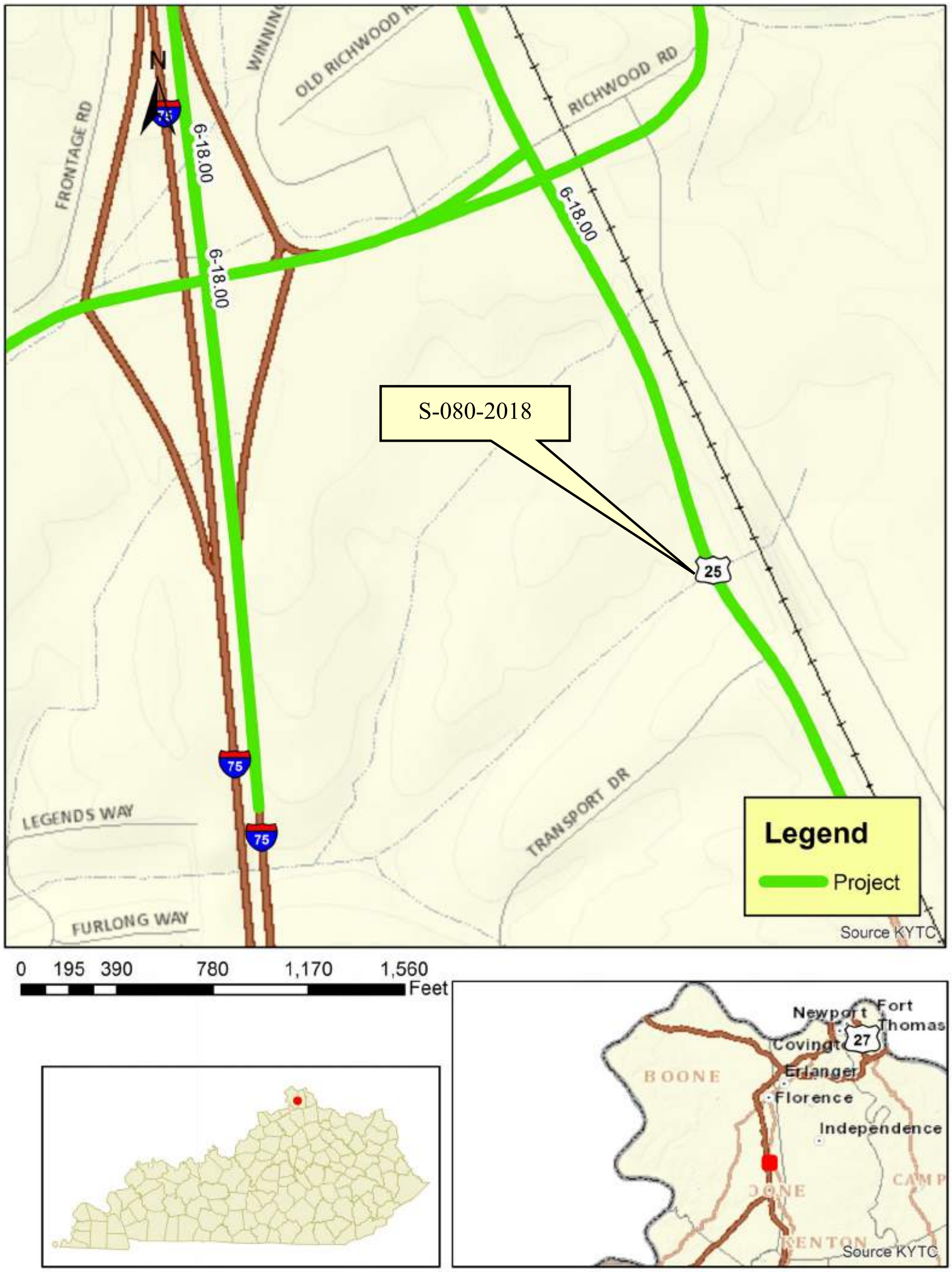
The designer should feel free to contact the Geotechnical Branch for further recommendations, or for any additional questions that arise pertaining to this project, at (502)564-2374.

Attachments:
- Nominal Bearing Resistance at Bottom of Footing for Various Footing Sizes and Depths of Granular Replacement Graph
- Project Location Map
- Subsurface Data Sheet
- Pipe Sheet
- Coordinate Data Sheet


Nominal Bearing Resistance at Bottom of Footing for Various Footing Sizes and Depths of Granular Replacement
Nominal Bearing Pressure at base of footing (psf)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
6
7
8
9
10
Depth of Granular Replacement beneath footing (ft)
2' footing width
3' footing width
5' footing width
10' footing width
12.5' footing width
15' footing width
20' footing width

S-080-2018
Boone Co., US-25
November 21, 2018
Item #: 6-18.00

Structure Location Map:



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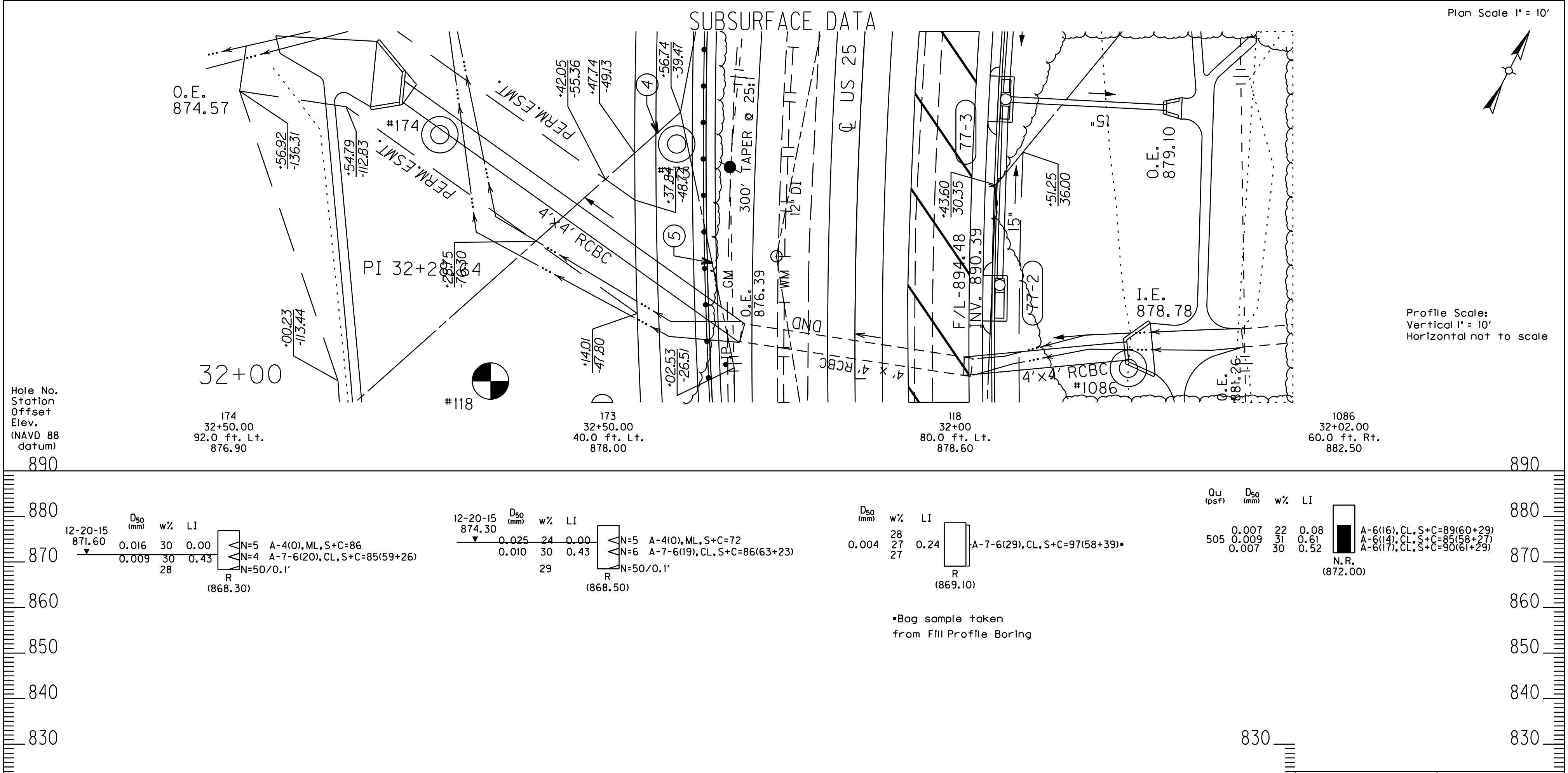
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:



DATE: 14-NOVEMBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: T. SHEFFIELD	D. GREER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
US 25	4'X4' RCBC EXT. AT STA. 32+06.4

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

S–080–18

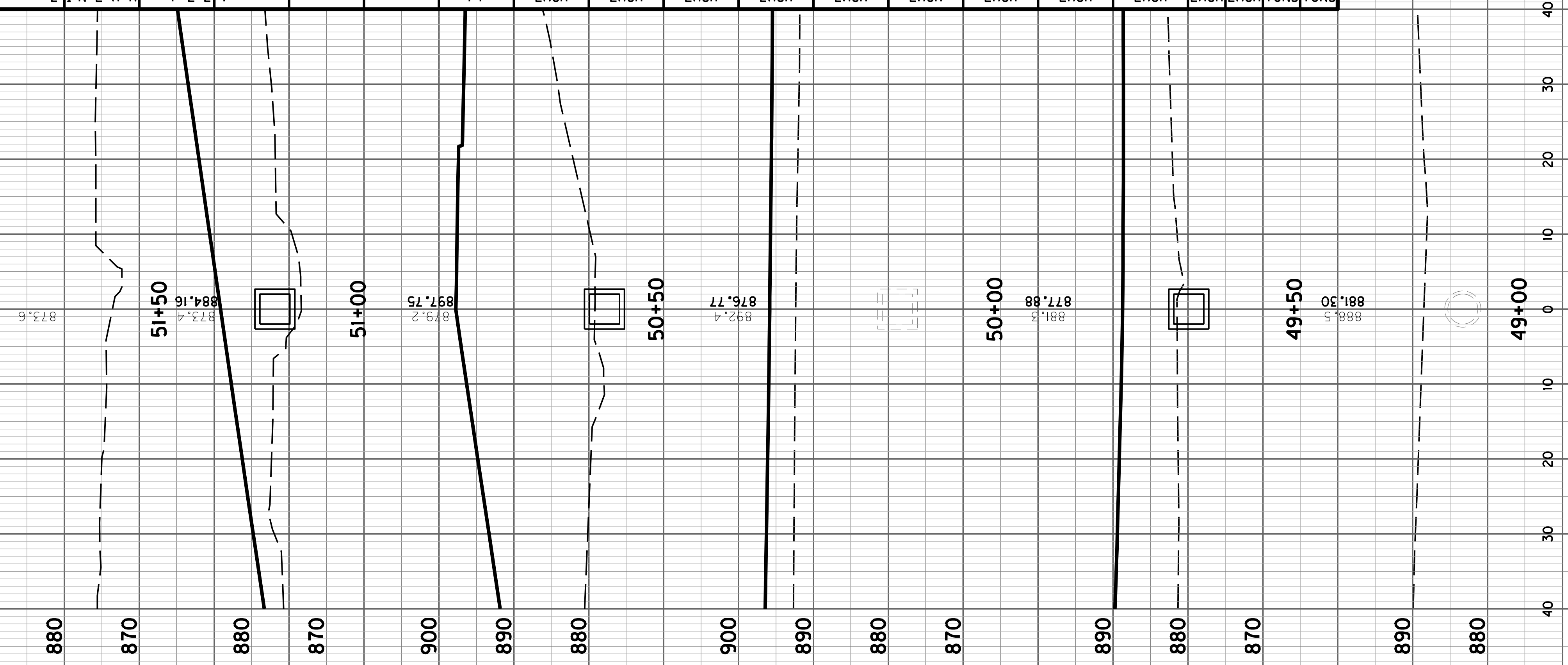
ITEM NUMBER
6–0018.00

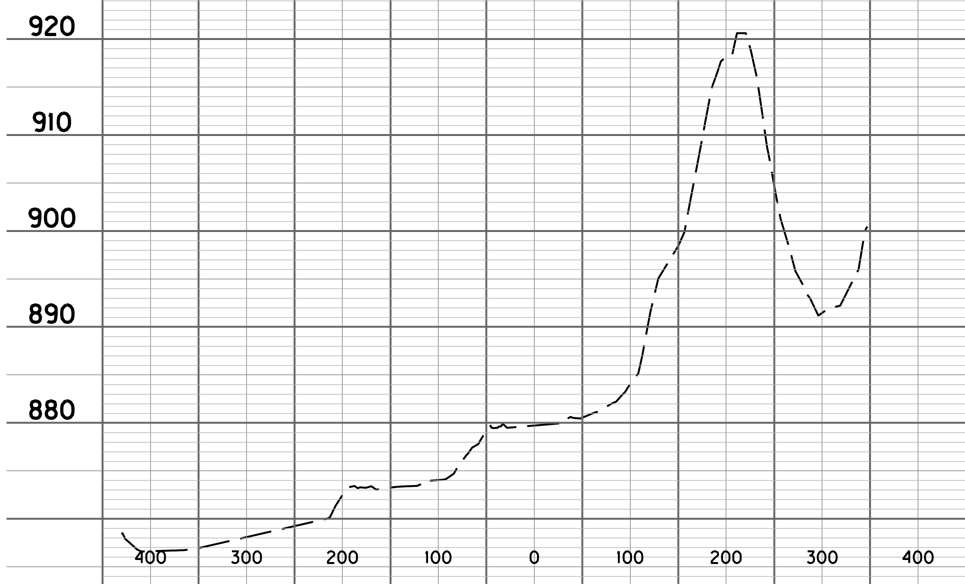
PIPE DRAINAGE SHEET 44 of 72

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	R613

CULVERT SITUATION
STA. 32+06.4
4′ x 4′ R.C.B.C.
@ 8°35′14" SKEW RT.

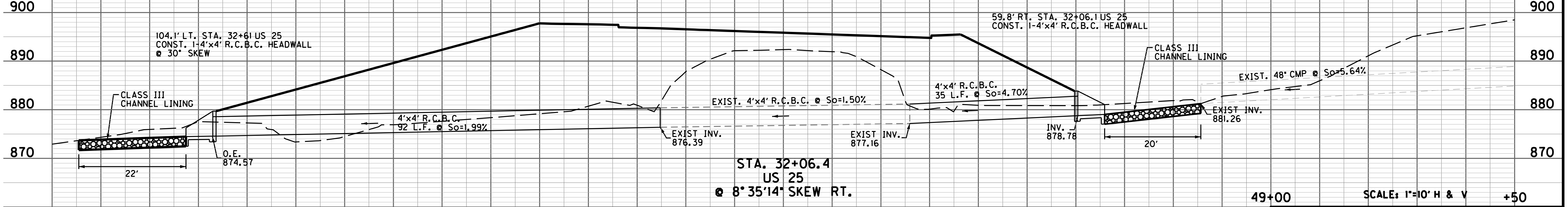
STORM SEWER PIPE									CULVERT PIPE					DESIGN pH LEVEL	MAXIMUM COVER HEIGHT	PIPE CULVERT HEADWALL - 15"	PIPE CULVERT HEADWALL - 18"	PIPE CULVERT HEADWALL - 30"	PIPE CULVERT HEADWALL - 36"	S & F BOX INLET-OUTLET 18"	CURB BOX INLET TYPE "A"	DROP BOX INLET TYPE I	JUNCTION BOX 18"	MANHOLE TYPE "A"	MANHOLE TYPE "B"	MANHOLE TYPE "C"	CHANNEL LINING CLASS II	CHANNEL LINING CLASS III
15"	18"	24"	30"	48"					18"	36"	4′x4′ R.C.B.C.	8′x5′ R.C.B.C.																
LINEAR FEET									LINEAR FEET						FT	EACH	EACH	EACH	EACH	EACH	EACH	EACH	EACH	EACH	EACH	EACH	TONS	TONS





AVG. So=8.63%

STREAM PROFILE
Scale : 1" = 100′ Hor., 1" = 10′ Vert.



STA. 32+06.4
US 25
@ 8°35′14" SKEW RT.

M 17.3

SCALE: 1"=10′ H & V

CULVERT SITUATION
STA. 32+06.4 US 25
@ 8°35′14" SKEW RT.

Addendum 2 - 7-11-19

FILE NAME: C:\PWWORKING\PITT\D1483157\R51000PD.DGN
USER: AWESTCOT
DATE PLOTTED: November 15, 2018
E-SHEET NAME:
MicroStation v8.11.9.832

S-080-2018 06-0018.00 Kentucky Transportation Cabinet

ID	Latitude	Longitude	Hole	Station	Offset	Elevation(ft)	Comments
1	38.91434027	-84.6215402	1086	32+02	60	882.48	
118			118	32+00	-80	878.595	
173			173	32+50	-40	877.951	Observation Well Installed On 12/7/15
174			174	32+50	-92	876.917	Observation Well Installed On 12/7/15

M E M O R A N D U M

cc: J. Van Zee
M. Bezold
R. Franxman
R. Turner
D. Gesso
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundation Section

DATE: November 21, 2018

SUBJECT: **Boone County**
FD52 12F0 008 0075 175-176; IMSTP0757129
I-71/75
Mars #: 8433801D
8'x5' RCBC Extension (27'Lt) at Sta. 435+53.90
Item #: 6-0018.00
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on Projectwise and through email for use in development of structure plans. The onsite geotechnical exploration for the project was performed by the consulting firm of Horn and Associates.

The proposed 8'x5' culvert extension will be utilized as part of the proposed reconstruction of the interchange between KY 338 and I-71/75 in Boone County. The structure is located on I-71/75 at approximate M.P. 174.9. The project is in Richwood, KY.

2.0 SITE GEOLOGIC CONDITIONS

This structure is located in the Union Geologic Quadrangle (GQ# 779). The geologic mapping indicates that the bedrock at this site consists primarily of the Fairview Formation.

3.0 FIELD INVESTIGATION

One (1) sample and core hole and one (1) mechanical rockline sounding was taken at this structure's location as part of the structural geotechnical investigation. After drilling, the rock cores were delivered to the KYTC Geotechnical Branch in Frankfort, KY where a geologist logged the rock cores. The soil samples were tested by the consulting firm of HDR, Inc. Two (2) sample borings from the roadway geotechnical investigation report for this project, R-049-2015, were also used in the analysis of this structure (Holes #169 and #170).

4.0 LABORATORY TESTING

The laboratory soil testing for the structural geotechnical investigation was completed by the consulting firm of HDR, Inc. The laboratory soil testing for the roadway investigation was performed by Stantec Consulting Services, Inc. The soil samples obtained from the borings were determined to consist of clayey sand, clayey gravel, and low plasticity clay. The soil samples were designated as SC, GC, and CL by the Unified Soil Classification System.

5.0 SUBSURFACE CONDITIONS

Depth to rock/refusal varied from 2.6 ft to 35.8 ft. The rock core taken at this site consisted of gray silty shale interbedded with limestone. The KY RQD values for the rock cores taken at this proposed culvert location were 0% and core recoveries ranged from 77% to 100%. The top of rock/auger refusal elevations at this site varied from 827.6 ft to 830.5 ft.

6.0 ENGINEERING ANALYSIS

As part of the roadway geotechnical investigation, an embankment stability analysis was performed near this structure at station 435+50 and satisfactory factors of safety were found. Please refer to Geotechnical Engineering Roadway Report R-049-2015 for geotechnical information related to construction of the roadway embankments.

Due to the rock depths and the proposed flow line elevations the culvert should be designed for a **non-yielding** foundation.

7.0 FOUNDATION RECOMMENDATIONS:

7.1 Design this culvert for a **non-yielding** foundation. The culvert should be extended to bedrock.

7.2 Spread footings shall be founded on unweathered bedrock. Size the footings at a service limit state using a factored bearing resistance of 16 ksf. The Designer shall provide a note in the plans directing that the footings be extended to rock and prohibiting the use of granular replacement. The note would indicate that the Presumptive Factored Bearing Resistance at the Service Limit State is 16 ksf for spread footings on Competent Unweathered Bedrock. Contact this Branch for a more detailed analysis of nominal bearing resistance if the strength or extreme limit states control the footing design.

7.3 This culvert should be designed with a paved flowline. The paved flowline shall also include the inlet and outlet apron portions of the culvert's flowline. The footings of the barrel of the culvert will require no embedment and bear directly on competent/unweathered bedrock. The footings of the wingwalls shall be embedded a minimum of 1.0 foot into unweathered bedrock.

7.4 All footing excavations in bedrock shall be cut neatly so that no forming or backfilling is necessary in the construction of the portions of the footings located in rock. Concrete should be placed directly against the cut rock faces. Mass concrete should be placed in the excavation from the top of the footing to the bedrock surface where the footing does not extend to the bedrock surface.

7.5 The wingwalls should be designed using Soil Type 3 of Exhibit 413 in the Division of Structural Design Guidance Manual. It should be noted that the backfill slope being referred to is that which is perpendicular to the wingwall.

8.0 Plan Notes

(Include the notes below at appropriate locations in the Plans.)

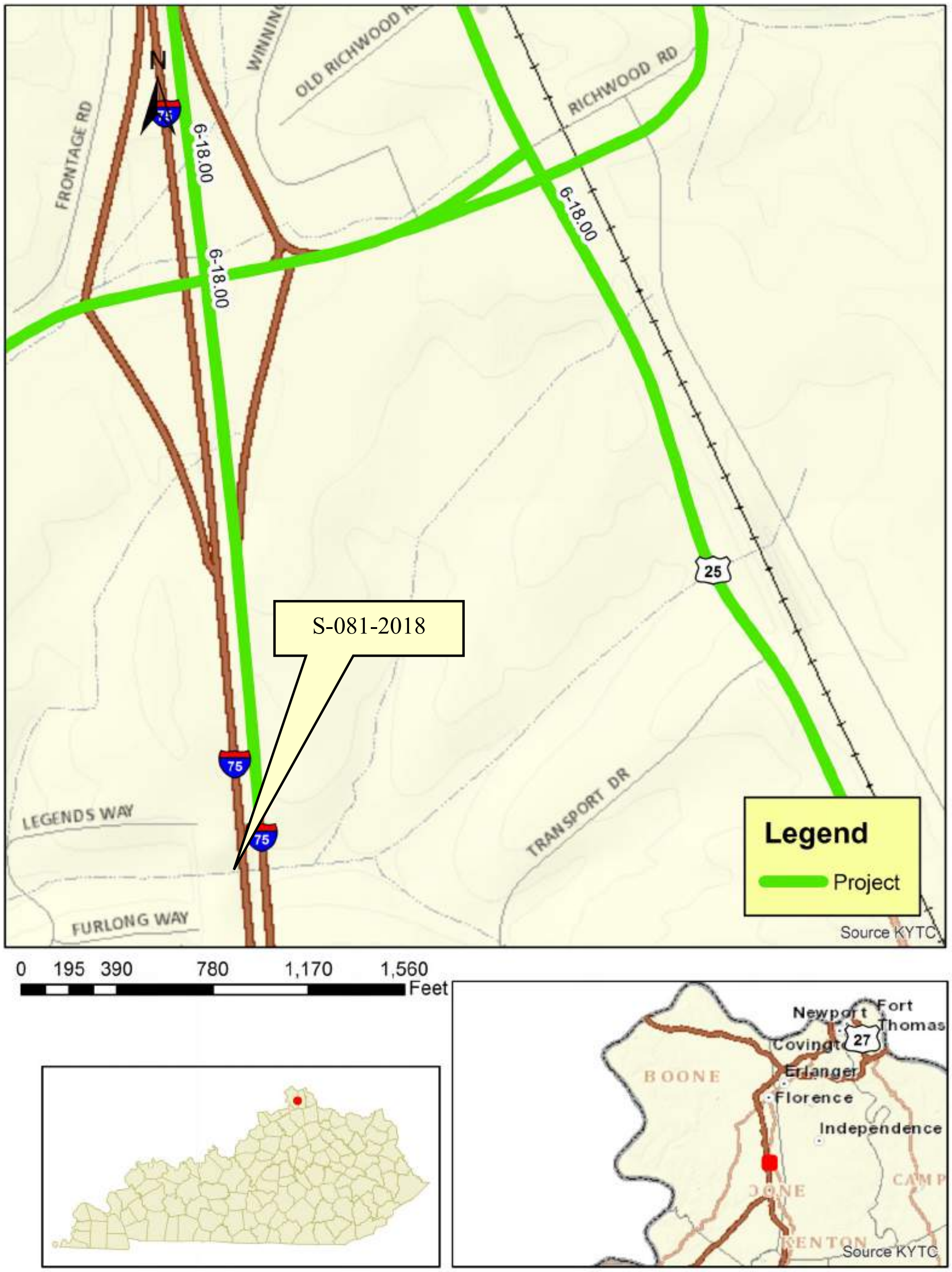
8.1 Solid rock excavation will be required to reach required footing elevations.

8.2 Temporary sheeting or shoring/cofferdams and/or a dewatering method will be required for installation of the footings.

The designer should feel free to contact the Geotechnical Branch for further recommendations, or for any additional questions that arise pertaining to this project, at (502)564-2374.

Attachments:
- Project Location Map
- Subsurface Data Sheet
- Pipe Sheet
- Coordinate Data Sheet

<u>Structure Location Map</u>:



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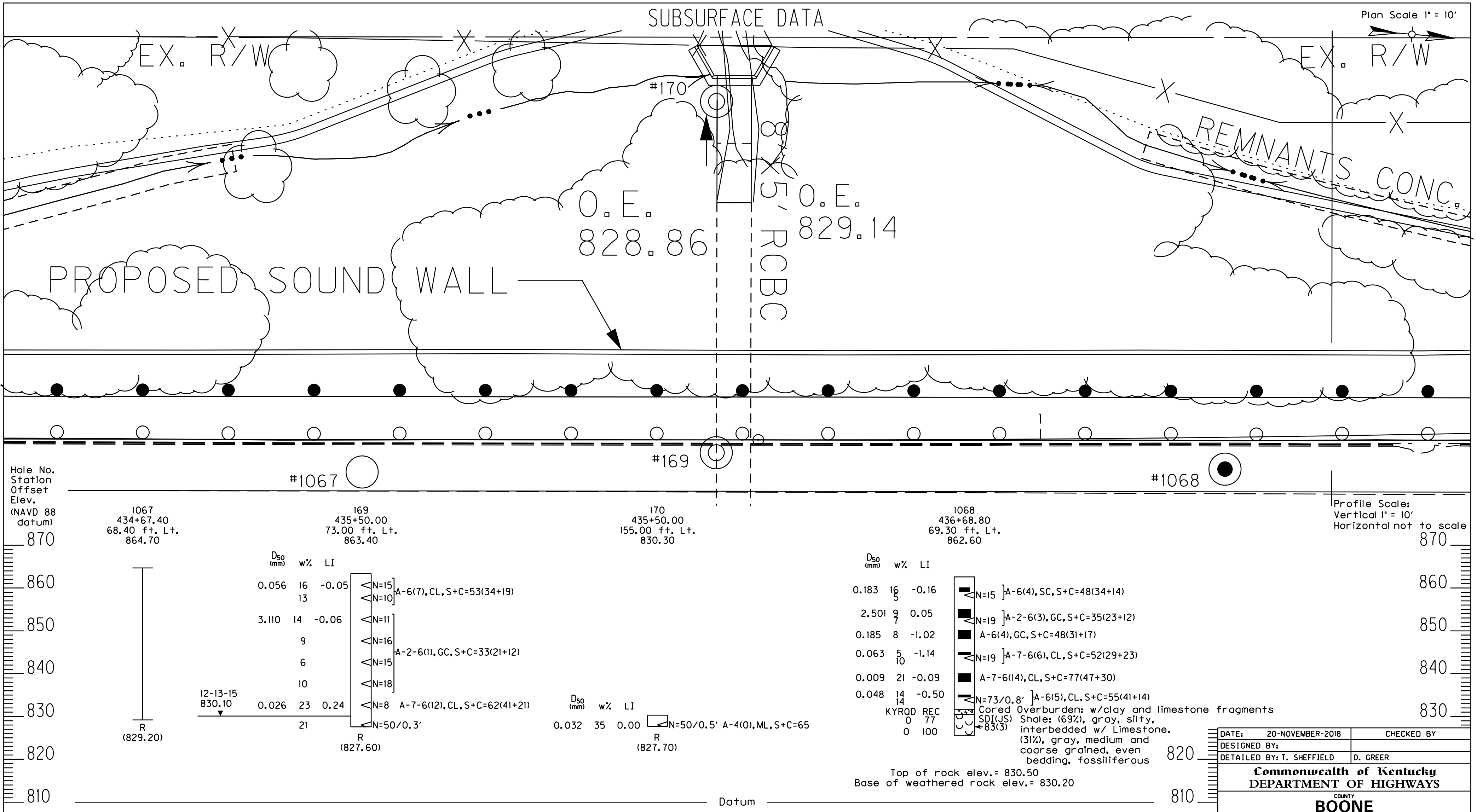
FILE NAME: $$$$design$$file$$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:



The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

S–081–18

ITEM NUMBER

6–0018.00

DATE: 20-NOVEMBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: T. SHEFFIELD	D. GREER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
I 71/75	8'X5' RCBC EXT. AT STA. 435+54

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

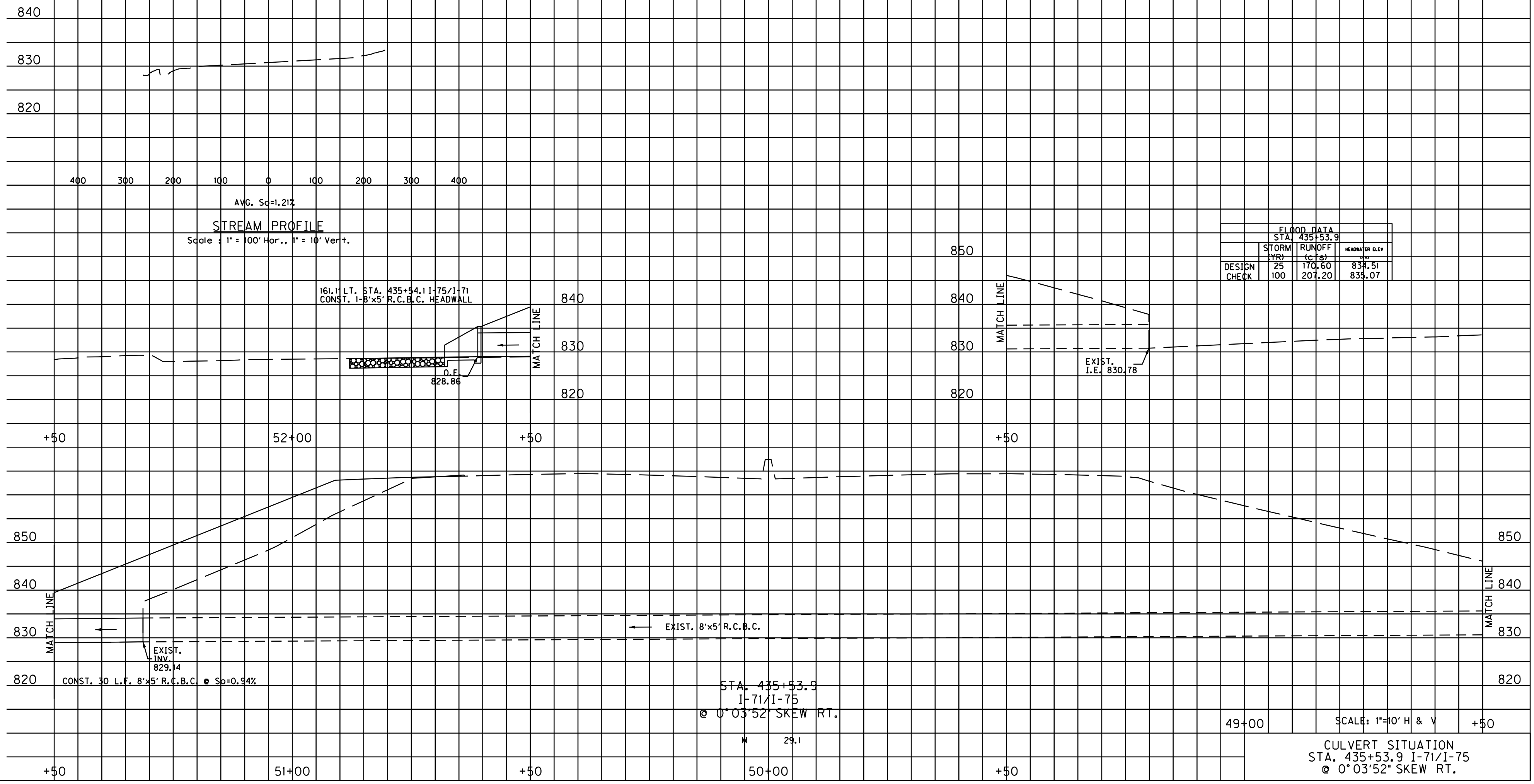
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	R595

PIPE DRAINAGE SHEET 26 of 72

CULVERT SITUATION
STA. 435+53.9
8′ × 5′ R.C.B.C.
@ 0°03′52″ SKEW RT.

STORM SEWER PIPE									CULVERT PIPE					DESIGN pH LEVEL	MAXIMUM COVER HEIGHT	PIPE CULVERT HEADWALL - 15"	PIPE CULVERT HEADWALL - 18"	PIPE CULVERT HEADWALL - 30"	PIPE CULVERT HEADWALL - 36"	S & F BOX INLET-OUTLET 18"	CURB BOX INLET TYPE "A"	DROP BOX INLET TYPE 1	JUNCTION BOX 18"	MANHOLE TYPE "A"	MANHOLE TYPE "B"	MANHOLE TYPE "C"	CHANNEL LINING CLASS II	CHANNEL LINING CLASS III
15"	18"	24"	30"						18"	36"	4′×4′ R.C.B.C.	8′×5′ R.C.B.C.																
LINEAR FEET									LINEAR FEET						FT	EACH	EACH	EACH	EACH	EACH	EACH	EACH	EACH	EACH	EACH	EACH	TONS	TONS



FLOOD DATA STA. 435+53.9	STORM (YR)	RUNOFF (cfs)	HEADWATER ELEV (ft)
DESIGN	25	170.60	834.51
CHECK	100	207.20	835.07

CULVERT SITUATION
STA. 435+53.9 I-71/I-75
@ 0°03′52″ SKEW RT.

FILE NAME: U:\GEOTECH\6-18 KY 338.I 75 INTERCHANGE\S-081-2018\I-75 STA 435+53 BOX CULVERT PIPE SHEET.DGN

USER: tyler.sheffield
DATE PLOTTED: November 21, 2018

E-SHEET NAME:

MicroStation v8.11.7.443

06-0018.00 Kentucky Transportation Cabinet

ID	Latitude	Longitude	Hole	Station	Offset	Elevation(ft)	Comments
11	38.91076166	-84.62857589	1067	434+67.4	-68.4	864.69	
12	38.91131283	-84.62863184	1068	436+68.8	-69.3	862.57	
169			169	435+50	-73	863.44	Observation Well Installed On 12/2/15
170			170	435+50	-155	830.34	

MEMORANDUM **(RA-002-2019)**

TO: **Randy Turner, PE**
Project Management Coordinator
Division of Highway Design

FROM: **Michael Carpenter, PE**
Geotechnical Branch Manager
Division of Structural Design

BY: **Erik Scott, PE**
Geotechnical Branch

DATE: **April 4, 2019**

SUBJECT: **Boone County**
FD04 008 0075 175-176
Reconstruction of I-75 / I-71 & KY 338 (Richwood Road) Interchange
KY 338 (Richwood Road) Station 99+00.00 to 392+43.78
US 25 (Dixie Highway) Station 5+83.94 to 77+00.00
I-75/71 Station 419+03.64 to 506+17.60
I-75 Milepoints 175.217 to 175.622
Item No. 6-18.00
Mars No. 8433801D
Geotechnical Engineering Roadway Report Addendum

I. Project Background

The original geotechnical engineering report for the subject project (R-049-2015) was completed by Stantec Consulting Services, Inc. and approved / issued by the KYTC Geotechnical Branch on November 14, 2016. Since that time various revisions have been made to the plans, which will require an updated geotechnical report. No additional drilling or testing were required for the addendum. A previous addendum (RA-010-2018), issued March 27, 2019, provided recommendations for the Norfolk Southern Railroad non-structural improvements. Structure foundation reports for the railroad bridge and other structures are being issued under separate covers.

This addendum includes updated subgrade recommendations, realignment at Best Pal Drive and the Pilot Entrance, and wall elimination or limit changes. In addition, the addendum provides subsurface information for pipes of 54-in diameter or larger, lightweight fill requirements for two box culvert extensions, and updates geotechnical notes as needed to reflect current wording and station references. Only revised geotechnical notes and recommendations are provided below. Only revised geotechnical sheets are attached (geotechnical notes, soil profile, cut stability, and embankment stability sheets). The CADD input for the revised or new roadway geotechnical sheets, in DGN format, is being e-mailed to the Designer, HDR Inc., for incorporation into the roadway plans. Other original DGNs that were not changed are still acceptable for use.

II. Subgrade Stabilization

The original report recommended chemical stabilization of the subgrade using lime. After the original report, the chemical was switched to cement due to a desire to save construction time. The soils on the project are highly favorable for lime stabilization. After further discussion, the stabilization will be changed back to lime. To address concerns for needing faster construction, especially for ramps, a special note is included for accelerated cement stabilization. This will be allowed provided that the existing DGA, and optionally some of the existing asphalt, is mixed with the cement and soil. This will allow the cement to work with area soils, and has been used on past projects in the area. Other chemically stabilized areas will require lime stabilization.

The original report recommended alternate stabilization methods where chemical stabilization may not be feasible due to cross-overs, property entrances, and narrow part-width construction. Coarse Aggregate wrapped with fabric was originally recommended. This stabilization recommendation is being changed to additional base aggregate underlain with geosynthetics. The Special Note for Spot Subgrade Stabilization will address this treatment. See Geotechnical Note No. 7.19 below for more information. For quantity estimation only, 4,000 linear feet of roadway should be included in the plans for this treatment. The bid item for this work will be Subgrade Stabilization.

III. Lightweight Fill

The structure geotechnical investigations were performed after the initial roadway work, and identified two culvert extension locations where lightweight fill will be required above the existing culverts. The first is the 8′X5′ RCBC Extension Left of I-75/I-71 Station 435+53. Construction plans for the existing culvert show a stepped-down top slab from the outlet extending back twenty-nine (29) feet toward I-75/I-71. Since the stepped top slab was not designed for the full existing embankment height, lightweight fill will be required to make sure applied pressures to the existing culvert are not increased with the new embankment. Evaluation of alternates by the Geotechnical Branch revealed two possible lightweight material options: lightweight cellular concrete, or expanded polystyrene (EPS) geofoam. Details sheets are being provided for both lightweight options for inclusion in the plans. Also the ***Special Note for EPS Block Embankments*** and the ***Special Note for Cellular Concrete Fill*** are being provided for inclusion with the contract proposal documents.

The second location is the 4′X4′ RCBC Extension Left and Right of US 25 Station 32+06. Existing plans could not be located to determine if the culvert was stepped. The project team suspected the culvert was likely not stepped due to the lower fill height. However, additional fill is being added above the existing culvert, so lightweight fill will be required to keep applied pressures from increasing. Lightweight cellular concrete or expanded polystyrene (EPS) geofoam alternates are suitable for this location. Details sheets are being provided for both options at this location. The same special notes will apply to both culvert locations.

IV. Updated Slope Stability Analyses

One original stability analysis had to be updated with this addendum. The stability analysis at I-75/I-71 Station 435+50 had to be updated to reflect the lightweight fill required for the culvert. Both the cellular concrete and geofoam options were evaluated for stability and the safety factors exceeded those from the original analyses. The railroad geotechnical recommendations required stability analyses for the embankment at Proposed Laydown Yard Station 9+50, and the cut at Proposed Temporary Spur Station 6+00. These analyses were included in the previous addendum with railroad geotechnical recommendations.

V. Changes to Roadway Plans

After the original geotechnical report was issued, there were minor changes to the begin/end stations for several routes. Also, the naming of several ramps was adjusted, and the I-75/I-71 auxiliary entrance and exit ramps were renamed to use I-75/I-71 stationing. All these changes were reflected in the updated notes and recommendations.

Major changes were made to the alignment of Best Pal Drive, which intersects proposed KY 338 at Station 373+27. These changes also affected the Pilot Entrance, which intersects proposed Best al Drive at Station 32+00. The geotechnical recommendations and drawings were updated for these changes, including revisions to three soil profile sheets and one cut stability sheet.

VI. Pipe Subsurface Information

There are several large reinforced concrete pipes proposed for the project. The Geotechnical Branch typically obtains rockline soundings for pipes with diameters of 54 inches or greater. Manual rod soundings were obtained for the proposed 72-inch pipe extensions on Triple Crown Boulevard. Specific pipe sounding information was not obtained for the other larger pipes, however nearby borings are used where available to provide rockline information.

A geotechnical note has been added referencing the locations of pipes at least 54 inches in diameter. (See Table 1 on the following page.) Available subsurface information for each pipe will be tabulated on the appropriate soil profile sheet. This will give the Contractor a better idea of the bedrock location in these areas, and the type of excavation that will be required.

Table 1: Summary of Pipe Subsurface Information (≥ 54″ Diameter)			
Proposed Size (in.)	**Approximate Location**	**Boring Nos.**	**Notes**
72	Triple Crown Blvd., Sta 51+00, LT.	194, 195	Extension of existing RCBC
72	Triple Crown Blvd., Sta 51+00, RT.	203	Extension of existing RCBC
72	KY 338, 119+50 to 124+07 EB KY 338, 100+00 to 105+00	20, 82, 94	4 segments. Connects existing 8'X4' RCBC & 72" pipe east of I-75/I-71 Ramp C
72	EB KY 338, Sta 105+91	2, 26	2 segments. Inlet north of I-75/I-71 Ramp A1; connects to proposed 72" pipe

REVISED GEOTECHNICAL NOTES:

7.1 Clearing and grubbing of embankment areas shall be completed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.2 Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.3 Procedures shall be performed as required to control erosion and water pollution in accordance with Sections 212 and 213 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.4 All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.5 All catch basins and manholes shall be filled and capped and all septic tanks shall be filled in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

7.6 All channel changes and special ditches shall be constructed prior to placement of any embankment materials adjacent to them in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Materials excavated from these areas may be utilized in construction of the embankments, but may require aeration to the proper moisture contents prior to compaction operations. No extra payment shall be permitted for re-handling, hauling, stockpiling, and/or manipulating these materials.

7.7 In accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, the moisture content of embankment and subgrade materials shall not vary from the optimum moisture content, as determined by KM 64-511, by more than ±2%. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

7.8 All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for re-handling, hauling, stockpiling, and/or manipulating soils.

7.9 The Contractor shall conduct grading operations in such a manner that limestone obtained from roadway excavation shall be stockpiled separately or otherwise manipulated so that ample quantities are available for those areas requiring said material. No direct payment will be allowed for such necessary manipulating as stockpiling and/or double handling the material. Limestone shall not be wasted unless prior approval is obtained from the Engineer.

7.10 The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be incidental to the earthwork.

7.11 Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas as directed by the Engineer shall be drained and stabilized using non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. An estimated 3-foot working platform shall be constructed in such areas.

7.12 As directed by the Engineer, a three-foot thickness of non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction shall be utilized to fill full-width and stabilize the existing drainage swales or stream channels located within the limits of the roadway embankment. The granular embankment shall also be placed over all adjacent areas that may be soft and saturated. Positive drainage of these abandoned stream channels shall be maintained to reduce the possibility of trapping water within the roadway embankments.

7.13 The Contractor shall construct embankment foundation benches and transverse benches as indicated on the plans or as directed by the Engineer, prior to placement of embankments in areas requiring such benches.

7.14 Foundation embankment benches and longitudinal perforated pipe underdrains shall be constructed in accordance with Standard Drawing RGX-010 at the locations listed below and/or as directed by the Engineer. Contrary to Standard Drawing RGX-010, the typical rise height for benching into soil/earth slopes shall be four (4) to six (6) feet. Benches in earth slopes shall be constructed one at a time beginning with the lowest bench, and each bench shall be backfilled prior to excavation of the next bench. If water is encountered during benching, construct a minimum one (1) foot thick drainage blanket as directed by the Engineer, or contact the Geotechnical Branch for guidance. The drainage blanket shall consist of Kentucky Coarse Aggregate No. 2 in accordance with Section 805 of the current Standard Specifications, or other available material deemed suitable by the Engineer. The drainage blanket shall extend to the toe of slope to provide positive drainage and shall be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

Approximate Station Limits

KY 338
99+25 to 106+75, Left
107+75 to 108+25, Left
387+50 to 390+75, Right

I-71/I-75
421+75 to 426+75, Left
432+75 to 437+75, Left

478+25 to 482+75, Left
479+75 to 483+00, Right

I-71/I-75 Ramp A
93+75 to 95+75, Right

I-75/I-71 Ramp B
256+25 to 264+25, Right

US 25
18+50 to 23+75, Left
18+25 to 21+25, Right
30+00 to 33+25, Right
31+25 to 33+50, Left

Triple Crown Blvd
50+75 to 51+75, Lt. and Rt.

7.15 Conventional transverse benches shall be constructed and perforated pipe underdrains installed at the following approximate locations in accordance with Kentucky Department of Highways Standard Drawings RDP-005 and RDP-006, project cross-sections (as applicable), and as directed by the Engineer. Contrary to Standard Drawing RDP-006, transverse benches and perforated pipe underdrains shall be installed in both uphill and downhill transition areas between cuts and fills. Existing perforated pipe underdrains should be extended.

Approximate Stations

I-75/I-71 Ramp A1
155+52
157+20

I-75/I-71 Ramp B
252+20

I-75/I-71 Ramp B1
202+02

TA Entrance
51+60
53+5

7.16 Perforated pipes for subgrade drainage shall be installed or extended at vertical sags and at the upgrade ends of structures, in accordance with Kentucky Department of Highways Standard Drawing RDP-005 and/or as directed by the Engineer. These drainage features shall be installed at the following approximate locations.

Approximate Stations

KY 338
100+25
108+60
113+40

I-75/I-71 Ramp A1
156+90

I-75/I-71 Ramp B1
202+45

I-75/I-71 Ramp C1
352+60

I-75/I-71 Ramp D
415+90

US 25
9+97
22+43
32+63
54+10

US 25 Ramp A
17+49

US 25 Ramp D
42+05

US 25 Ramp E
59+22

US 25 Ramp G
71+25

Grand National Blvd
98+90

Grand National Access Drive
50+20
55+75

Triple Crown Blvd
51+80

Best Pal Drive
17+68
26+28

TA Entrance
50+99

Old Lexington Pike
5+65

Frogtown Connector Road
600+70

I-75 / I-71
439+50

Ridge Transportation Entrance 1
10+48

Ridge Transportation Entrance 2
19+62

Richwood Road
22+95

7.17 The Contractor shall conduct grading operations in such a manner that soil (free of rock larger than 4 inches) from roadway excavation be stockpiled separately or otherwise manipulated so that ample quantities are available for a chemically stabilized roadbed meeting the requirements of Section 208 of the current Standard Specifications for Road and Bridge Construction. No direct payment will be allowed for such necessary manipulating as stockpiling, hauling and/or handling the material.

7.18 Construct an eight (8)-inch **lime stabilized** soil subgrade for the project. Apply the lime in accordance with Section 208 of the Standard Specifications for Road and Bridge Construction. Where soft and/or wet subgrade is encountered during construction, the thickness of the chemically modified soil may need to be adjusted (increased up to 16-inch max) to also serve as a working platform for subgrade stabilization. These adjustments shall be as directed by the Engineer, and may depend on the seasonal fluctuations in the water table. In areas where existing Dense Graded Aggregate (DGA) and/or milled asphalt can be incorporated into the 8-inches of chemically stabilized soil, cement may be used for stabilization in lieu of lime. This may result in a decreased curing time. The stabilization shall be in accordance with the Special Note for Accelerated Cement Subgrade Stabilization and payment shall use lime stabilization bid items.

7.19 In areas where the chemical stabilization is not feasible (such as cross-overs, tie-ins, narrow widenings, etc.) the subgrade shall be constructed with either eight (8) additional inches of Crushed Stone Base (CSB) underlain with geogrid or six (6) additional inches of Crushed Stone Base (CSB) underlain with high-strength fabric. Geogrid, if used, shall be underlain with Geotextile Fabric, in accordance with Sections 214 & 843 of the current Standard Specifications. Contrary to the Standard Specifications, Type IV Geotextile Fabric shall be used in lieu of Type III Fabric. The subgrade material properties and installation shall be in accordance with the Special Note for Spot Subgrade Stabilization (Alternatives C or D only) and the current Standard Specifications for Road and Bridge Construction. The aggregate shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction.

7.20 Where non-durable shale (SDI ≤ 95) or limestone bedrock is encountered at the top of subgrade in the cuts, the roadbed shall be undercut one (1) foot below the proposed grade and the limits of the roadbed excavation shall be extended to the ditchlines. The refill shall consist of soil for a chemically stabilized roadbed in accordance with Section 208 of the current Standard Specifications for Road and Bridge Construction.

7.21 Where pile foundations are utilized for bridges, pile cores shall be constructed in accordance with Kentucky Standard Drawings RGX-100 and RGX-105, meeting the material requirements of the current edition of Special Provision 69.

7.22 As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and backfilled with suitable subgrade material in accordance with Section 207 of the current Standard Specifications.

Approximate Station Limits

KY 338
99+00 to 124+07
370+20 to 371+50
388+50 to 392+00

EB KY 338
100+00 to 105+00
112+00 to 116+07

WB KY 338
205+00 to 216+22

I-75/I-71
419+04 to 443+50
475+00 to 506+18

I-75/I-71 Ramp A
87+60 to 97+00

I-75/I-71 Ramp B
255+50 to 265+40

I-75/I-71 Ramp C
304+50 to 313+50

I-75/I-71 Ramp D
400+00 to 410+50
415+50 to 416+00

US 25
5+84 to 22+90
27+60 to 30+80
34+00 to 77+00

Triple Crown Blvd
50+00 to 53+14

Best Pal Drive
24+25 to 28+25

Paddock Drive
201+00 to 203+40

Frogtown Connector
601+50 to 602+50

Old Lexington Road
9+50 to 11+50

Richwood Road
19+00 to 21+00

7.23 As directed by the Engineer, existing bituminous concrete at the following approximate locations that is positioned within the limits of new roadway embankments and positioned at a distance greater than three feet below proposed subgrade elevation, shall be scarified or broken until all cleavage planes are destroyed, or the pavement shall be removed entirely as conditions demand in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Subgrade materials remaining after removal of pavements may need to be stabilized prior to placement of new pavement sections, as directed by the Engineer.

Approximate Station Limits

US 25
30+80 to 34+00

7.24 The retaining walls at the following locations will affect the cut slope and embankment construction. For these areas, please refer to the structural plans for specific instructions for cut slope and embankment construction.

Approximate Station Limits

KY 338
Retaining Wall No. 1: 103+88 to 106+10, Left
Retaining Wall No. 1A: 107+72 to 108+28, Left
Retaining Wall No. 2: 113+80 to 114+70, Left

WB KY 338
Retaining Wall No. 3: 201+13 to 202+73, Left
Retaining Wall No. 15: 207+80 to 209+45, Right

EB KY 338
Retaining Wall No. 14: 107+85 to 109+58, Left

Best Pal Drive
Retaining Wall No. 4: 23+00 to 24+48, Right

US 25
Retaining Wall No. 7: 42+25 to 46+68.52, Left
Retaining Wall No. 8: 49+57.27 to 55+25, Left
Retaining Wall No. 9: 42+25 to 46+68.52, Left
Retaining Wall No. 10: 49+56.52 to 54+25, Right

US 25: Ramp A / Ramp B
Retaining Wall No. 11: 13+50 (Ramp A to 20+60.93 (Ramp B), Right

US 25: Ramp C
Retaining Wall No. 12: 30+45.8 to 31+50, Right

I-75/I-71
Retaining Wall No. 13: 489+85 to 490+25, Right

7.25 Embankment slopes at the following location will need to be flatter than a 2:1 (H:V) to maintain minimum factor of safety requirements for slope stability. The fill limits and required sections show the flattened slopes and results of the stability analysis.

Approximate Station Limits	**Steepest Allowable Slope**
I-75/I-71: 434+80 to 436+20	2.5:1 (H:V)

7.26 All embankment construction using non-durable shale will be in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction, “Embankment Principally of Non-Durable Shale”.

7.27 Some areas of the project may contain silts or sands at subgrade. Lime may not be effective in stabilizing these materials. If such soils are encountered cement should be more effective. The Stabilization Contractor shall adjust the stabilization techniques, as directed by the Engineer. Based on boring information, these soils may be encountered at the following locations. Geotechnical Branch personnel are available to assist in identifying these soil types and providing alternative treatment recommendations, if needed. The original lime stabilization bid items will be used for payment for any such changes.

Approximate Station Limits

I-75/I-71 Ramp B
260+50 to 265+40

Old Lexington Pike
5+00 to 10+00

7.28 Soil borings were performed near the reinforced concrete pipe culverts (RCPs) at the following locations. See the Geotechnical Profile Sheets for rockline information.

Approximate Stations

EB KY 338
100+00
105+91

Triple Crown Blvd.
51+00

Lightweight Fill for Culvert Extensions @ I-75/I-71 Sta 435+53, US 25 Sta 32+06:

7.29 Place lightweight fill material as shown in the plans and in accordance with the Special Note for Cellular Concrete Fill OR the Special Note for EPS Foam Block Embankments, and the appropriate Lightweight Fill Detail Sheet. These documents provide additional detail on the construction of the lightweight fill. The fill shall extend perpendicular to the culvert to the minimum limits shown on the detail sheets.

7.30 Lightweight fill shall be covered with a minimum two (2)-foot of soil cap when it is not directly beneath pavement and base aggregate. The soil shall consist of clay classified as either CL or CH in the Unified Soil Classification System (USCS) and placed and compacted in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction.

7.31 When EPS geofoam fill is within five (5) feet of the proposed road grade, a concrete load distributor is required above the top layer of geofoam blocks. The Special Note for EPS Foam Block Embankments provides details for the concrete load distributor.

7.32 Temporary sheeting or shoring may be required for construction of the lightweight fill. The specific designs for any necessary sheeting and shoring shall be performed by the Contractor and approved by the Engineer. Construction and stability of temporary slopes required for lightweight fill placement are the responsibility of the Contractor. Caution should be used with sheeting/shoring or temporary slopes adjacent to existing roadways. The time any temporary cut slopes are left open should be minimized to reduce the likely of slope instability.

7.33 Any changes in lightweight fill configuration and material type from the applicable Lightweight Fill Detail Sheet and Special Note will require additional design and analysis by the Contractor or Supplier, meeting the approval of the Engineer.

7.34 A proposed soundwall will be constructed in the area of the 8X5 culvert extension at I-75/I-71 Station 435+53. Drilled shaft soundwall foundations should be considered prior to lightweight fill placement to prevent negative impact to the lightweight fill materials. For any drilled shafts within the lightweight fill zone, drilling should not be performed through geofoam materials. Drilled shaft side capacity should be neglected in lightweight fill materials, unless updated designs are provided by the Contractor and approved by the Department.

REVISED DESIGN RECOMMENDATIONS:

8.1 The project shall be designed using a soil CBR of 2 beneath the chemically stabilized soil.

8.2 The project should be designed for a chemically stabilized subgrade. Chemical treatment for the top eight (8) inches of subgrade is recommended. The appropriate chemical for treating the soil types encountered on this project is **lime.** It is suggested that 6 percent, by dry mass, be utilized to determine plan quantities, using an average dry density of 101 lb/ft^3. The chemical shall be applied in accordance with Section 208 of the Standard Specifications for Road and Bridge Construction, current edition.

8.3 An average soil shrinkage value of 3% is recommended for soil to be excavated on this project. This value is to be used in calculating an "apparent" shrinkage value in accordance with Section 61-03.0400 of the Kentucky Transportation Cabinet Division of Design Guidance Manual. This shrinkage value should be applied only to soil positioned above the top of rock. A shrink/swell value of zero (0) should be applied to Rock Disintegration Zone (RDZ) material.

8.4 The recommended rock swell factor is 10% for material excavated below the RDZ.

8.5 Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas directed by the Engineer shall be drained and stabilized, as specified in Geotechnical Note 7.11 of this report. For quantity estimating purposes only, the following areas shall be considered for this treatment.

Approximate Station Limits

EB KY 338
110+50 to 116+00, Left

I-71/I-75
422+50 to 438+75, Left

US 25
32+00 to 33+00, Left
60+00 to 62+00, Right

8.6 As directed by the Engineer, existing drainage swales or stream channels shall be filled and stabilized with non-erodible Granular Embankment, as specified in Geotechnical Note 7.12 of this report. For quantity estimating purposes only, the following intervals shall be considered.

Approximate Station Limits

KY 338
107+75 to 108+25, Left

WB KY 338
214+00 to 216+00, Left

I-75/I-71
433+00 to 434+25, Left

I-75/I-71
479+50 to 480+25, Right
482+00 to 484+00, Right

I-75/I-71 Ramp A
94+00 to 95+50, Right

I-75/I-71 Ramp B
251+50 to 252+25, Right

I-75/I-71 Ramp B1
200+00 to 201+50, Left and Right

cc: **Division of Design (Plan Processing Section)**
TEBM for Pavement Design
Division of Construction
TEBM for Project Delivery & Preservation (District 6)
TEBM for Project Development (District 6)
Project Manager (District 6)
HMB, Inc.
HDR, Inc.
Parsons

Attachments:

Attachment #1

Revised Geotechnical Drawings

GEOTECHNICAL NOTES

1. Clearing and grubbing of embankment areas shall be completed in accordance with Section 202 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

2. Removal of existing structures and other obstructions shall be completed in accordance with Section 203 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

3. Procedures shall be performed as required to control erosion and water pollution in accordance with Sections 212 and 213 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

4. All water wells and/or cisterns within the limits of construction, whether shown on the plans or not, shall be plugged in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

5. All catch basins and manholes shall be filled and capped and all septic tanks shall be filled in accordance with Section 708 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

6. All channel changes and special ditches shall be constructed prior to placement of any embankment materials adjacent to them in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Materials excavated from these areas may be utilized in construction of the embankments, but may require aeration to the proper moisture contents prior to compaction operations. No extra payment shall be permitted for re-handling, hauling, stockpiling, and/or manipulating these materials.

7. In accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, the moisture content of embankment and subgrade materials shall not vary from the optimum moisture content, as determined by KM 64-511, by more than *2%. This moisture content requirement shall have equal weight with the density requirement when determining the acceptability of embankment or subgrade construction. Refer to the family of curves for moisture-density relationships.

8. All soils, whether from roadway excavation or borrow, may require manipulation to obtain proper moisture contents prior to compaction. Direct payment shall not be permitted for re-handling, hauling, stockpiling, and/or manipulating soils.

9. The Contractor shall conduct grading operations in such a manner that limestone obtained from roadway excavation shall be stockpiled separately or otherwise manipulated so that ample quantities are available for those areas requiring said material. No direct payment will be allowed for such necessary manipulating as stockpiling and/or double handling the material. Limestone shall not be wasted unless prior approval is obtained from the Engineer.

10. The Contractor is responsible for conducting any operations necessary to excavate the cut areas to the required typical sections. The cost of these operations shall be incidental to the earthwork.

11. Any saturated, soft, unstable areas encountered within embankment foundation limits and/or any other areas as directed by the Engineer shall be drained and stabilized using non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. An estimated 3-foot working platform shall be constructed in such areas.

12. As directed by the Engineer, a three-foot thickness of non-erodible Granular Embankment meeting the requirements of Section 805 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction shall be utilized to fill full-width and stabilize the existing drainage swales or stream channels located within the limits of the roadway embankment. The granular embankment shall also be placed over all adjacent areas that may be soft and saturated. Positive drainage of these abandoned stream channels shall be maintained to reduce the possibility of trapping water within the roadway embankments.

13. The Contractor shall construct embankment foundation benches and transverse benches as indicated on the plans or as directed by the Engineer, prior to placement of embankments in areas requiring such benches.

14. Foundation embankment benches and longitudinal perforated pipe underdrains shall be constructed in accordance with Standard Drawing RGX-010 at the locations listed below and/or as directed by the Engineer. Contrary to Standard Drawing RGX-010, the typical rise height for benching into soil/earth slopes shall be four (4) to six (6) feet. Benches in earth slopes shall be constructed one at a time beginning with the lowest bench, and each bench shall be backfilled prior to excavation of the next bench. If water is encountered during benching, construct a minimum one (1) foot thick drainage blanket as directed by the Engineer, or contact the Geotechnical Branch for guidance. The drainage blanket shall consist of Kentucky Coarse Aggregate No. 2 in accordance with Section 805 of the current Standard Specifications, or other available material deemed suitable by the Engineer. The drainage blanket shall extend to the toe of slope to provide positive drainage and shall be wrapped with Type IV Geotextile Fabric in accordance with Sections 214 and 843 of the current Standard Specifications.

Approximate Station Limits
KY 338
99+25 to 106+75, Left
107+75 to 108+25, Left
387+50 to 390+75, Right

I-71/I-75
421+75 to 426+75, Left
432+75 to 437+75, Left
478+25 to 482+75, Left
479+75 to 483+00, Right

I-75/I-71 Ramp A
93+75 to 95+75, Right

I-75/I-71 Ramp B
256+25 to 264+25, Right

US 25
18+50 to 23+75, Left
18+25 to 21+25, Right
30+00 to 33+25, Right
31+25 to 33+50, Left

Triple Crown Blvd
50+75 to 51+75, Left and Right

15. Conventional transverse benches shall be constructed and perforated pipe underdrains installed at the following approximate locations in accordance with Kentucky Department of Highways Standard Drawings RDP-005 and RDP-006, project cross-sections (as applicable), and as directed by the Engineer. Contrary to Standard Drawing RDP-006, transverse benches and perforated pipe underdrains shall be installed in both uphill and downhill transition areas between cuts and fills. Existing perforated pipe underdrains should be extended.

Approximate Station Limits
I-75/I-71 Ramp A1
155+52
157+20

I-75/I-71 Ramp B
252+20

I-75/I-71 Ramp B1
202+02

TA Entrance
51+60
53+50

16. Perforated pipes for subgrade drainage shall be installed or extended at vertical sags and at the upgrade ends of structures, in accordance with Kentucky Department of Highways Standard Drawing RDP-005 and/or as directed by the Engineer. These drainage features shall be installed at the following approximate locations.

Approximate Station Limits
KY 338
100+25
108+60
113+40

I-75/I-71
439+50

I-75/I-71 Ramp A1
156+90

I-75/I-71 Ramp B1
202+45

I-75/I-71 Ramp C1
352+60

I-75/I-71 Ramp D
415+90

US 25
9+97
22+43
32+63
54+10

US 25 Ramp A
17+49

US 25 Ramp D
42+05

US 25 Ramp E
59+22

US 25 Ramp G
71+25

Grand National Blvd
98+90

Grand National Access Drive
50+20
55+75

Triple Crown Blvd
51+80

Best Pal Drive
17+68
26+28

TA Entrance
50+99

Old Lexington Pike
5+65

Frogtown Connector Road
600+70

Ridge Transportation Entrance 1
10+48

Ridge Transportation Entrance 2
19+62

Richwood Road
22+95

17. The Contractor shall conduct grading operations in such a manner that soil (free of rock larger than 4 inches) from roadway excavation be stockpiled separately or otherwise manipulated so that ample quantities are available for a chemically stabilized roadbed meeting the requirements of Section 208 of the current Standard Specifications for Road and Bridge Construction. No direct payment will be allowed for such necessary manipulating as stockpiling, hauling and/or handling the material.

18. Construct an eight (8)-inch lime stabilized soil subgrade for the project. Apply the lime in accordance with Section 208 of the Standard Specifications for Road and Bridge Construction. Where soft and/or wet subgrade is encountered during construction, the thickness of the chemically modified soil may need to be adjusted (increased up to 16-inch max) to also serve as a working platform for subgrade stabilization. These adjustments shall be as directed by the Engineer, and may depend on the seasonal fluctuations in the water table. In areas where existing Dense Graded Aggregate (DGA) and/or milled asphalt can be incorporated into the 8-inches of chemically stabilized soil, cement may be used for stabilization in lieu of lime. This may result in a decreased curing time. The stabilization shall be in accordance with the Special Note for Accelerated Cement Subgrade Stabilization and payment shall use lime stabilization bid items.

DESIGNED BY:
DATE SUBMITTED:

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS: FD52 008 0075 175-176

GEOTECHNICAL NOTES
Addendum 2 -- 7-11-19

GEOTECHNICAL NOTES

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

19. In areas where the chemical stabilization is not feasible (such as cross-overs, tie-ins, narrow widenings, etc.) the subgrade shall be constructed with either eight (8) additional inches of Crushed Stone Base (CSB) underlain with geogrid or six (6) additional inches of Crushed Stone Base (CSB) underlain with high-strength fabric. Geogrid, if used, shall be underlain with Geotextile Fabric, in accordance with Sections 214 & 843 of the current Standard Specifications. Contrary to the Standard Specifications, Type IV Geotextile Fabric shall be used in lieu of Type III Fabric. The subgrade material properties and installation shall be in accordance with the Special Note for Spot Subgrade Stabilization (Alternatives C or D only) and the current Standard Specifications for Road and Bridge Construction. The aggregate shall daylight horizontally to the edge of embankment in fills and to the ditchline in cuts to ensure positive drainage. The actual locations will be determined by the Engineer during construction.

20. Where shale (or limestone) bedrock is encountered at the top of subgrade in the cuts, the roadbed shall be undercut one foot below the proposed grade and the limits of the roadbed excavation shall be extended to the ditchlines. The refill shall consist of soil and shall be constructed as specified in Section 204 of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction, current edition. Shale cannot be used in the top one foot of the subgrade. For Roadway Excavation projects, the placement of soil refill shall be incidental. For Embankment-in-Place projects, the placement of soil refill shall be paid at the unit bid price for Embankment-in-Place and the excavation of the bedrock material shall be incidental. For either case, no compensation shall be made for the incidental portions of this work.

21. Pile cores shall be constructed at the bridge approach embankments in accordance with Kentucky Standard Drawings RGX-100 and RGX-105, meeting the material requirements of the current edition of Special Provision 69.

22. As directed by the Engineer, existing bituminous pavement at the following approximate locations that is positioned less than three feet from proposed subgrade level, and is not being overlaid, shall be undercut a minimum of two feet beneath proposed subgrade level in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and backfilled with suitable subgrade material in accordance with Section 207 of the current Standard Specifications.

Approximate Station Limits
KY 338
99+00 to 124+07
370+20 to 371+50
388+50 to 392+00

EB KY 338
100+00 to 105+00
112+00 to 116+07

WB KY 338
205+00 to 216+22

SB I-71/I-75 AUX. ENTRANCE RAMP
419+04 to 443+50
475+00 to 506+18

I-75/I-71 Ramp A
87+60 to 97+00

I-75/I-71 Ramp B
255+50 to 265+40

I-75/I-71 Ramp C
304+50 to 313+50

I-75/I-71 Ramp D
400+00 to 410+50
415+50 to 416+00

US 25
5+84 to 22+90
27+60 to 30+80
34+00 to 77+00

Triple Crown Blvd
50+00 to 53+14

Paddock Drive
201+00 to 203+40

Best Pal Drive
24+25 to 28+25

Frogtown Connector
601+50 to 602+50

Old Lexington Road
9+50 to 11+50

Richwood Road
19+00 to 21+00

23. As directed by the Engineer, existing bituminous concrete at the following approximate locations that is positioned within the limits of new roadway embankments and positioned at a distance greater than three feet below proposed subgrade elevation, shall be scarified or broken until all cleavage planes are destroyed, or the pavement shall be removed entirely as conditions demand in accordance with Section 206 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. Subgrade materials remaining after removal of pavements may need to be stabilized prior to placement of new pavement sections, as directed by the Engineer.

Approximate Station Limits
US 25
30+80 to 34+00

24. The retaining walls at the following locations will affect the cut slope and embankment construction. For these areas, please refer to the structural plans for specific instructions for cut slope and embankment construction.

Approximate Station Limits

KY 338
Retaining Wall No. 1: 103+88 to 106+10, Left
Retaining Wall No. 1A: 107+72 to 108+28, Left
Retaining Wall No. 2: 113+80 to 114+70, Left

EB KY 338
Retaining Wall No. 14: 107+85 to 109+58, Left

WB KY 338
Retaining Wall No. 3: 201+13 to 202+73, Left
Retaining Wall No. 15: 207+80 to 209+45, Right

US 25
Retaining Wall No. 7: 42+25 to 46+68.52, Left
Retaining Wall No. 8: 49+57.27 to 55+25, Left
Retaining Wall No. 9: 42+25 to 46+68.52, Left
Retaining Wall No. 10: 49+56.52 to 54+25, Right

US 25 Ramp A / Ramp B
Retaining Wall No. 11: 13+50 (RAMP A to 20+60.93 (RAMP B), Right

US 25 Ramp C
Retaining Wall No. 12: 30+45.8 to 31+50, Right

I-75/I-71
Retaining Wall No. 13: 489+85 to 490+25, Right

25. Embankment slopes at the following location will need to be flatter than a 2:1 (H:V) to maintain minimum factor of safety requirements for slope stability. The fill limitsand required sections show the flattened slopes and results of the stability analysis.

Approximate Station Limits	Steepest Allowable Slope
I-75/I-71: 434+80 to 436+20	2.5:1 (H:V)

26. All embankment construction using non-durable shale will be in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction, "Embankment Principally of Non-Durable Shale".

27. Some areas of the project may contain silts or sands at subgrade. Lime may not be effective in stabilizing these materials. If such soils are encountered cement should be more effective. The Stabilization Contractor shall adjust the stabilization techniques, as directed by the Engineer. Based on boring information, these soils may be encountered at the following locations. Geotechnical Branch personnel are available to assist in identifying these soil types and providing alternative treatment recommendations, if needed. The original lime stabilization bid items will be used for payment for any such changes.

Approximate Station Limits
RAMP B
260+50 to 265+40

OLD LEXINGTON PIKE
5+00 to 10+00

28. Soil borings were performed near the reinforced concrete pipe culverts (RCPs) at the following locations. See the Geotechnical Profile Sheets for rockline information.

Approximate Station Limits
EB KY 338
100+00
105+91

Triple Crown Blvd
51+00

DESIGNED BY:
DATE SUBMITTED:

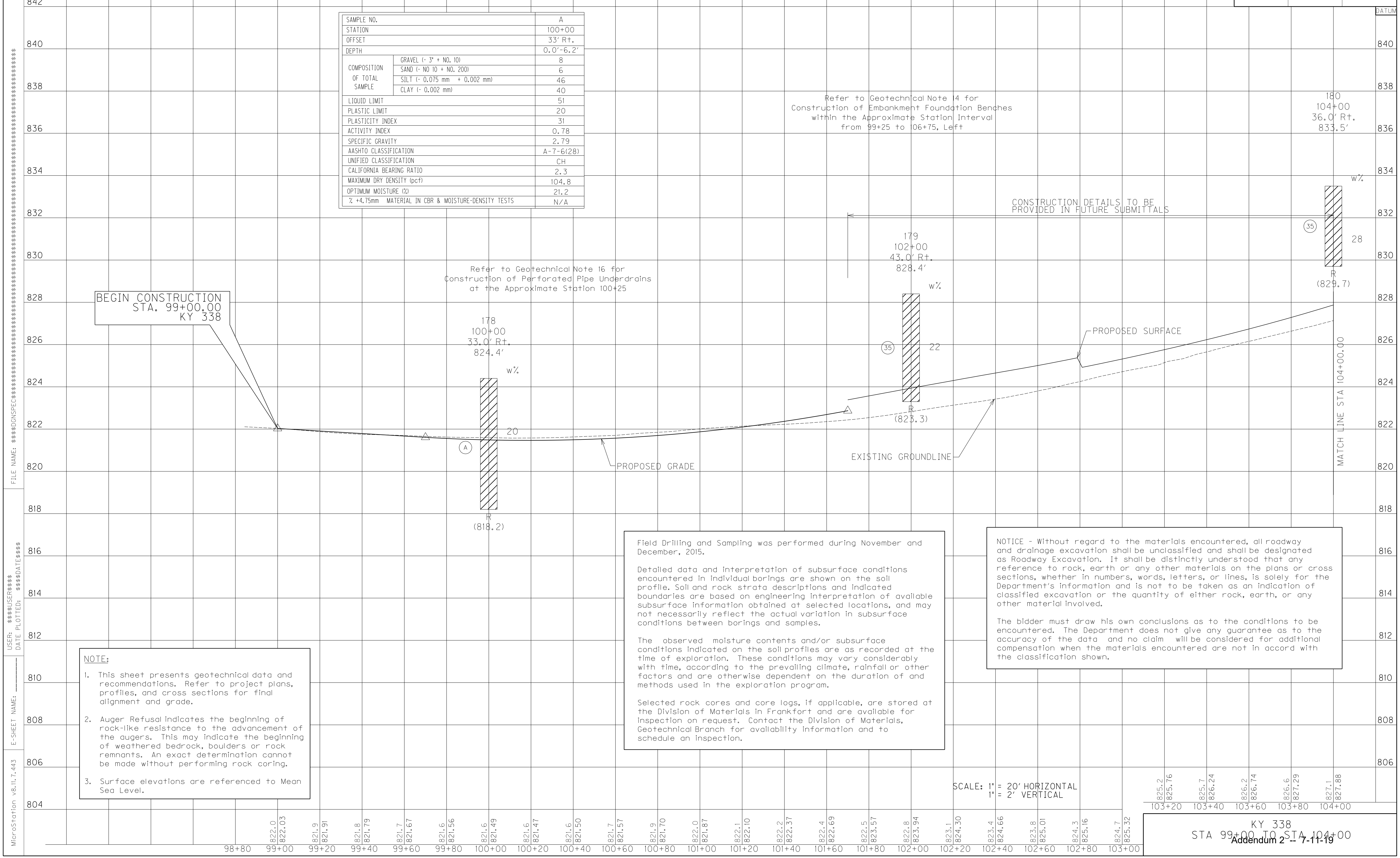
Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF
BOONE

PROJECT NUMBERS: FD52 008 0075 175-176

GEOTECHNICAL NOTES
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		A
STATION		100+00
OFFSET		33′ Rt.
DEPTH		0.0′-6.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	8
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		20
PLASTICITY INDEX		31
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(28)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.3
MAXIMUM DRY DENSITY (pcf)		104.8
OPTIMUM MOISTURE (%)		21.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



98+80		
99+00	822.0	822.03
99+20	821.9	821.91
99+40	821.8	821.79
99+60	821.7	821.67
99+80	821.6	821.56
100+00	821.6	821.49
100+20	821.6	821.47
100+40	821.6	821.50
100+60	821.7	821.57
100+80	821.9	821.70
101+00	822.0	821.87
101+20	822.1	822.10
101+40	822.2	822.37
101+60	822.4	822.69
101+80	822.5	823.57
102+00	822.8	823.94
102+20	823.1	824.30
102+40	823.4	824.66
102+60	823.8	825.01
102+80	824.3	825.16
103+00	824.7	825.32
103+20	825.2	825.76
103+40	825.7	826.24
103+60	826.2	826.74
103+80	826.6	827.29
104+00	827.1	827.88

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

Field Drilling and Sampling was performed during November and December, 2015.

Detailed data and interpretation of subsurface conditions encountered in individual borings are shown on the soil profile. Soil and rock strata descriptions and indicated boundaries are based on engineering interpretation of available subsurface information obtained at selected locations, and may not necessarily reflect the actual variation in subsurface conditions between borings and samples.

The observed moisture contents and/or subsurface conditions indicated on the soil profiles are as recorded at the time of exploration. These conditions may vary considerably with time, according to the prevailing climate, rainfall or other factors and are otherwise dependent on the duration of and methods used in the exploration program.

Selected rock cores and core logs, if applicable, are stored at the Division of Materials in Frankfort and are available for inspection on request. Contact the Division of Materials, Geotechnical Branch for availability information and to schedule an inspection.

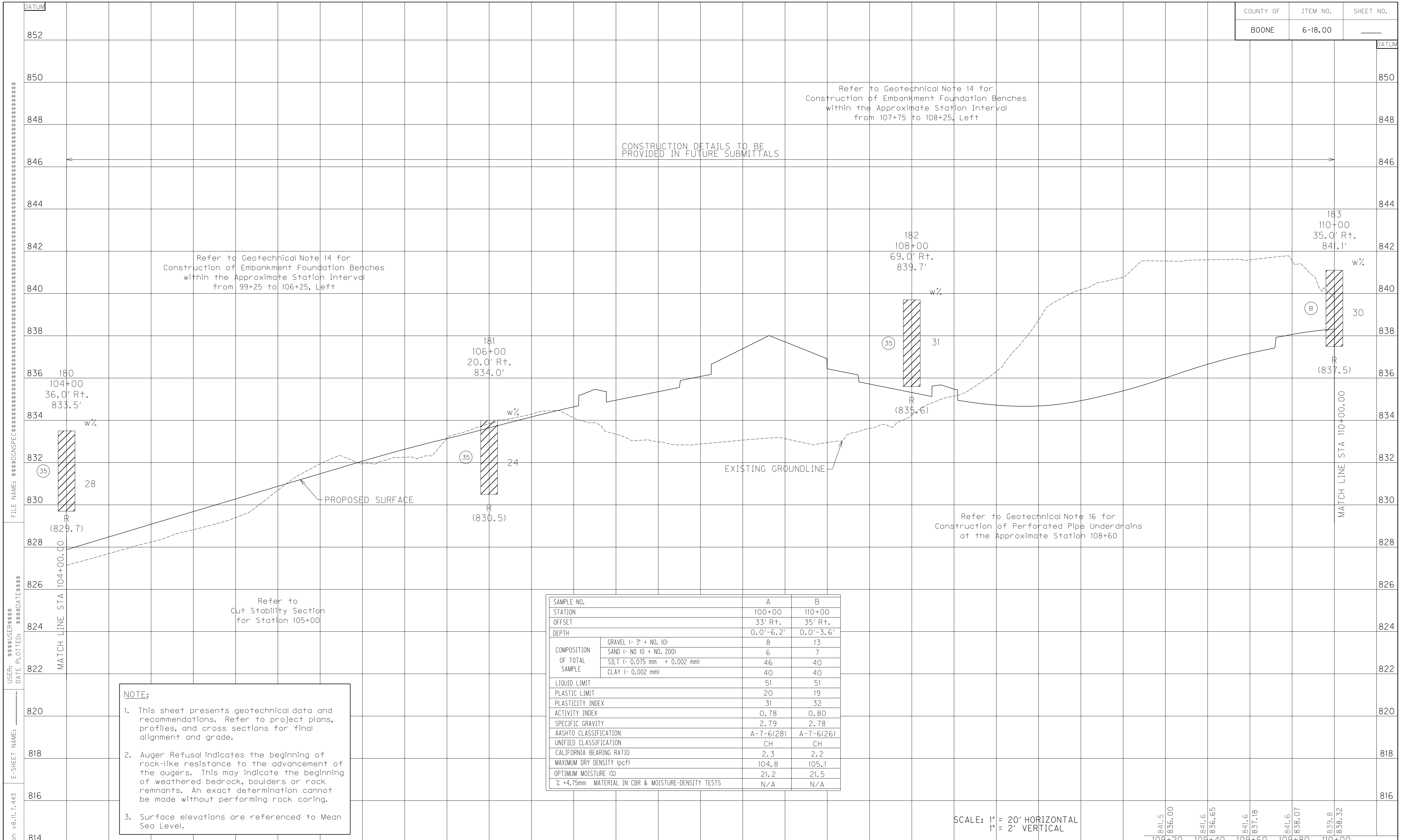
NOTICE - Without regard to the materials encountered, all roadway and drainage excavation shall be unclassified and shall be designated as Roadway Excavation. It shall be distinctly understood that any reference to rock, earth or any other materials on the plans or cross sections, whether in numbers, words, letters, or lines, is solely for the Department's information and is not to be taken as an indication of classified excavation or the quantity of either rock, earth, or any other material involved.

The bidder must draw his own conclusions as to the conditions to be encountered. The Department does not give any guarantee as to the accuracy of the data and no claim will be considered for additional compensation when the materials encountered are not in accord with the classification shown.

KY 338
STA 99+00 TO STA 104+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



104+00	827.1	827.88
104+20	827.7	828.48
104+40	828.2	829.08
104+60	828.8	829.68
104+80	829.4	830.28
105+00	830.7	830.88
105+20	831.9	831.47
105+40	831.9	832.07
105+60	832.2	832.63
105+80	833.1	833.14
106+00	833.8	833.64
106+20	834.3	834.16
106+40	834.1	834.64
106+60	833.3	834.95
106+80	833.0	835.35
107+00	832.9	836.08
107+20	833.1	837.39
107+40	833.1	837.71
107+60	832.9	836.44
107+80	833.6	835.72
108+00	834.2	835.32
108+20	835.1	835.47
108+40	836.3	834.72
108+60	838.8	834.68
108+80	840.2	834.93
109+00	840.8	835.40
109+20	841.5	836.00
109+40	841.6	836.65
109+60	841.6	837.18
109+80	841.6	838.07
110+00	839.8	838.32

SAMPLE NO.		A	B
STATION		100+00	110+00
OFFSET		33′ Rt.	35′ Rt.
DEPTH		0.0′-6.2′	0.0′-3.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	8	13
	SAND (- NO 10 + NO. 200)	6	7
	SILT (- 0.075 mm + 0.002 mm)	46	40
	CLAY (- 0.002 mm)	40	40
LIQUID LIMIT		51	51
PLASTIC LIMIT		20	19
PLASTICITY INDEX		31	32
ACTIVITY INDEX		0.78	0.80
SPECIFIC GRAVITY		2.79	2.78
AASHTO CLASSIFICATION		A-7-6(28)	A-7-6(26)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		2.3	2.2
MAXIMUM DRY DENSITY (pcf)		104.8	105.1
OPTIMUM MOISTURE (%)		21.2	21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

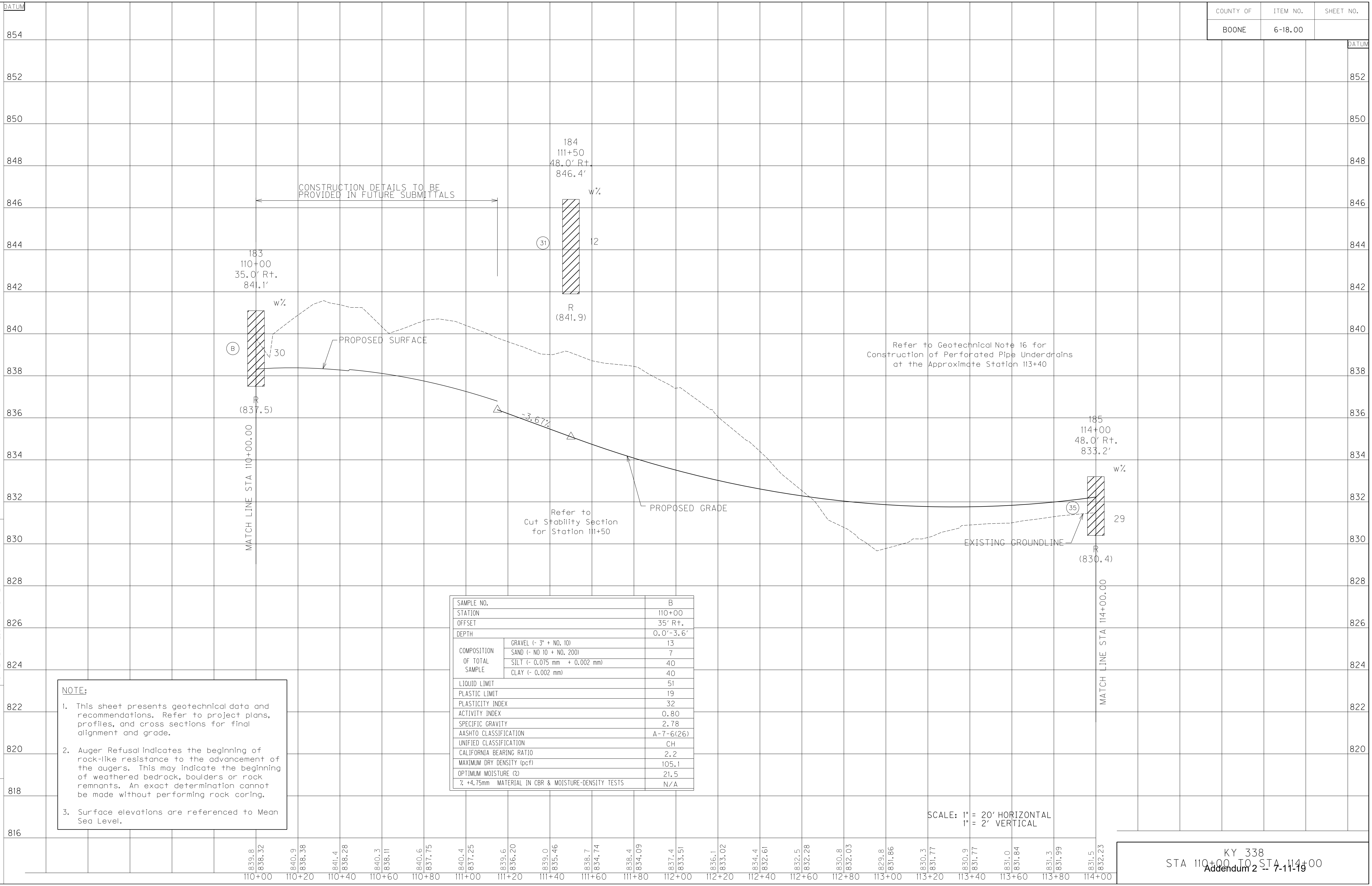
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA 104+00 TO STA 110+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME: ____
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		B
STATION		110+00
OFFSET		35' Rt.
DEPTH		0.0'-3.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

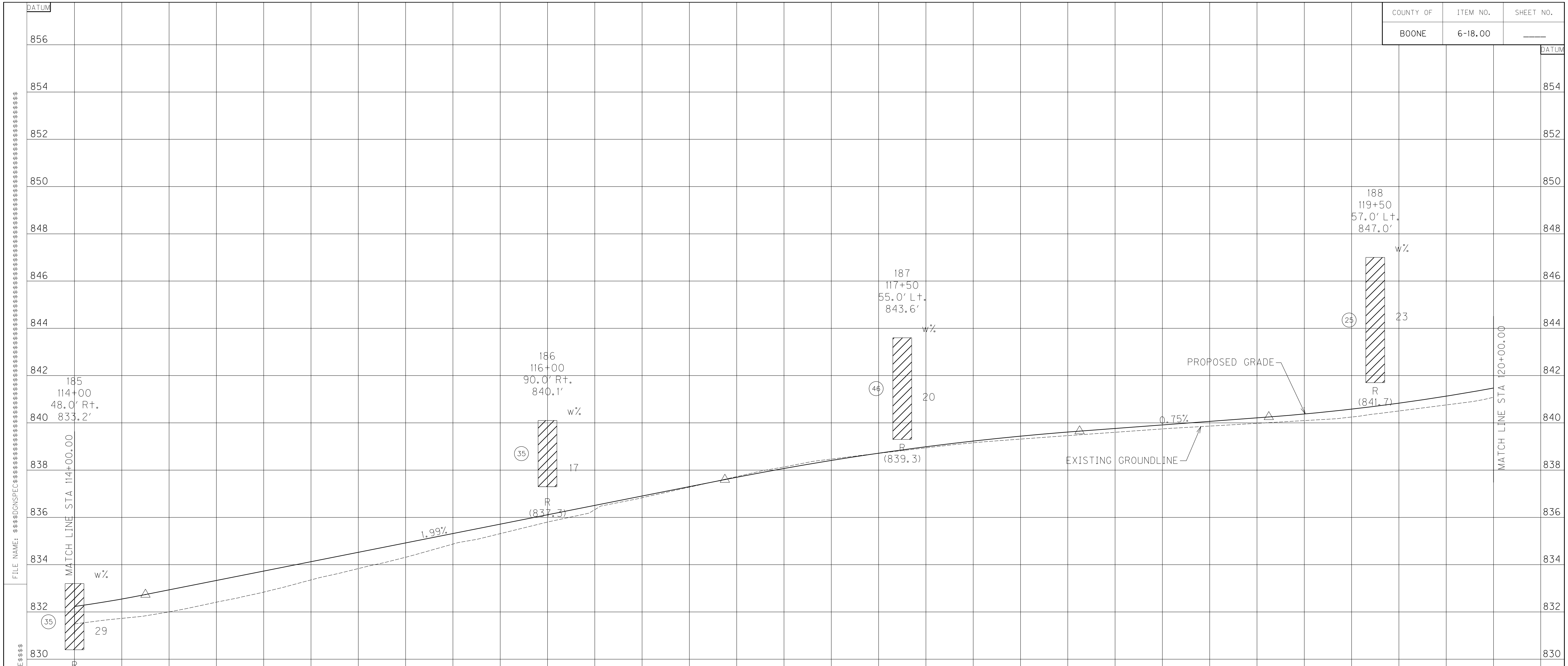
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 338
STA 110+00 TO STA 114+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		B
STATION		110+00
OFFSET		35′ Rt.
DEPTH		0.0′-3.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

828
826
824
822
820
818

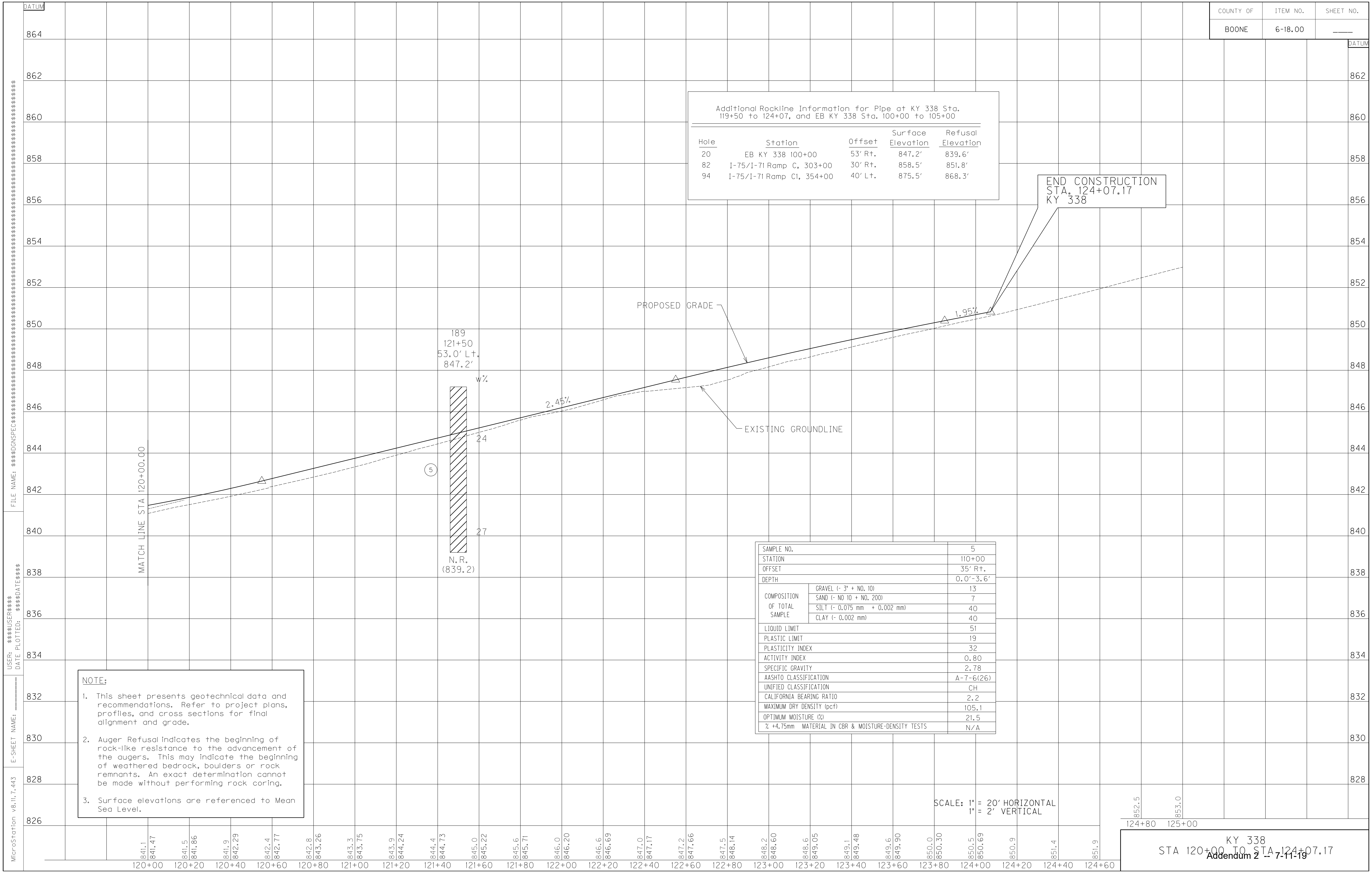
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

114+00	831.5	832.23
114+20	831.7	832.55
114+40	832.0	832.93
114+60	832.4	833.33
114+80	832.8	833.73
115+00	833.4	834.12
115+20	833.8	834.52
115+40	834.3	834.92
115+60	834.9	835.32
115+80	835.3	835.71
116+00	835.8	836.11
116+20	836.3	836.51
116+40	836.8	836.90
116+60	837.3	837.30
116+80	837.7	837.70
117+00	838.1	838.07
117+20	838.5	838.41
117+40	838.7	838.72
117+60	838.9	838.99
117+80	839.2	839.23
118+00	839.3	839.44
118+20	839.5	839.61
118+40	839.6	839.76
118+60	839.7	839.91
118+80	839.9	840.06
119+00	840.0	840.21
119+20	840.1	840.38
119+40	840.2	840.58
119+60	840.5	840.83
119+80	840.8	841.13
120+00	841.1	841.47

KY 338
STA 114+00 TO STA 120+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



120+00	841.1	841.47
120+20	841.5	841.86
120+40	841.9	842.29
120+60	842.4	842.77
120+80	842.8	843.26
121+00	843.3	843.75
121+20	843.9	844.24
121+40	844.4	844.73
121+60	845.0	845.22
121+80	845.6	845.71
122+00	846.0	846.20
122+20	846.6	846.69
122+40	847.0	847.17
122+60	847.2	847.66
122+80	847.5	848.14
123+00	848.2	848.60
123+20	848.6	849.05
123+40	849.1	849.48
123+60	849.6	849.90
123+80	850.0	850.30
124+00	850.5	850.69
124+20	850.9	
124+40	851.4	
124+60	851.9	
124+80	852.5	
125+00	853.0	

END CONSTRUCTION
STA. 124+07.17
KY 338

Additional Rockline Information for Pipe at KY 338 Sta. 119+50 to 124+07, and EB KY 338 Sta. 100+00 to 105+00

Hole	Station	Offset	Surface Elevation	Refusal Elevation
20	EB KY 338 100+00	53' Rt.	847.2'	839.6'
82	I-75/I-71 Ramp C, 303+00	30' Rt.	858.5'	851.8'
94	I-75/I-71 Ramp C1, 354+00	40' Lt.	875.5'	868.3'

SAMPLE NO.		5
STATION		110+00
OFFSET		35' Rt.
DEPTH		0.0'-3.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	13
	SAND (- NO 10 + NO. 200)	7
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	40
LIQUID LIMIT		51
PLASTIC LIMIT		19
PLASTICITY INDEX		32
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(26)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		105.1
OPTIMUM MOISTURE (%)		21.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 338
STA 120+00 TO STA 124+07.17

Addendum 2 -- 7-11-19

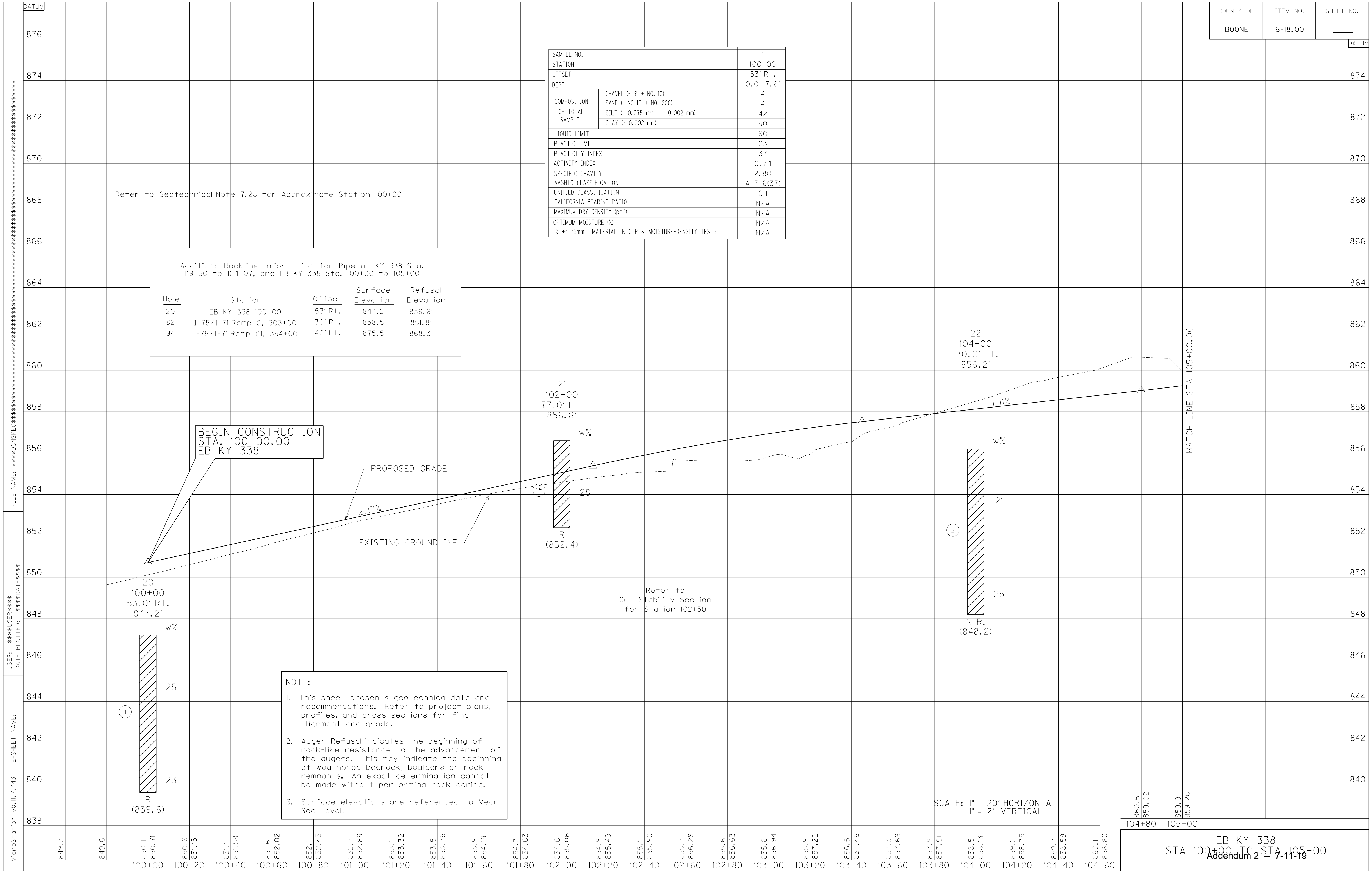
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ____

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		1
STATION		100+00
OFFSET		53' Rt.
DEPTH		0.0'-7.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	42
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		60
PLASTIC LIMIT		23
PLASTICITY INDEX		37
ACTIVITY INDEX		0.74
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(37)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Additional Rockline Information for Pipe at KY 338 Sta. 119+50 to 124+07, and EB KY 338 Sta. 100+00 to 105+00

Hole	Station	Offset	Surface Elevation	Refusal Elevation
20	EB KY 338 100+00	53' Rt.	847.2'	839.6'
82	I-75/I-71 Ramp C, 303+00	30' Rt.	858.5'	851.8'
94	I-75/I-71 Ramp C1, 354+00	40' Lt.	875.5'	868.3'

NOTE:

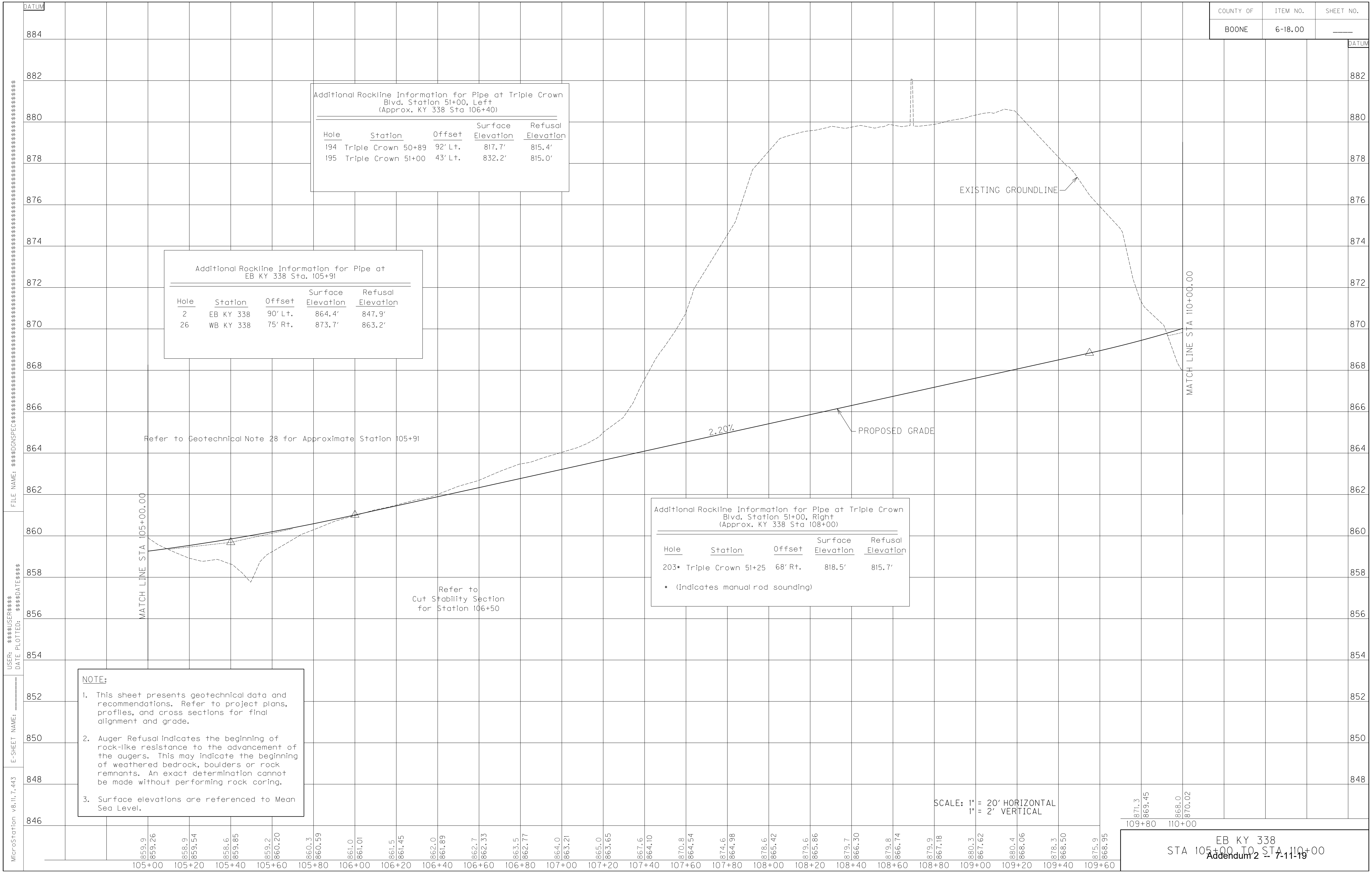
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

EB KY 338
STA 100+00 TO STA 105+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



Additional Rockline Information for Pipe at Triple Crown Blvd. Station 51+00, Left
(Approx. KY 338 Sta 106+40)

Hole	Station	Offset	Surface Elevation	Refusal Elevation
194	Triple Crown 50+89	92' Lt.	817.7'	815.4'
195	Triple Crown 51+00	43' Lt.	832.2'	815.0'

Additional Rockline Information for Pipe at EB KY 338 Sta. 105+91

Hole	Station	Offset	Surface Elevation	Refusal Elevation
2	EB KY 338	90' Lt.	864.4'	847.9'
26	WB KY 338	75' Rt.	873.7'	863.2'

Refer to Geotechnical Note 28 for Approximate Station 105+91

Additional Rockline Information for Pipe at Triple Crown Blvd. Station 51+00, Right
(Approx. KY 338 Sta 108+00)

Hole	Station	Offset	Surface Elevation	Refusal Elevation
203*	Triple Crown 51+25	68' Rt.	818.5'	815.7'

* (Indicates manual rod sounding)

Refer to
Cut Stability Section
for Station 106+50

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

105+00	859.9	859.26
105+20	858.9	859.54
105+40	858.6	859.85
105+60	859.2	860.20
105+80	860.3	860.59
106+00	861.0	861.01
106+20	861.5	861.45
106+40	862.0	861.89
106+60	862.7	862.33
106+80	863.5	862.77
107+00	864.0	863.21
107+20	865.0	863.65
107+40	867.6	864.10
107+60	870.8	864.54
107+80	874.6	864.98
108+00	878.6	865.42
108+20	879.6	865.86
108+40	879.7	866.30
108+60	879.8	866.74
108+80	879.9	867.18
109+00	880.3	867.62
109+20	880.4	868.06
109+40	878.3	868.50
109+60	875.9	868.95
109+80	871.3	869.45
110+00	868.0	870.02

EB KY 338
STA 105+00 TO STA 110+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$

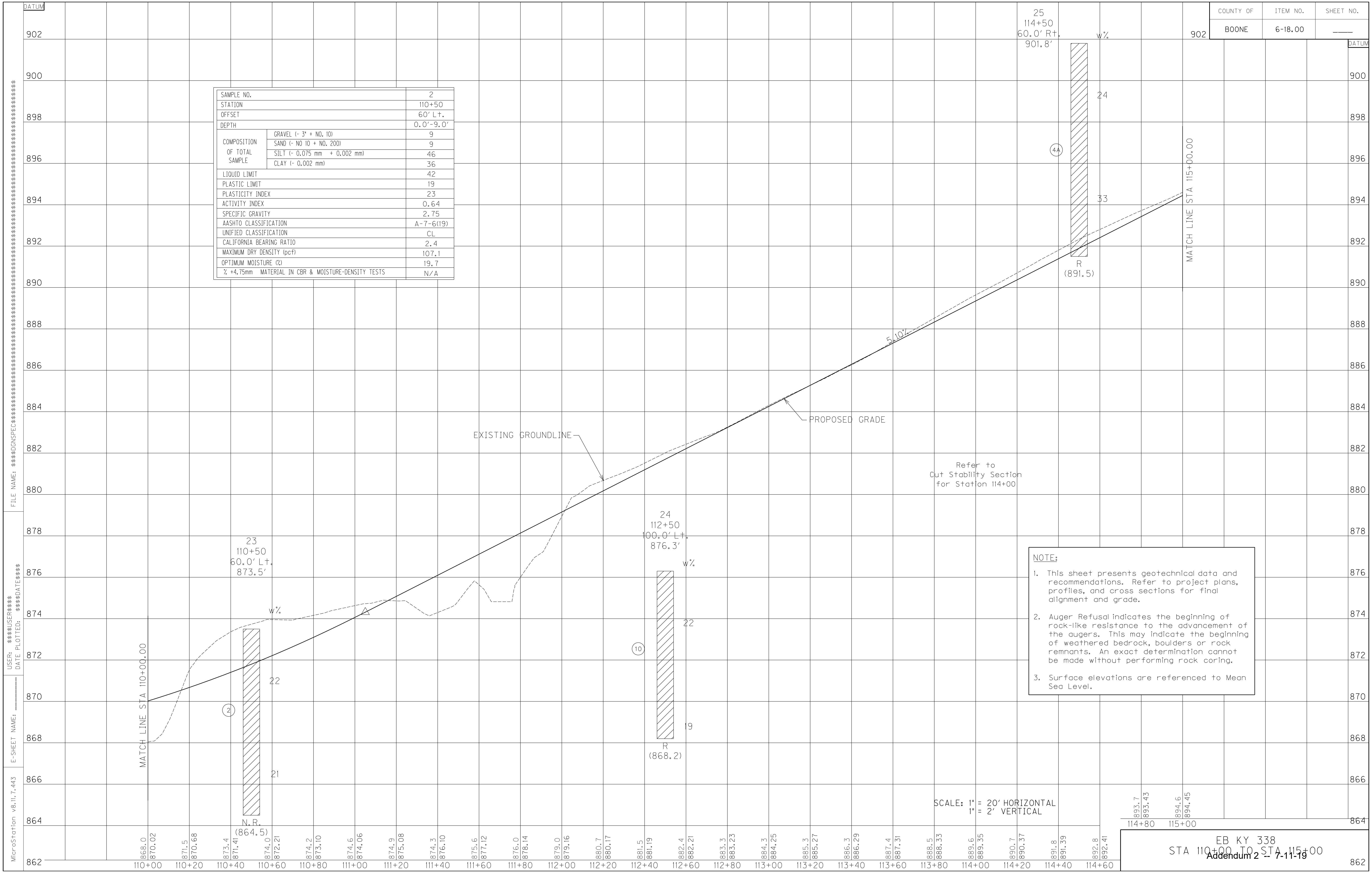
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ____________

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		2
STATION		110+50
OFFSET		60′ Lt.
DEPTH		0.0′-9.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	9
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	36
LIQUID LIMIT		42
PLASTIC LIMIT		19
PLASTICITY INDEX		23
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.75
AASHTO CLASSIFICATION		A-7-6(19)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.4
MAXIMUM DRY DENSITY (pcf)		107.1
OPTIMUM MOISTURE (%)		19.7
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



110+00	868.0	870.02
110+20	871.5	870.68
110+40	873.4	871.41
110+60	874.0	872.21
110+80	874.2	873.10
111+00	874.6	874.06
111+20	874.9	875.08
111+40	874.3	876.10
111+60	875.6	877.12
111+80	876.0	878.14
112+00	879.0	879.16
112+20	880.7	880.17
112+40	881.5	881.19
112+60	882.4	882.21
112+80	883.3	883.23
113+00	884.3	884.25
113+20	885.3	885.27
113+40	886.3	886.29
113+60	887.4	887.31
113+80	888.5	888.33
114+00	889.6	889.35
114+20	890.7	890.37
114+40	891.8	891.39
114+60	892.8	892.41
114+80	893.7	893.43
115+00	894.6	894.45

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

EB KY 338
STA 110+00 TO STA 115+00

Addendum 2 -- 7-11-19

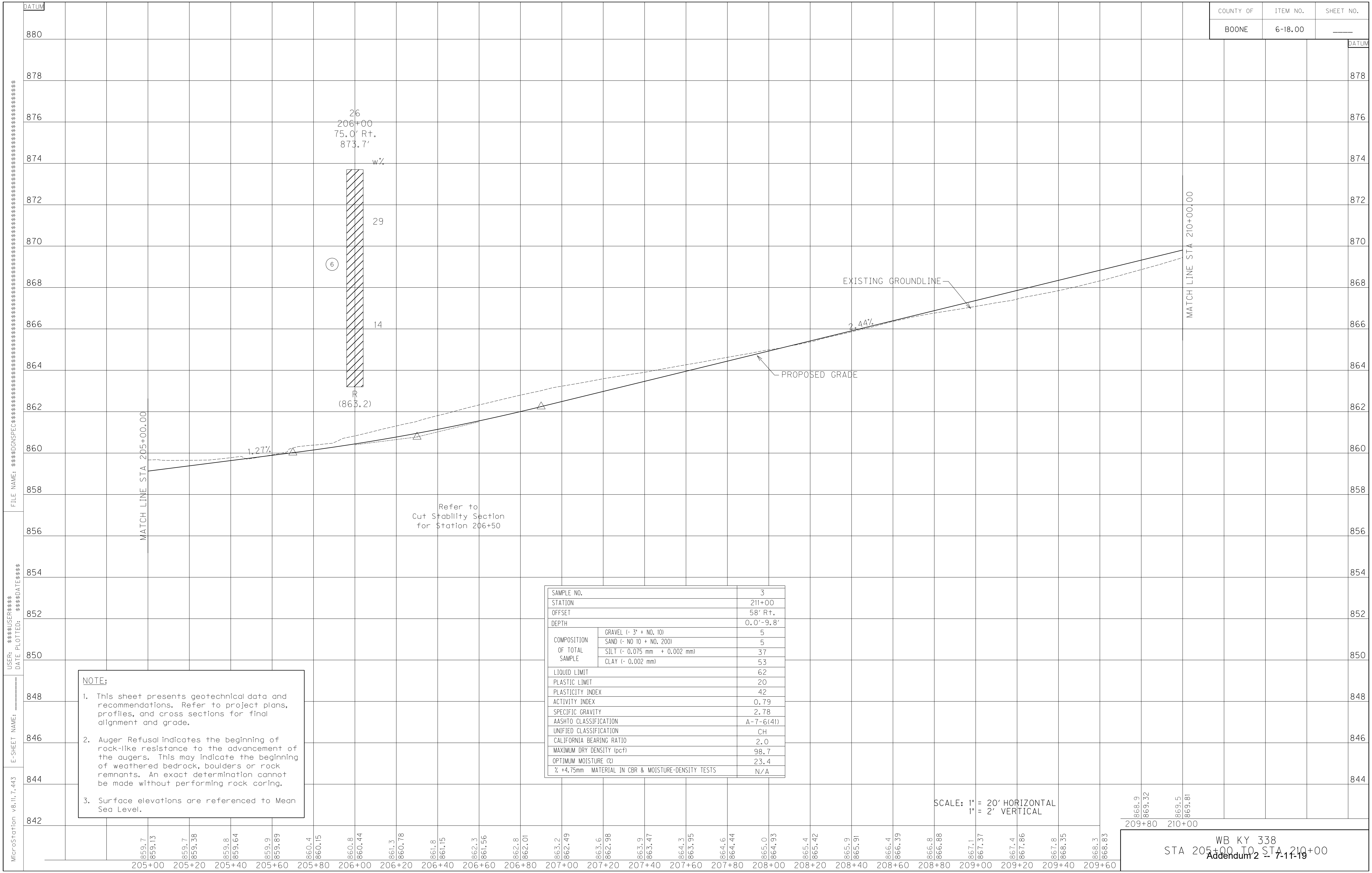
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ______

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



Refer to
Cut Stability Section
for Station 206+50

SAMPLE NO.		3
STATION		211+00
OFFSET		58′ Rt.
DEPTH		0.0′-9.8′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

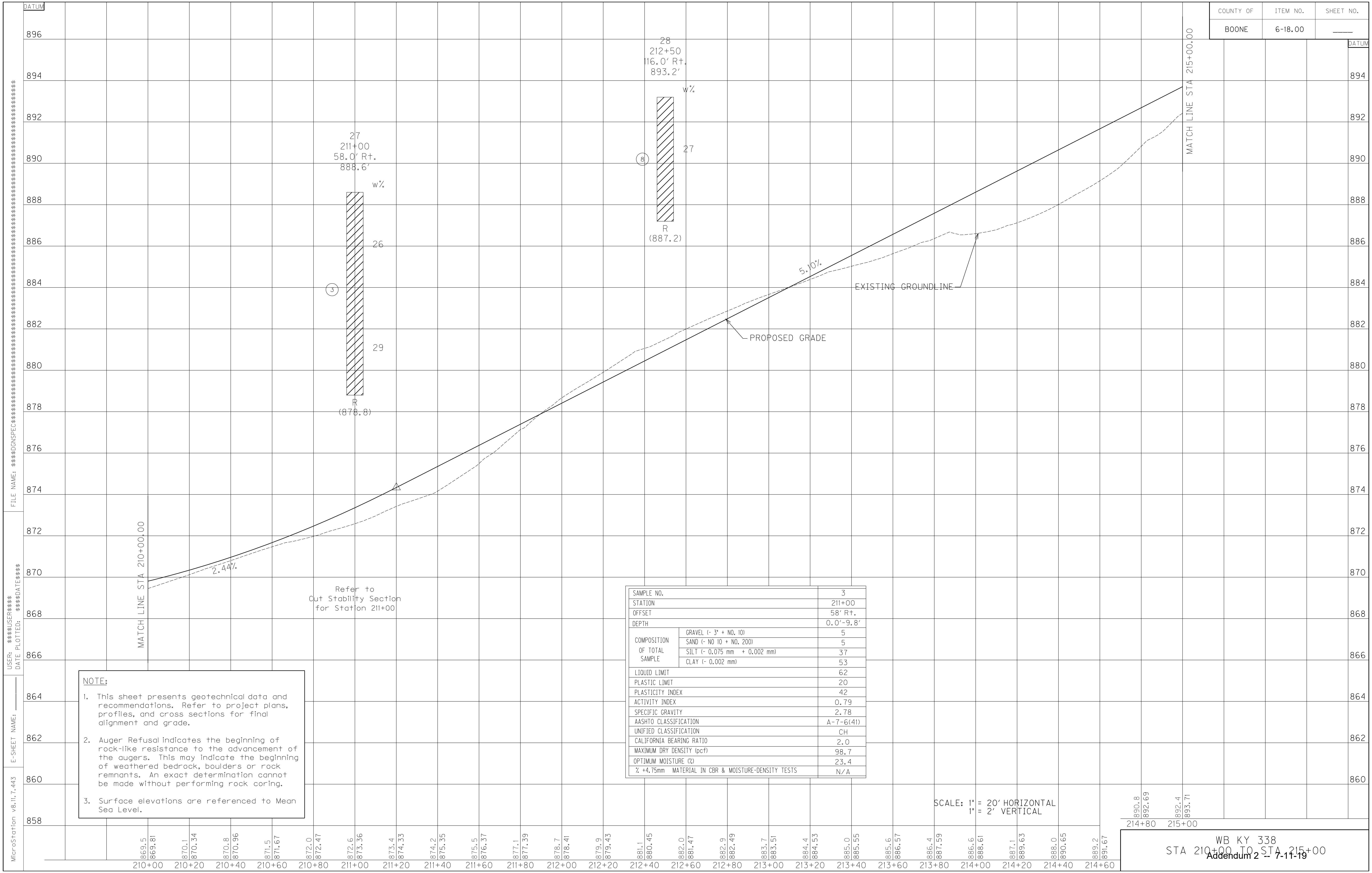
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

WB KY 338
STA 205+00 TO STA 210+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



Refer to Cut Stability Section for Station 211+00

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		3
STATION		211+00
OFFSET		58' Rt.
DEPTH		0.0'-9.8'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

WB KY 338
STA 210+00 TO STA 215+00

Addendum 2 -- 7-11-19

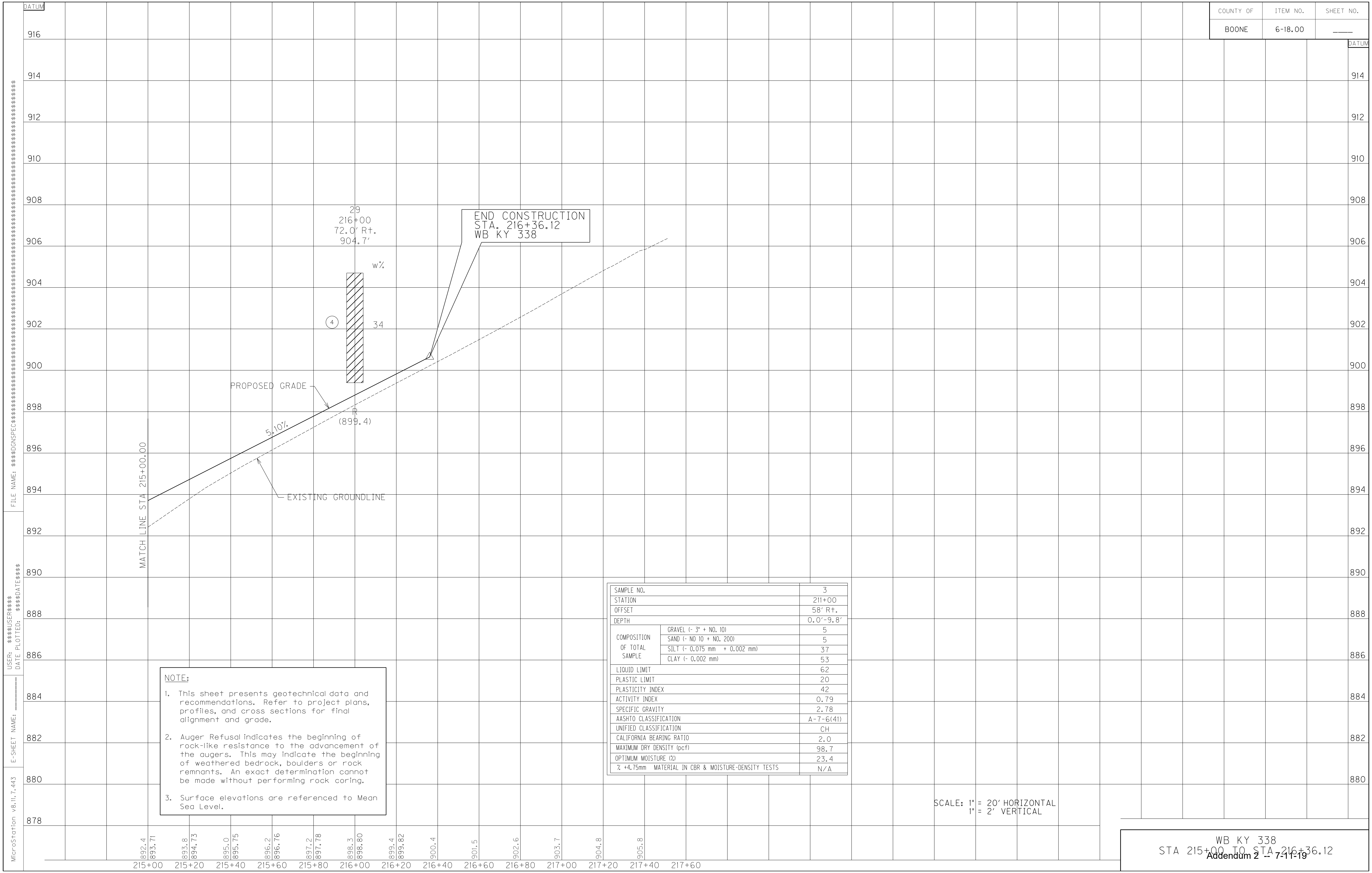
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ______

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

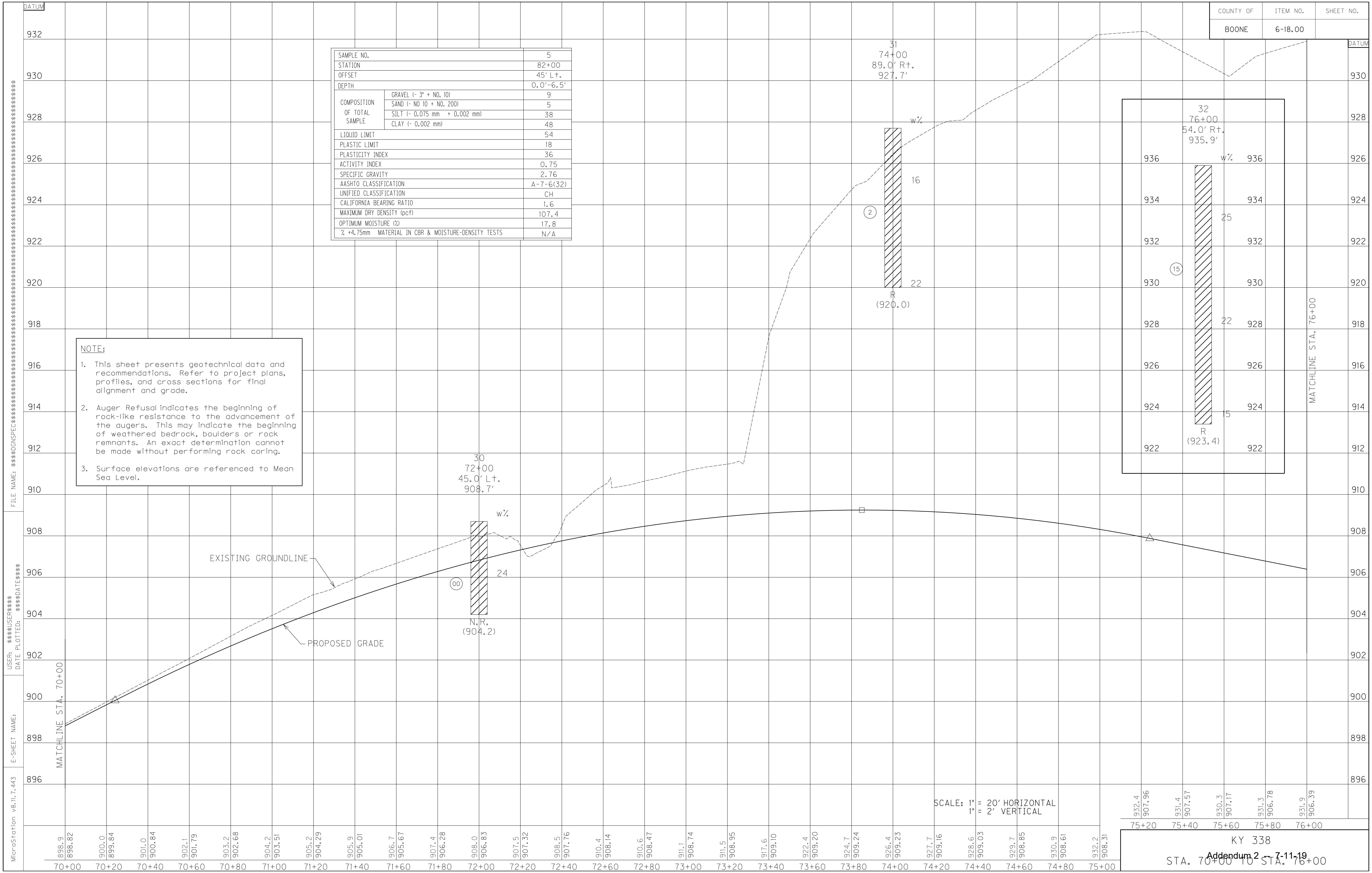
SAMPLE NO.		3
STATION		211+00
OFFSET		58′ Rt.
DEPTH		0.0′-9.8′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	37
	CLAY (- 0.002 mm)	53
LIQUID LIMIT		62
PLASTIC LIMIT		20
PLASTICITY INDEX		42
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(41)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

WB KY 338
STA 215+00 TO STA 216+36.12

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		5
STATION		82+00
OFFSET		45′ Lt.
DEPTH		0.0′-6.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		54
PLASTIC LIMIT		18
PLASTICITY INDEX		36
ACTIVITY INDEX		0.75
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(32)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		107.4
OPTIMUM MOISTURE (%)		17.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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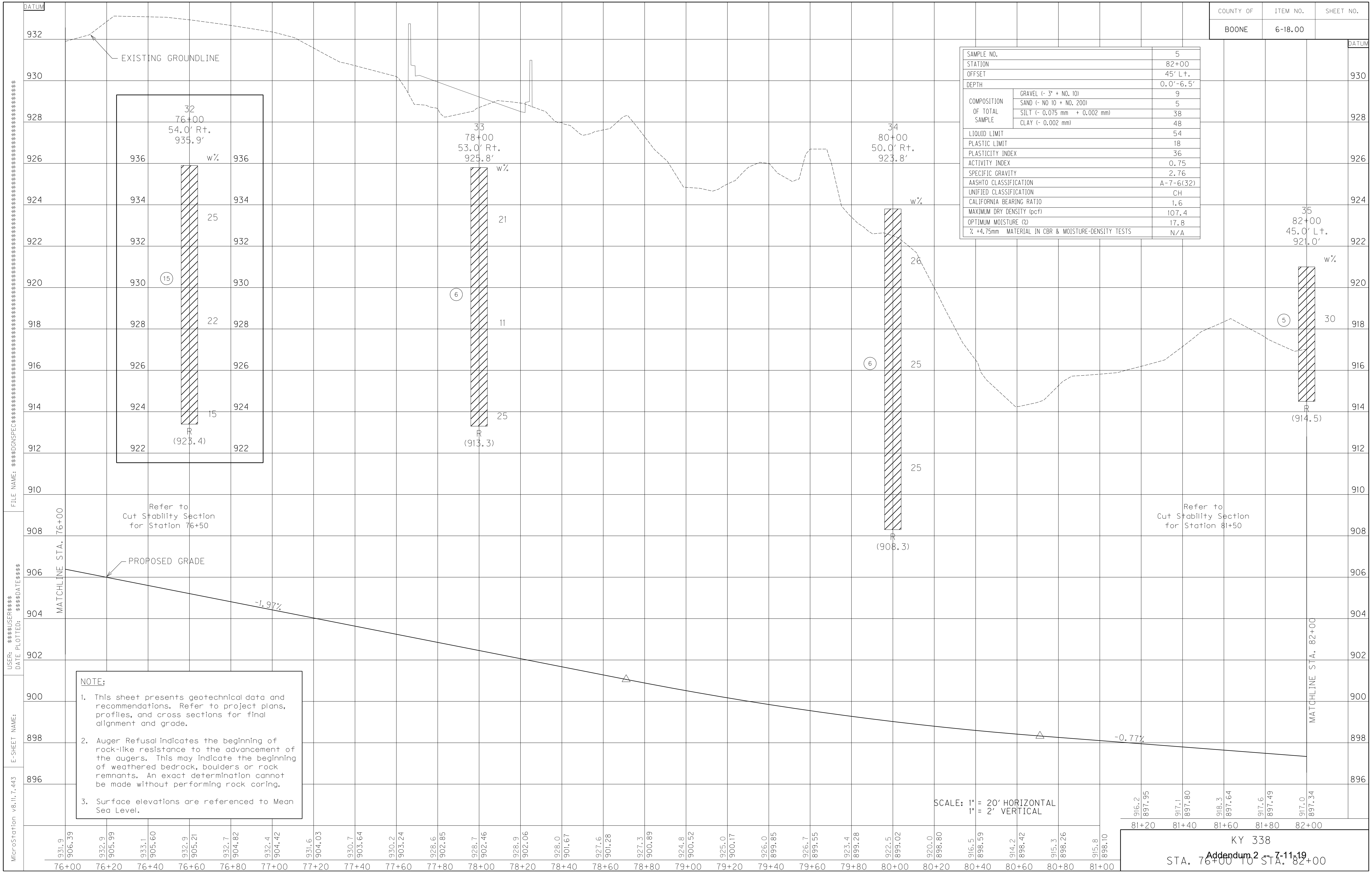
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

KY 338

Addendum 2 -- 7-11-19

STA. 70+00 TO STA. 76+00

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



76+00	931.9	906.39
76+20	932.9	905.99
76+40	933.1	905.60
76+60	932.9	905.21
76+80	932.7	904.82
77+00	932.4	904.42
77+20	931.6	904.03
77+40	930.7	903.64
77+60	930.2	903.24
77+80	928.6	902.85
78+00	928.7	902.46
78+20	928.9	902.06
78+40	928.0	901.67
78+60	927.6	901.28
78+80	927.3	900.89
79+00	924.8	900.52
79+20	925.0	900.17
79+40	926.0	899.85
79+60	926.7	899.55
79+80	923.4	899.28
80+00	922.5	899.02
80+20	920.0	898.80
80+40	916.5	898.59
80+60	914.2	898.42
80+80	915.3	898.26
81+00	915.8	898.10
81+20	916.2	897.95
81+40	917.1	897.80
81+60	918.3	897.64
81+80	917.6	897.49
82+00	917.0	897.34

SAMPLE NO.		5
STATION		82+00
OFFSET		45′ Lt.
DEPTH		0.0′-6.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		54
PLASTIC LIMIT		18
PLASTICITY INDEX		36
ACTIVITY INDEX		0.75
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(32)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		107.4
OPTIMUM MOISTURE (%)		17.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

KY 338

STA. 76+00 TO STA. 82+00

Addendum 2 -- 7-11-19

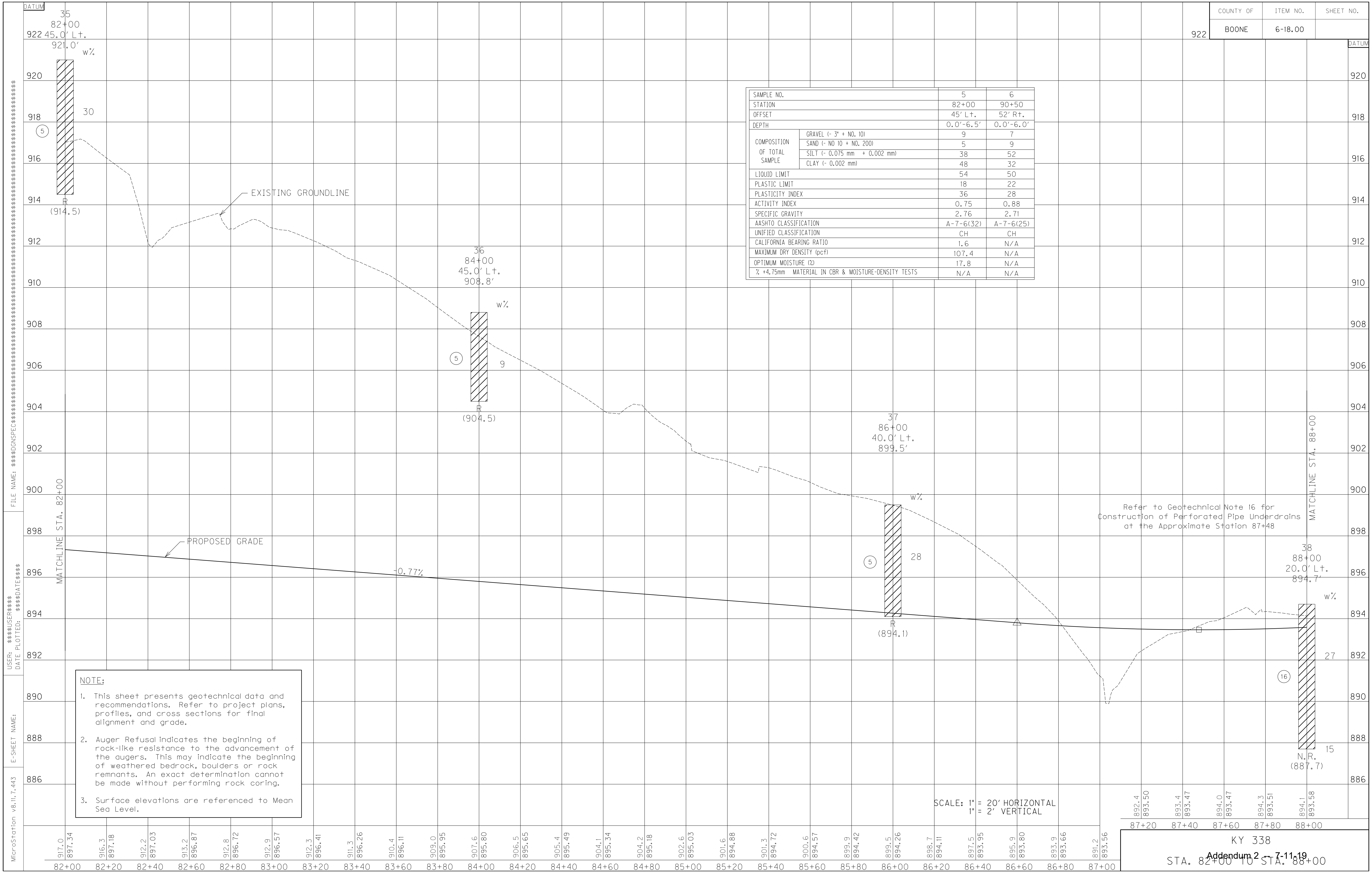
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		5	6
STATION		82+00	90+50
OFFSET		45′ Lt.	52′ Rt.
DEPTH		0.0′-6.5′	0.0′-6.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	9	7
	SAND (- NO 10 + NO. 200)	5	9
	SILT (- 0.075 mm + 0.002 mm)	38	52
	CLAY (- 0.002 mm)	48	32
LIQUID LIMIT		54	50
PLASTIC LIMIT		18	22
PLASTICITY INDEX		36	28
ACTIVITY INDEX		0.75	0.88
SPECIFIC GRAVITY		2.76	2.71
AASHTO CLASSIFICATION		A-7-6(32)	A-7-6(25)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		1.6	N/A
MAXIMUM DRY DENSITY (pcf)		107.4	N/A
OPTIMUM MOISTURE (%)		17.8	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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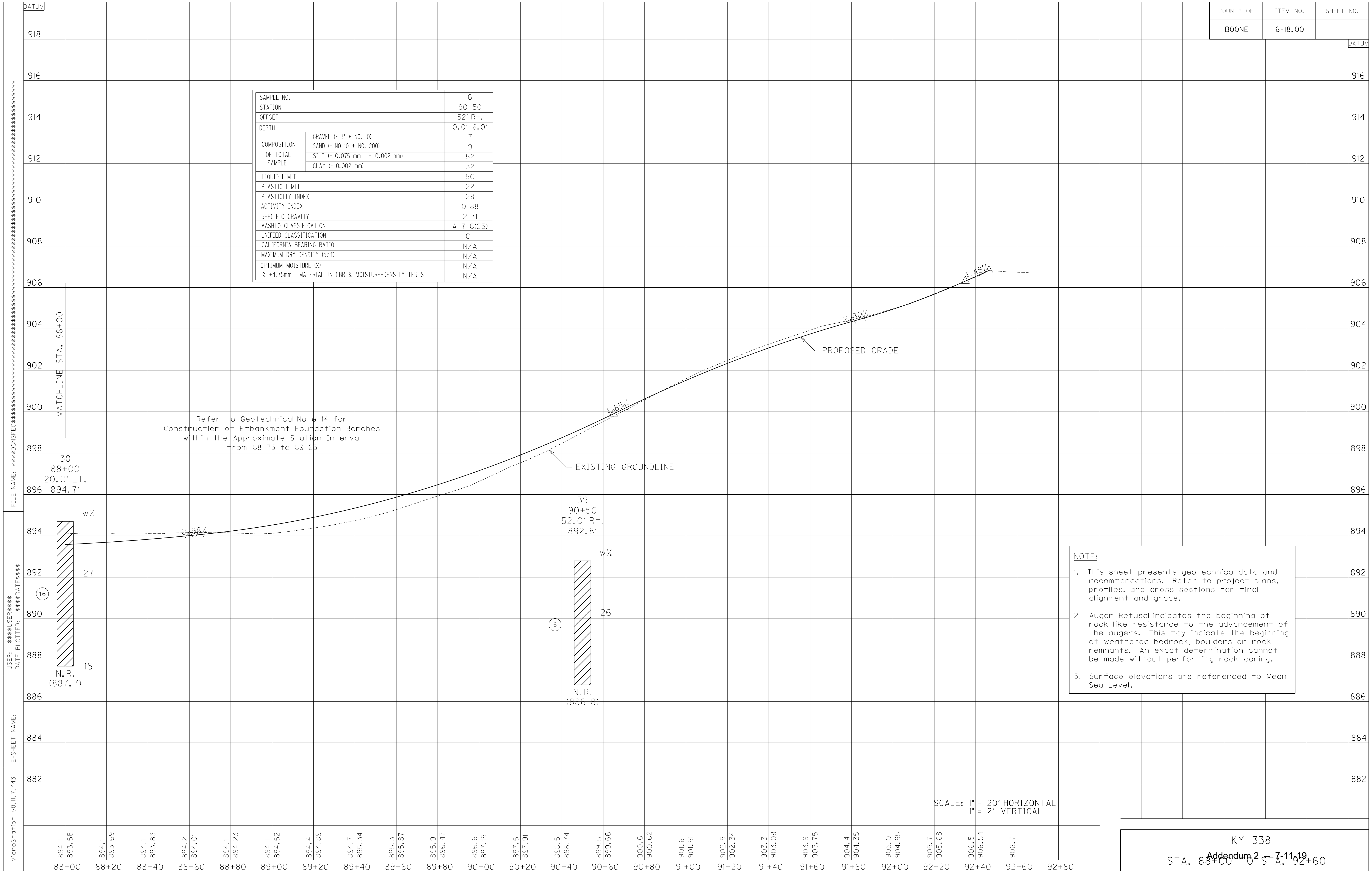
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

KY 338
STA. 82+00 TO STA. 88+00
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		6
STATION		90+50
OFFSET		52' Rt.
DEPTH		0.0'-6.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7
	SAND (- NO 10 + NO. 200)	9
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	32
LIQUID LIMIT		50
PLASTIC LIMIT		22
PLASTICITY INDEX		28
ACTIVITY INDEX		0.88
SPECIFIC GRAVITY		2.71
AASHTO CLASSIFICATION		A-7-6(25)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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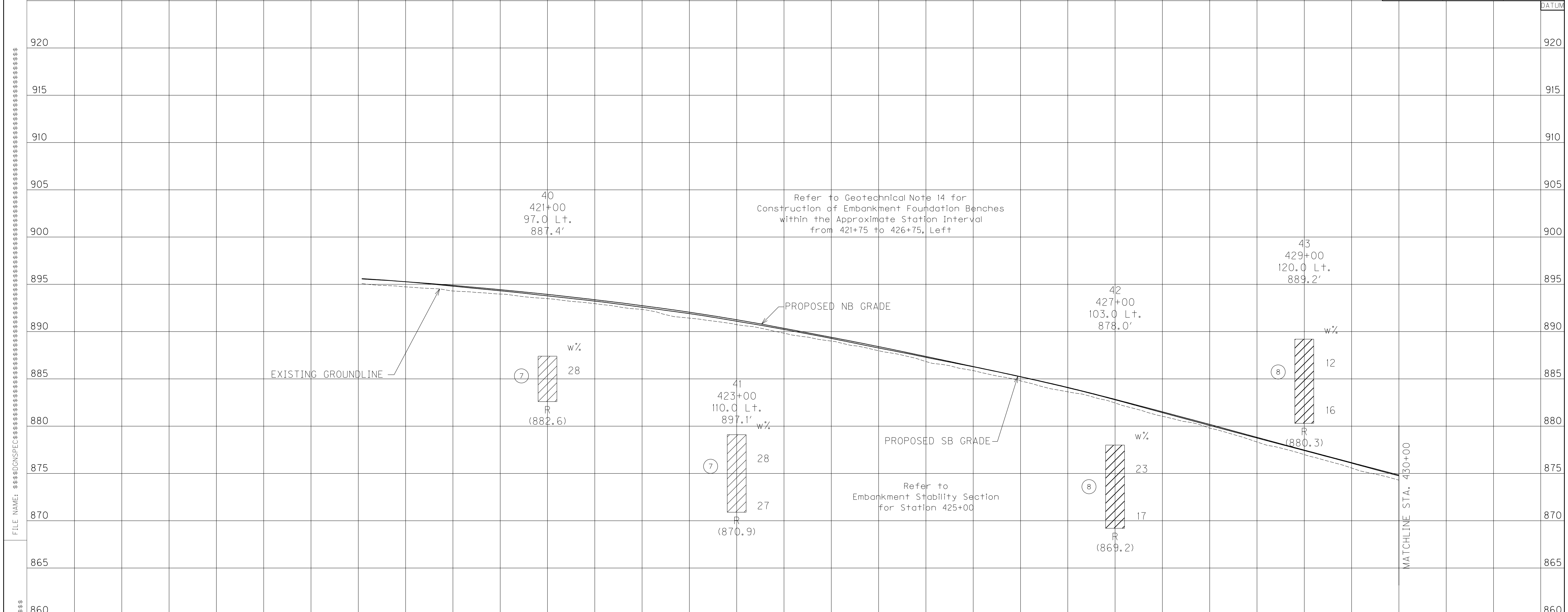
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

KY 338

STA. 88+00 TO STA. 92+60

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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SAMPLE NO.		7	8
STATION		421+00	429+00
OFFSET		97′ Lt.	120′ Lt.
DEPTH		0.0′-4.8′	0.0′-8.9′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	5	11
	SAND (- NO 10 + NO. 200)	10	7
	SILT (- 0.075 mm + 0.002 mm)	48	30
	CLAY (- 0.002 mm)	37	52
LIQUID LIMIT		49	63
PLASTIC LIMIT		20	21
PLASTICITY INDEX		29	42
ACTIVITY INDEX		0.78	0.81
SPECIFIC GRAVITY		2.76	2.79
AASHTO CLASSIFICATION		A-7-6(26)	A-7-6(36)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		N/A	1.7
MAXIMUM DRY DENSITY (pcf)		N/A	100.3
OPTIMUM MOISTURE (%)		N/A	24.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

	419+00	419+50	420+00	420+50	421+00	421+50	422+00	422+50	423+00	423+50	424+00
LEFT EP GP		895.28	894.81	894.32	893.78	893.23	892.59	891.90	891.10	890.23	889.28
RIGHT EP GP		894.7 895.28	894.3 894.89	894.0 894.44	893.5 893.94	893.0 893.37	892.3 892.75	891.4 892.05	890.7 891.26	889.8 890.35	889.0 889.40

	424+50	425+00	425+50	426+00	426+50	427+00	427+50	428+00	428+50	429+00	429+50	430+00
LEFT EP GP	888.27	887.28	886.28	885.22	884.06	882.79	881.43	880.08	878.75	877.42	876.09	874.75
RIGHT EP GP	888.0 888.42	886.8 887.37	885.9 886.31	884.8 885.24	883.6 884.10	882.5 882.84	881.0 881.52	879.8 880.19	878.3 878.82	877.0 877.47	875.6 876.15	874.3 874.83

I-71/I-75
STA. 419+00 TO STA. 430+00

Addendum 2 – 7-11-19

FILE NAME: $$$$DGNSPEC$$$

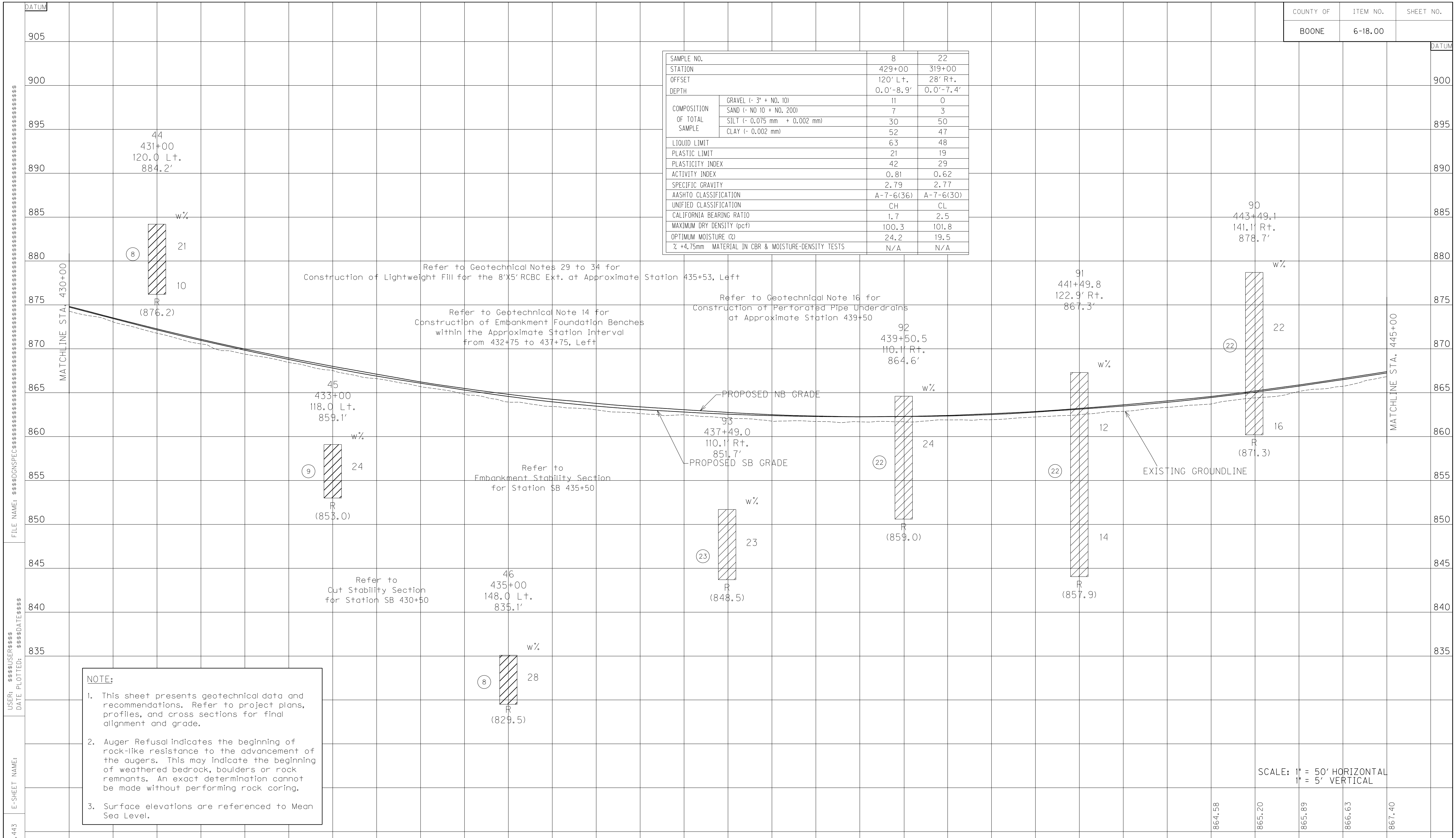
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		8	22
STATION		429+00	319+00
OFFSET		120′ Lt.	28′ Rt.
DEPTH		0.0′-8.9′	0.0′-7.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	11	0
	SAND (- NO 10 + NO. 200)	7	3
	SILT (- 0.075 mm + 0.002 mm)	30	50
	CLAY (- 0.002 mm)	52	47
LIQUID LIMIT		63	48
PLASTIC LIMIT		21	19
PLASTICITY INDEX		42	29
ACTIVITY INDEX		0.81	0.62
SPECIFIC GRAVITY		2.79	2.77
AASHTO CLASSIFICATION		A-7-6(36)	A-7-6(30)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		1.7	2.5
MAXIMUM DRY DENSITY (pcf)		100.3	101.8
OPTIMUM MOISTURE (%)		24.2	19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 50′ HORIZONTAL
1" = 5′ VERTICAL

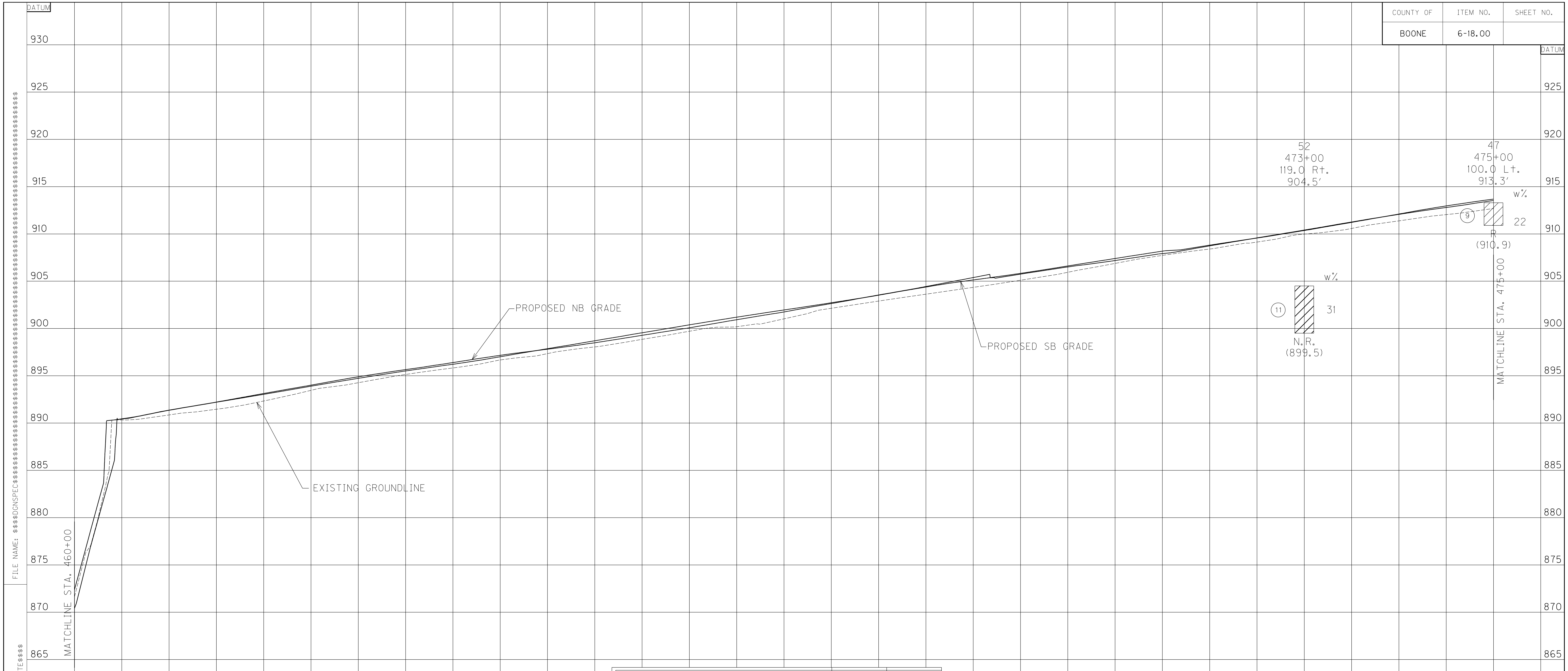
	LEFT EP GP	RIGHT EP GP
430+00	874.75	874.3 874.83
430+50	873.44	873.1 873.53
431+00	872.15	871.8 872.27
431+50	870.96	870.6 871.09
432+00	869.84	869.4 869.98
432+50	868.79	868.5 868.96
433+00	867.80	867.5 868.01
433+50	866.89	866.6 867.11
434+00	866.08	865.7 866.23
434+50	865.30	864.8 865.49
435+00	864.58	863.9 864.82
435+50	863.96	863.4 864.25
436+00	863.47	863.0 863.79
436+50	863.09	862.6 863.39
437+00	862.80	862.5 863.06
437+50	862.55	862.1 862.75
438+00	862.39	861.8 862.50
438+50	862.29	861.7 862.35
439+00	862.26	861.7 862.25
439+50	862.30	861.7 862.30
440+00	862.41	861.9 862.35
440+50	862.61	861.9 862.51
441+00	862.86	862.2 862.79
441+50	863.21	862.5 863.12
442+00	863.62	862.9 863.48
442+50	864.06	863.3 863.91
443+00	864.58	863.7 864.45
443+50	865.20	864.4 865.06
444+00	865.89	865.1 865.75
444+50	866.63	865.7 866.49
445+00	867.40	866.8 867.25

I-71/I-75

Addendum 2 -- 7-11-19

STA. 430+00 TO STA. 445+00

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		9	11
STATION		475+00	473+00
OFFSET		100' Lt.	119' Rt.
DEPTH		0.0'-2.4'	0.0'-5.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	0
	SAND (- NO 10 + NO. 200)	11	7
	SILT (- 0.075 mm + 0.002 mm)	42	38
	CLAY (- 0.002 mm)	41	55
LIQUID LIMIT		48	66
PLASTIC LIMIT		19	23
PLASTICITY INDEX		29	43
ACTIVITY INDEX		0.71	0.78
SPECIFIC GRAVITY		2.79	2.78
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(45)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		1.0	N/A
MAXIMUM DRY DENSITY (pcf)		99.2	N/A
OPTIMUM MOISTURE (%)		13.2	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

	LEFT EP GP	RIGHT EP GP
460+00	872.39	871.6 870.43
460+50	890.43	890.3 890.45
461+00	891.35	890.9 891.37
461+50	892.21	891.5 892.22
462+00	893.04	892.3 893.13
462+50	893.90	893.5 894.01
463+00	894.73	894.3 894.89
463+50	895.51	895.1 895.65
464+00	896.22	895.8 896.40
464+50	897.01	896.7 897.16
465+00	897.87	897.3 897.81
465+50	898.70	898.1 898.49
466+00	899.55	898.9 899.28
466+50	900.39	899.7 900.07
467+00	901.20	900.2 900.93
467+50	901.96	901.0 901.75
468+00	902.72	902.1 902.64
468+50	903.52	902.9 903.54
469+00	904.38	903.6 904.44
469+50	905.13	904.4 905.39
470+00	905.83	905.1 905.75
470+50	906.61	905.9 906.51
471+00	907.40	906.9 907.19
471+50	908.18	907.7 907.92
472+00	908.81	908.4 908.74
472+50	909.56	909.1 909.58

473+00	910.36	910.0 910.41
473+50	911.22	910.6 911.26
474+00	912.10	911.4 912.07
474+50	912.96	912.0 912.80
475+00	913.68	912.7 913.54

I-71/I-75

STA. 460+00 TO STA. 475+00

Addendum 2 -- 7-11-19

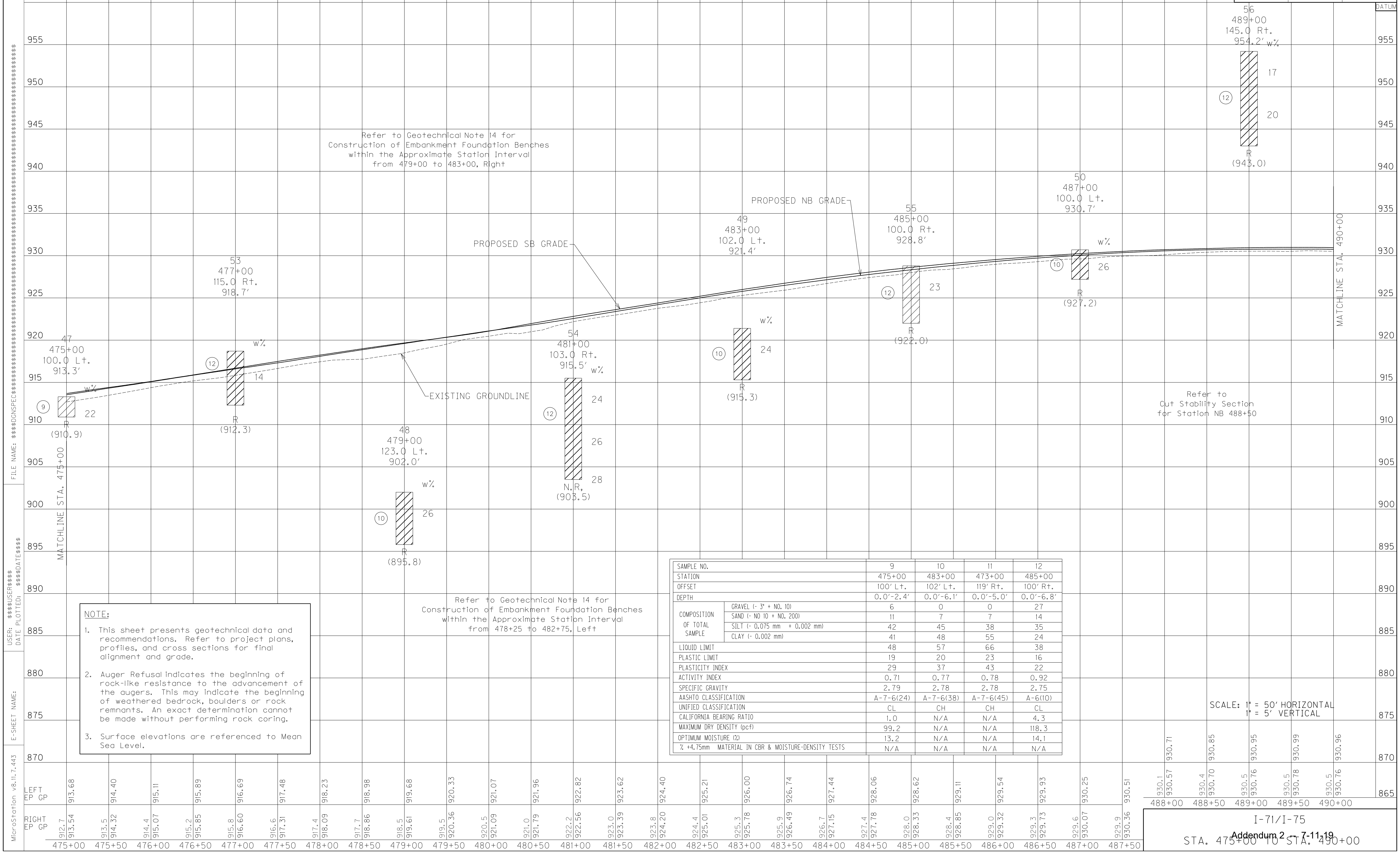
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 14 for
Construction of Embankment Foundation Benches
within the Approximate Station Interval
from 479+00 to 483+00, Right

Refer to Geotechnical Note 14 for
Construction of Embankment Foundation Benches
within the Approximate Station Interval
from 478+25 to 482+75, Left

Refer to
Cut Stability Section
for Station NB 488+50

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

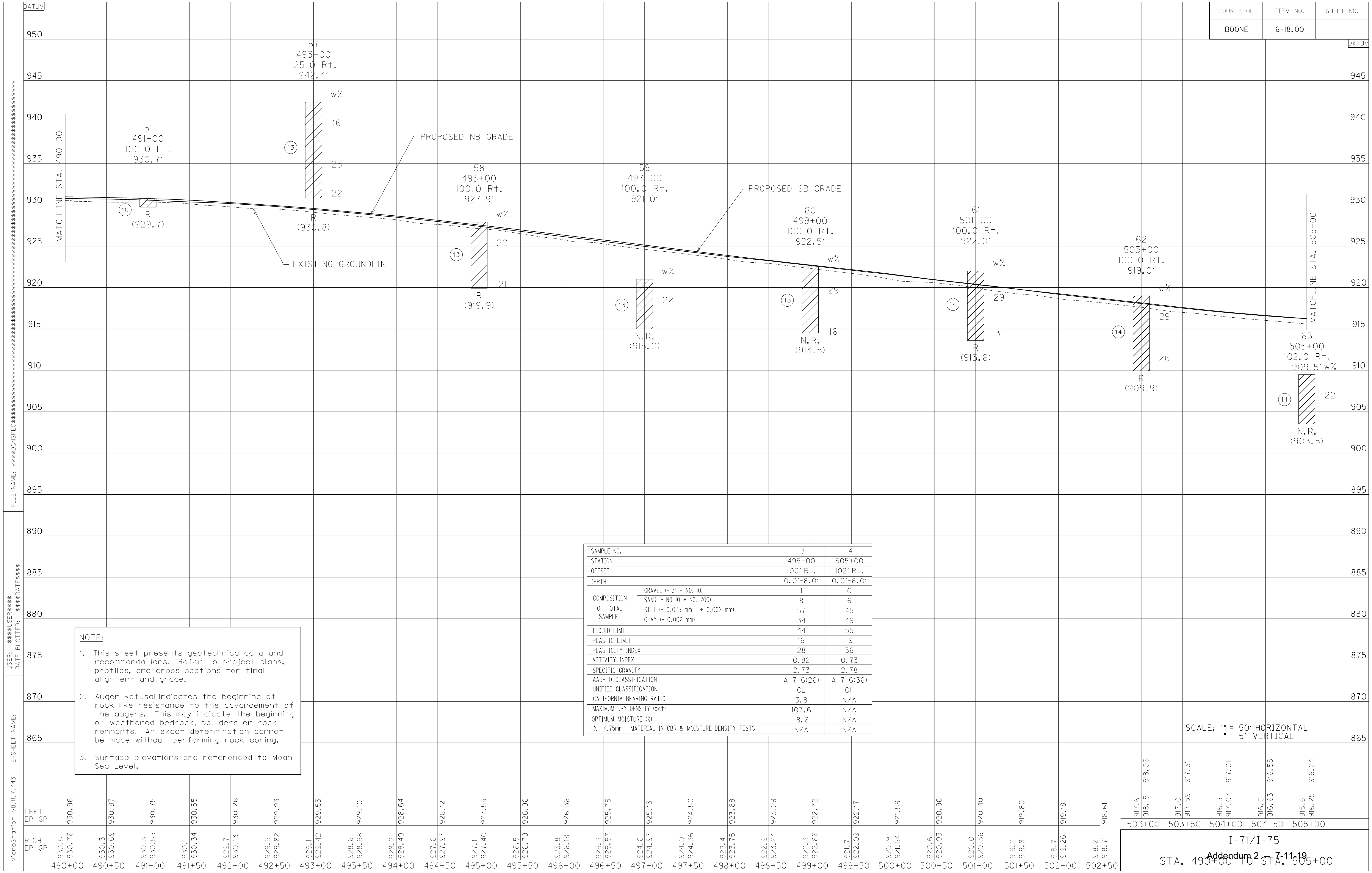
SAMPLE NO.		9	10	11	12
STATION		475+00	483+00	473+00	485+00
OFFSET		100' Lt.	102' Lt.	119' Rt.	100' Rt.
DEPTH		0.0'-2.4'	0.0'-6.1'	0.0'-5.0'	0.0'-6.8'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	0	0	27
	SAND (- NO 10 + NO. 200)	11	7	7	14
	SILT (- 0.075 mm + 0.002 mm)	42	45	38	35
	CLAY (- 0.002 mm)	41	48	55	24
LIQUID LIMIT		48	57	66	38
PLASTIC LIMIT		19	20	23	16
PLASTICITY INDEX		29	37	43	22
ACTIVITY INDEX		0.71	0.77	0.78	0.92
SPECIFIC GRAVITY		2.79	2.78	2.78	2.75
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(38)	A-7-6(45)	A-6(10)
UNIFIED CLASSIFICATION		CL	CH	CH	CL
CALIFORNIA BEARING RATIO		1.0	N/A	N/A	4.3
MAXIMUM DRY DENSITY (pcf)		99.2	N/A	N/A	118.3
OPTIMUM MOISTURE (%)		13.2	N/A	N/A	14.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A	N/A	N/A

I-71/I-75

STA. 475+00 TO STA. 490+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		13	14
STATION		495+00	505+00
OFFSET		100' Rt.	102' Rt.
DEPTH		0.0'-8.0'	0.0'-6.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1	0
	SAND (- NO 10 + NO. 200)	8	6
	SILT (- 0.075 mm + 0.002 mm)	57	45
	CLAY (- 0.002 mm)	34	49
LIQUID LIMIT		44	55
PLASTIC LIMIT		16	19
PLASTICITY INDEX		28	36
ACTIVITY INDEX		0.82	0.73
SPECIFIC GRAVITY		2.73	2.78
AASHTO CLASSIFICATION		A-7-6(26)	A-7-6(36)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		3.8	N/A
MAXIMUM DRY DENSITY (pcf)		107.6	N/A
OPTIMUM MOISTURE (%)		18.6	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

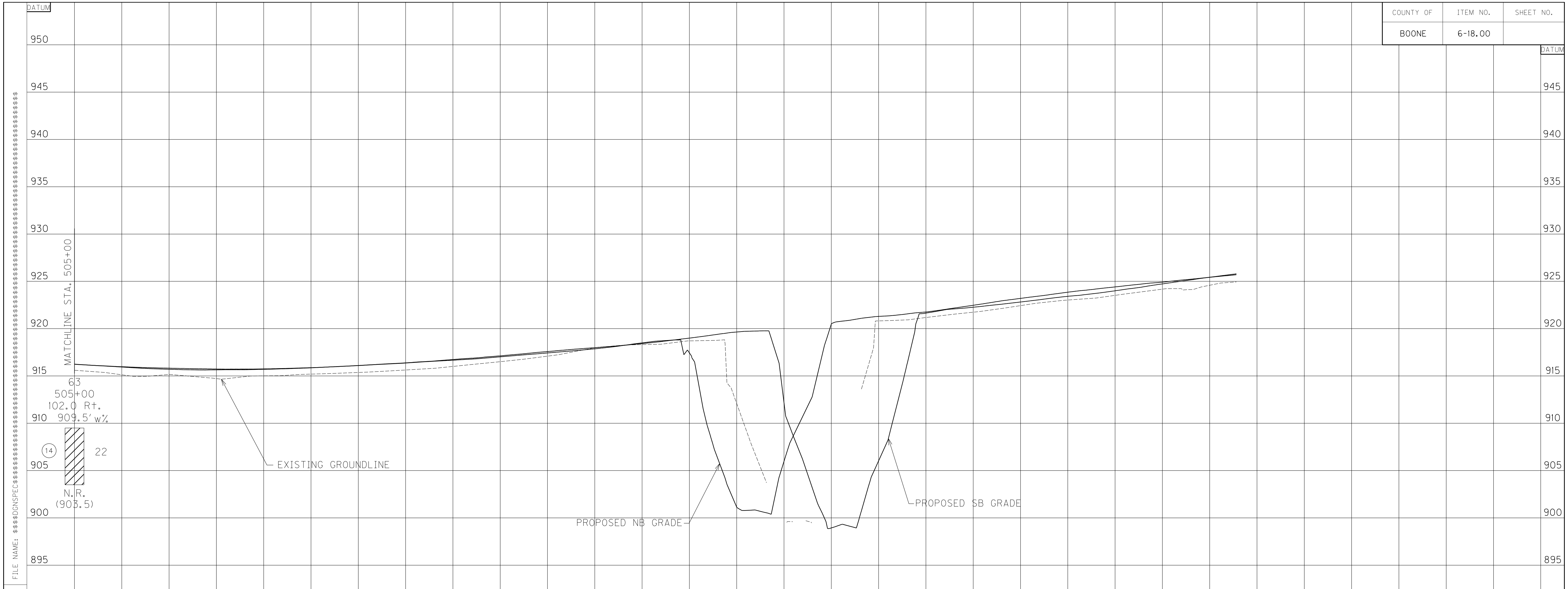
SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

I-71/I-75

STA. 490+00 TO STA. 505+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		14
STATION		505+00
OFFSET		102' Rt.
DEPTH		0.0'-6.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	45
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		55
PLASTIC LIMIT		19
PLASTICITY INDEX		36
ACTIVITY INDEX		0.73
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(36)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

890
885
880
875
870
865

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 50' HORIZONTAL
1" = 5' VERTICAL

	LEFT EP GP	RIGHT EP GP
505+00	916.24	915.6 916.25
505+50	915.98	915.1 915.95
506+00	915.82	915.2 915.71
506+50	915.73	914.7 915.65
507+00	915.75	915.0 915.70
507+50	915.88	915.2 915.86
508+00	916.11	915.4 916.10
508+50	916.39	915.6 916.37
509+00	916.74	916.0 916.67
509+50	917.12	916.5 917.02
510+00	917.58	917.1 917.43
510+50	917.99	918.0 917.87
511+00	918.42	918.3 918.50
511+50	919.00	918.7 917.43
512+00	919.65	912.1 901.14
512+50	912.15	905.97
513+00	898.94	920.49
513+50	906.03	920.8 921.30
514+00	921.64	921.2 921.76
514+50	922.26	921.7 922.47
515+00	922.82	922.4 923.20
515+50	923.42	923.0 923.85
516+00	924.00	923.5 924.41
516+50	924.73	924.2 924.91
517+00	925.43	924.6 925.43

FILE NAME: $$$$DGNSPEC$$

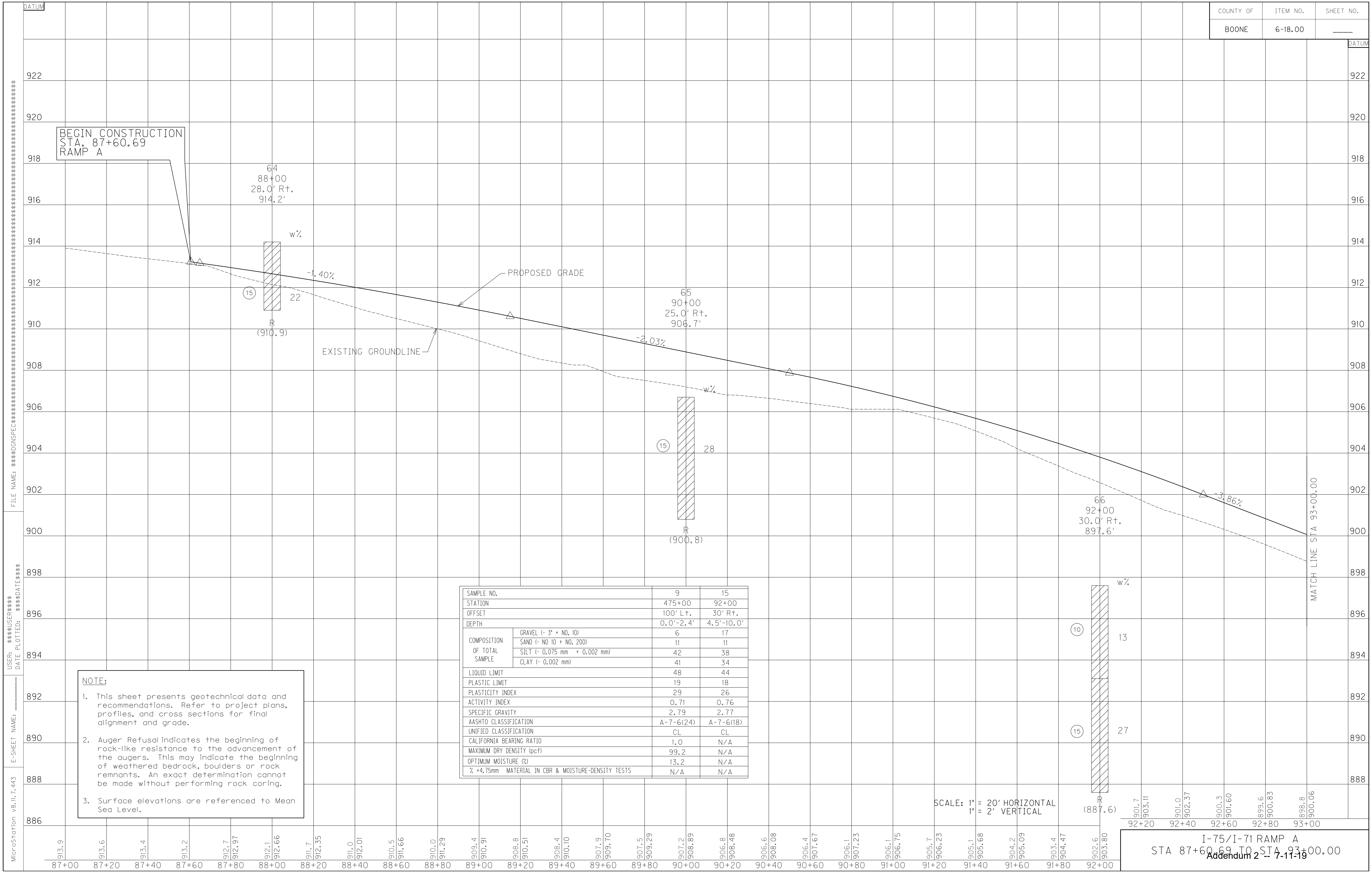
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

I-71/I-75
STA. 505+00 TO END CONSTRUCTION
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
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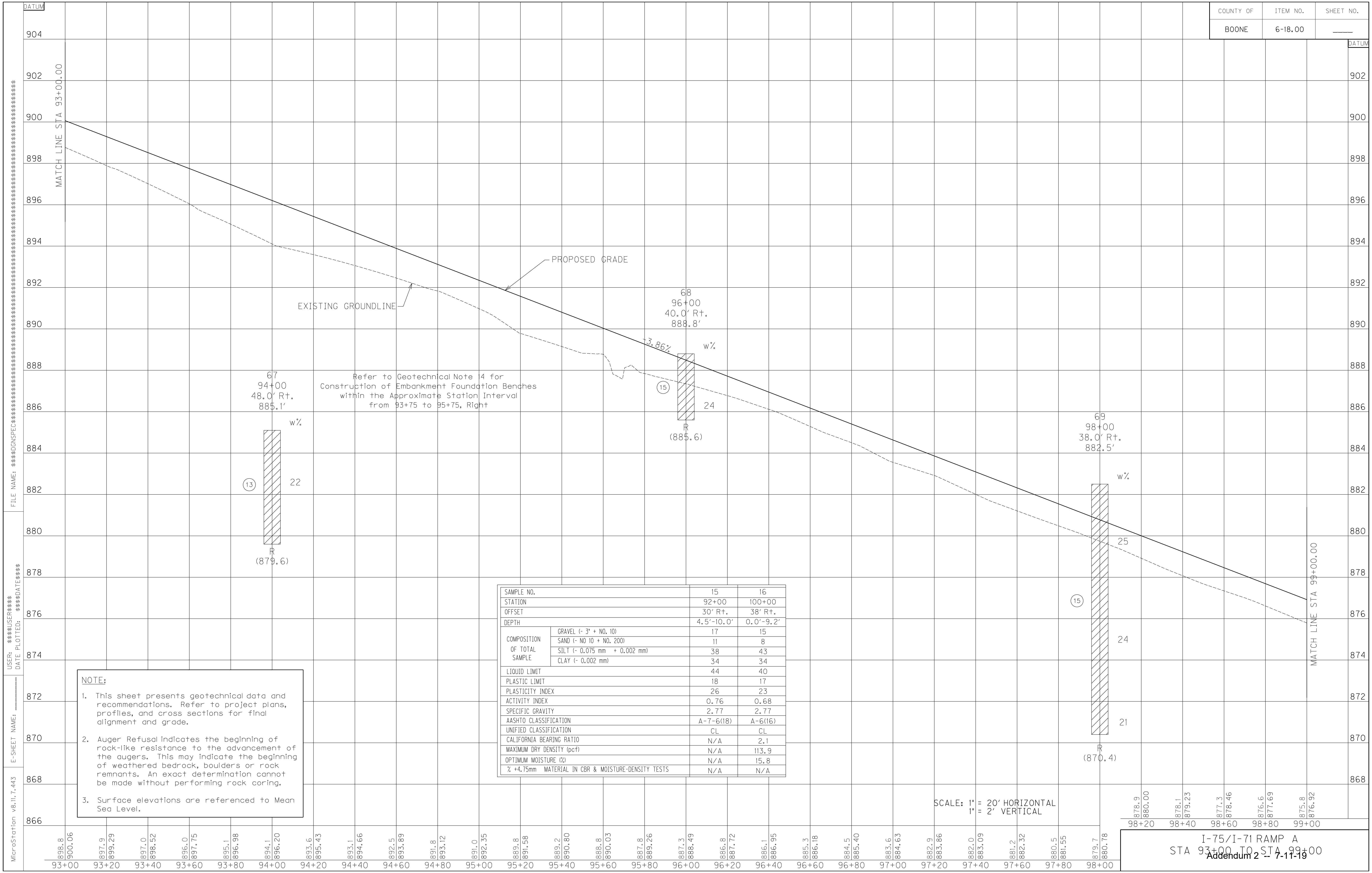
SAMPLE NO.		9	15
STATION		475+00	92+00
OFFSET		100' Lt.	30' Rt.
DEPTH		0.0'-2.4'	4.5'-10.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	17
	SAND (- NO 10 + NO. 200)	11	11
	SILT (- 0.075 mm + 0.002 mm)	42	38
	CLAY (- 0.002 mm)	41	34
LIQUID LIMIT		48	44
PLASTIC LIMIT		19	18
PLASTICITY INDEX		29	26
ACTIVITY INDEX		0.71	0.76
SPECIFIC GRAVITY		2.79	2.77
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(18)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	N/A
MAXIMUM DRY DENSITY (pcf)		99.2	N/A
OPTIMUM MOISTURE (%)		13.2	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

I-75/I-71 RAMP A
STA 87+60.69 TO STA 93+00.00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

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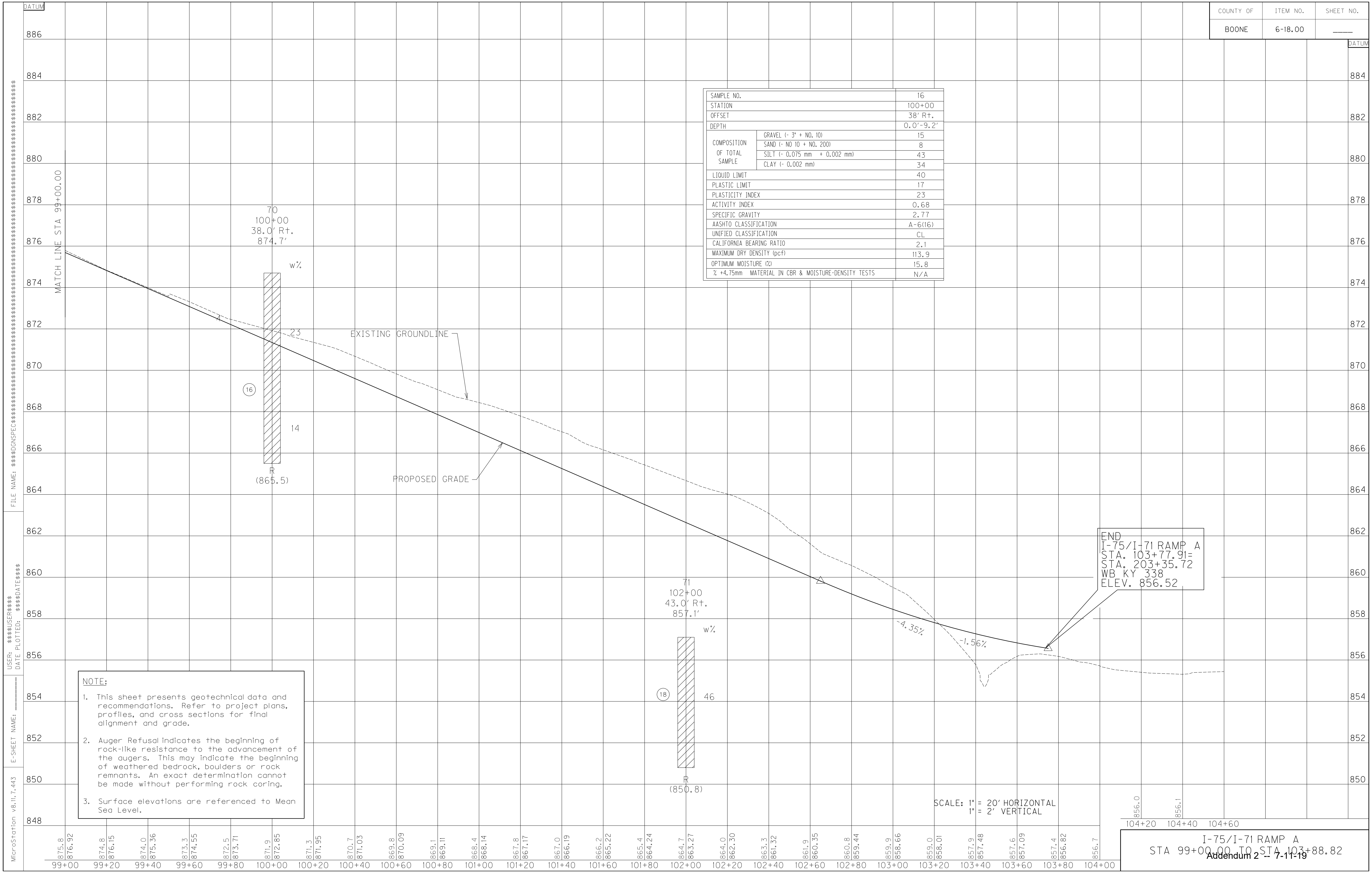
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		15	16
STATION		92+00	100+00
OFFSET		30' Rt.	38' Rt.
DEPTH		4.5'-10.0'	0.0'-9.2'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	17	15
	SAND (- NO 10 + NO. 200)	11	8
	SILT (- 0.075 mm + 0.002 mm)	38	43
	CLAY (- 0.002 mm)	34	34
LIQUID LIMIT		44	40
PLASTIC LIMIT		18	17
PLASTICITY INDEX		26	23
ACTIVITY INDEX		0.76	0.68
SPECIFIC GRAVITY		2.77	2.77
AASHTO CLASSIFICATION		A-7-6(18)	A-6(16)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		N/A	2.1
MAXIMUM DRY DENSITY (pcf)		N/A	113.9
OPTIMUM MOISTURE (%)		N/A	15.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

I-75/I-71 RAMP A
STA 93+00 TO STA 99+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		16
STATION		100+00
OFFSET		38′ Rt.
DEPTH		0.0′-9.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	15
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	43
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		40
PLASTIC LIMIT		17
PLASTICITY INDEX		23
ACTIVITY INDEX		0.68
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-6(16)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.1
MAXIMUM DRY DENSITY (pcf)		113.9
OPTIMUM MOISTURE (%)		15.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

99+00	875.8	876.92
99+20	874.8	876.15
99+40	874.0	875.36
99+60	873.3	874.55
99+80	872.5	873.71
100+00	871.9	872.85
100+20	871.3	871.95
100+40	870.7	871.03
100+60	869.8	870.09
100+80	869.1	869.11
101+00	868.4	868.14
101+20	867.8	867.17
101+40	867.0	866.19
101+60	866.2	865.22
101+80	865.4	864.24
102+00	864.7	863.27
102+20	864.0	862.30
102+40	863.3	861.32
102+60	861.9	860.35
102+80	860.8	859.44
103+00	859.9	858.66
103+20	859.0	858.01
103+40	857.9	857.48
103+60	857.6	857.09
103+80	857.4	856.82
104+00	856.7	
104+20	856.0	
104+40	856.1	
104+60		

FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

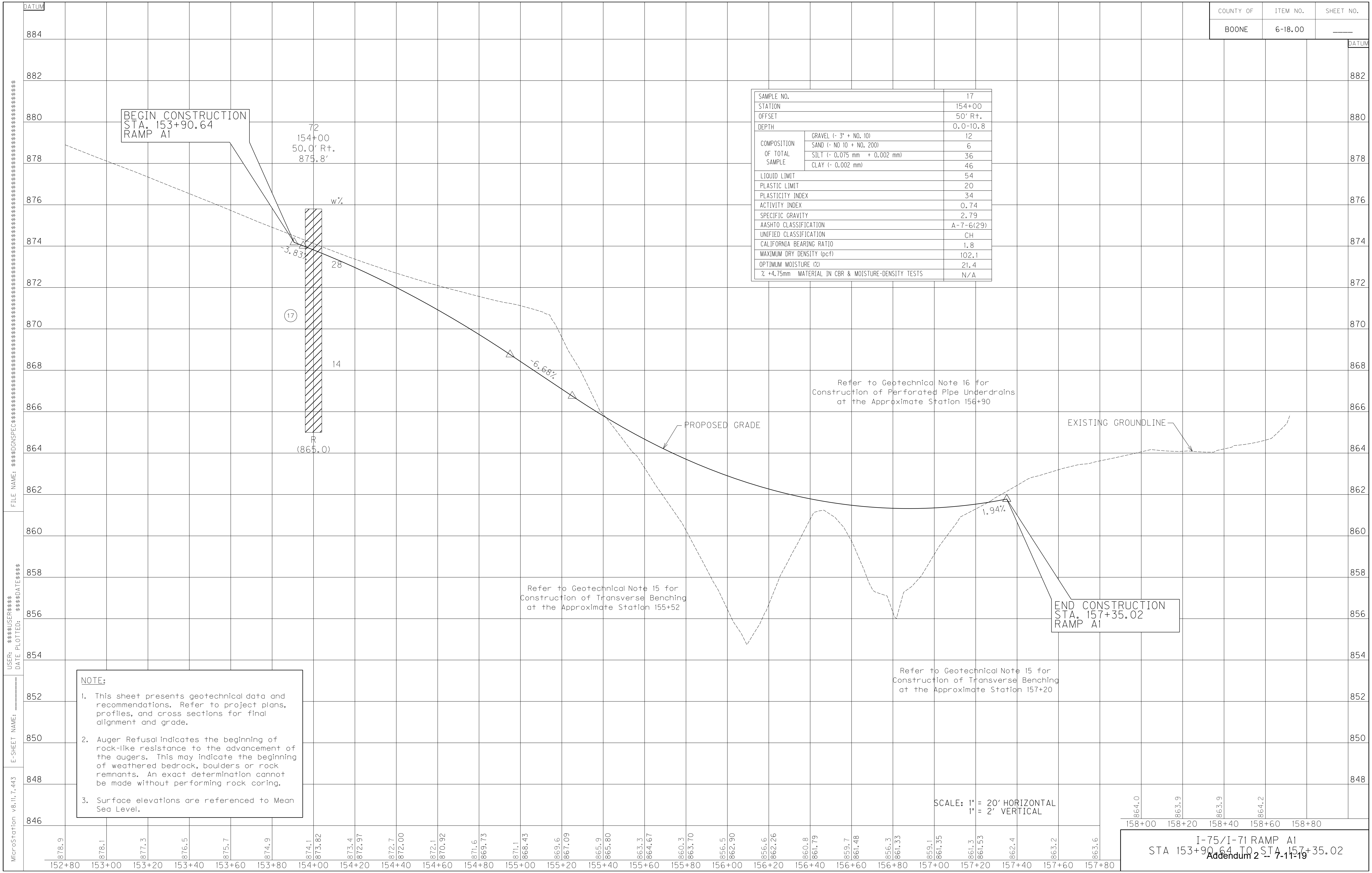
E-SHEET NAME: ____

MicroStation v8.11.7.443

I-75/I-71 RAMP A
STA 99+00.00 TO STA 103+88.82

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		17
STATION		154+00
OFFSET		50' Rt.
DEPTH		0.0-10.8
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	12
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	36
	CLAY (- 0.002 mm)	46
LIQUID LIMIT		54
PLASTIC LIMIT		20
PLASTICITY INDEX		34
ACTIVITY INDEX		0.74
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(29)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.8
MAXIMUM DRY DENSITY (pcf)		102.1
OPTIMUM MOISTURE (%)		21.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 156+90

Refer to Geotechnical Note 15 for Construction of Transverse Benching at the Approximate Station 155+52

Refer to Geotechnical Note 15 for Construction of Transverse Benching at the Approximate Station 157+20

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

I-75/I-71 RAMP A1
STA 153+90.64 TO STA 157+35.02

Addendum 2 -- 7-11-19

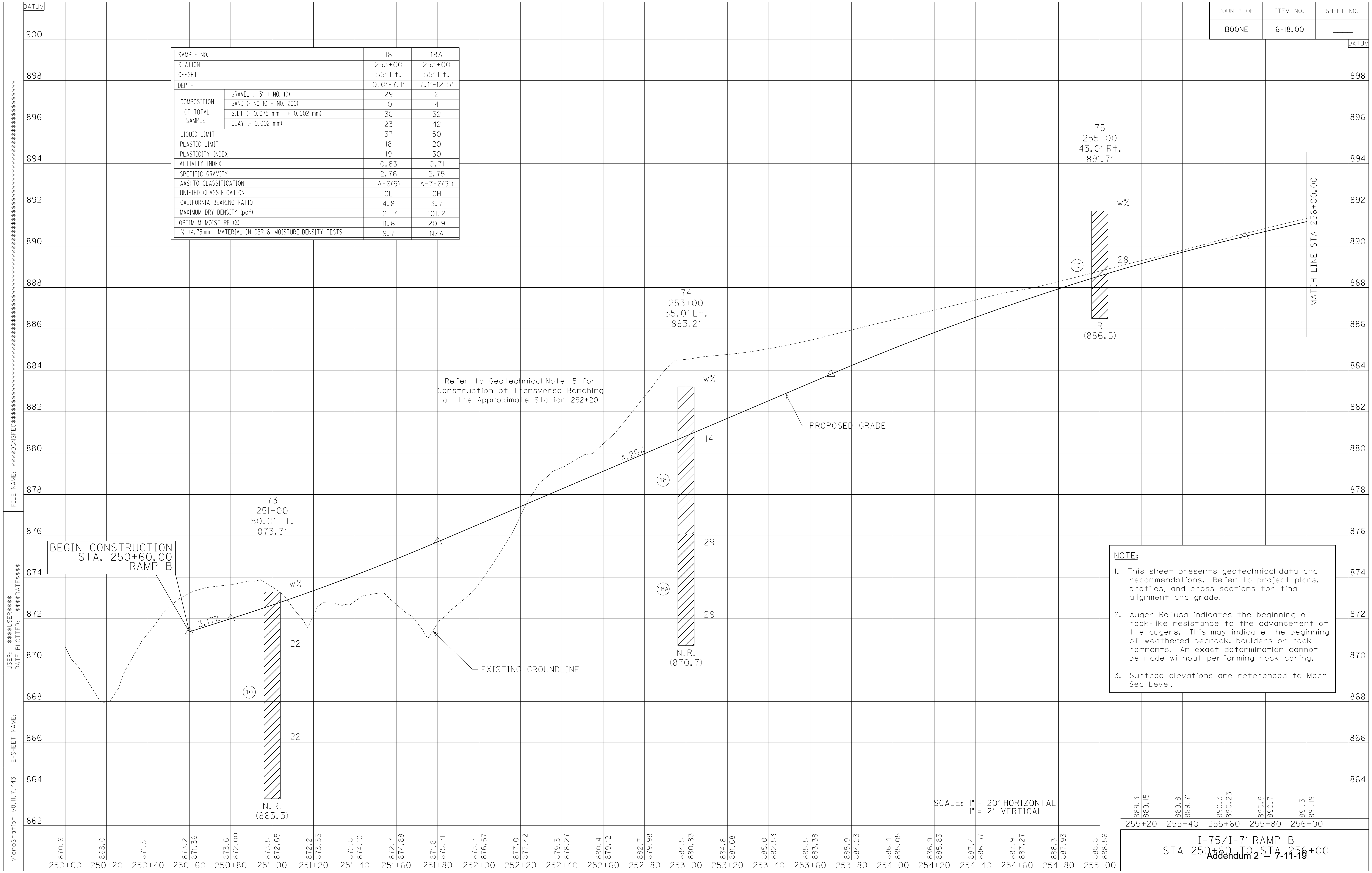
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ________

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		18	18A
STATION		253+00	253+00
OFFSET		55′ Lt.	55′ Lt.
DEPTH		0.0′-7.1′	7.1′-12.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	29	2
	SAND (- NO 10 + NO. 200)	10	4
	SILT (- 0.075 mm + 0.002 mm)	38	52
	CLAY (- 0.002 mm)	23	42
LIQUID LIMIT		37	50
PLASTIC LIMIT		18	20
PLASTICITY INDEX		19	30
ACTIVITY INDEX		0.83	0.71
SPECIFIC GRAVITY		2.76	2.75
AASHTO CLASSIFICATION		A-6(9)	A-7-6(31)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		4.8	3.7
MAXIMUM DRY DENSITY (pcf)		121.7	101.2
OPTIMUM MOISTURE (%)		11.6	20.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		9.7	N/A

NOTE:

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I-75/I-71 RAMP B
STA 250+60 TO STA 256+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ____

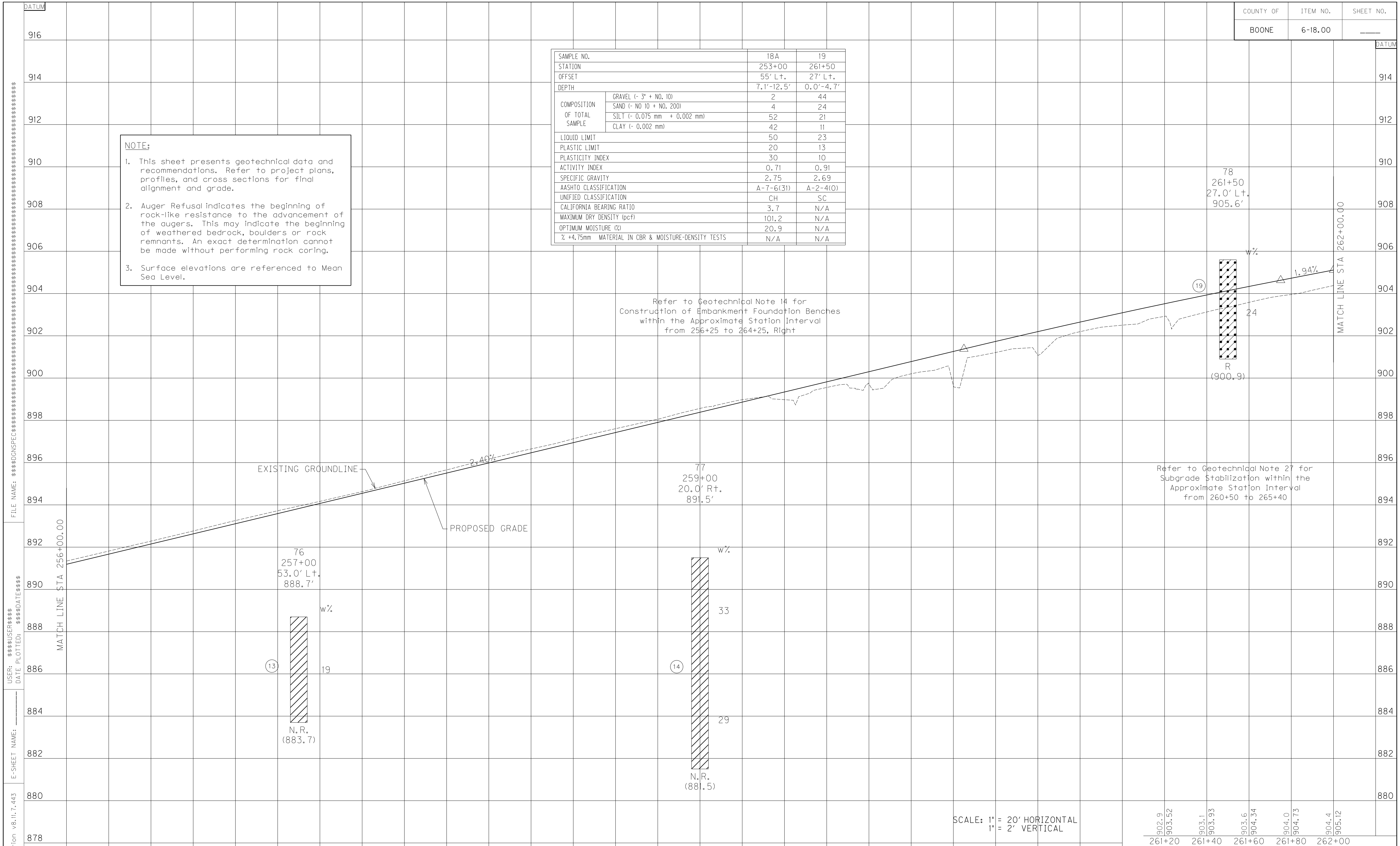
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		18A	19
STATION		253+00	261+50
OFFSET		55′ Lt.	27′ Lt.
DEPTH		7.1′-12.5′	0.0′-4.7′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2	44
	SAND (- NO 10 + NO. 200)	4	24
	SILT (- 0.075 mm + 0.002 mm)	52	21
	CLAY (- 0.002 mm)	42	11
LIQUID LIMIT		50	23
PLASTIC LIMIT		20	13
PLASTICITY INDEX		30	10
ACTIVITY INDEX		0.71	0.91
SPECIFIC GRAVITY		2.75	2.69
AASHTO CLASSIFICATION		A-7-6(31)	A-2-4(0)
UNIFIED CLASSIFICATION		CH	SC
CALIFORNIA BEARING RATIO		3.7	N/A
MAXIMUM DRY DENSITY (pcf)		101.2	N/A
OPTIMUM MOISTURE (%)		20.9	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 256+25 to 264+25, Right

Refer to Geotechnical Note 27 for Subgrade Stabilization within the Approximate Station Interval from 260+50 to 265+40

256+00	891.3	891.19
256+20	891.8	891.67
256+40	892.3	892.15
256+60	892.8	892.63
256+80	893.3	893.11
257+00	893.7	893.59
257+20	894.2	894.07
257+40	894.6	894.55
257+60	895.1	895.03
257+80	895.7	895.51
258+00	896.2	895.98
258+20	896.6	896.46
258+40	897.1	896.94
258+60	897.6	897.42
258+80	898.1	897.90
259+00	898.6	898.38
259+20	899.0	898.86
259+40	899.0	899.34
259+60	899.6	899.82
259+80	899.7	900.30
260+00	900.2	900.78
260+20	899.6	901.26
260+40	901.2	901.74
260+60	901.1	902.20
260+80	902.2	902.65
261+00	902.5	903.09
261+20	902.9	903.52
261+40	903.1	903.93
261+60	903.6	904.34
261+80	904.0	904.73
262+00	904.4	905.12

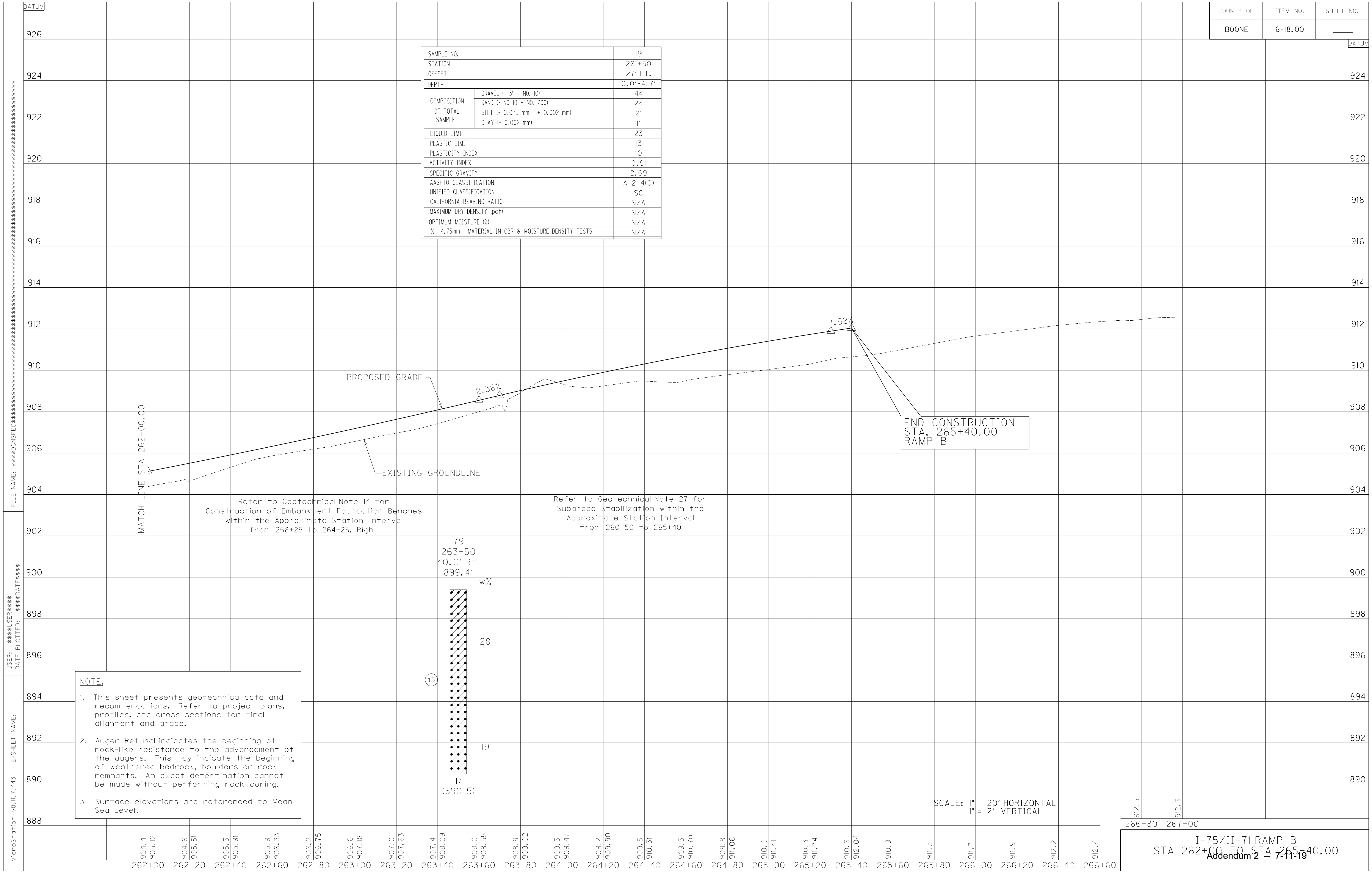
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/I-71 RAMP B
STA 256+00 TO STA 262+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		19
STATION		261+50
OFFSET		27′ Lt.
DEPTH		0.0′-4.7′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	44
	SAND (- NO 10 + NO. 200)	24
	SILT (- 0.075 mm + 0.002 mm)	21
	CLAY (- 0.002 mm)	11
LIQUID LIMIT		23
PLASTIC LIMIT		13
PLASTICITY INDEX		10
ACTIVITY INDEX		0.91
SPECIFIC GRAVITY		2.69
AASHTO CLASSIFICATION		A-2-4(0)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		N/A
MAXIMUM DRY DENSITY (pcf)		N/A
OPTIMUM MOISTURE (%)		N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



NOTE:

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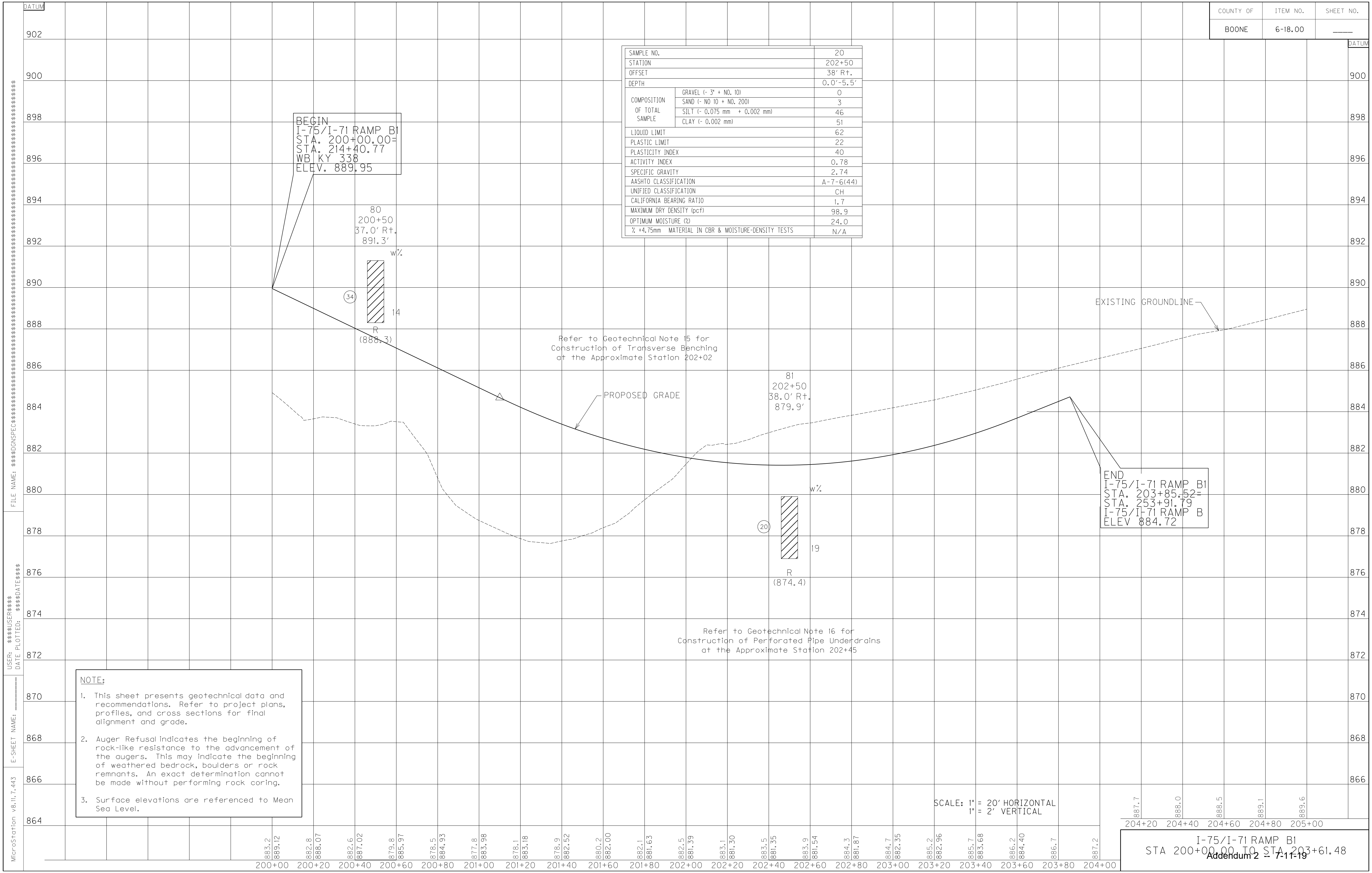
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-75/II-71 RAMP B
STA 262+00 TO STA 265+40.00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		20
STATION		202+50
OFFSET		38' Rt.
DEPTH		0.0'-5.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	46
	CLAY (- 0.002 mm)	51
LIQUID LIMIT		62
PLASTIC LIMIT		22
PLASTICITY INDEX		40
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(44)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		98.9
OPTIMUM MOISTURE (%)		24.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

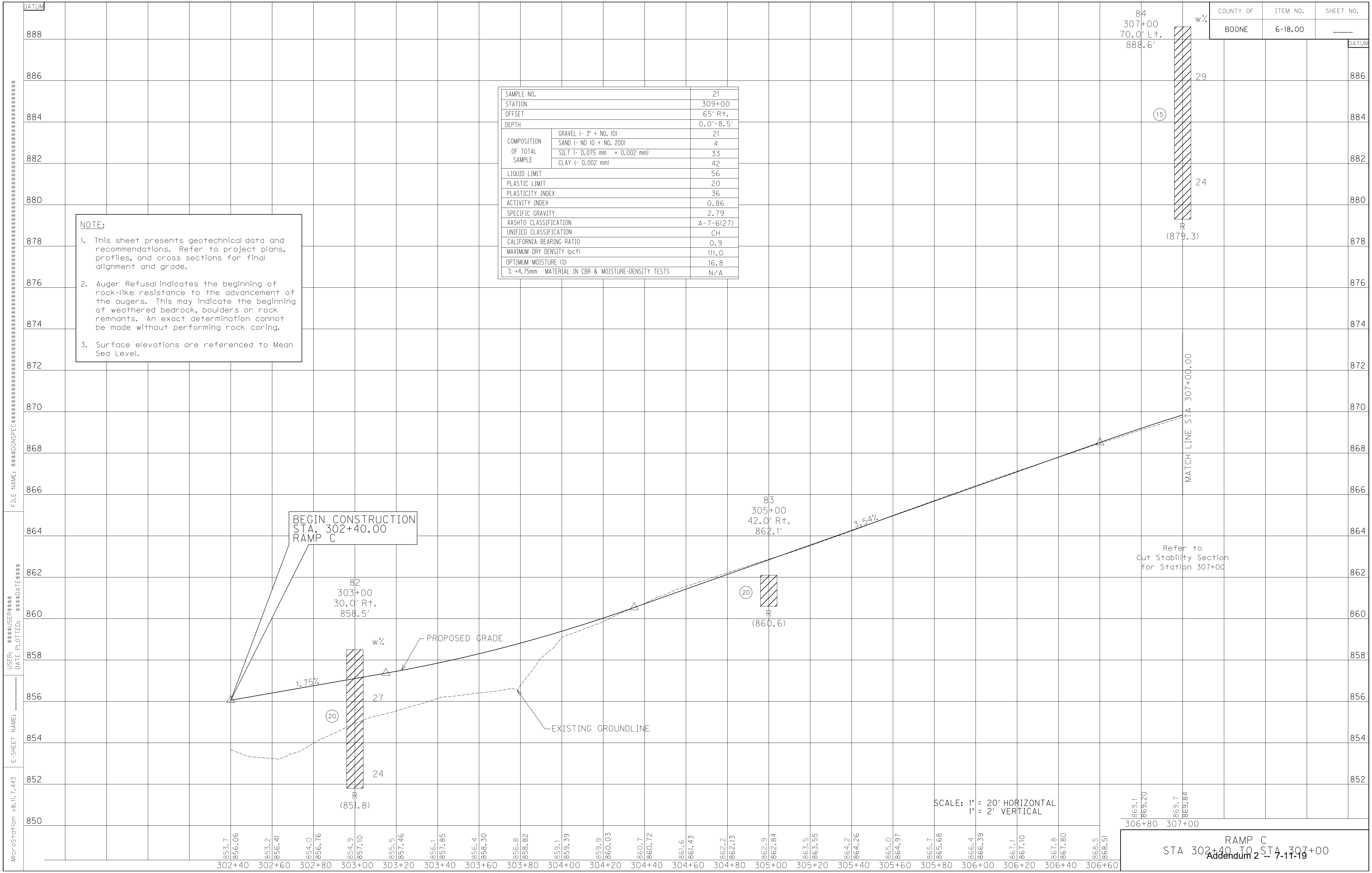
NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-75/I-71 RAMP B1
STA 200+00.00 TO STA 203+61.48

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		21
STATION		309+00
OFFSET		65' Rt.
DEPTH		0.0'-8.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	33
	CLAY (- 0.002 mm)	42
LIQUID LIMIT		56
PLASTIC LIMIT		20
PLASTICITY INDEX		36
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		0.9
MAXIMUM DRY DENSITY (pcf)		111.0
OPTIMUM MOISTURE (%)		16.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

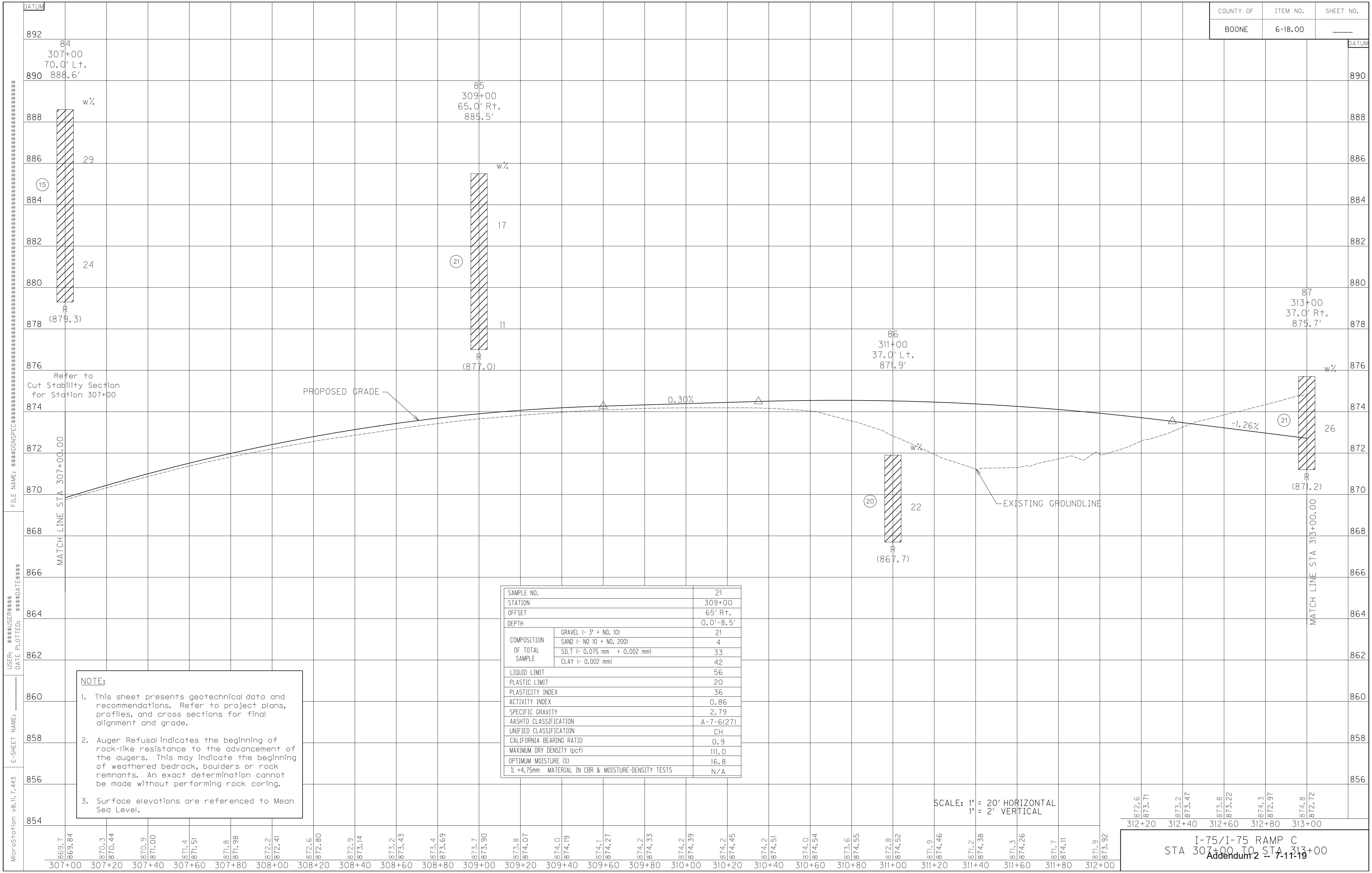
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME: ________
MicroStation v8.11.7.443

RAMP C
STA 302+40 TO STA 307+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



307+00	869.7	869.84
307+20	870.3	870.44
307+40	870.9	871.00
307+60	871.4	871.51
307+80	871.8	871.98
308+00	872.2	872.41
308+20	872.6	872.80
308+40	872.9	873.14
308+60	873.2	873.43
308+80	873.4	873.69
309+00	873.7	873.90
309+20	873.8	874.07
309+40	874.0	874.19
309+60	874.1	874.27
309+80	874.2	874.33
310+00	874.2	874.39
310+20	874.2	874.45
310+40	874.2	874.51
310+60	874.0	874.54
310+80	873.6	874.55
311+00	872.8	874.52
311+20	871.9	874.46
311+40	871.2	874.38
311+60	871.3	874.26
311+80	871.7	874.11
312+00	871.9	873.92
312+20	872.6	873.71
312+40	873.2	873.47
312+60	873.8	873.22
312+80	874.3	872.97
313+00	874.8	872.72

SAMPLE NO.		21
STATION		309+00
OFFSET		65′ Rt.
DEPTH		0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21
	SAND (- NO 10 + NO. 200)	4
	SILT (- 0.075 mm + 0.002 mm)	33
	CLAY (- 0.002 mm)	42
LIQUID LIMIT		56
PLASTIC LIMIT		20
PLASTICITY INDEX		36
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		0.9
MAXIMUM DRY DENSITY (pcf)		111.0
OPTIMUM MOISTURE (%)		16.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

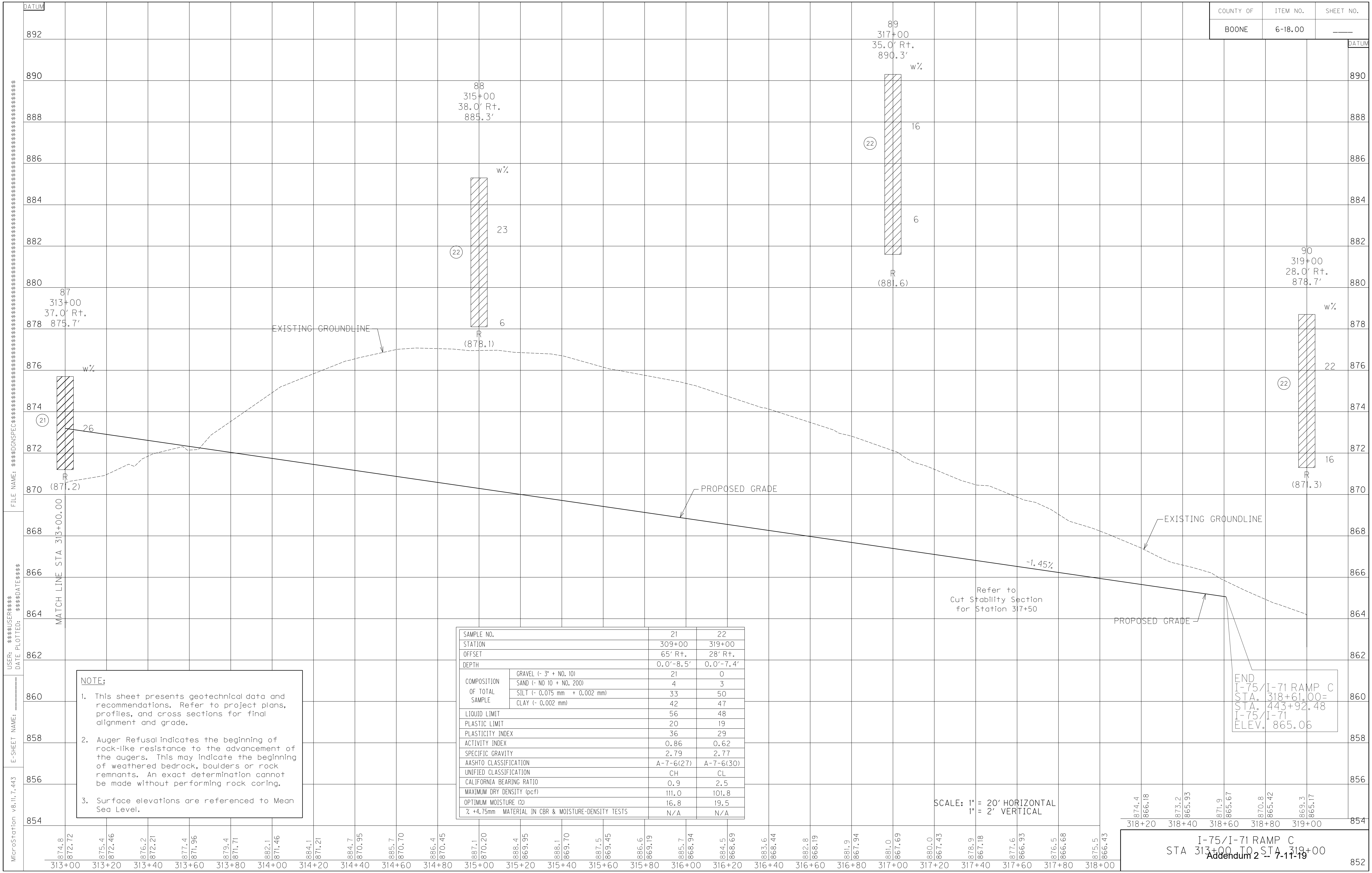
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-75/I-75 RAMP C
STA 307+00 TO STA 313+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME: ____
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		21	22
STATION		309+00	319+00
OFFSET		65′ Rt.	28′ Rt.
DEPTH		0.0′-8.5′	0.0′-7.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	21	0
	SAND (- NO 10 + NO. 200)	4	3
	SILT (- 0.075 mm + 0.002 mm)	33	50
	CLAY (- 0.002 mm)	42	47
LIQUID LIMIT		56	48
PLASTIC LIMIT		20	19
PLASTICITY INDEX		36	29
ACTIVITY INDEX		0.86	0.62
SPECIFIC GRAVITY		2.79	2.77
AASHTO CLASSIFICATION		A-7-6(27)	A-7-6(30)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		0.9	2.5
MAXIMUM DRY DENSITY (pcf)		111.0	101.8
OPTIMUM MOISTURE (%)		16.8	19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

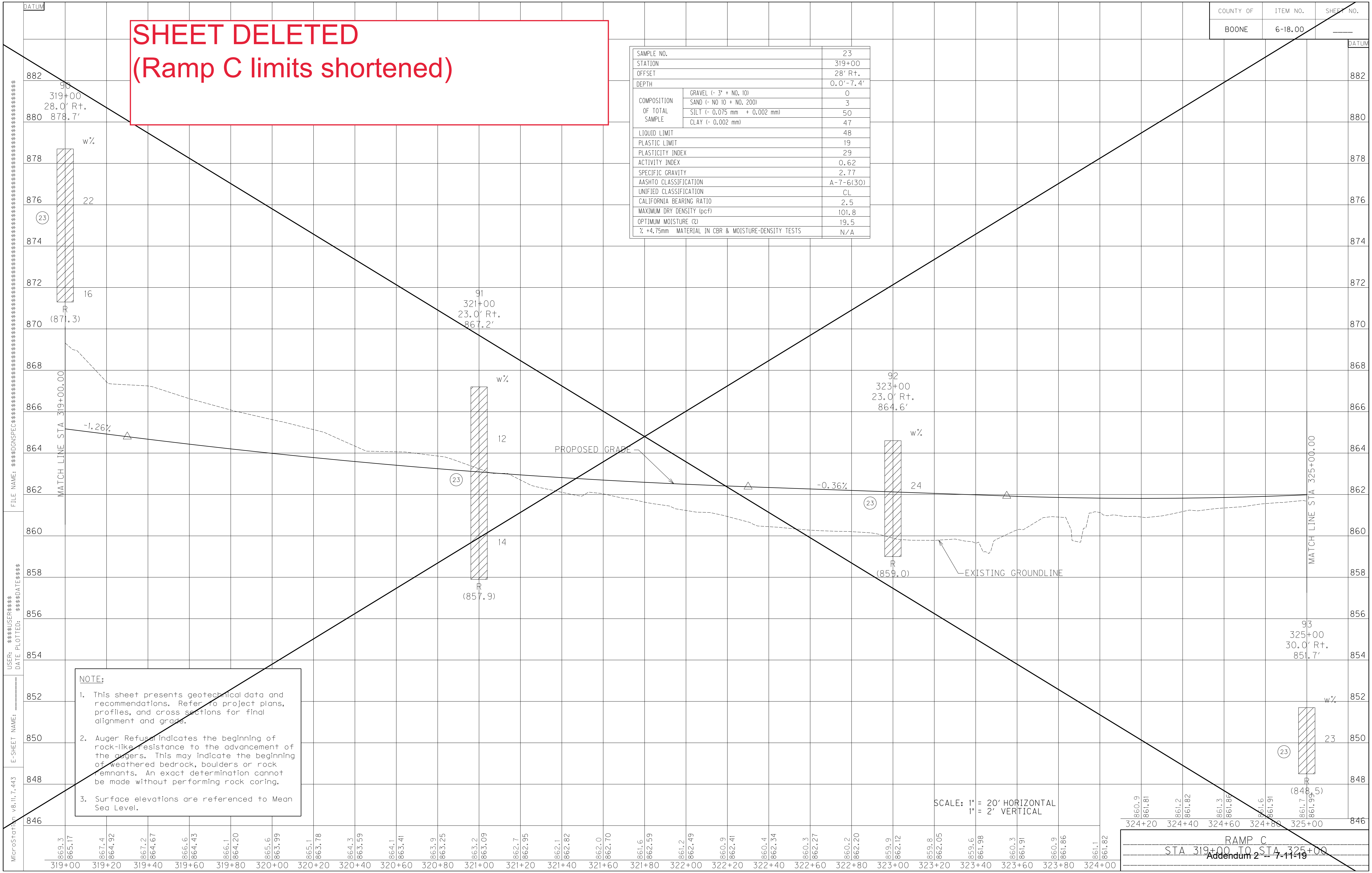
I-75/I-71 RAMP C
STA 313+00 TO STA 319+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SHEET DELETED
(Ramp C limits shortened)

SAMPLE NO.		23
STATION		319+00
OFFSET		28′ Rt.
DEPTH		0.0′-7.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	50
	CLAY (- 0.002 mm)	47
LIQUID LIMIT		48
PLASTIC LIMIT		19
PLASTICITY INDEX		29
ACTIVITY INDEX		0.62
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-7-6(30)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		101.8
OPTIMUM MOISTURE (%)		19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



NOTE:

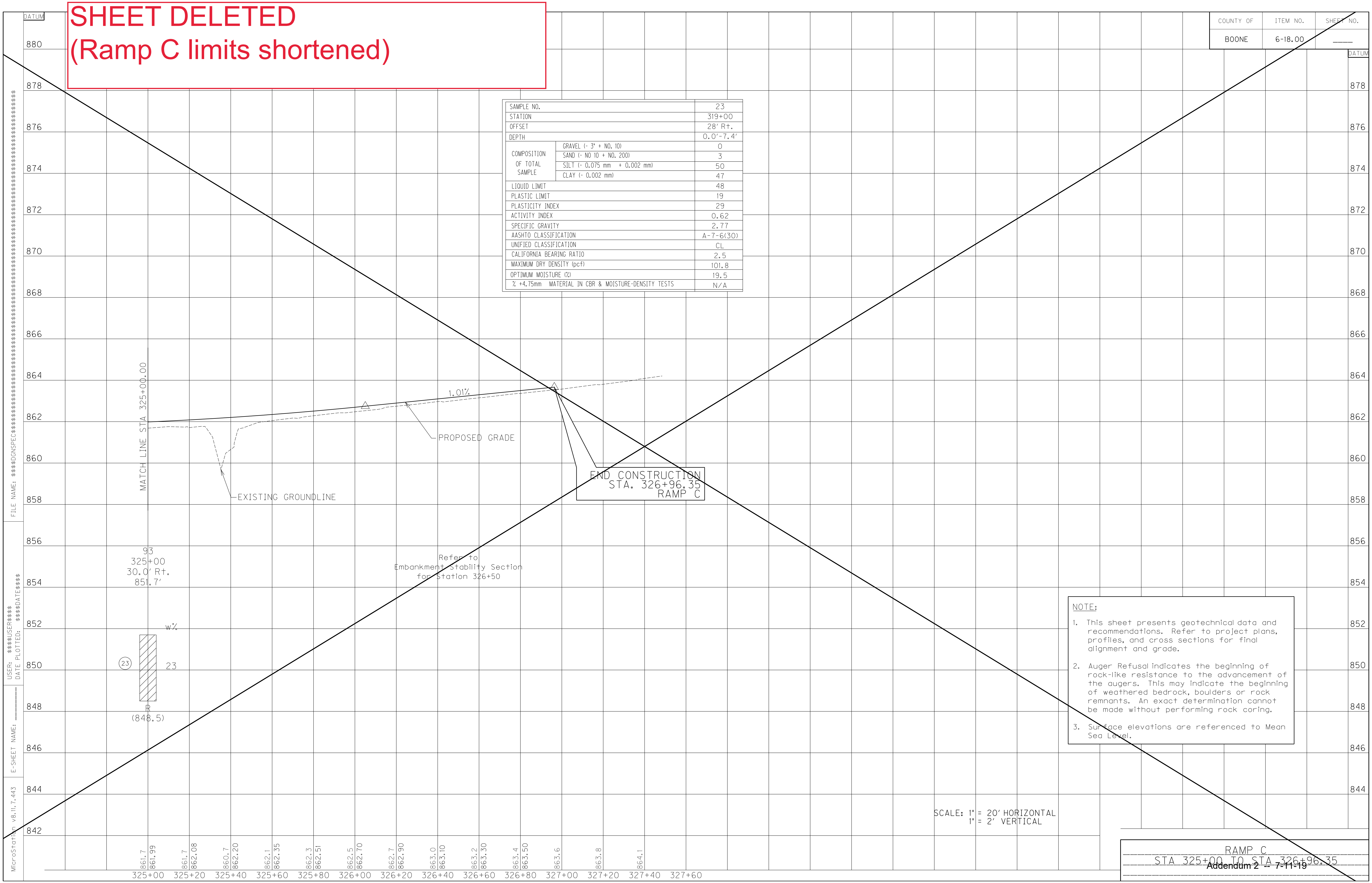
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

RAMP C
STA 319+00 TO STA 325+00
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SHEET DELETED
(Ramp C limits shortened)



SAMPLE NO.		23
STATION		319+00
OFFSET		28' Rt.
DEPTH		0.0'-7.4'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0
	SAND (- NO 10 + NO. 200)	3
	SILT (- 0.075 mm + 0.002 mm)	50
	CLAY (- 0.002 mm)	47
LIQUID LIMIT		48
PLASTIC LIMIT		19
PLASTICITY INDEX		29
ACTIVITY INDEX		0.62
SPECIFIC GRAVITY		2.77
AASHTO CLASSIFICATION		A-7-6(30)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		101.8
OPTIMUM MOISTURE (%)		19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

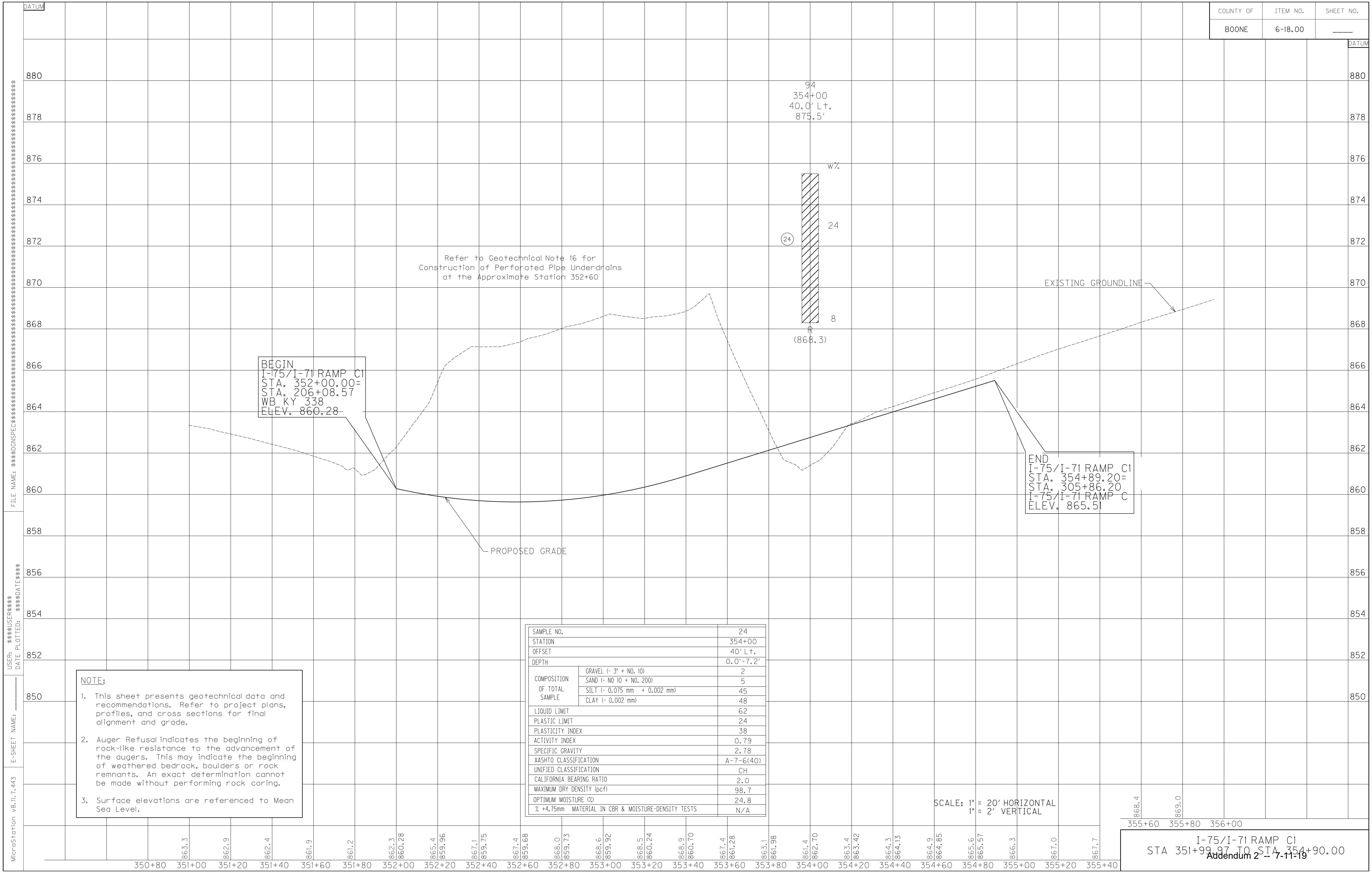
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

RAMP C
STA 325+00 TO STA 326+96.35

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME: ________
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		24
STATION		354+00
OFFSET		40′ Lt.
DEPTH		0.0′-7.2′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	45
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		62
PLASTIC LIMIT		24
PLASTICITY INDEX		38
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		98.7
OPTIMUM MOISTURE (%)		24.8
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/I-71 RAMP C1
STA 351+99.97 TO STA 354+90.00

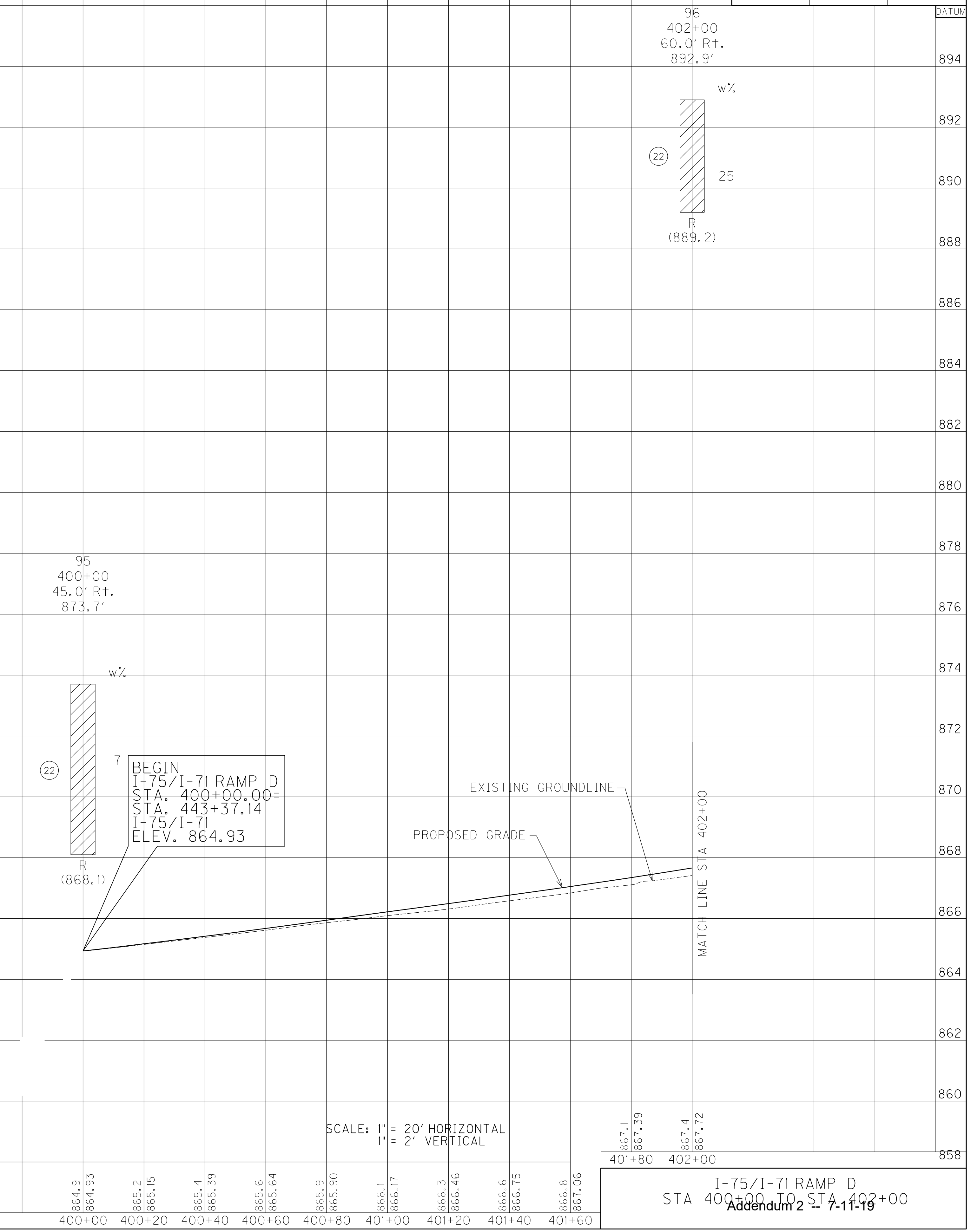
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____

SAMPLE NO.		22
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

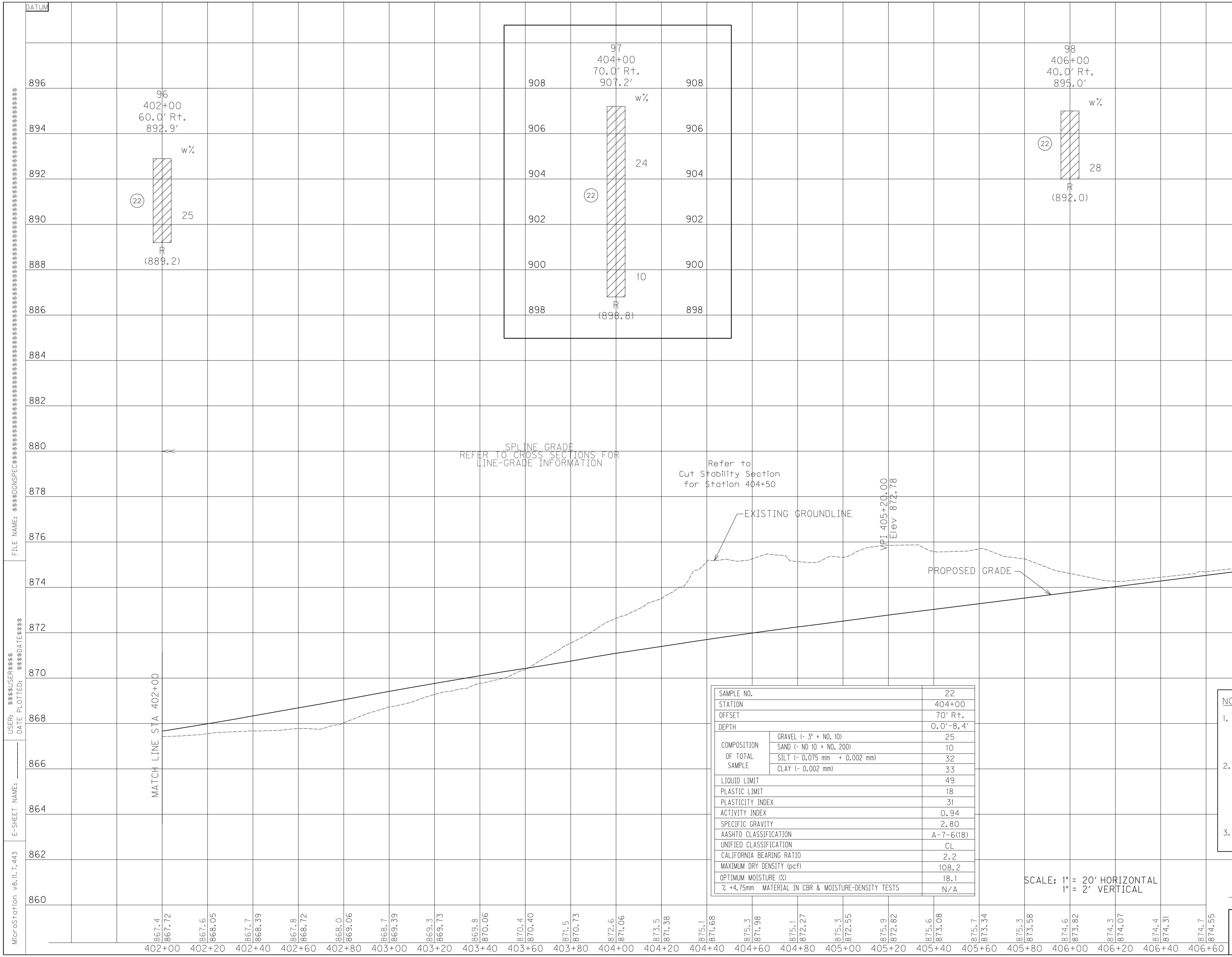


SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/I-71 RAMP D
STA 400+00 TO STA 402+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		22
STATION		404+00
OFFSET		70' Rt.
DEPTH		0.0'-8.4'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

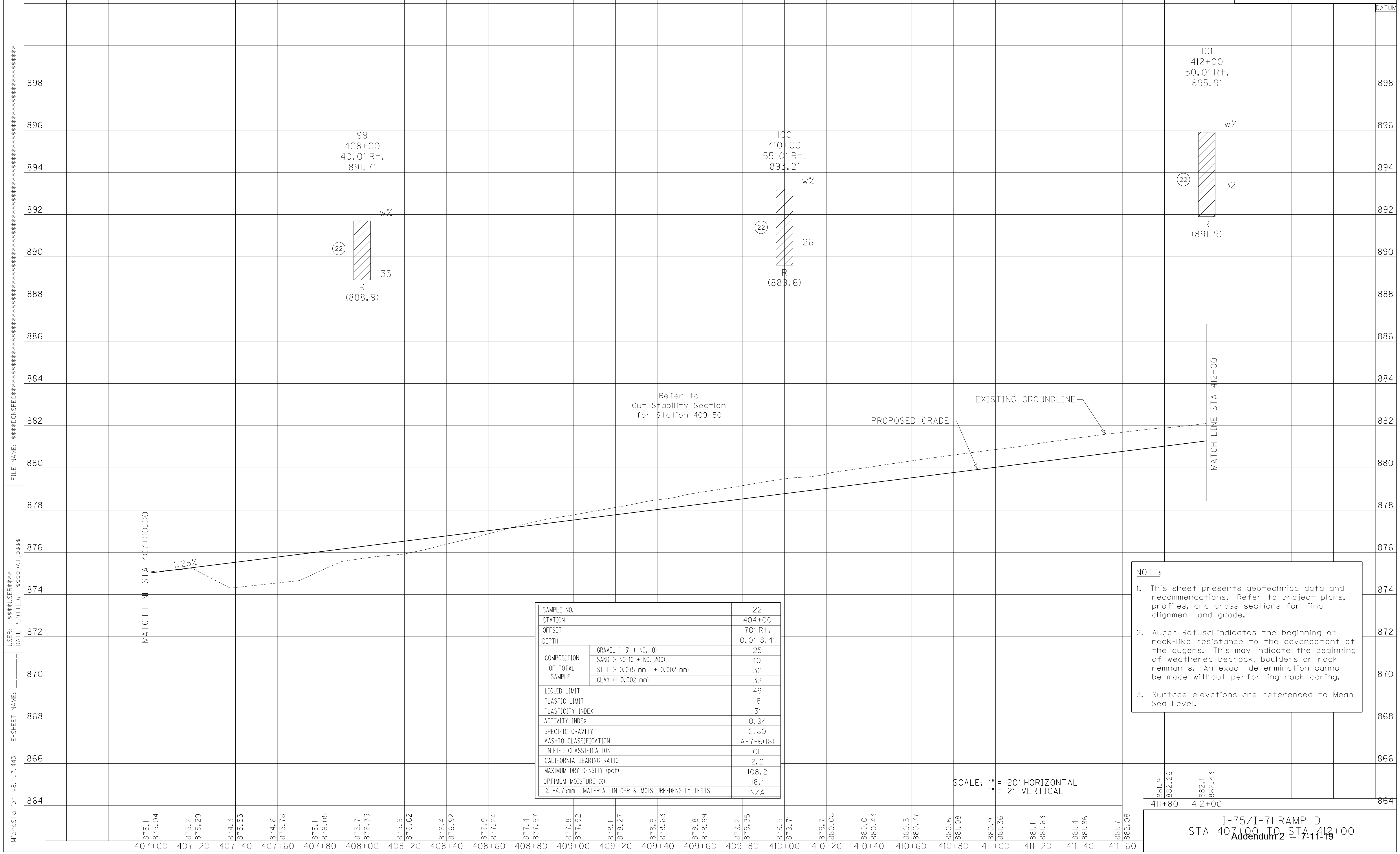
NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-75/I-71 RAMP D
STA 402+00 TO STA 407+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		22
STATION		404+00
OFFSET		70′ Rt.
DEPTH		0.0′-8.4′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

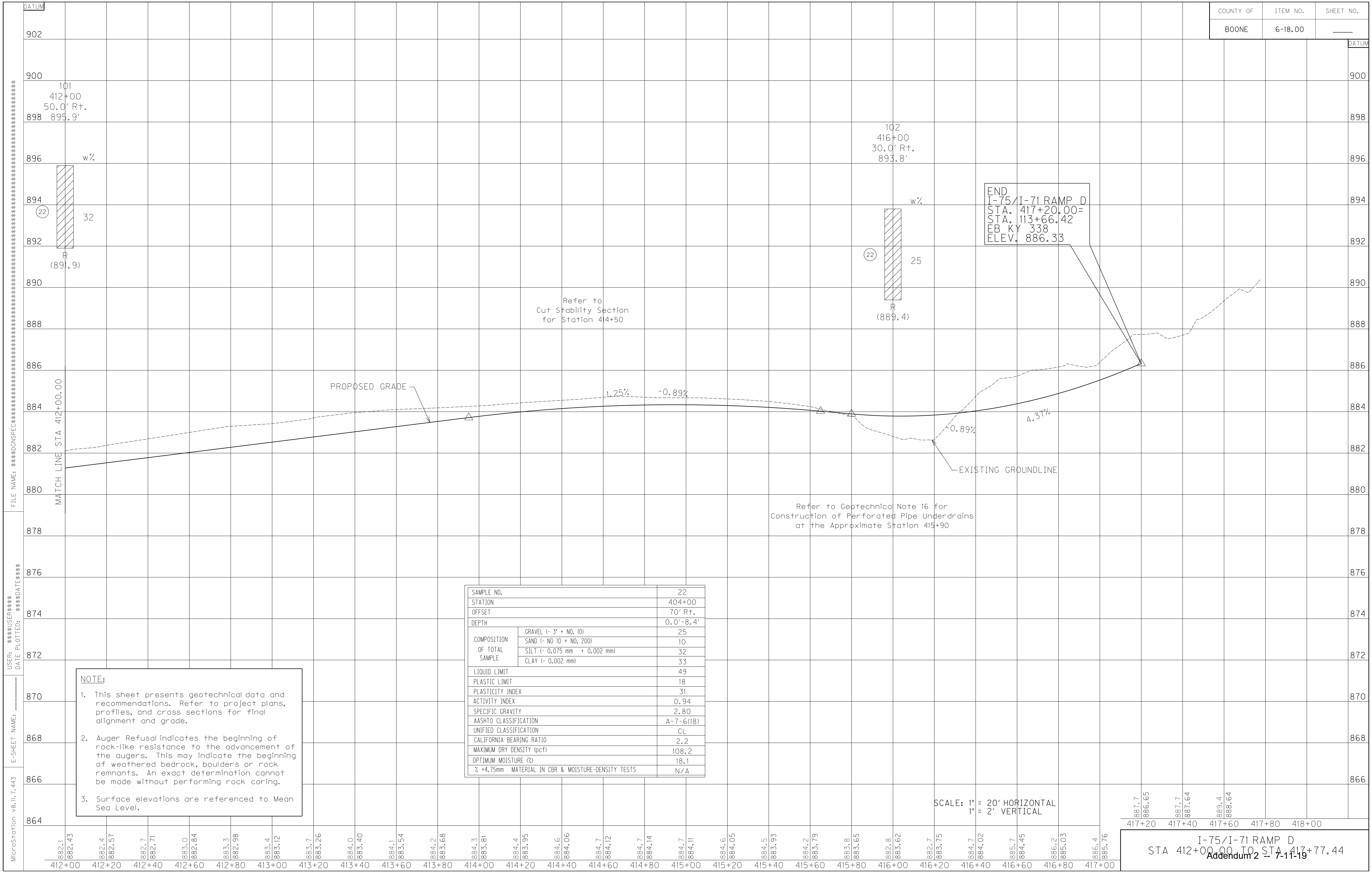
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

I-75/I-71 RAMP D
STA 407+00 TO STA 412+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		22
STATION		404+00
OFFSET		70' Rt.
DEPTH		0.0'-8.4'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	25
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	32
	CLAY (- 0.002 mm)	33
LIQUID LIMIT		49
PLASTIC LIMIT		18
PLASTICITY INDEX		31
ACTIVITY INDEX		0.94
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(18)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

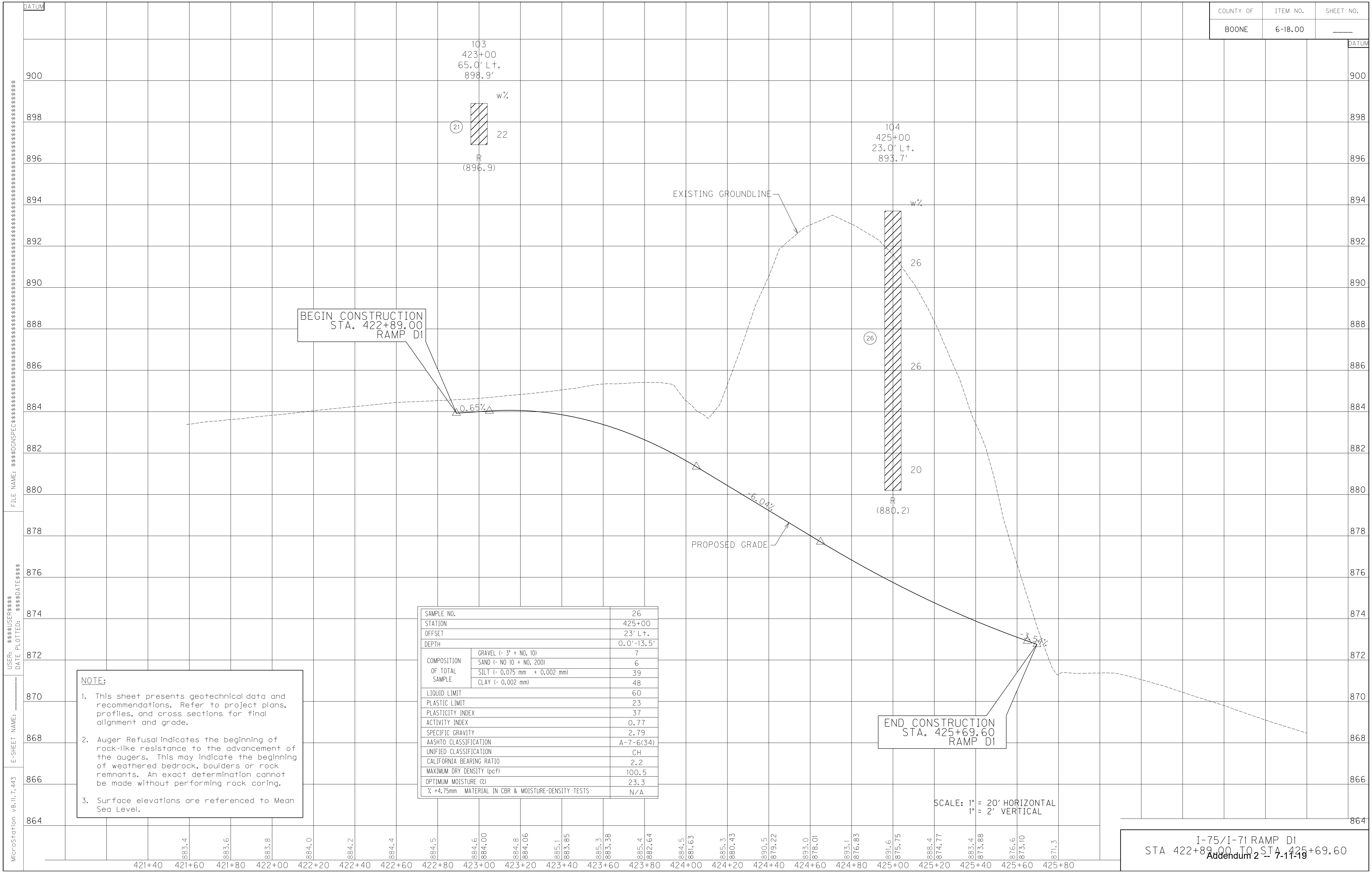
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

I-75/I-71 RAMP D
STA 412+00.00 TO STA 417+77.44

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME: ____
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		26
STATION		425+00
OFFSET		23′ Lt.
DEPTH		0.0′-13.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	39
	CLAY (- 0.002 mm)	48
LIQUID LIMIT		60
PLASTIC LIMIT		23
PLASTICITY INDEX		37
ACTIVITY INDEX		0.77
SPECIFIC GRAVITY		2.79
AASHTO CLASSIFICATION		A-7-6(34)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.2
MAXIMUM DRY DENSITY (pcf)		100.5
OPTIMUM MOISTURE (%)		23.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

I-75/I-71 RAMP D1
STA 422+89.00 TO STA 425+69.60

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$

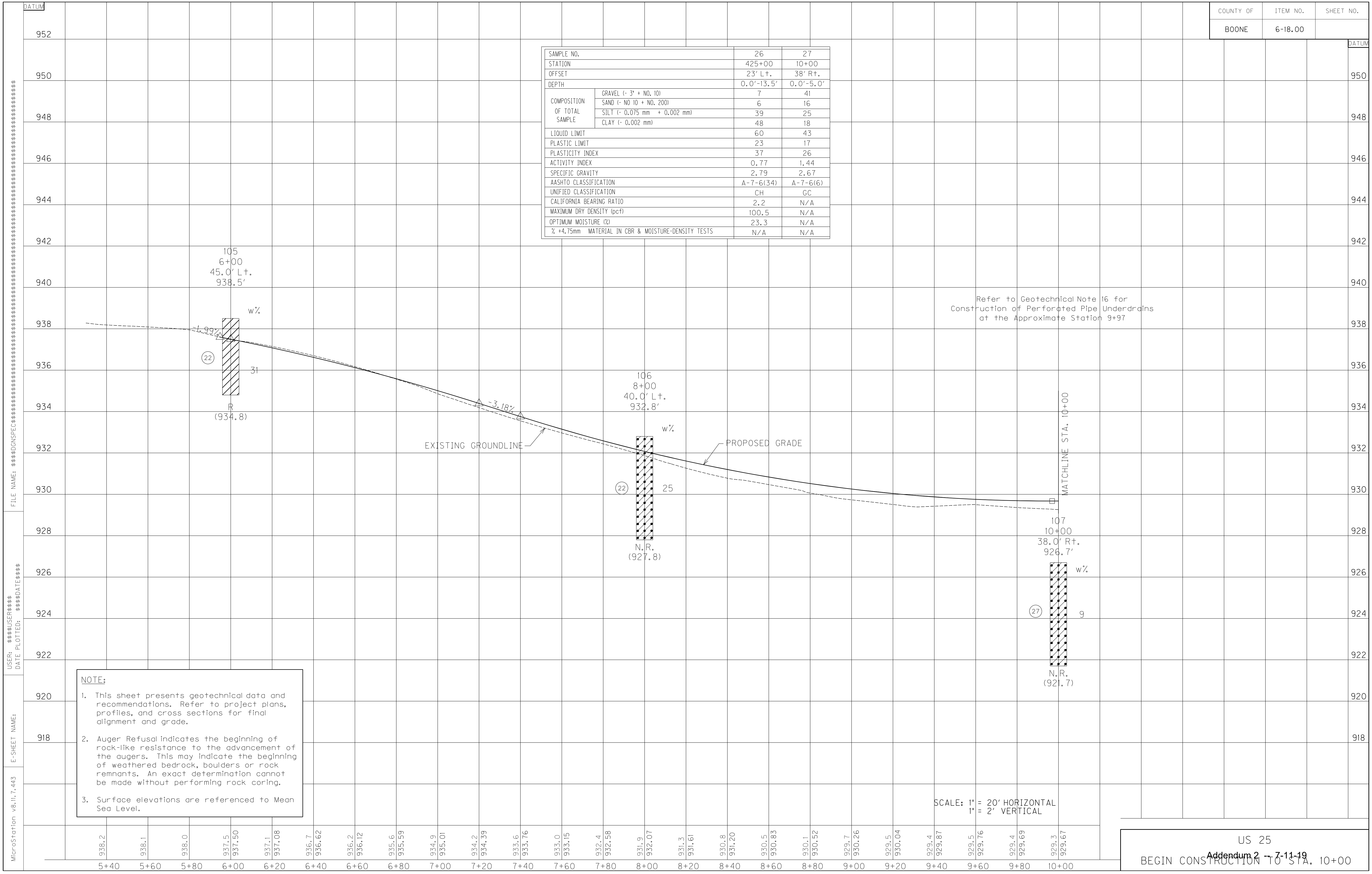
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ________

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		26	27
STATION		425+00	10+00
OFFSET		23′ Lt.	38′ Rt.
DEPTH		0.0′-13.5′	0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	7	41
	SAND (- NO 10 + NO. 200)	6	16
	SILT (- 0.075 mm + 0.002 mm)	39	25
	CLAY (- 0.002 mm)	48	18
LIQUID LIMIT		60	43
PLASTIC LIMIT		23	17
PLASTICITY INDEX		37	26
ACTIVITY INDEX		0.77	1.44
SPECIFIC GRAVITY		2.79	2.67
AASHTO CLASSIFICATION		A-7-6(34)	A-7-6(6)
UNIFIED CLASSIFICATION		CH	GC
CALIFORNIA BEARING RATIO		2.2	N/A
MAXIMUM DRY DENSITY (pcf)		100.5	N/A
OPTIMUM MOISTURE (%)		23.3	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



Refer to Geotechnical Note 16 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 9+97

NOTE:

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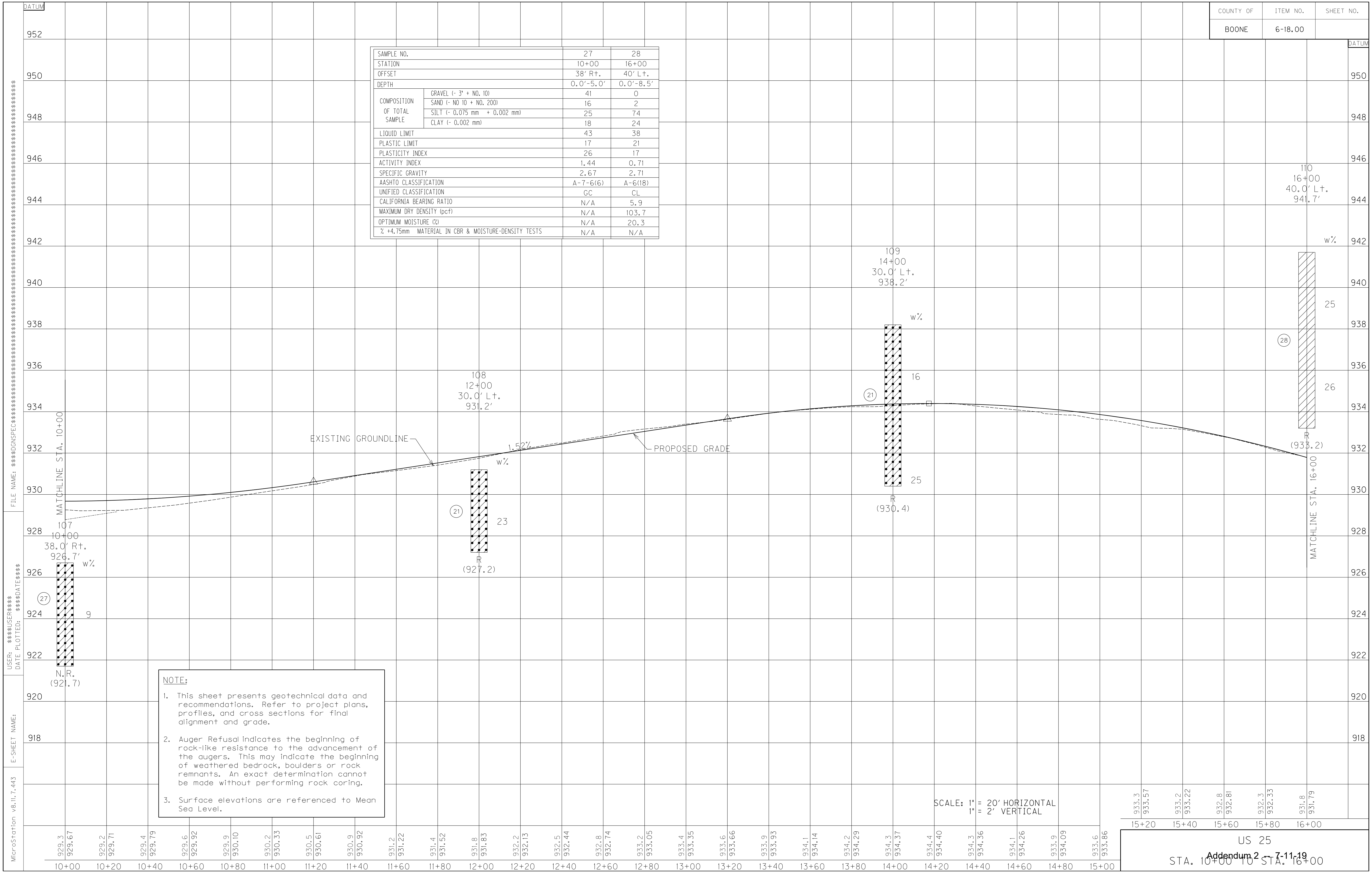
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
BEGIN CONSTRUCTION TO STA. 10+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



10+00	929.3	929.67
10+20	929.2	929.71
10+40	929.4	929.79
10+60	929.6	929.92
10+80	929.9	930.10
11+00	930.2	930.33
11+20	930.5	930.61
11+40	930.9	930.92
11+60	931.2	931.22
11+80	931.4	931.52
12+00	931.8	931.83
12+20	932.2	932.13
12+40	932.5	932.44
12+60	932.8	932.74
12+80	933.2	933.05
13+00	933.4	933.35
13+20	933.6	933.66
13+40	933.9	933.93
13+60	934.1	934.14
13+80	934.2	934.29
14+00	934.3	934.37
14+20	934.4	934.40
14+40	934.3	934.36
14+60	934.1	934.26
14+80	933.9	934.09
15+00	933.6	933.86
15+20	933.3	933.57
15+40	933.2	933.22
15+60	932.8	932.81
15+80	932.3	932.33
16+00	931.8	931.79

SAMPLE NO.		27	28
STATION		10+00	16+00
OFFSET		38′ Rt.	40′ Lt.
DEPTH		0.0′-5.0′	0.0′-8.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	41	0
	SAND (- NO 10 + NO. 200)	16	2
	SILT (- 0.075 mm + 0.002 mm)	25	74
	CLAY (- 0.002 mm)	18	24
LIQUID LIMIT		43	38
PLASTIC LIMIT		17	21
PLASTICITY INDEX		26	17
ACTIVITY INDEX		1.44	0.71
SPECIFIC GRAVITY		2.67	2.71
AASHTO CLASSIFICATION		A-7-6(6)	A-6(18)
UNIFIED CLASSIFICATION		GC	CL
CALIFORNIA BEARING RATIO		N/A	5.9
MAXIMUM DRY DENSITY (pcf)		N/A	103.7
OPTIMUM MOISTURE (%)		N/A	20.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

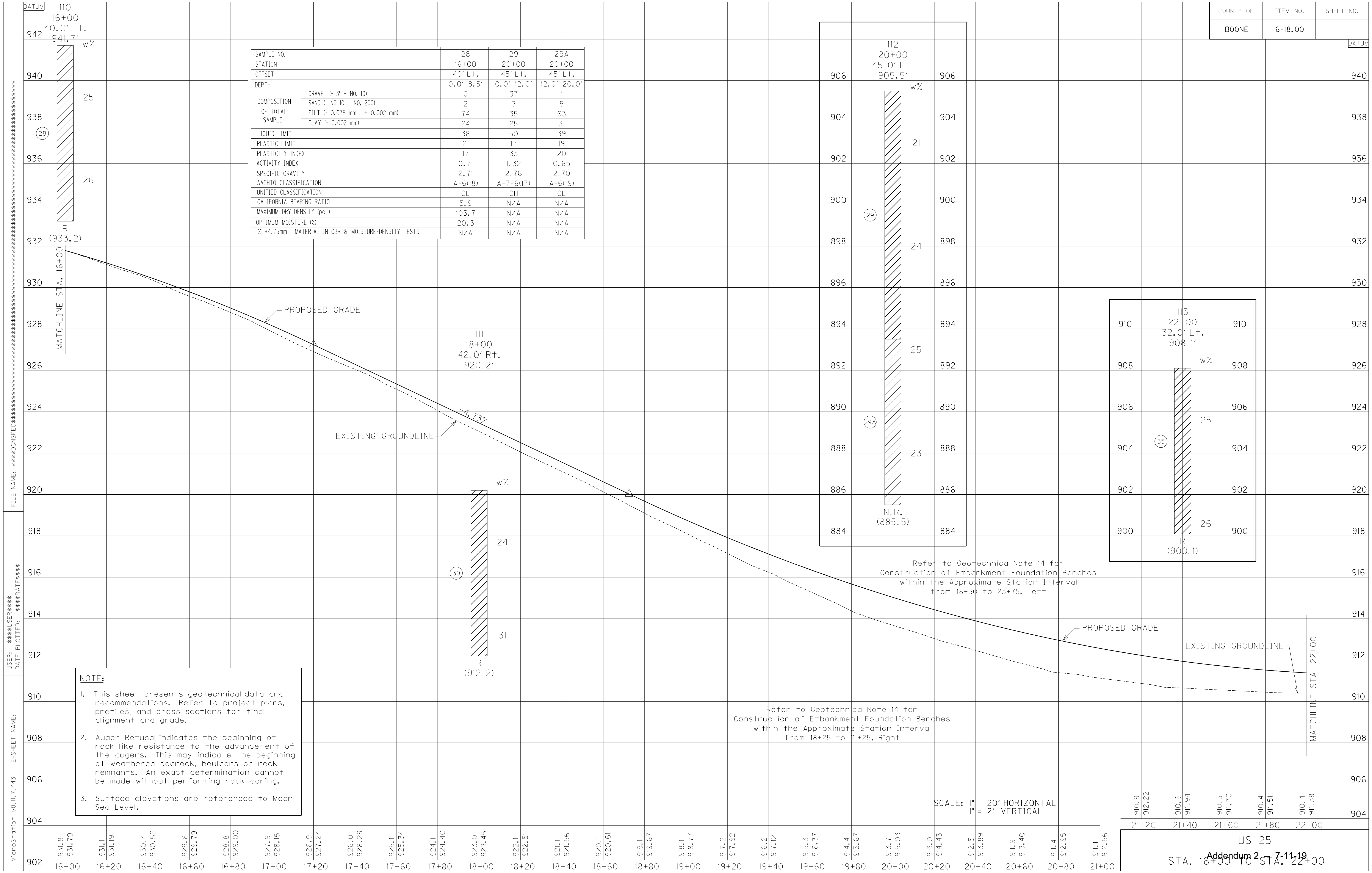
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25

STA. 10+00 TO STA. 16+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



16+00	931.8	931.79
16+20	931.1	931.19
16+40	930.4	930.52
16+60	929.6	929.79
16+80	928.8	929.00
17+00	927.9	928.15
17+20	926.9	927.24
17+40	926.0	926.29
17+60	925.1	925.34
17+80	924.1	924.40
18+00	923.0	923.45
18+20	922.1	922.51
18+40	921.1	921.56
18+60	920.1	920.61
18+80	919.1	919.67
19+00	918.1	918.77
19+20	917.2	917.92
19+40	916.2	917.12
19+60	915.3	916.37
19+80	914.4	915.67
20+00	913.7	915.03
20+20	913.0	914.43
20+40	912.5	913.89
20+60	911.9	913.40
20+80	911.4	912.95
21+00	911.1	912.56
21+20	910.9	912.22
21+40	910.6	911.94
21+60	910.5	911.70
21+80	910.4	911.51
22+00	910.4	911.38

SAMPLE NO.		28	29	29A
STATION		16+00	20+00	20+00
OFFSET		40′ Lt.	45′ Lt.	45′ Lt.
DEPTH		0.0′-8.5′	0.0′-12.0′	12.0′-20.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	37	1
	SAND (- NO 10 + NO. 200)	2	3	5
	SILT (- 0.075 mm + 0.002 mm)	74	35	63
	CLAY (- 0.002 mm)	24	25	31
LIQUID LIMIT		38	50	39
PLASTIC LIMIT		21	17	19
PLASTICITY INDEX		17	33	20
ACTIVITY INDEX		0.71	1.32	0.65
SPECIFIC GRAVITY		2.71	2.76	2.70
AASHTO CLASSIFICATION		A-6(18)	A-7-6(17)	A-6(19)
UNIFIED CLASSIFICATION		CL	CH	CL
CALIFORNIA BEARING RATIO		5.9	N/A	N/A
MAXIMUM DRY DENSITY (pcf)		103.7	N/A	N/A
OPTIMUM MOISTURE (%)		20.3	N/A	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A	N/A

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 18+50 to 23+75, Left

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 18+25 to 21+25, Right

NOTE:

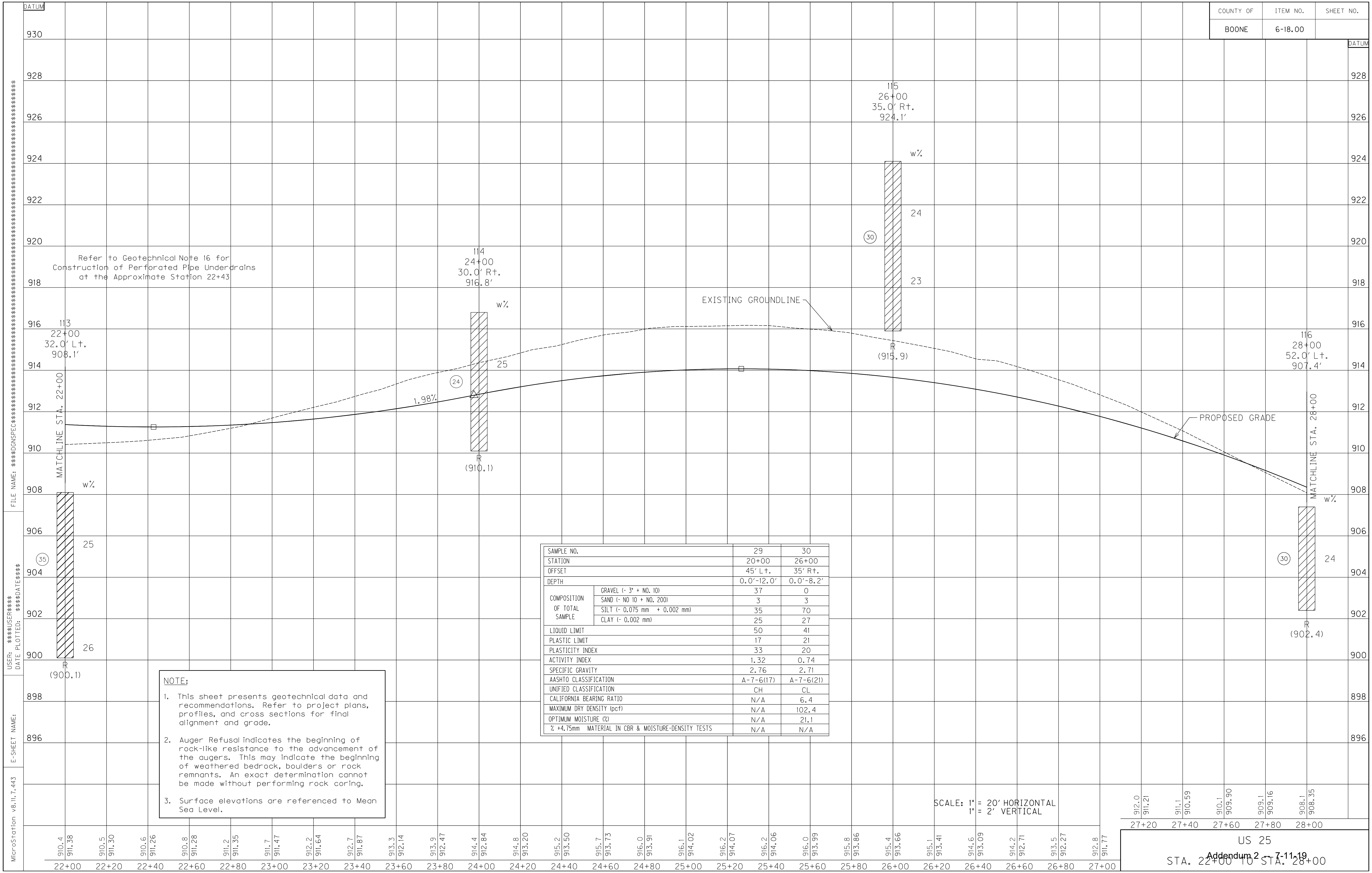
1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 16+00 TO STA. 22+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		29	30
STATION		20+00	26+00
OFFSET		45' Lt.	35' Rt.
DEPTH		0.0'-12.0'	0.0'-8.2'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	37	0
	SAND (- NO 10 + NO. 200)	3	3
	SILT (- 0.075 mm + 0.002 mm)	35	70
	CLAY (- 0.002 mm)	25	27
LIQUID LIMIT		50	41
PLASTIC LIMIT		17	21
PLASTICITY INDEX		33	20
ACTIVITY INDEX		1.32	0.74
SPECIFIC GRAVITY		2.76	2.71
AASHTO CLASSIFICATION		A-7-6(17)	A-7-6(21)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		N/A	6.4
MAXIMUM DRY DENSITY (pcf)		N/A	102.4
OPTIMUM MOISTURE (%)		N/A	21.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25

STA. 22+00 TO STA. 28+00

Addendum 2 -- 7-11-19

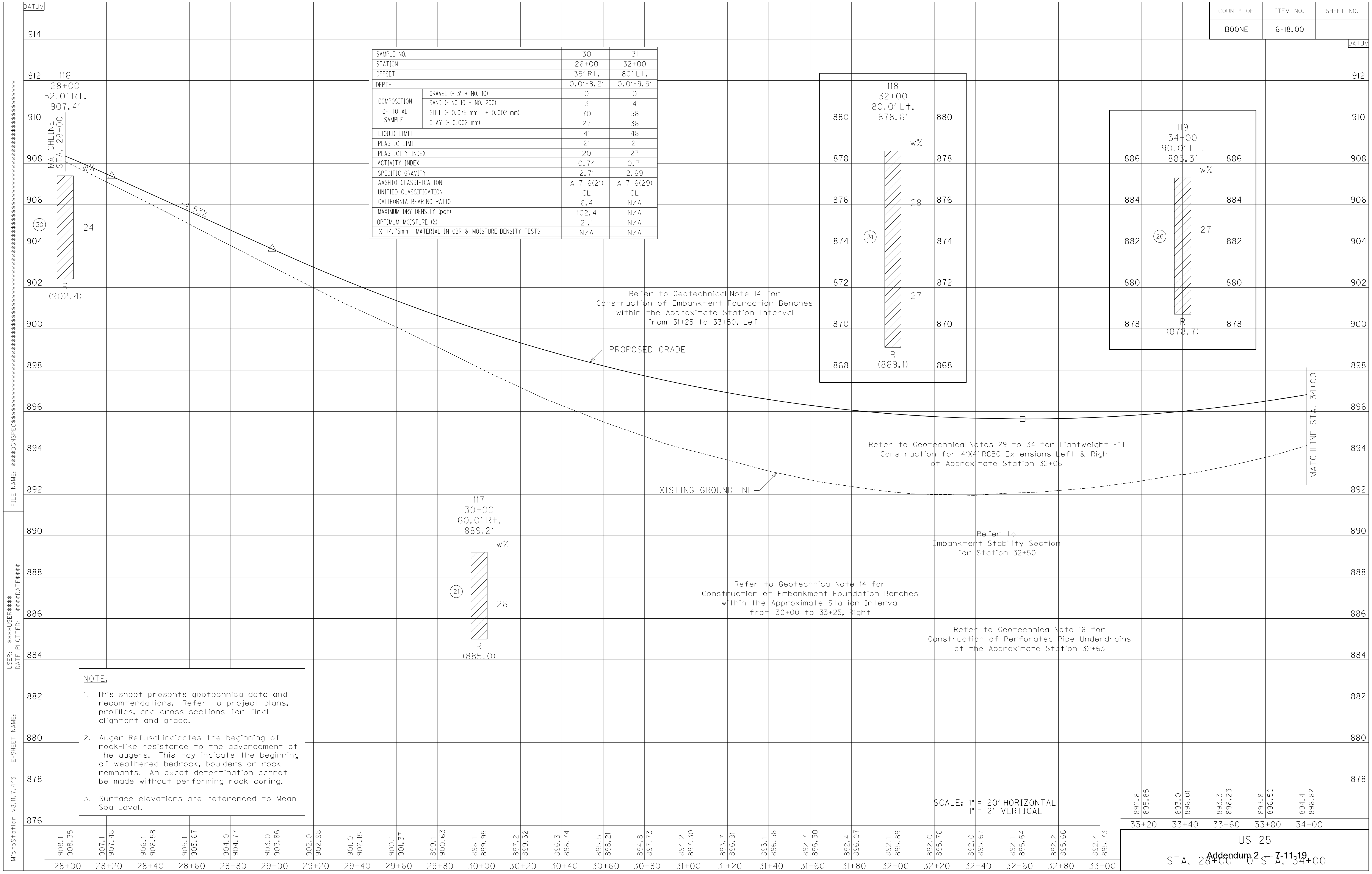
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		30	31
STATION		26+00	32+00
OFFSET		35′ Rt.	80′ Lt.
DEPTH		0.0′-8.2′	0.0′-9.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0
	SAND (- NO 10 + NO. 200)	3	4
	SILT (- 0.075 mm + 0.002 mm)	70	58
	CLAY (- 0.002 mm)	27	38
LIQUID LIMIT		41	48
PLASTIC LIMIT		21	21
PLASTICITY INDEX		20	27
ACTIVITY INDEX		0.74	0.71
SPECIFIC GRAVITY		2.71	2.69
AASHTO CLASSIFICATION		A-7-6(21)	A-7-6(29)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		6.4	N/A
MAXIMUM DRY DENSITY (pcf)		102.4	N/A
OPTIMUM MOISTURE (%)		21.1	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 31+25 to 33+50, Left

Refer to Geotechnical Notes 29 to 34 for Lightweight Fill Construction for 4′X4′ RCBC Extensions Left & Right of Approximate Station 32+06

Refer to Embankment Stability Section for Station 32+50

Refer to Geotechnical Note 14 for Construction of Embankment Foundation Benches within the Approximate Station Interval from 30+00 to 33+25, Right

Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 32+63

NOTE:

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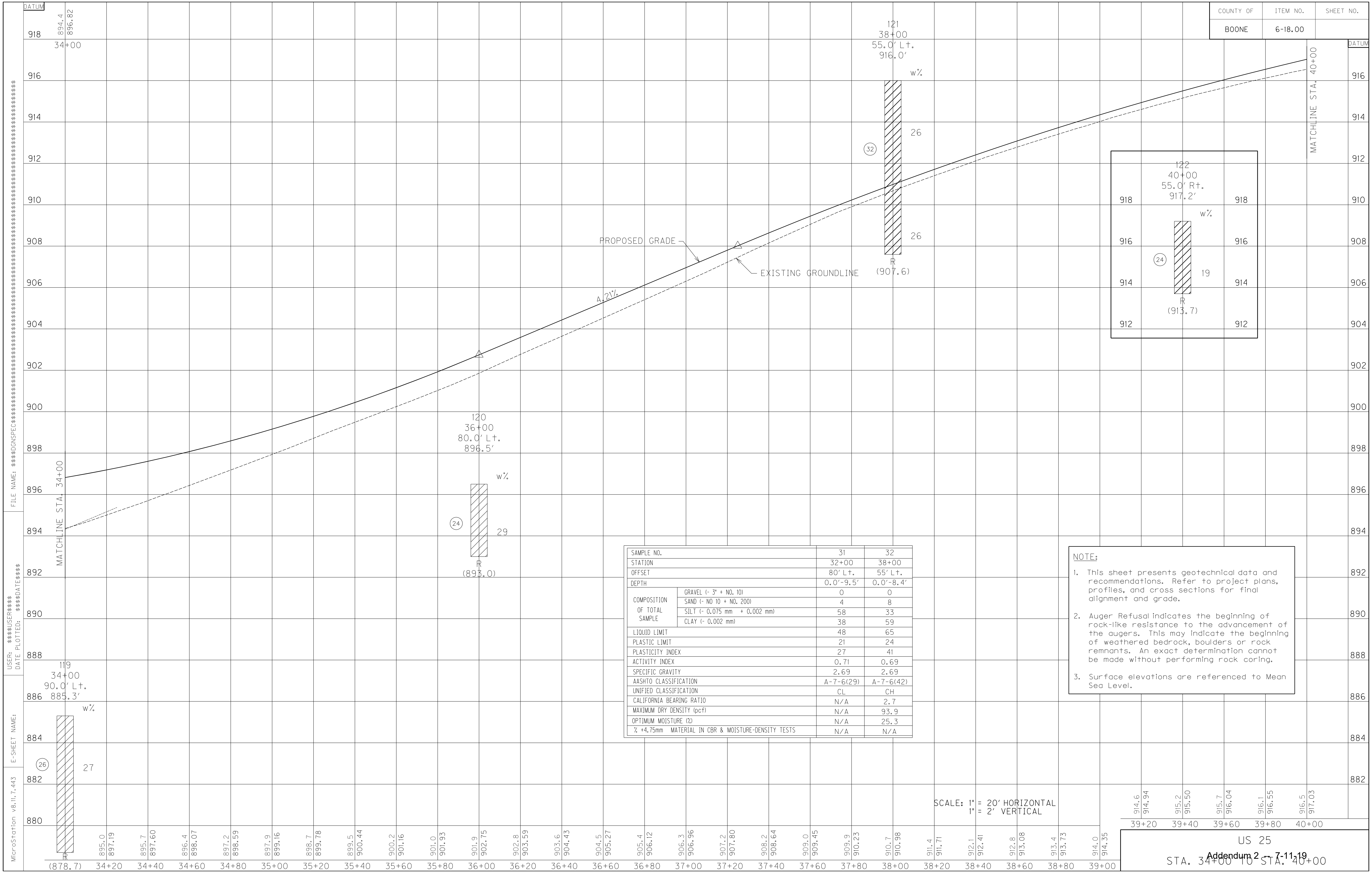
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25
STA. 28+00 TO STA. 34+00
Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		31	32
STATION		32+00	38+00
OFFSET		80' Lt.	55' Lt.
DEPTH		0.0'-9.5'	0.0'-8.4'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	0
	SAND (- NO 10 + NO. 200)	4	8
	SILT (- 0.075 mm + 0.002 mm)	58	33
	CLAY (- 0.002 mm)	38	59
LIQUID LIMIT		48	65
PLASTIC LIMIT		21	24
PLASTICITY INDEX		27	41
ACTIVITY INDEX		0.71	0.69
SPECIFIC GRAVITY		2.69	2.69
AASHTO CLASSIFICATION		A-7-6(29)	A-7-6(42)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		N/A	2.7
MAXIMUM DRY DENSITY (pcf)		N/A	93.9
OPTIMUM MOISTURE (%)		N/A	25.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
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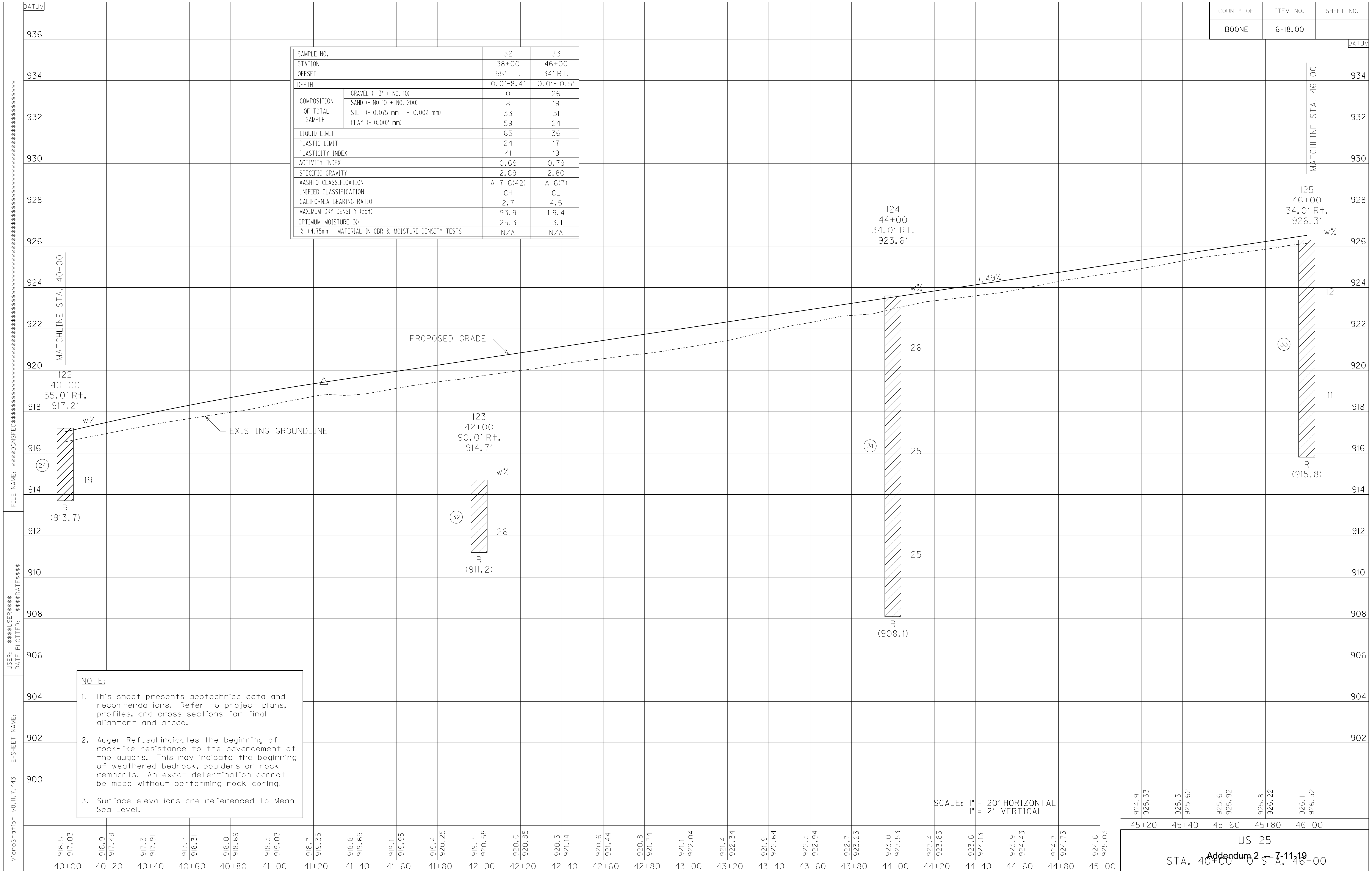
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25
STA. 34+00 TO STA. 40+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		32	33
STATION		38+00	46+00
OFFSET		55′ Lt.	34′ Rt.
DEPTH		0.0′-8.4′	0.0′-10.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	0	26
	SAND (- NO 10 + NO. 200)	8	19
	SILT (- 0.075 mm + 0.002 mm)	33	31
	CLAY (- 0.002 mm)	59	24
LIQUID LIMIT		65	36
PLASTIC LIMIT		24	17
PLASTICITY INDEX		41	19
ACTIVITY INDEX		0.69	0.79
SPECIFIC GRAVITY		2.69	2.80
AASHTO CLASSIFICATION		A-7-6(42)	A-6(7)
UNIFIED CLASSIFICATION		CH	CL
CALIFORNIA BEARING RATIO		2.7	4.5
MAXIMUM DRY DENSITY (pcf)		93.9	119.4
OPTIMUM MOISTURE (%)		25.3	13.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A



SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

US 25
STA. 40+00 TO STA. 46+00

Addendum 2 -- 7-11-19

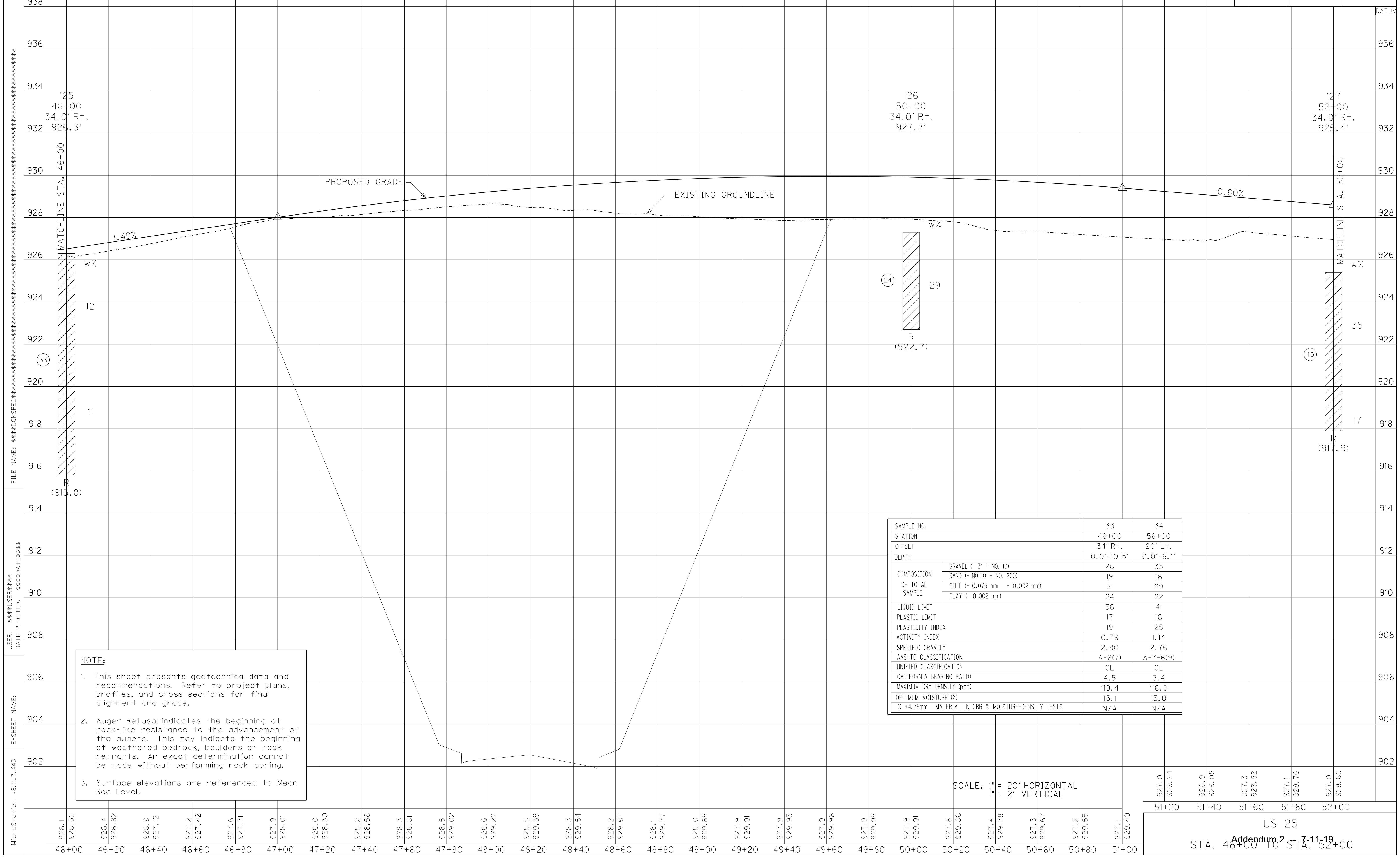
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



46+00	926.1	926.52
46+20	926.4	926.82
46+40	926.8	927.12
46+60	927.2	927.42
46+80	927.6	927.71
47+00	927.9	928.01
47+20	928.0	928.30
47+40	928.2	928.56
47+60	928.3	928.81
47+80	928.5	929.02
48+00	928.6	929.22
48+20	928.5	929.39
48+40	928.3	929.54
48+60	928.2	929.67
48+80	928.1	929.77
49+00	928.0	929.85
49+20	927.9	929.91
49+40	927.9	929.95
49+60	927.9	929.96
49+80	927.9	929.95
50+00	927.9	929.91
50+20	927.8	929.86
50+40	927.4	929.78
50+60	927.3	929.67
50+80	927.2	929.55
51+00	927.1	929.40
51+20	927.0	929.24
51+40	926.9	929.08
51+60	927.3	928.92
51+80	927.1	928.76
52+00	927.0	928.60

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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		33	34
STATION		46+00	56+00
OFFSET		34′ Rt.	20′ Lt.
DEPTH		0.0′-10.5′	0.0′-6.1′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	26	33
	SAND (- NO 10 + NO. 200)	19	16
	SILT (- 0.075 mm + 0.002 mm)	31	29
	CLAY (- 0.002 mm)	24	22
LIQUID LIMIT		36	41
PLASTIC LIMIT		17	16
PLASTICITY INDEX		19	25
ACTIVITY INDEX		0.79	1.14
SPECIFIC GRAVITY		2.80	2.76
AASHTO CLASSIFICATION		A-6(7)	A-7-6(9)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		4.5	3.4
MAXIMUM DRY DENSITY (pcf)		119.4	116.0
OPTIMUM MOISTURE (%)		13.1	15.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25

STA. 46+00 TO STA. 52+00

Addendum 2 -- 7-11-19

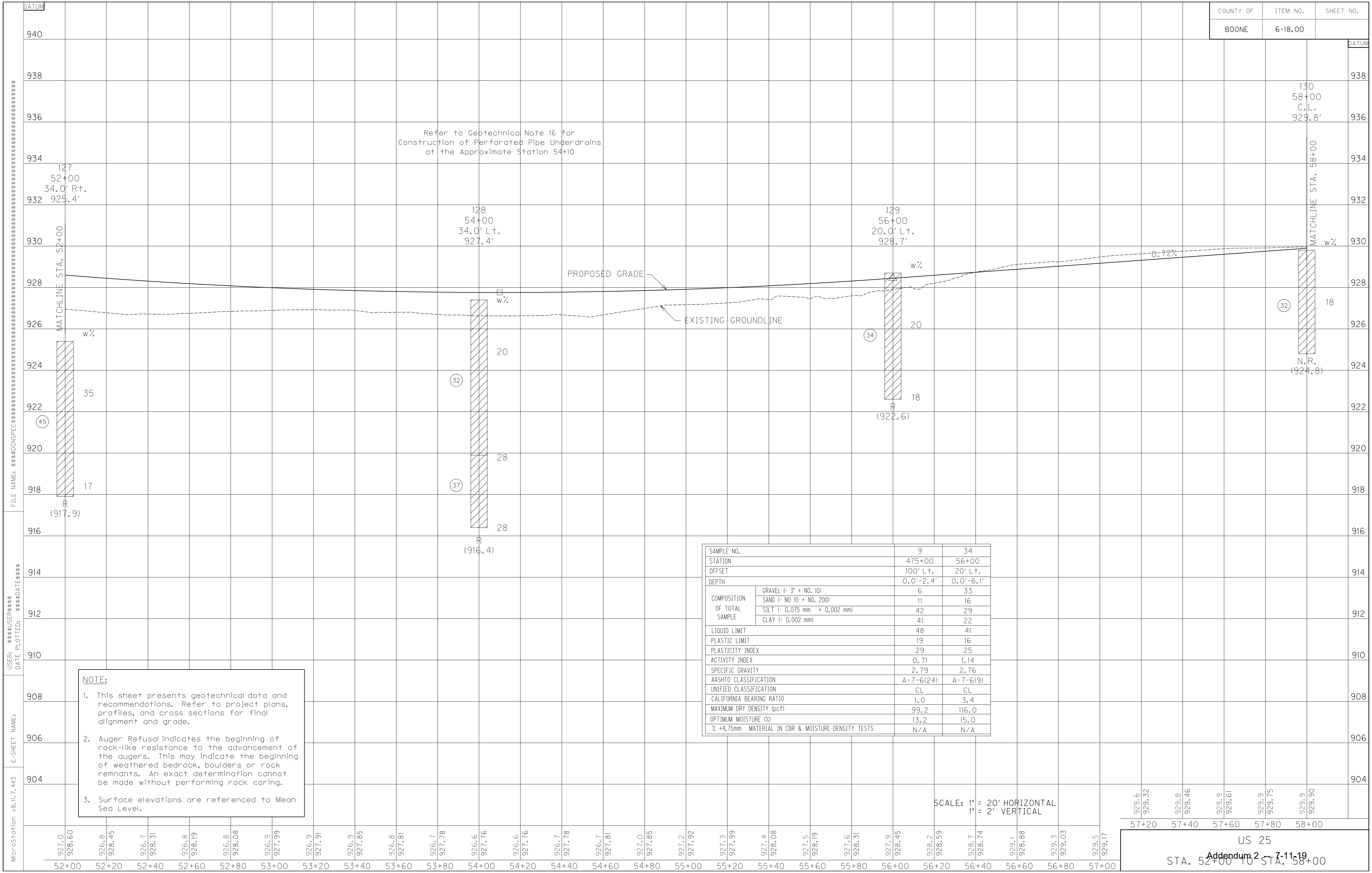
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

SAMPLE NO.		9	34
STATION		475+00	56+00
OFFSET		100′ Lt.	20′ Lt.
DEPTH		0.0′-2.4′	0.0′-6.1′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	33
	SAND (- NO 10 + NO. 200)	11	16
	SILT (- 0.075 mm + 0.002 mm)	42	29
	CLAY (- 0.002 mm)	41	22
LIQUID LIMIT		48	41
PLASTIC LIMIT		19	16
PLASTICITY INDEX		29	25
ACTIVITY INDEX		0.71	1.14
SPECIFIC GRAVITY		2.79	2.76
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(9)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	3.4
MAXIMUM DRY DENSITY (pcf)		99.2	116.0
OPTIMUM MOISTURE (%)		13.2	15.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

US 25

STA. 52+00 TO STA. 58+00

Addendum 2 -- 7-11-19

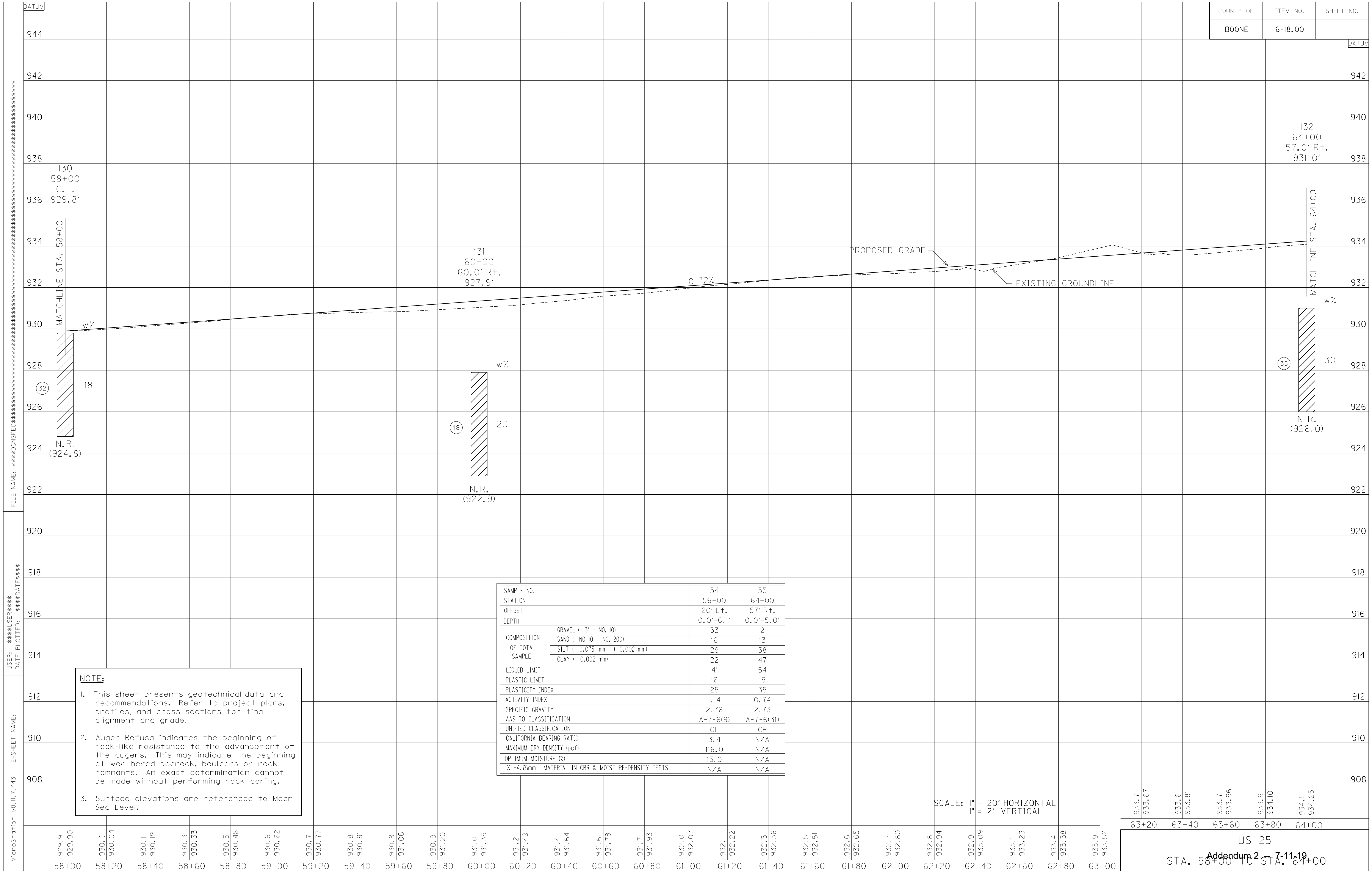
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		34	35
STATION		56+00	64+00
OFFSET		20′ Lt.	57′ Rt.
DEPTH		0.0′-6.1′	0.0′-5.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	33	2
	SAND (- NO 10 + NO. 200)	16	13
	SILT (- 0.075 mm + 0.002 mm)	29	38
	CLAY (- 0.002 mm)	22	47
LIQUID LIMIT		41	54
PLASTIC LIMIT		16	19
PLASTICITY INDEX		25	35
ACTIVITY INDEX		1.14	0.74
SPECIFIC GRAVITY		2.76	2.73
AASHTO CLASSIFICATION		A-7-6(9)	A-7-6(31)
UNIFIED CLASSIFICATION		CL	CH
CALIFORNIA BEARING RATIO		3.4	N/A
MAXIMUM DRY DENSITY (pcf)		116.0	N/A
OPTIMUM MOISTURE (%)		15.0	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25

STA. 58+00 TO STA. 64+00

Addendum 2 -- 7-11-19

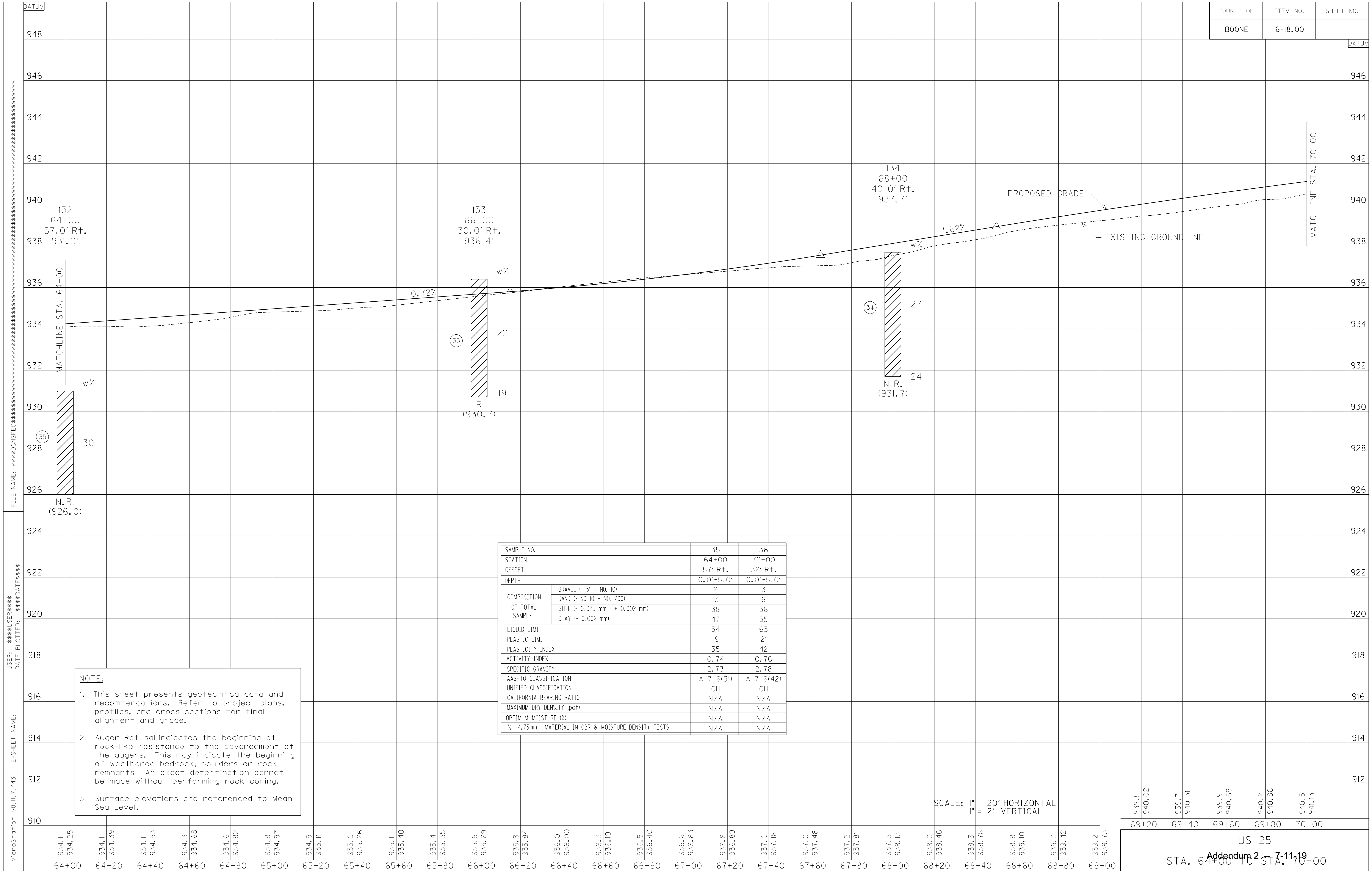
FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		35	36
STATION		64+00	72+00
OFFSET		57' Rt.	32' Rt.
DEPTH		0.0'-5.0'	0.0'-5.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2	3
	SAND (- NO 10 + NO. 200)	13	6
	SILT (- 0.075 mm + 0.002 mm)	38	36
	CLAY (- 0.002 mm)	47	55
LIQUID LIMIT		54	63
PLASTIC LIMIT		19	21
PLASTICITY INDEX		35	42
ACTIVITY INDEX		0.74	0.76
SPECIFIC GRAVITY		2.73	2.78
AASHTO CLASSIFICATION		A-7-6(31)	A-7-6(42)
UNIFIED CLASSIFICATION		CH	CH
CALIFORNIA BEARING RATIO		N/A	N/A
MAXIMUM DRY DENSITY (pcf)		N/A	N/A
OPTIMUM MOISTURE (%)		N/A	N/A
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

US 25

STA. 64+00 TO STA. 70+00

Addendum 2 -- 7-11-19

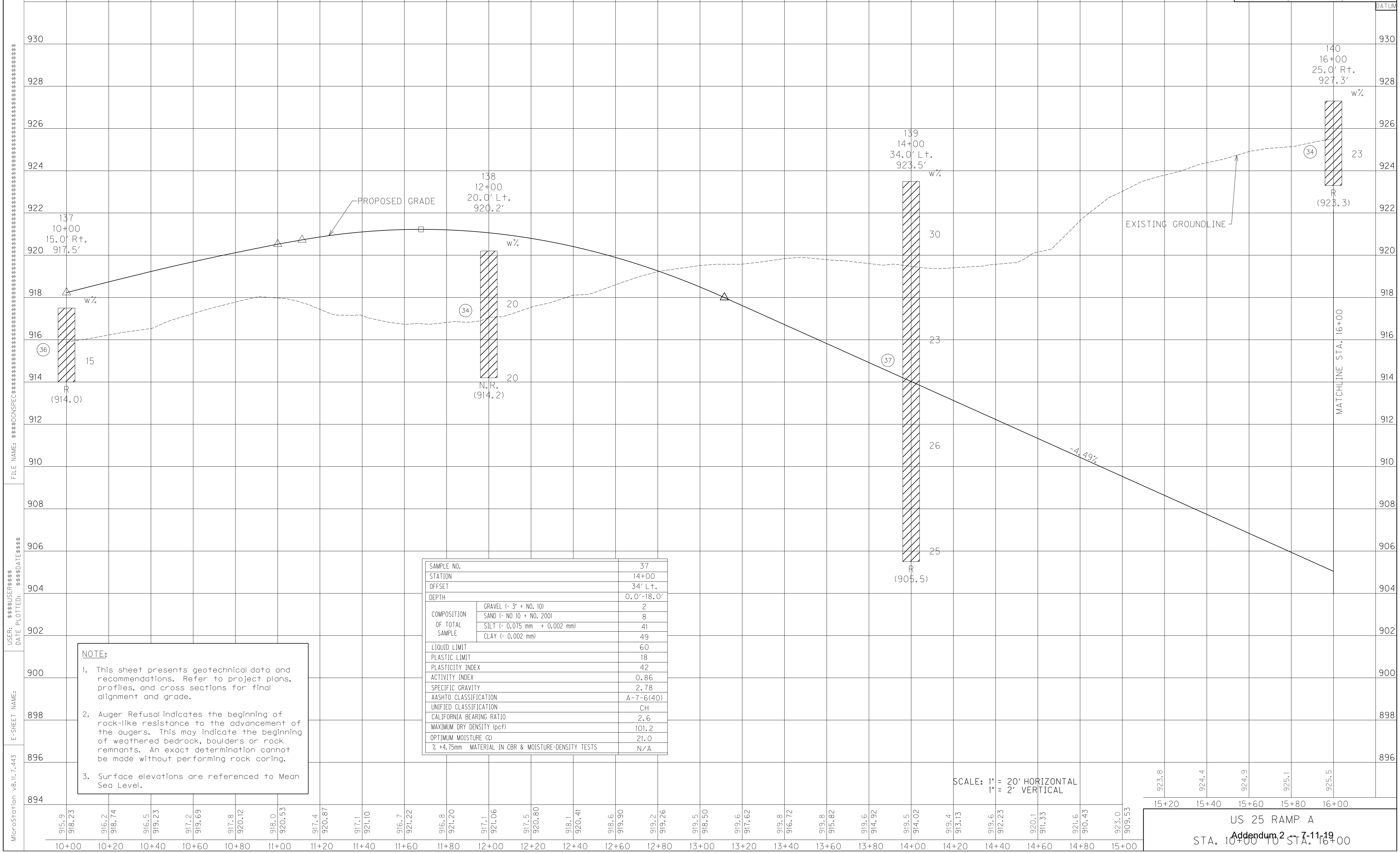
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		37
STATION		14+00
OFFSET		34′ Lt.
DEPTH		0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	41
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		60
PLASTIC LIMIT		18
PLASTICITY INDEX		42
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.6
MAXIMUM DRY DENSITY (pcf)		101.2
OPTIMUM MOISTURE (%)		21.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP A

STA. 10+00 TO STA. 16+00

Addendum 2 -- 7-11-19

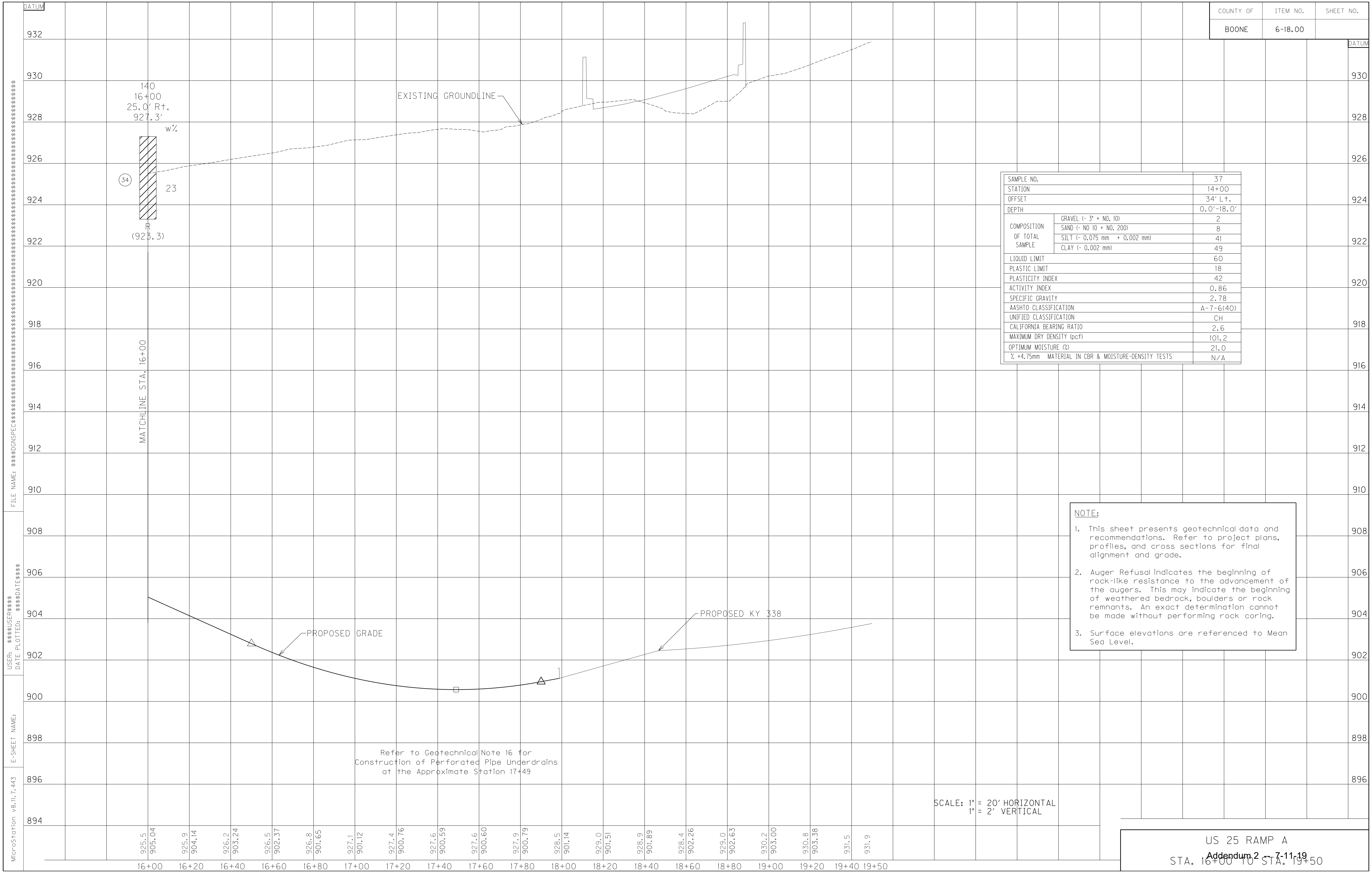
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		37
STATION		14+00
OFFSET		34′ Lt.
DEPTH		0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	41
	CLAY (- 0.002 mm)	49
LIQUID LIMIT		60
PLASTIC LIMIT		18
PLASTICITY INDEX		42
ACTIVITY INDEX		0.86
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(40)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.6
MAXIMUM DRY DENSITY (pcf)		101.2
OPTIMUM MOISTURE (%)		21.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 17+49

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP A

STA. 16+00 TO STA. 19+50

Addendum 2 -- 7-11-19

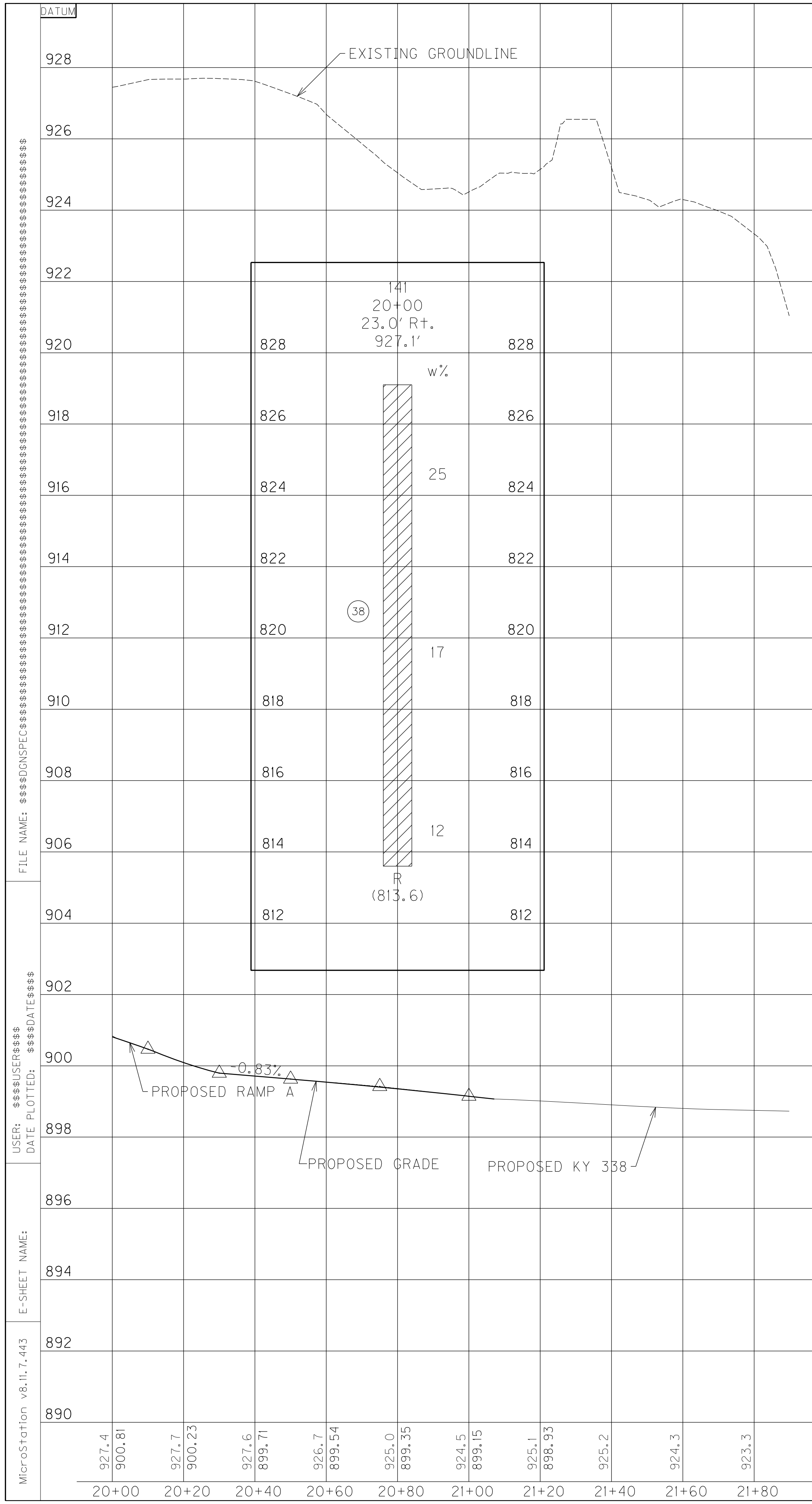
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		38
STATION		20+00
OFFSET		23' Rt.
DEPTH		0.0'-13.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	14
	SAND (- NO 10 + NO. 200)	12
	SILT (- 0.075 mm + 0.002 mm)	40
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		42
PLASTIC LIMIT		18
PLASTICITY INDEX		24
ACTIVITY INDEX		0.71
SPECIFIC GRAVITY		2.80
AASHTO CLASSIFICATION		A-7-6(16)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.6
MAXIMUM DRY DENSITY (pcf)		108.2
OPTIMUM MOISTURE (%)		18.9
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.

2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.

3. Surface elevations are referenced to Mean Sea Level.

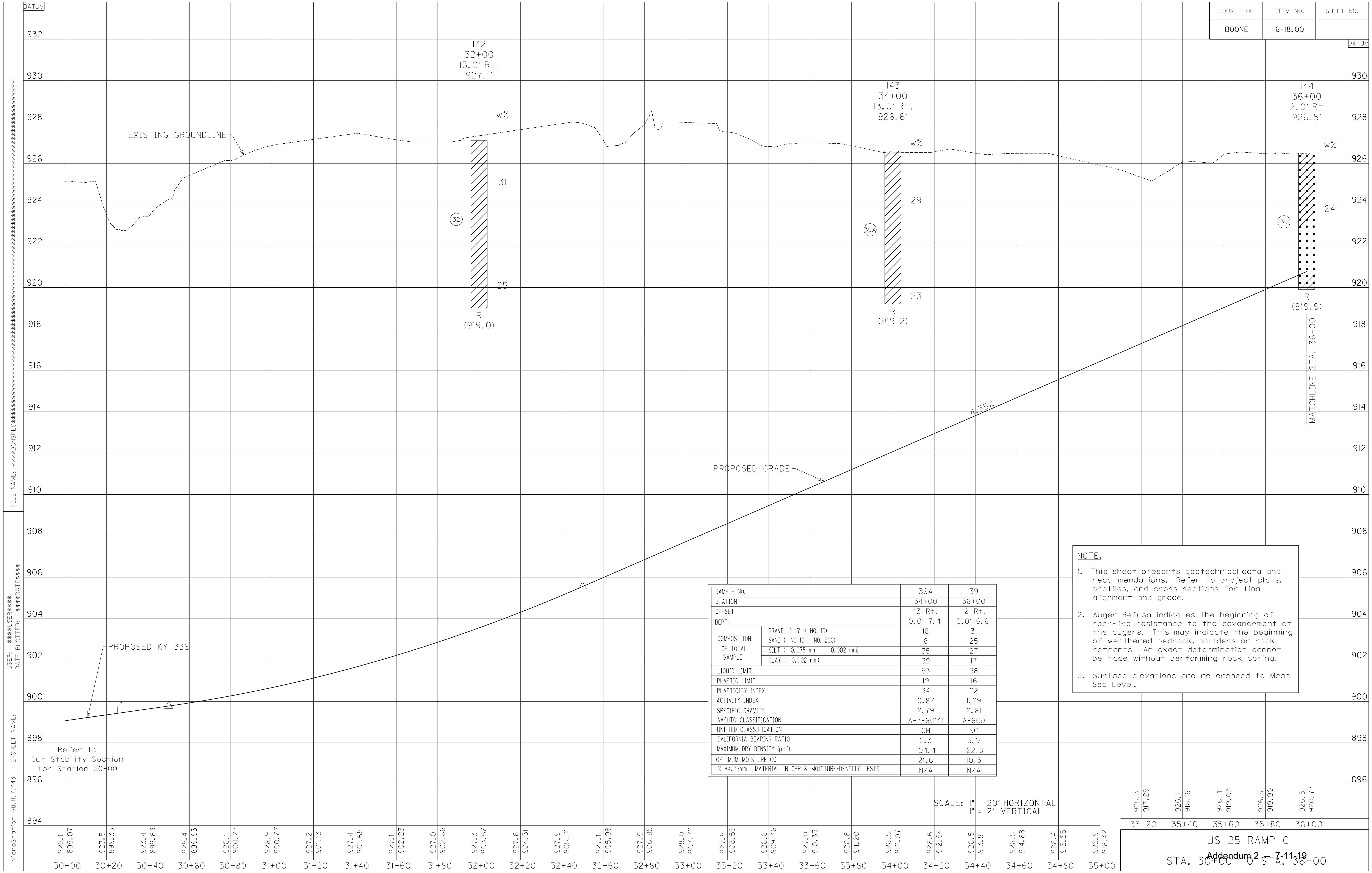
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25 RAMP B

STA. 20+00 TO STA. 21+37.04

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		39A	39
STATION		34+00	36+00
OFFSET		13' Rt.	12' Rt.
DEPTH		0.0'-7.4'	0.0'-6.6'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	18	31
	SAND (- NO 10 + NO. 200)	8	25
	SILT (- 0.075 mm + 0.002 mm)	35	27
	CLAY (- 0.002 mm)	39	17
LIQUID LIMIT		53	38
PLASTIC LIMIT		19	16
PLASTICITY INDEX		34	22
ACTIVITY INDEX		0.87	1.29
SPECIFIC GRAVITY		2.79	2.61
AASHTO CLASSIFICATION		A-7-6(24)	A-6(5)
UNIFIED CLASSIFICATION		CH	SC
CALIFORNIA BEARING RATIO		2.3	5.0
MAXIMUM DRY DENSITY (pcf)		104.4	122.8
OPTIMUM MOISTURE (%)		21.6	10.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

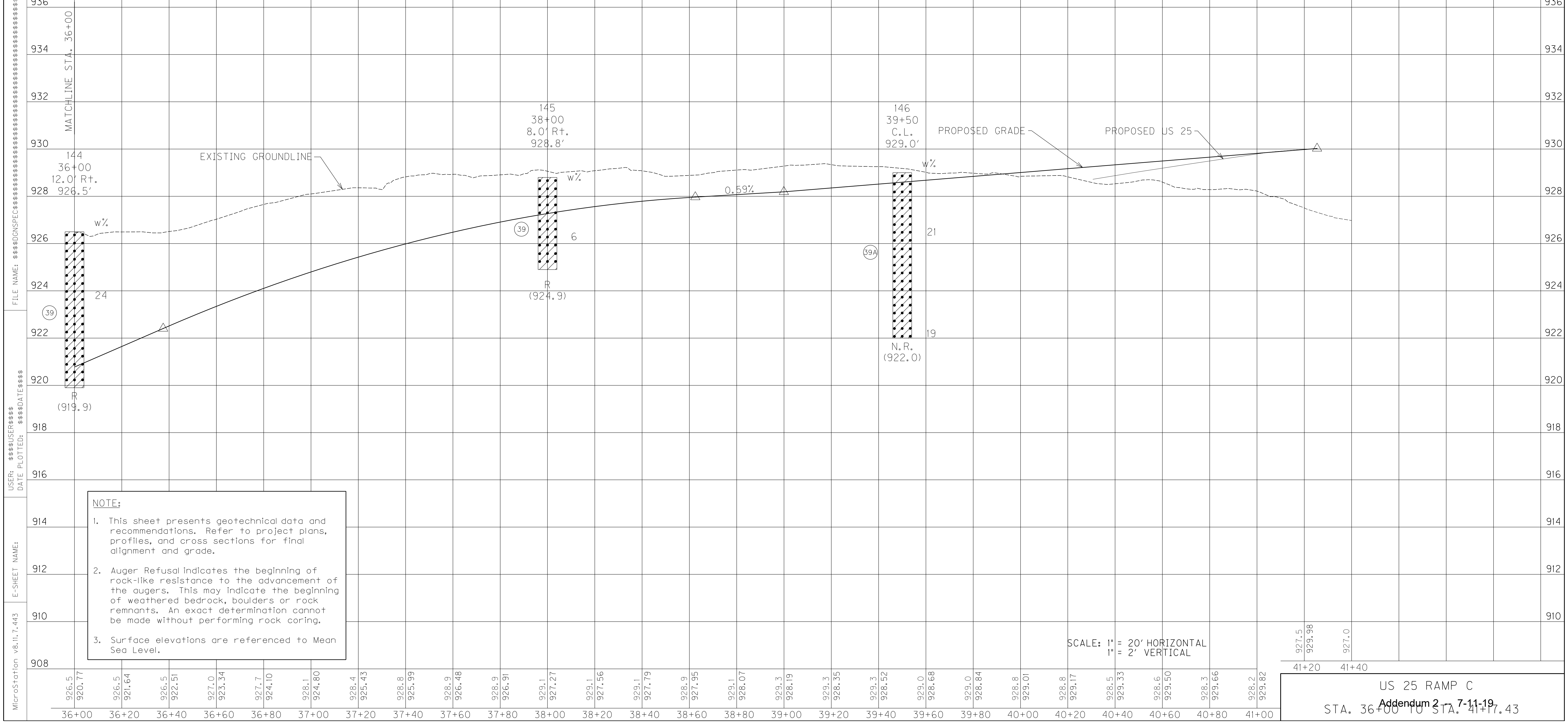
SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25 RAMP C
STA. 30+00 TO STA. 36+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		39
STATION		36+00
OFFSET		12′ Rt.
DEPTH		0.0′-6.6′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	31
	SAND (- NO 10 + NO. 200)	25
	SILT (- 0.075 mm + 0.002 mm)	27
	CLAY (- 0.002 mm)	17
LIQUID LIMIT		38
PLASTIC LIMIT		16
PLASTICITY INDEX		22
ACTIVITY INDEX		1.29
SPECIFIC GRAVITY		2.61
AASHTO CLASSIFICATION		A-6(5)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		5.0
MAXIMUM DRY DENSITY (pcf)		122.8
OPTIMUM MOISTURE (%)		10.3
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

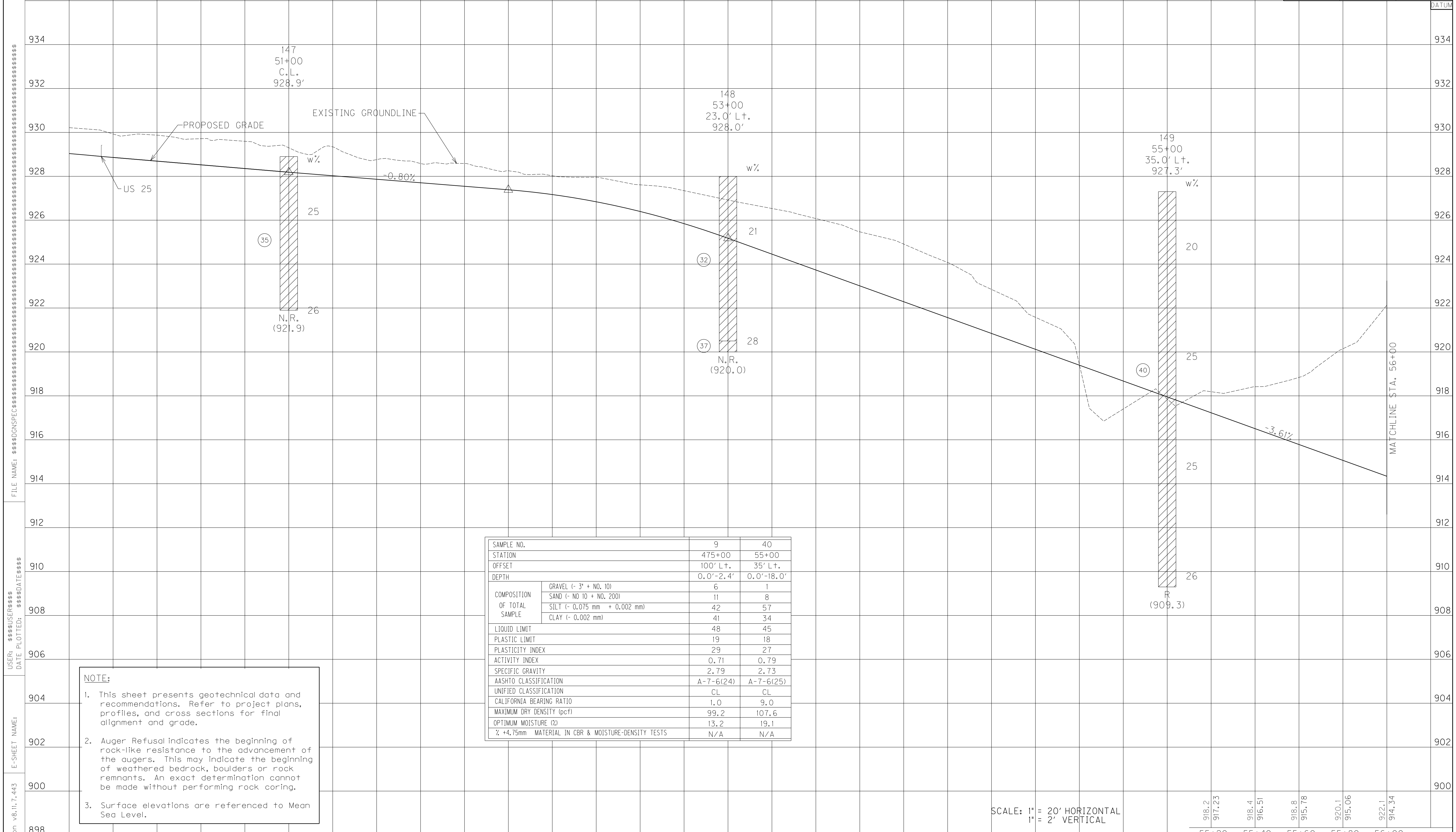
SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP C
STA. 36+00 TO STA. 41+17.43

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		9	40
STATION		475+00	55+00
OFFSET		100′ Lt.	35′ Lt.
DEPTH		0.0′-2.4′	0.0′-18.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	6	1
	SAND (- NO 10 + NO. 200)	11	8
	SILT (- 0.075 mm + 0.002 mm)	42	57
	CLAY (- 0.002 mm)	41	34
LIQUID LIMIT		48	45
PLASTIC LIMIT		19	18
PLASTICITY INDEX		29	27
ACTIVITY INDEX		0.71	0.79
SPECIFIC GRAVITY		2.79	2.73
AASHTO CLASSIFICATION		A-7-6(24)	A-7-6(25)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.0	9.0
MAXIMUM DRY DENSITY (pcf)		99.2	107.6
OPTIMUM MOISTURE (%)		13.2	19.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

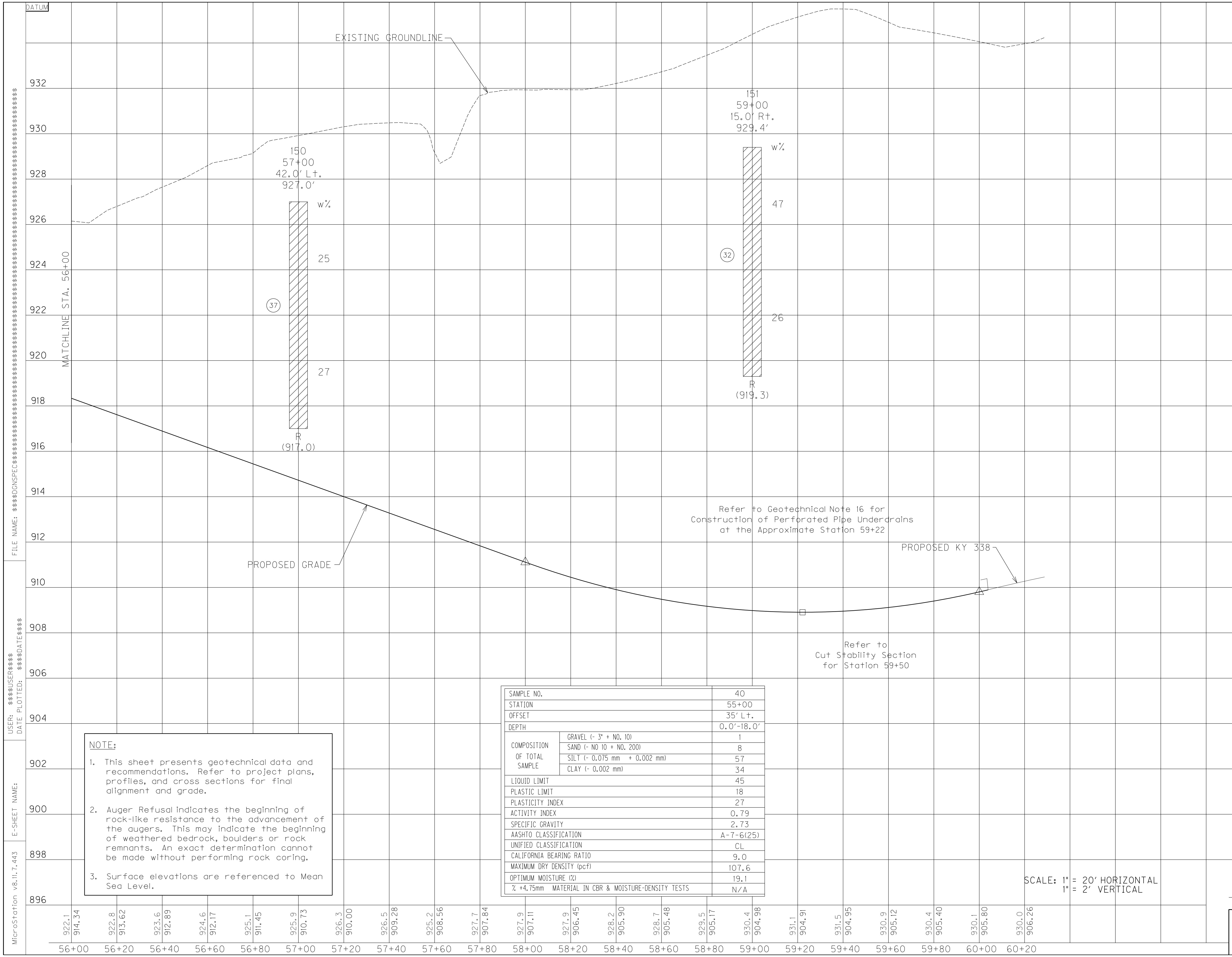
50+00	930.2	929.04
50+20	929.9	928.86
50+40	929.9	928.69
50+60	929.7	928.52
50+80	929.6	928.35
51+00	929.3	928.19
51+20	929.3	928.03
51+40	928.8	927.87
51+60	928.6	927.70
51+80	928.6	927.54
52+00	928.2	927.38
52+20	928.0	927.17
52+40	928.0	926.84
52+60	927.6	926.40
52+80	927.3	925.84
53+00	926.9	925.18
53+20	926.5	924.46
53+40	926.1	923.73
53+60	925.5	923.01
53+80	924.9	922.29
54+00	924.1	921.56
54+20	922.8	920.84
54+40	921.6	920.12
54+60	919.4	919.40
54+80	917.4	918.67
55+00	917.9	917.95
55+20	918.2	917.23
55+40	918.4	916.51
55+60	918.8	915.78
55+80	920.1	915.06
56+00	922.1	914.34

US 25 RAMP E

STA. 50+00 TO STA. 56+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



56+00	922.1	914.34
56+20	922.8	913.62
56+40	923.6	912.89
56+60	924.6	912.17
56+80	925.1	911.45
57+00	925.9	910.73
57+20	926.3	910.00
57+40	926.5	909.28
57+60	925.2	908.56
57+80	927.7	907.84
58+00	927.9	907.11
58+20	927.9	906.45
58+40	928.2	905.90
58+60	928.7	905.48
58+80	929.5	905.17
59+00	930.4	904.98
59+20	931.1	904.91
59+40	931.5	904.95
59+60	930.9	905.12
59+80	930.4	905.40
60+00	930.1	905.80
60+20	930.0	906.26

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SAMPLE NO.		40
STATION		55+00
OFFSET		35' Lt.
DEPTH		0.0'-18.0'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1
	SAND (- NO 10 + NO. 200)	8
	SILT (- 0.075 mm + 0.002 mm)	57
	CLAY (- 0.002 mm)	34
LIQUID LIMIT		45
PLASTIC LIMIT		18
PLASTICITY INDEX		27
ACTIVITY INDEX		0.79
SPECIFIC GRAVITY		2.73
AASHTO CLASSIFICATION		A-7-6(25)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		9.0
MAXIMUM DRY DENSITY (pcf)		107.6
OPTIMUM MOISTURE (%)		19.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

FILE NAME: $$$$DGNSPEC$$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

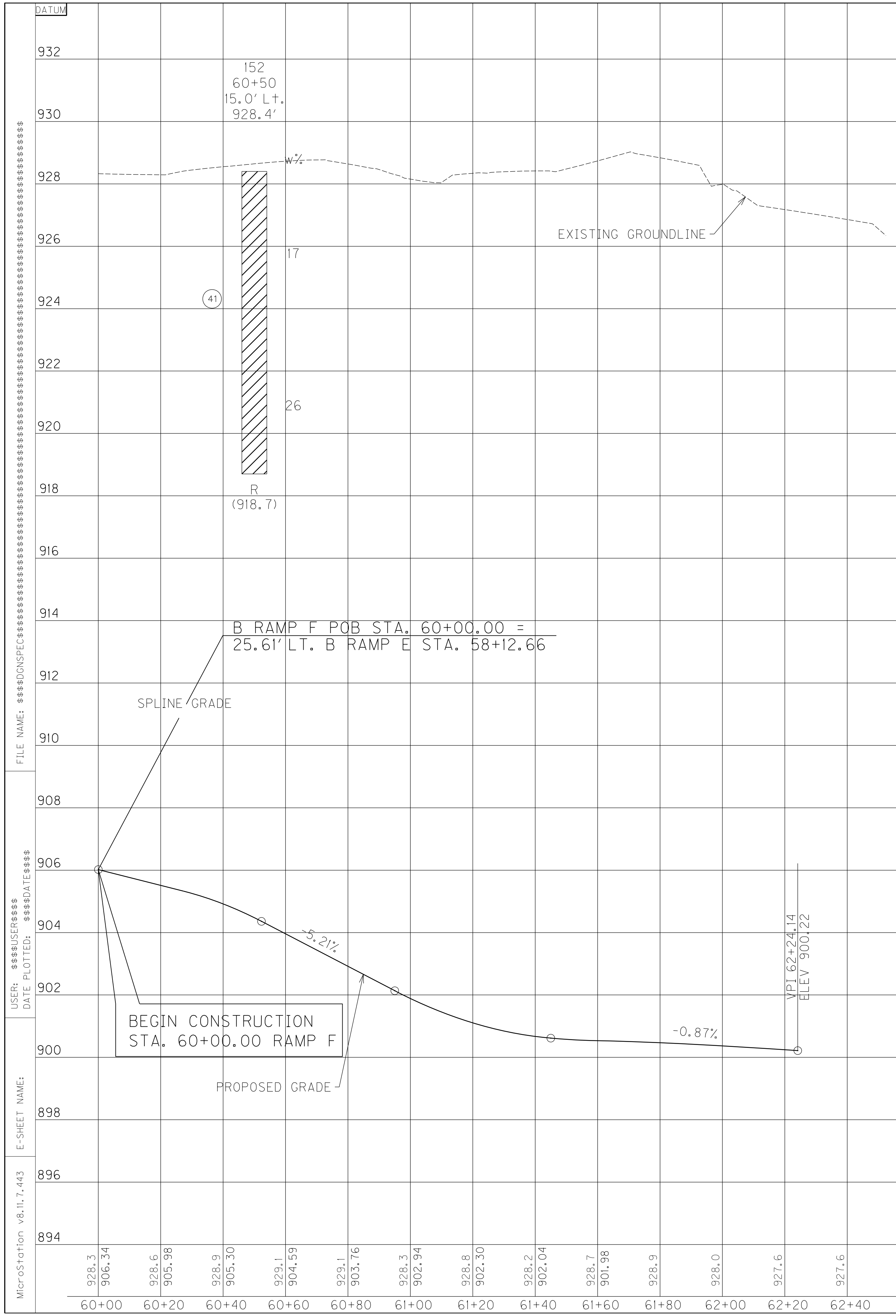
E-SHEET NAME:

MicroStation v8.11.7.443

US 25 RAMP E
STA. 56+00 TO STA. 60+28.81

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		41
STATION		60+50
OFFSET		15' Lt.
DEPTH		0.0'-9.7'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	2
	SAND (- NO 10 + NO. 200)	10
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		63
PLASTIC LIMIT		23
PLASTICITY INDEX		40
ACTIVITY INDEX		0.80
SPECIFIC GRAVITY		2.83
AASHTO CLASSIFICATION		A-7-6(39)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		1.9
MAXIMUM DRY DENSITY (pcf)		96.6
OPTIMUM MOISTURE (%)		25.1
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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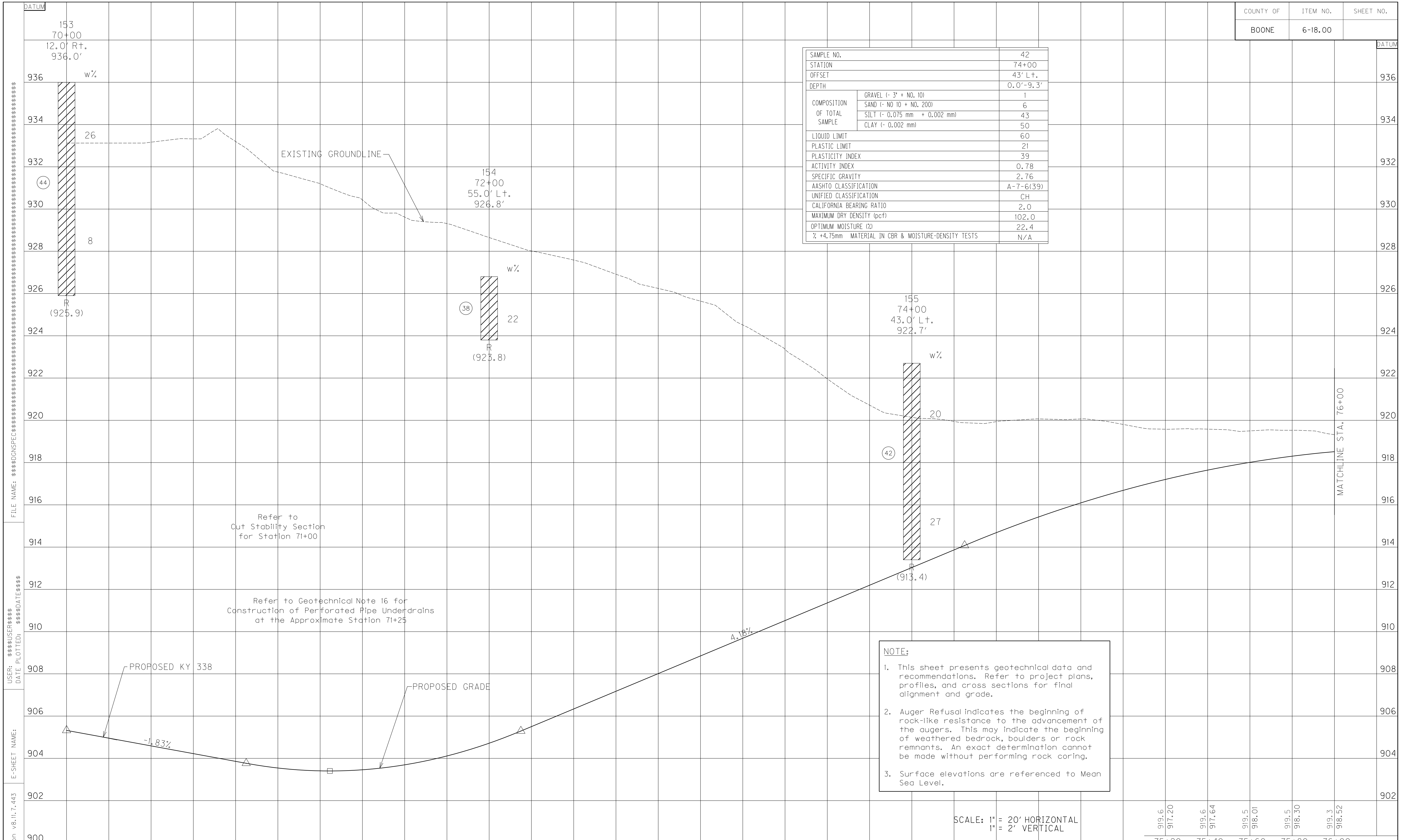
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

US 25 RAMP F
STA. 60+00 TO STA. 62+76.49

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		42
STATION		74+00
OFFSET		43' Lt.
DEPTH		0.0'-9.3'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	1
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	43
	CLAY (- 0.002 mm)	50
LIQUID LIMIT		60
PLASTIC LIMIT		21
PLASTICITY INDEX		39
ACTIVITY INDEX		0.78
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(39)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.0
MAXIMUM DRY DENSITY (pcf)		102.0
OPTIMUM MOISTURE (%)		22.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Refer to
Cut Stability Section
for Station 71+00

Refer to Geotechnical Note 16 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 71+25

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

70+00	933.1	905.33
70+20	933.1	904.96
70+40	933.2	904.59
70+60	933.3	904.23
70+80	933.2	903.86
71+00	931.8	903.55
71+20	931.2	903.41
71+40	930.4	903.46
71+60	929.6	903.69
71+80	929.3	904.11
72+00	928.7	904.72
72+20	928.0	905.50
72+40	927.6	906.34
72+60	926.9	907.18
72+80	926.2	908.01
73+00	925.6	908.85
73+20	924.5	909.69
73+40	923.4	910.52
73+60	922.0	911.36
73+80	920.7	912.20
74+00	920.1	913.03
74+20	919.9	913.87
74+40	919.9	914.68
74+60	920.1	915.43
74+80	920.1	916.09
75+00	919.8	916.69
75+20	919.6	917.20
75+40	919.6	917.64
75+60	919.5	918.01
75+80	919.5	918.30
76+00	919.3	918.52

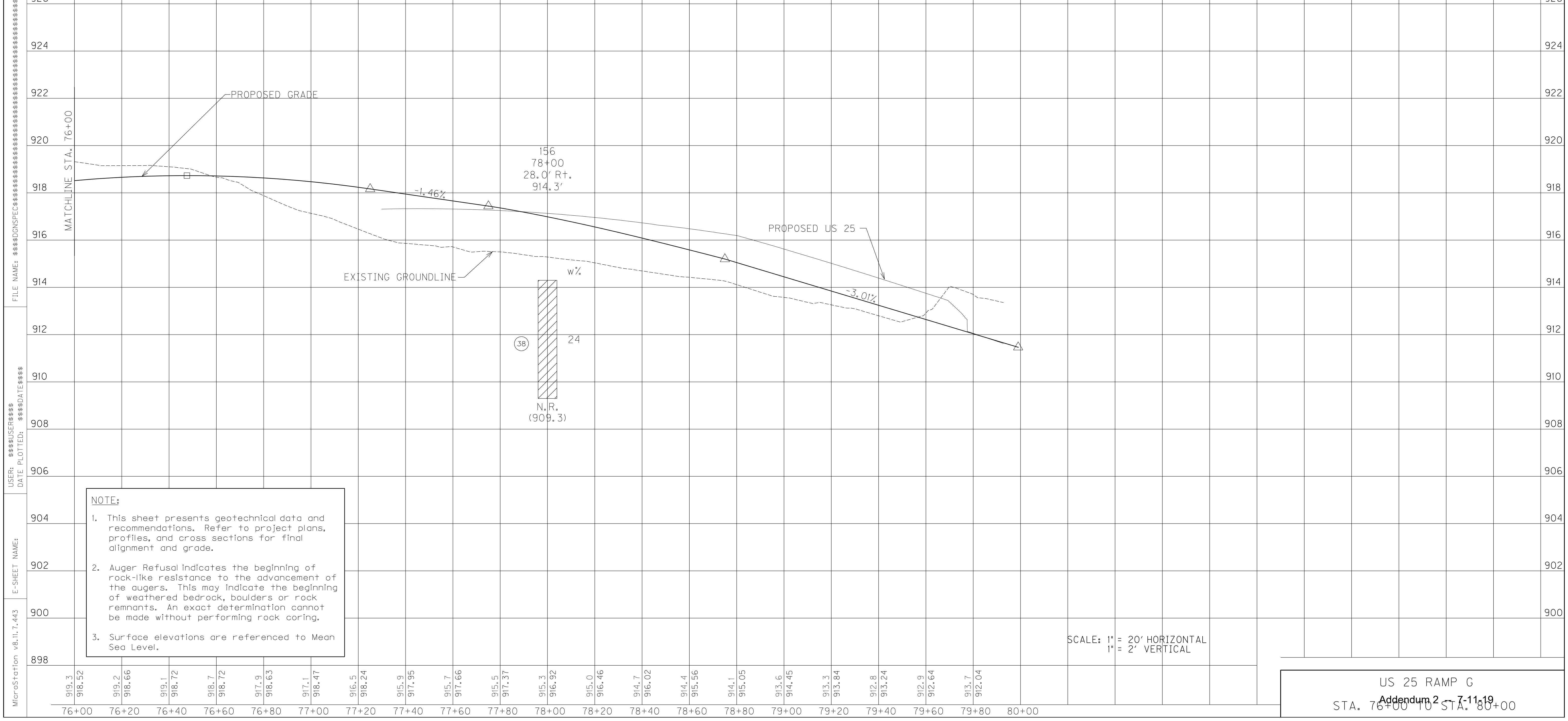
US 25 RAMP G
STA. 70+00 TO STA. 76+00

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

SAMPLE NO.		43
STATION		82+00
OFFSET		25′ Lt.
DEPTH		0.0′-4.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	39
LIQUID LIMIT		45
PLASTIC LIMIT		20
PLASTICITY INDEX		25
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(24)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		107.0
OPTIMUM MOISTURE (%)		20.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

US 25 RAMP G
STA. 76+00 TO STA. 80+00

Addendum 2 -- 7-11-19

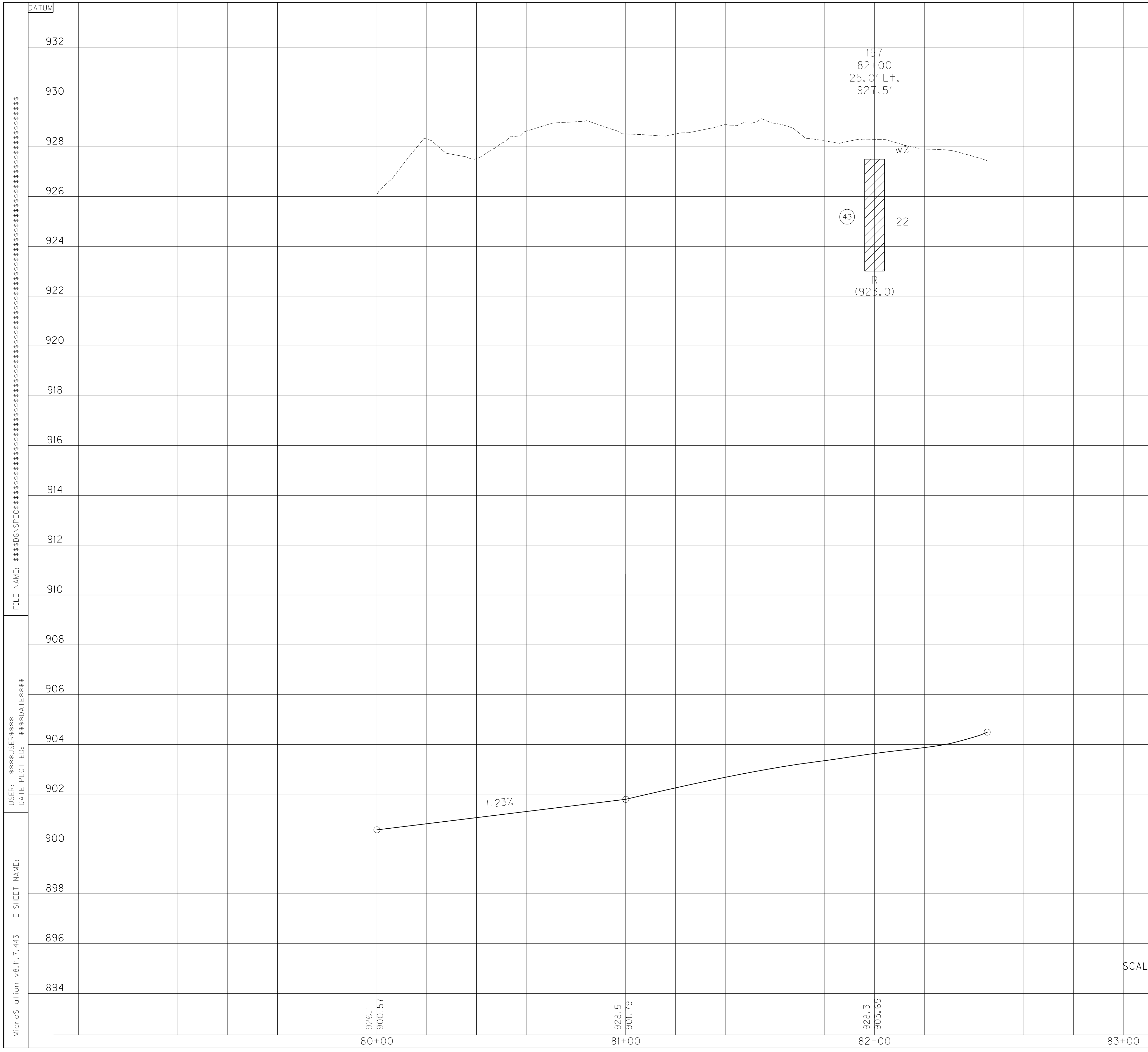
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		43
STATION		82+00
OFFSET		25′ Lt.
DEPTH		0.0′-4.5′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	52
	CLAY (- 0.002 mm)	39
LIQUID LIMIT		45
PLASTIC LIMIT		20
PLASTICITY INDEX		25
ACTIVITY INDEX		0.64
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(24)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.7
MAXIMUM DRY DENSITY (pcf)		107.0
OPTIMUM MOISTURE (%)		20.0
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

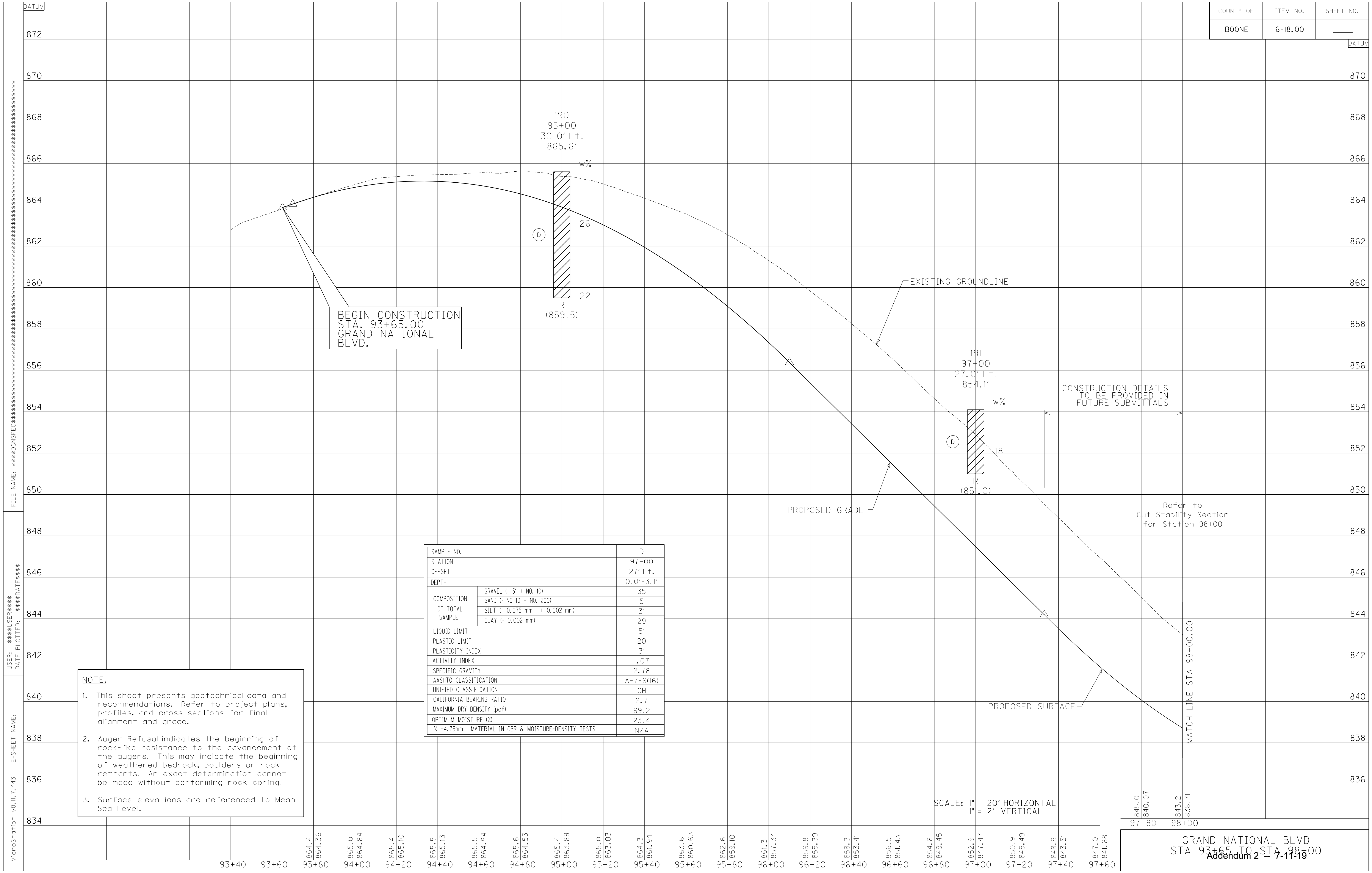
DATUM 930 928 926 924 922 920 918 916 914 912 910 908 906 904 902 900 898 896

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

SOIL PROFILE SHEET
RAMP H
STA. 80+00 TO STA. 83+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	____



SAMPLE NO.		D
STATION		97+00
OFFSET		27′ Lt.
DEPTH		0.0′-3.1′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	35
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	31
	CLAY (- 0.002 mm)	29
LIQUID LIMIT		51
PLASTIC LIMIT		20
PLASTICITY INDEX		31
ACTIVITY INDEX		1.07
SPECIFIC GRAVITY		2.78
AASHTO CLASSIFICATION		A-7-6(16)
UNIFIED CLASSIFICATION		CH
CALIFORNIA BEARING RATIO		2.7
MAXIMUM DRY DENSITY (pcf)		99.2
OPTIMUM MOISTURE (%)		23.4
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

GRAND NATIONAL BLVD
STA 93+65 TO STA 98+00

Addendum 2 -- 7-11-19

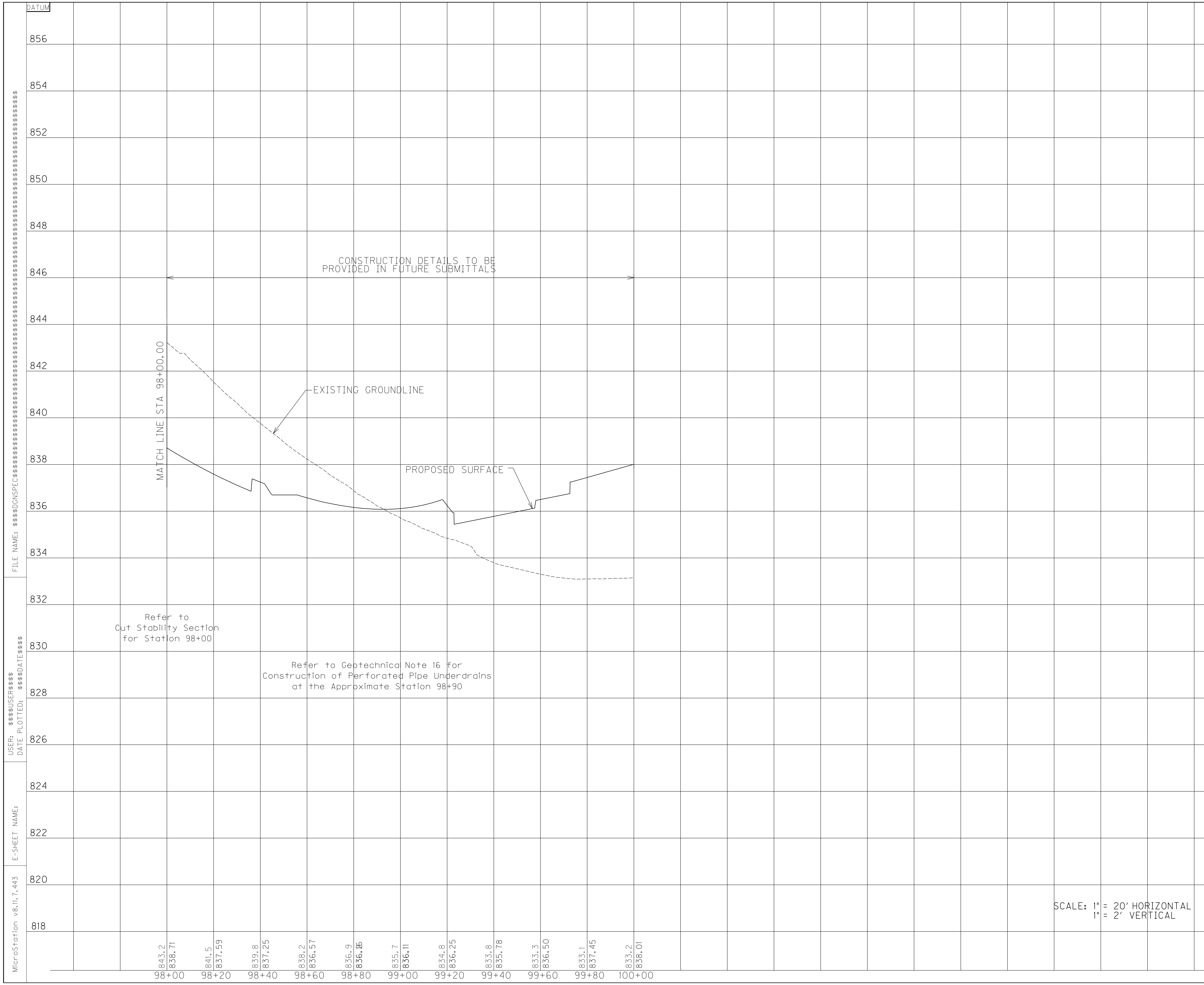
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME: ________

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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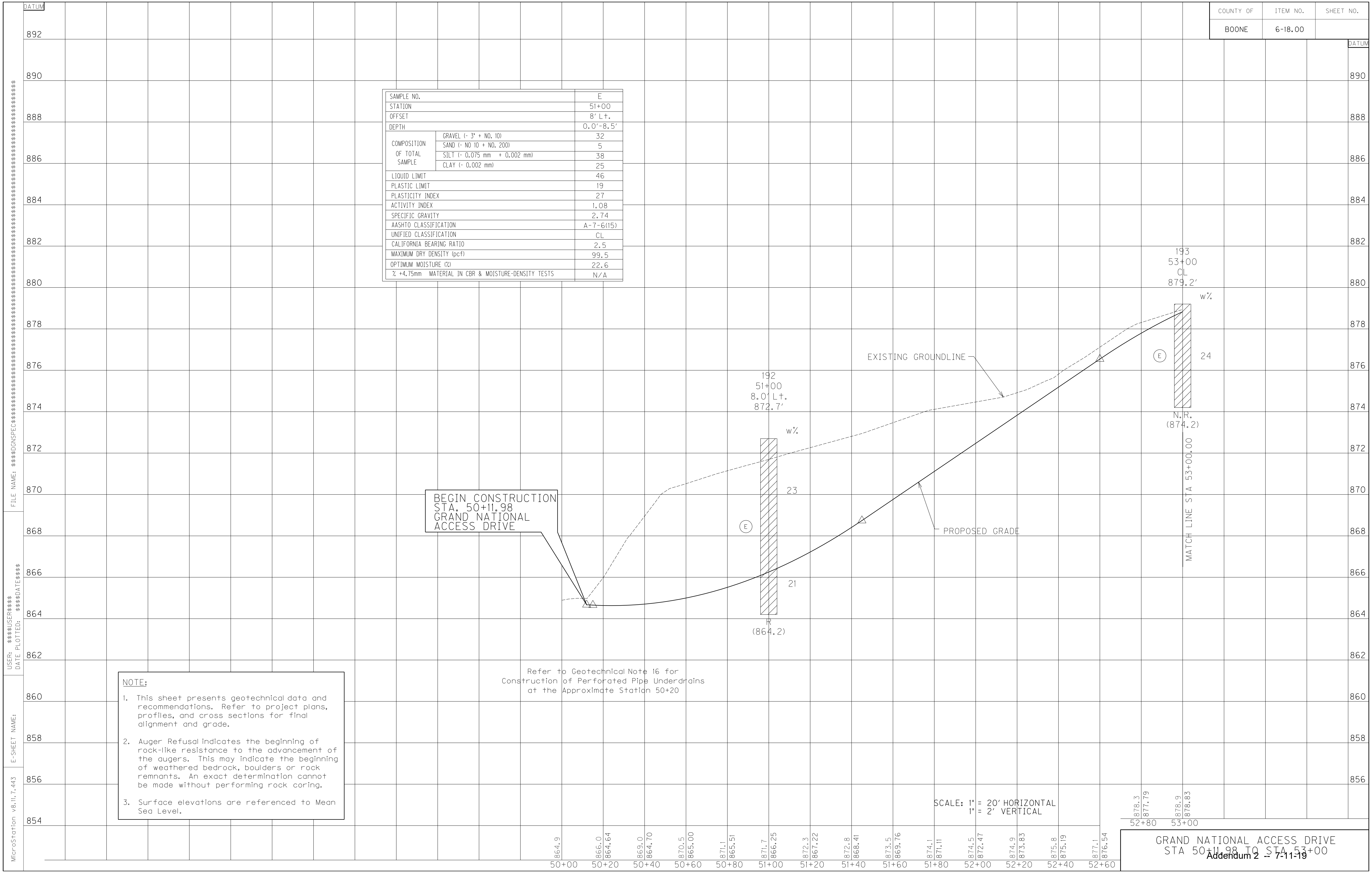
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

GRAND NATIONAL BLVD
STA 98+00 TO STA 100+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		E
STATION		51+00
OFFSET		8' Lt.
DEPTH		0.0'-8.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	32
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	25
LIQUID LIMIT		46
PLASTIC LIMIT		19
PLASTICITY INDEX		27
ACTIVITY INDEX		1.08
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(15)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		99.5
OPTIMUM MOISTURE (%)		22.6
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

Refer to Geotechnical Note 16 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 50+20

NOTE:

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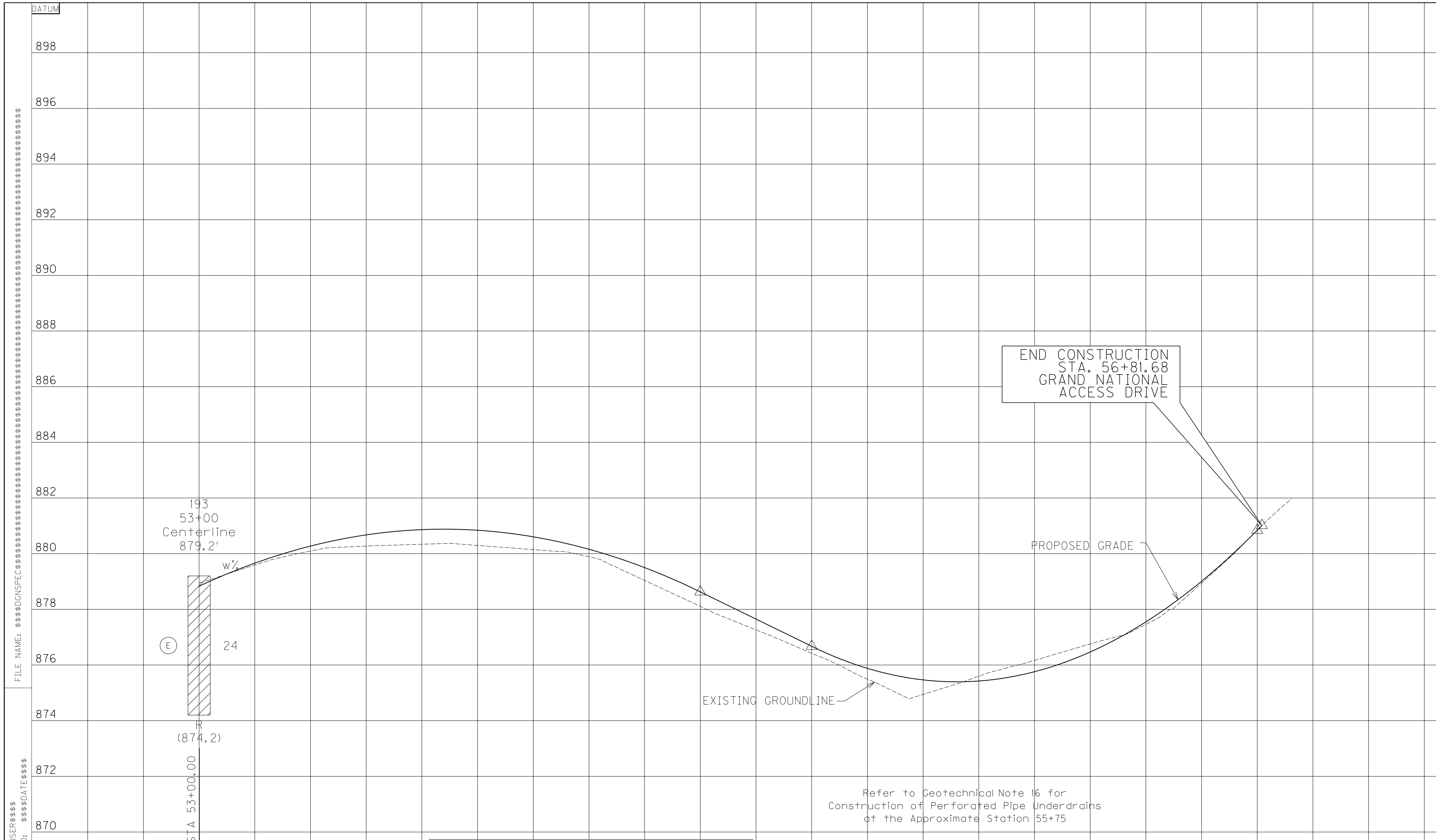
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

GRAND NATIONAL ACCESS DRIVE
STA 50+11.98 TO STA 53+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Refer to Geotechnical Note 16 for Construction of Perforated Pipe Underdrains at the Approximate Station 55+75

SAMPLE NO.		E
STATION		51+00
OFFSET		8' Lt.
DEPTH		0.0'-8.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	32
	SAND (- NO 10 + NO. 200)	5
	SILT (- 0.075 mm + 0.002 mm)	38
	CLAY (- 0.002 mm)	25
LIQUID LIMIT		46
PLASTIC LIMIT		19
PLASTICITY INDEX		27
ACTIVITY INDEX		1.08
SPECIFIC GRAVITY		2.74
AASHTO CLASSIFICATION		A-7-6(15)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		2.5
MAXIMUM DRY DENSITY (pcf)		99.5
OPTIMUM MOISTURE (%)		22.6
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

GRAND NATIONAL ACCESS DRIVE
STA 53+00 TO STA 56+81.68

Addendum 2 -- 7-11-19

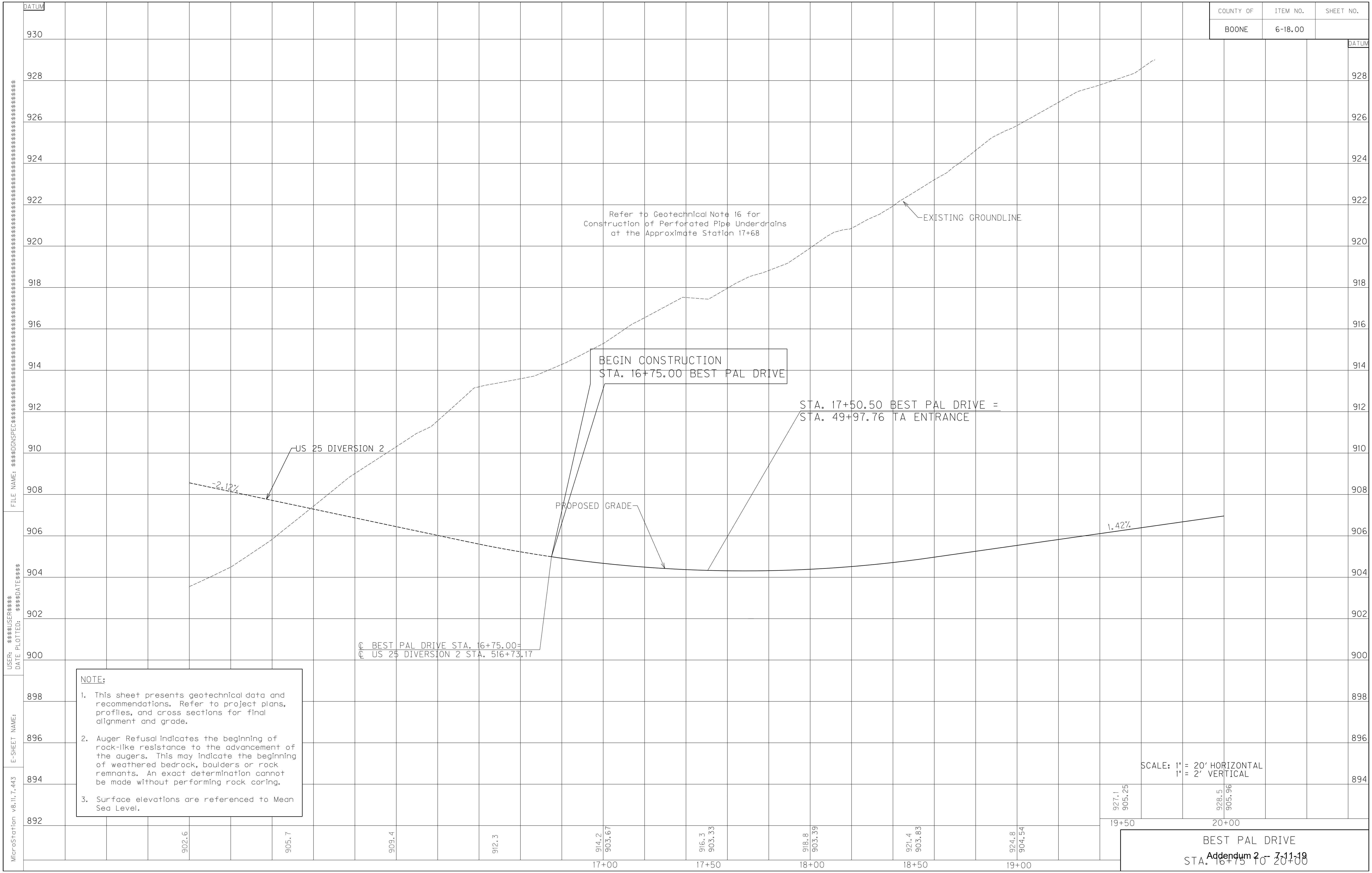
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

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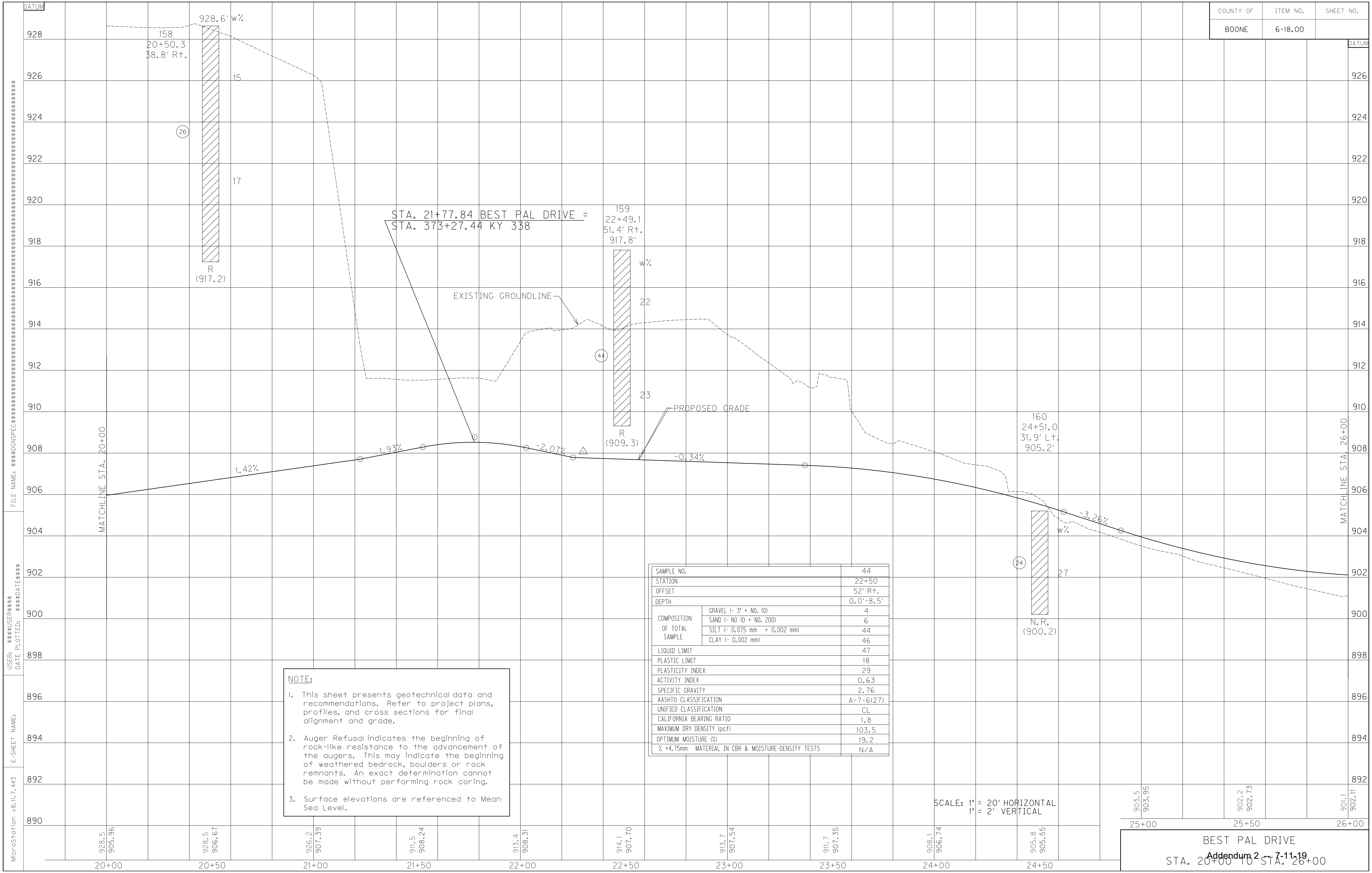
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

BEST PAL DRIVE

STA. 16+75 TO 20+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		44
STATION		22+50
OFFSET		52' Rt.
DEPTH		0.0'-8.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4
	SAND (- NO 10 + NO. 200)	6
	SILT (- 0.075 mm + 0.002 mm)	44
	CLAY (- 0.002 mm)	46
LIQUID LIMIT		47
PLASTIC LIMIT		18
PLASTICITY INDEX		29
ACTIVITY INDEX		0.63
SPECIFIC GRAVITY		2.76
AASHTO CLASSIFICATION		A-7-6(27)
UNIFIED CLASSIFICATION		CL
CALIFORNIA BEARING RATIO		1.8
MAXIMUM DRY DENSITY (pcf)		103.5
OPTIMUM MOISTURE (%)		19.2
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

BEST PAL DRIVE
STA. 20+00 TO STA. 26+00

Addendum 2 -- 7-11-19

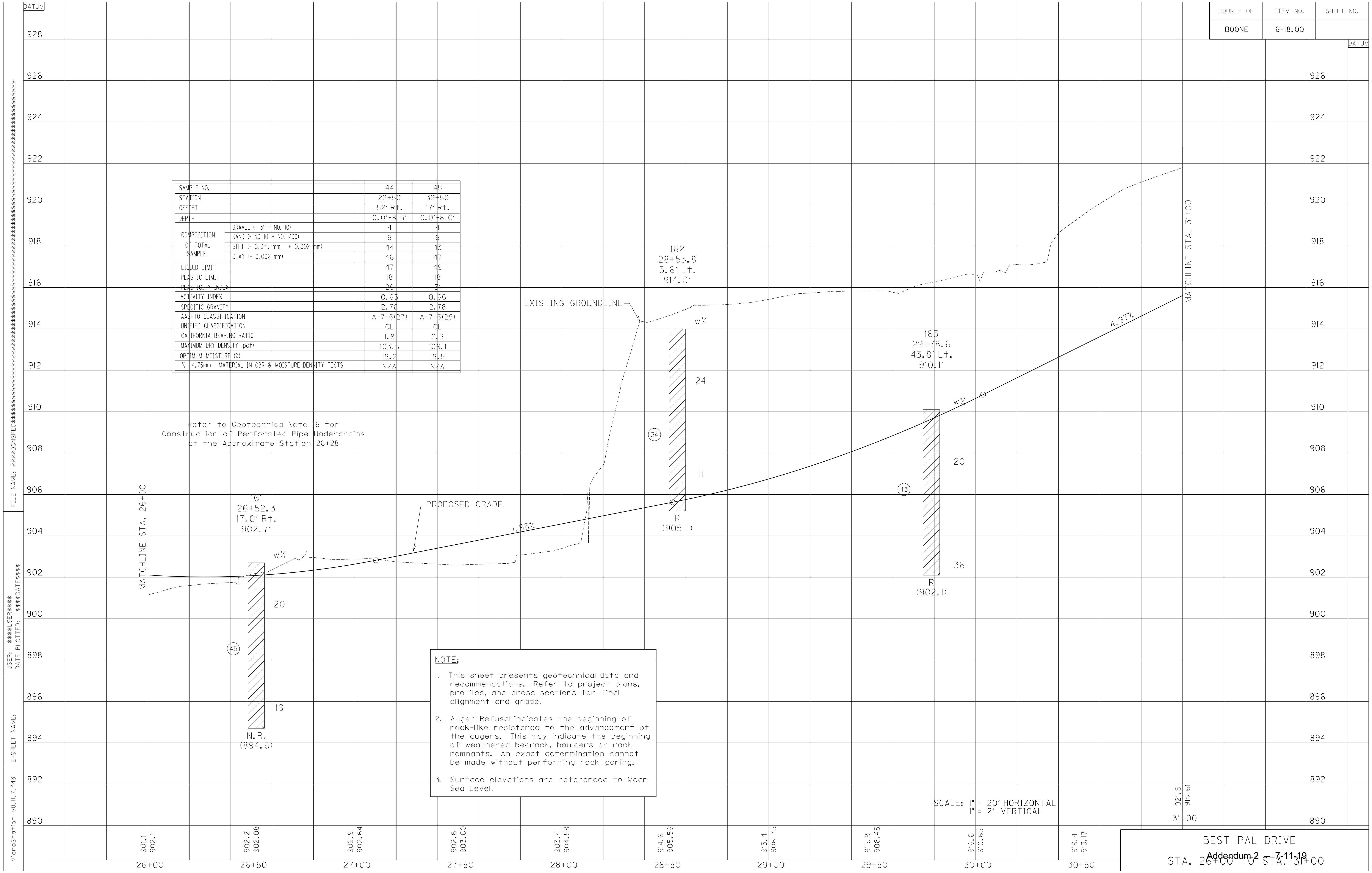
FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



SAMPLE NO.		44	45
STATION		22+50	32+50
OFFSET		52′ Rt.	17′ Rt.
DEPTH		0.0′-8.5′	0.0′-8.0′
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	4	4
	SAND (- NO 10 + NO. 200)	6	6
	SILT (- 0.075 mm + 0.002 mm)	44	43
	CLAY (- 0.002 mm)	46	47
LIQUID LIMIT		47	49
PLASTIC LIMIT		18	18
PLASTICITY INDEX		29	31
ACTIVITY INDEX		0.63	0.66
SPECIFIC GRAVITY		2.76	2.78
AASHTO CLASSIFICATION		A-7-6(27)	A-7-6(29)
UNIFIED CLASSIFICATION		CL	CL
CALIFORNIA BEARING RATIO		1.8	2.3
MAXIMUM DRY DENSITY (pcf)		103.5	106.1
OPTIMUM MOISTURE (%)		19.2	19.5
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A	N/A

Refer to Geotechnical Note 6 for
Construction of Perforated Pipe Underdrains
at the Approximate Station 26+28

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

SCALE: 1" = 20′ HORIZONTAL
1" = 2′ VERTICAL

FILE NAME: $$$$DGNSPEC$$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

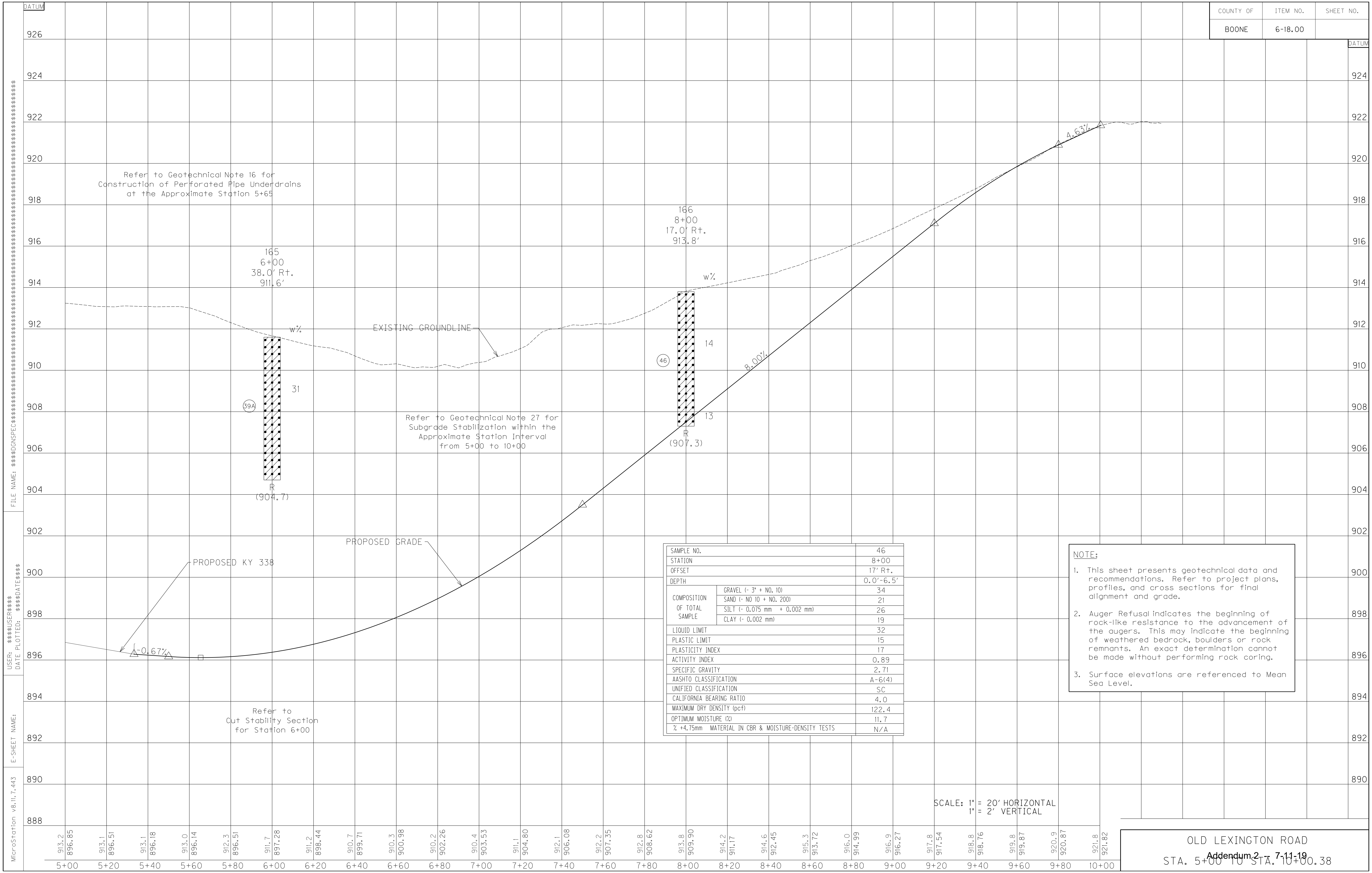
E-SHEET NAME:

MicroStation v8.11.7.443

BEST PAL DRIVE
STA. 26+00 TO STA. 31+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



5+00	913.2	896.85
5+20	913.1	896.51
5+40	913.1	896.18
5+60	913.0	896.14
5+80	912.3	896.51
6+00	911.7	897.28
6+20	911.2	898.44
6+40	910.7	899.71
6+60	910.3	900.98
6+80	910.2	902.26
7+00	910.4	903.53
7+20	911.1	904.80
7+40	912.1	906.08
7+60	912.2	907.35
7+80	912.8	908.62
8+00	913.8	909.90
8+20	914.2	911.17
8+40	914.6	912.45
8+60	915.3	913.72
8+80	916.0	914.99
9+00	916.9	916.27
9+20	917.8	917.54
9+40	918.8	918.76
9+60	919.8	919.87
9+80	920.9	920.87
10+00	921.8	921.82

SAMPLE NO.		46
STATION		8+00
OFFSET		17' Rt.
DEPTH		0.0'-6.5'
COMPOSITION OF TOTAL SAMPLE	GRAVEL (- 3" + NO. 10)	34
	SAND (- NO 10 + NO. 200)	21
	SILT (- 0.075 mm + 0.002 mm)	26
	CLAY (- 0.002 mm)	19
LIQUID LIMIT		32
PLASTIC LIMIT		15
PLASTICITY INDEX		17
ACTIVITY INDEX		0.89
SPECIFIC GRAVITY		2.71
AASHTO CLASSIFICATION		A-6(4)
UNIFIED CLASSIFICATION		SC
CALIFORNIA BEARING RATIO		4.0
MAXIMUM DRY DENSITY (pcf)		122.4
OPTIMUM MOISTURE (%)		11.7
% +4.75mm MATERIAL IN CBR & MOISTURE-DENSITY TESTS		N/A

NOTE:

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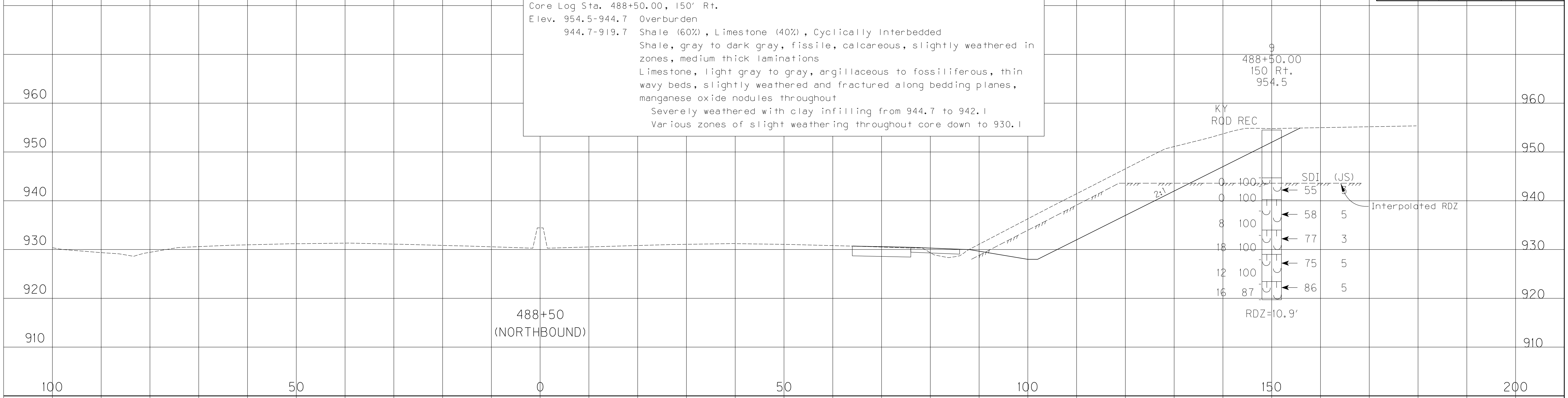
3. Surface elevations are referenced to Mean Sea Level.

OLD LEXINGTON ROAD
STA. 5+00 TO STA. 10+00.38

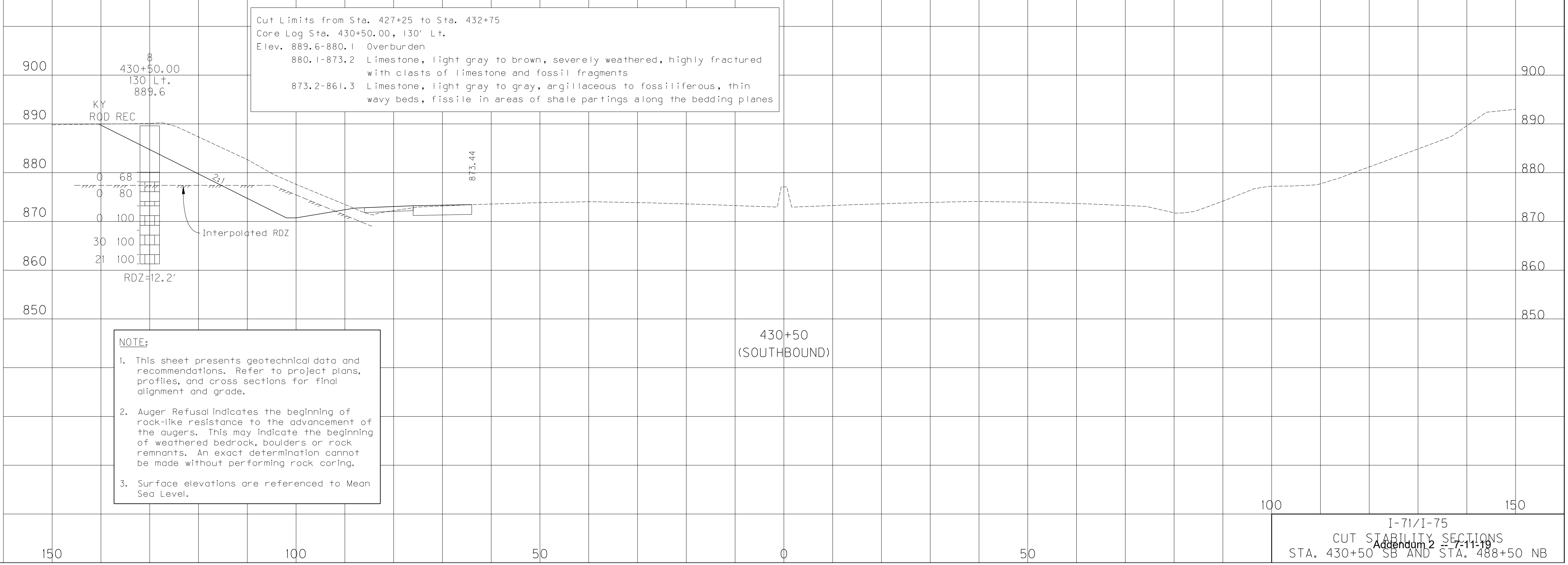
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 482+25 to Sta. 497+25
Core Log Sta. 488+50.00, 150′ Rt.
Elev. 954.5-944.7 Overburden
944.7-919.7 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Severely weathered with clay infilling from 944.7 to 942.1
Various zones of slight weathering throughout core down to 930.1



Cut Limits from Sta. 427+25 to Sta. 432+75
Core Log Sta. 430+50.00, 130′ Lt.
Elev. 889.6-880.1 Overburden
880.1-873.2 Limestone, light gray to brown, severely weathered, highly fractured with clasts of limestone and fossil fragments
873.2-861.3 Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, fissile in areas of shale partings along the bedding planes



NOTE:

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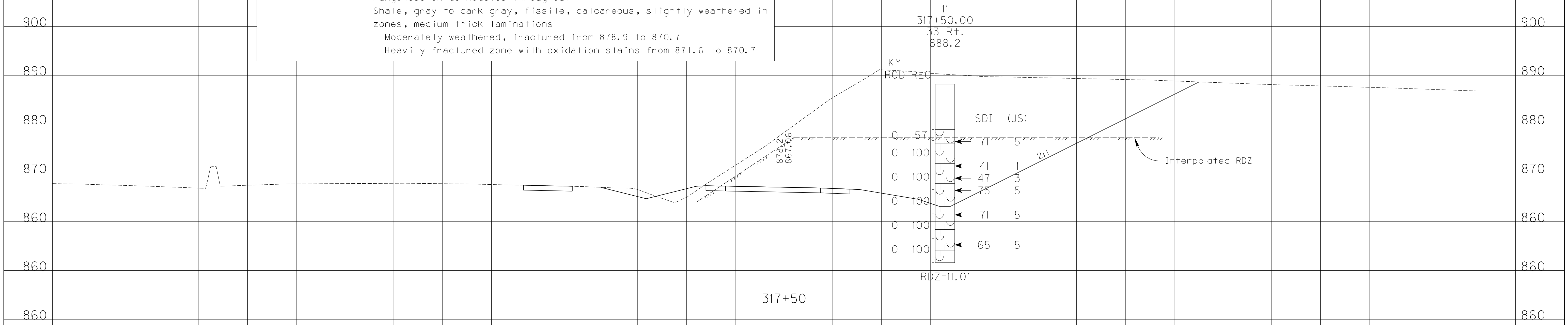
I-71/I-75
CUT STABILITY SECTIONS
STA. 430+50 SB AND STA. 488+50 NB

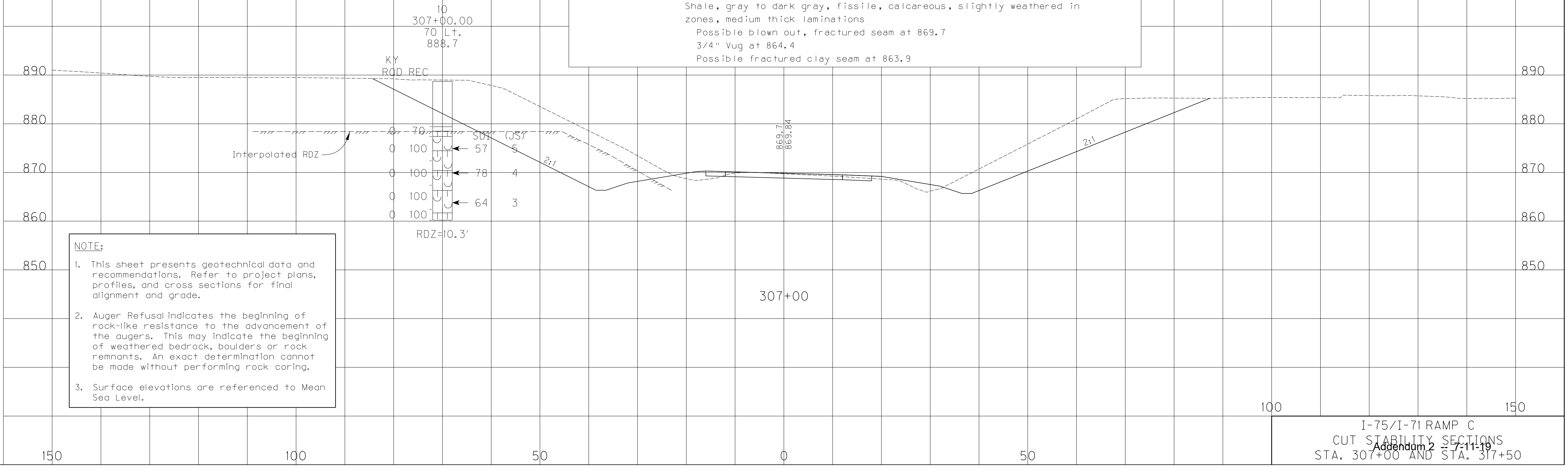
Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 311+75 to Sta. 324+25
Core Log Sta. 317+50.00, 33' Rt.
Elev. 888.2-878.9 Overburden
878.9-851.6 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Moderately weathered, fractured from 878.9 to 870.7
Heavily fractured zone with oxidation stains from 871.6 to 870.7



Cut Limits from Sta. 302+50 to Sta. 310+00
Core Log Sta. 307+00.00, 70' Lt.
Elev. 888.7-879.4 Overburden
879.4-877.4 Limestone, gray, moderately weathered, slightly fractured with clay infilling
877.4-860.2 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Possible blown out, fractured seam at 869.7
3/4" Vug at 864.4
Possible fractured clay seam at 863.9



NOTE:

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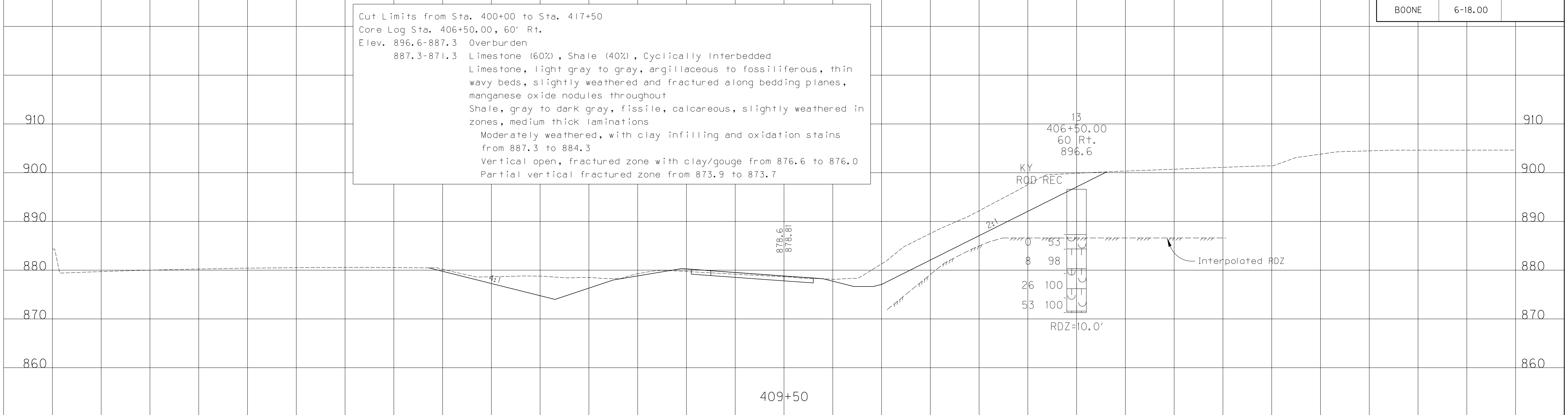
3. Surface elevations are referenced to Mean Sea Level.

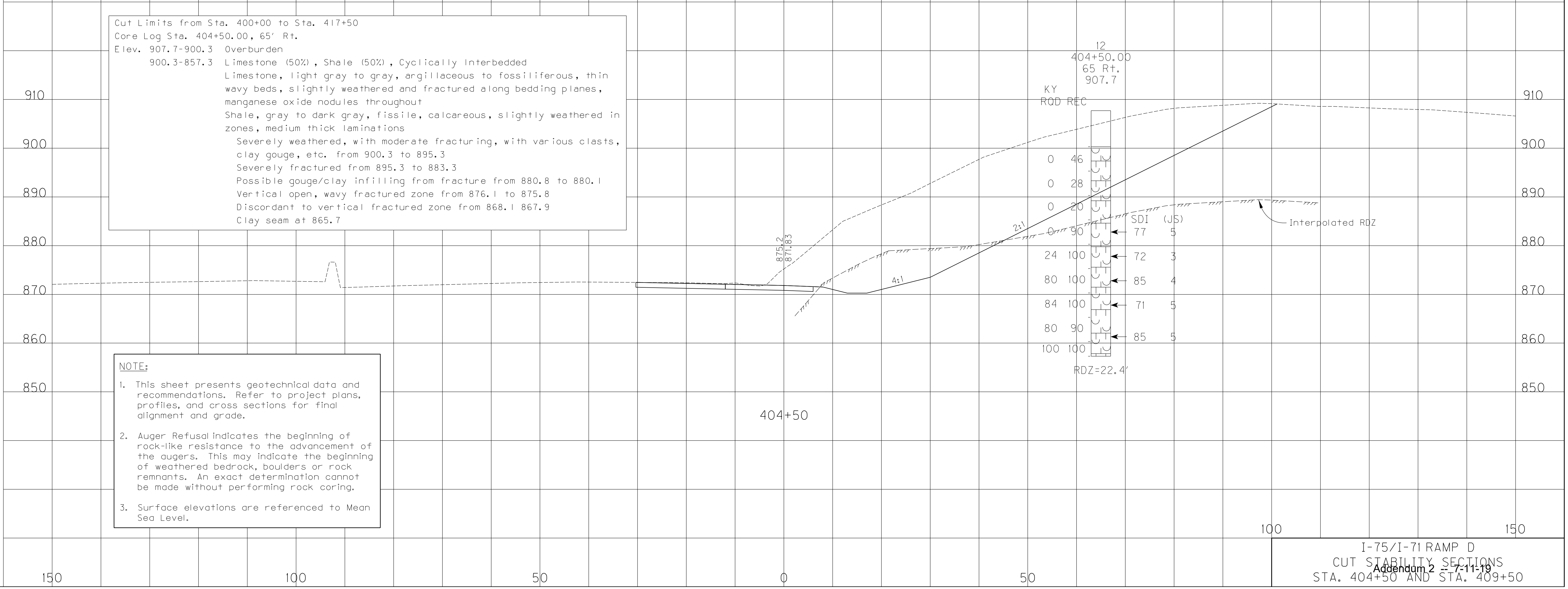
I-75/I-71 RAMP C
CUT STABILITY SECTIONS
STA. 307+00 AND STA. 317+50

Addendum 2 - 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 406+50.00, 60' Rt.
Elev. 896.6-887.3 Overburden
887.3-871.3 Limestone (60%), Shale (40%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Moderately weathered, with clay infilling and oxidation stains from 887.3 to 884.3
Vertical open, fractured zone with clay/gouge from 876.6 to 876.0
Partial vertical fractured zone from 873.9 to 873.7



Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 404+50.00, 65' Rt.
Elev. 907.7-900.3 Overburden
900.3-857.3 Limestone (50%), Shale (50%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Severely weathered, with moderate fracturing, with various clasts, clay gouge, etc. from 900.3 to 895.3
Severely fractured from 895.3 to 883.3
Possible gouge/clay infilling from fracture from 880.8 to 880.1
Vertical open, wavy fractured zone from 876.1 to 875.8
Discordant to vertical fractured zone from 868.1 867.9
Clay seam at 865.7

NOTE:

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3. Surface elevations are referenced to Mean Sea Level.

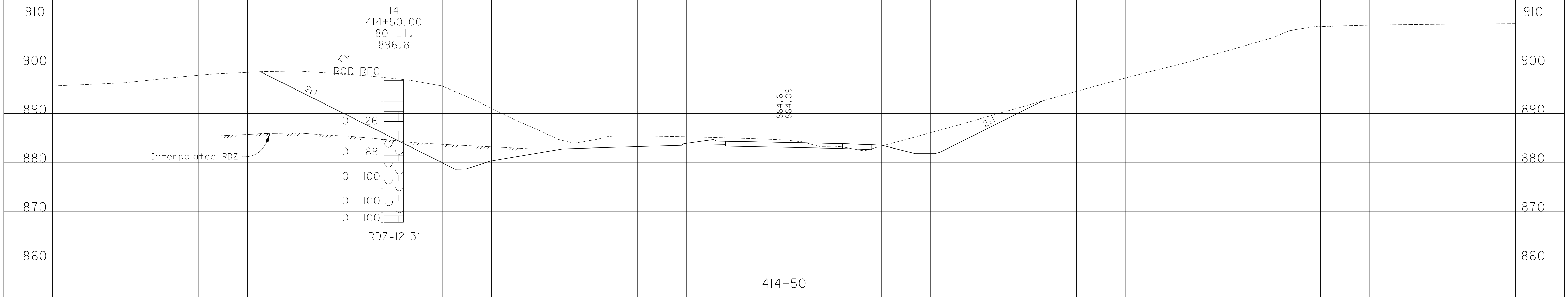
I-75/I-71 RAMP D
CUT STABILITY SECTIONS
STA. 404+50 AND STA. 409+50

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 400+00 to Sta. 417+50
Core Log Sta. 414+50.00, 80' Lt.
Elev. 896.8-892.4 Overburden
892.4-884.4 Limestone, light gray to gray, finely crystalline to slightly fossiliferous, thin wavy bedding, slightly weathered, moderately to severely fractured/fragmented with clay infilling
884.4-867.7 Limestone (55%), Shale (45%), Cyclically Interbedded
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations,
Open fractured zone from 880.0 to 879.7
3/4" Vug at 873.4
Large clay seam from 872.2 to 871.9
Partial open fracture at 869.5



NOTE:

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2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
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I-75/I-71 RAMP D
CUT STABILITY SECTION
STA. 414+50

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$

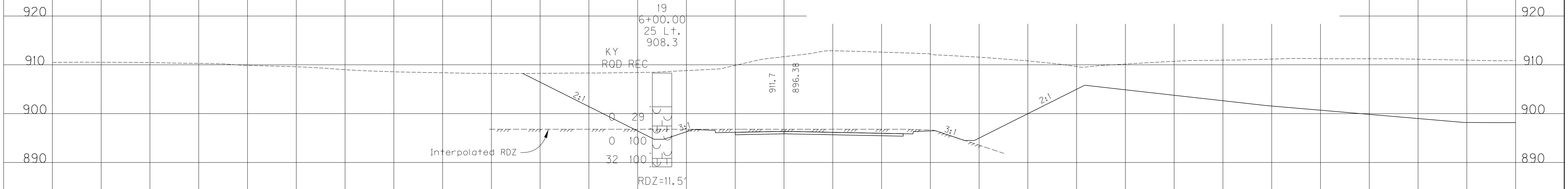
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

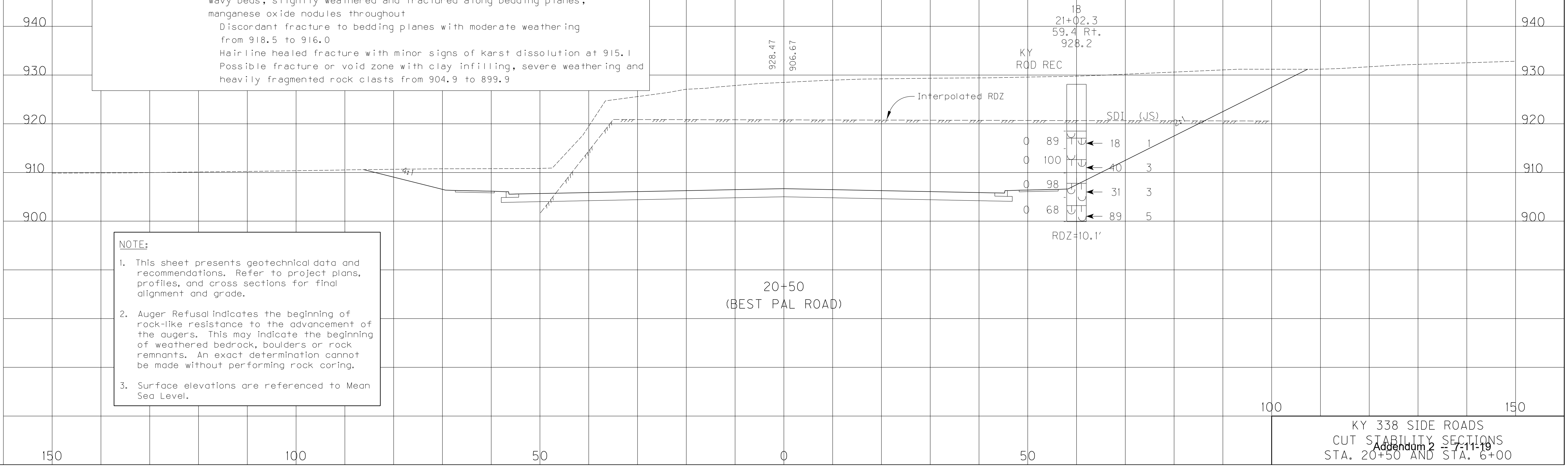
COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

Cut Limits from Sta. 5+25 to Sta. 10+00
Core Log Sta. 6+00.00, 25' Lt.
Elev. 908.3-901.4 Overburden
901.4-889.1 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Slight to moderate weathering with clay infilling and minor karst dissolution from 901.4 to 896.8
Large clay filled void from 896.3 to 895.6
Oxidation stains along bedding the planes from 894.5 to 894.3
Vertical, open fractured zone with slight weathering and oxidation stains from 892.6 to 892.4 and 890.9 to 890.6



6+00
(OLD LEXINGTON ROAD)

Cut Limits from Sta. 20+50 to Sta. 24+25
Core Log Sta. 21+02.3, 59.4' Rt.
Elev. 928.1-918.5 Overburden
918.5-889.9 Shale (60%), Limestone (40%), Cyclically Interbedded
Shale, gray to dark gray, fissile, calcareous, slightly weathered in zones, medium thick laminations
Limestone, light gray to gray, argillaceous to fossiliferous, thin wavy beds, slightly weathered and fractured along bedding planes, manganese oxide nodules throughout
Discordant fracture to bedding planes with moderate weathering from 918.5 to 916.0
Hairline healed fracture with minor signs of karst dissolution at 915.1
Possible fracture or void zone with clay infilling, severe weathering and heavily fragmented rock clasts from 904.9 to 899.9



20+50
(BEST PAL ROAD)

NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

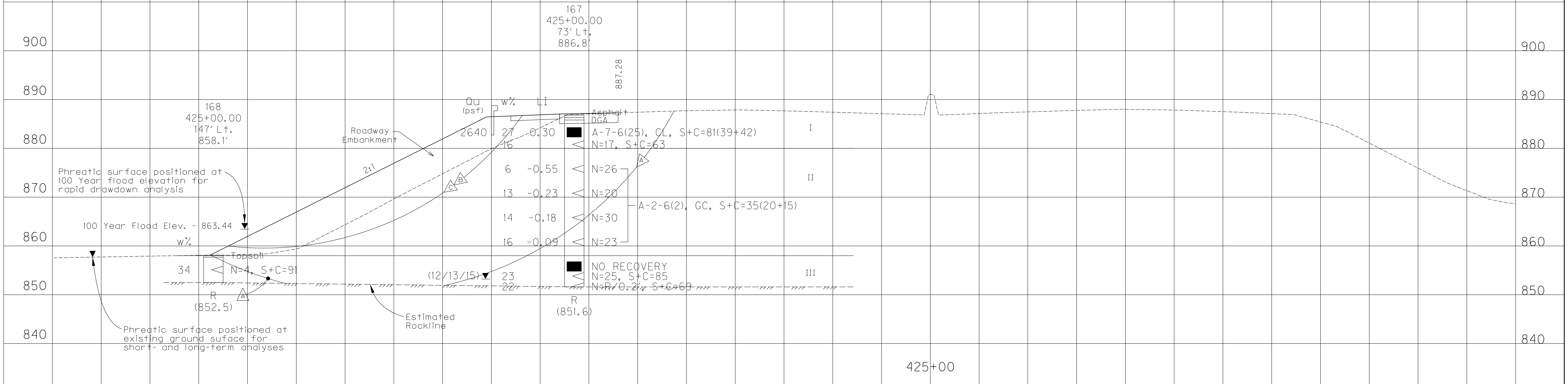
KY 338 SIDE ROADS
CUT STABILITY SECTIONS
STA. 20+50 AND STA. 6+00
Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

ESTIMATED SOIL STRENGTH PARAMETERS				
SOIL	I	II	III	ROADWAY EMBANKMENT
SHORT TERM	γ = 120 pcf c = 1300 psf ø = 0°	γ = 133 pcf c = 0 psf ø = 34°	γ = 120 pcf c = 600 psf ø = 0°	γ = 125 pcf c = 1000 psf ø = 0°
LONG TERM AND RAPID DRAWDOWN	γ = 120 pcf c̄ = 270 psf ø̄ = 28°	γ = 133 pcf c̄ = 0 psf ø̄ = 34°	γ = 120 pcf c̄ = 270 psf ø̄ = 28°	γ = 125 pcf c̄ = 150 psf ø̄ = 25°

FACTORS OF SAFETY		
SHORT TERM	A	1.2
LONG TERM	B	1.5
RAPID DRAWDOWN	C	1.4



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

150 100 50 0 50 100

I-75/I-71
EMBANKMENT STABILITY SECTION
STA. 425+00

Addendum 2 -- 7-11-19

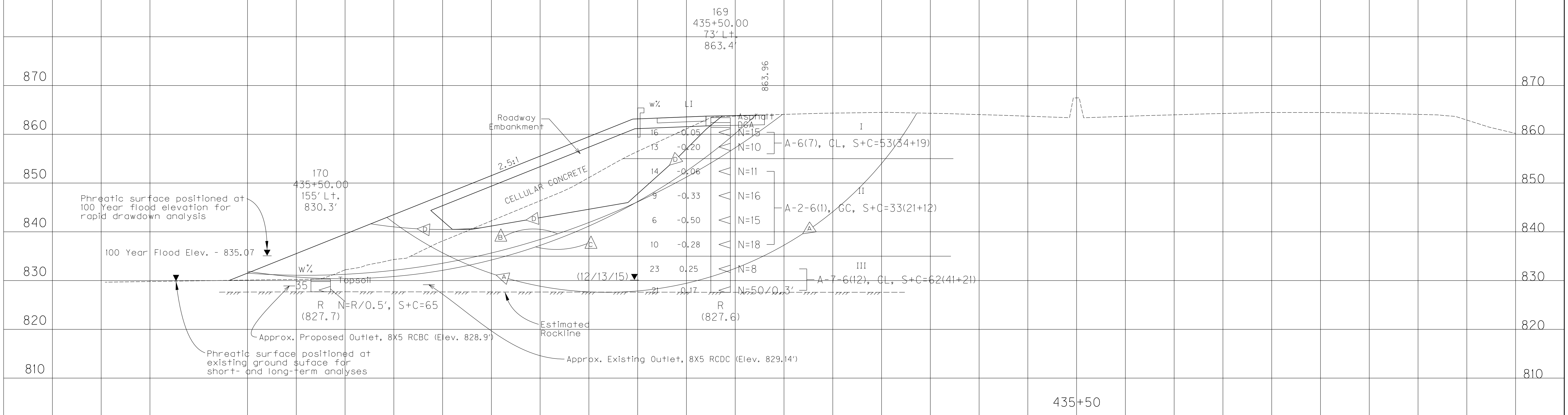
MicroStation v8.11.7.443
E-SHEET NAME:
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
FILE NAME: $$$$DGNSPEC$$$

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

ESTIMATED SOIL STRENGTH PARAMETERS						
SOIL	I	II	III	ROADWAY EMBANKMENT	CELLULAR CONCRETE	EPS GEOFOAM
SHORT TERM	γ = 120 pcf c = 1300 psf ø = 0°	γ = 133 pcf c = 0 psf ø = 34°	γ = 120 pcf c = 600 psf ø = 0°	γ = 125 pcf c = 1000 psf ø = 0°	γ = 36 pcf c = 2880 psf ø = 0°	γ = 3.2 pcf c = 1650 psf ø = 0°
LONG TERM AND RAPID DRAWDOWN	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{ø}$ = 28°	γ = 133 pcf $\bar{c}$ = 0 psf $\bar{ø}$ = 34°	γ = 120 pcf $\bar{c}$ = 270 psf $\bar{ø}$ = 28°	γ = 125 pcf $\bar{c}$ = 150 psf $\bar{ø}$ = 25°	γ = 36 pcf $\bar{c}$ = 2880 psf $\bar{ø}$ = 0°	γ = 3.2 pcf $\bar{c}$ = 1650 psf $\bar{ø}$ = 0°

FACTORS OF SAFETY	NORMAL FILL	EPS GEOFOAM	CELLULAR CONCRETE
SHORT TERM	1.4	2.3	2.2 △A*
LONG TERM	1.7	2.2	2.5 △B*
RAPID DRAWDOWN	1.7	2.2	2.4 △C*
SLIDING		1.7	1.4 △D*

*See failure surface on cross-section below.
Normal fill and Geofoam configuration failure surfaces not shown.



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

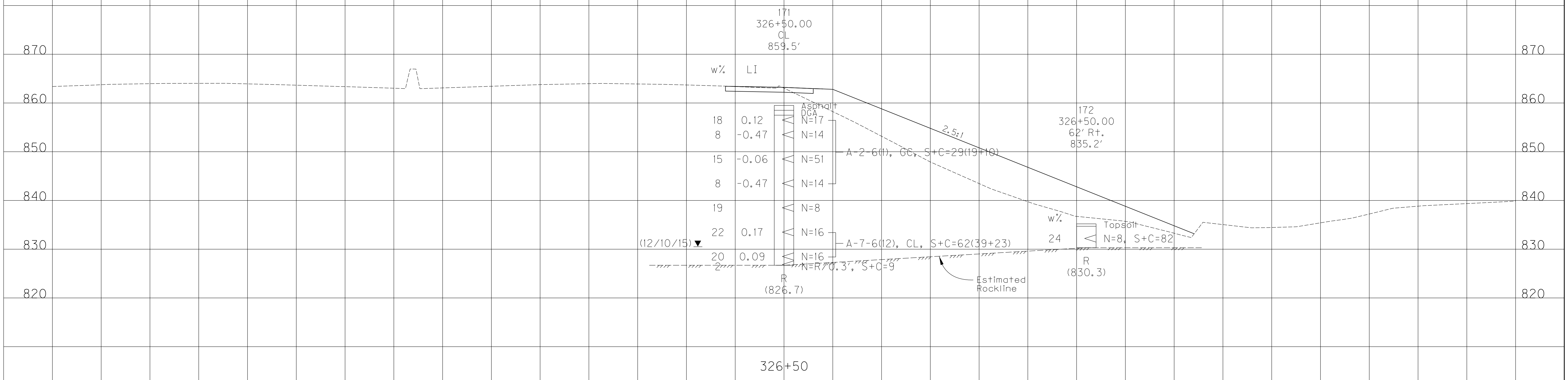
50

I-71/75
EMBANKMENT STABILITY SECTION
STA. 435+50

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$$$
USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$
E-SHEET NAME:
MicroStation v8.11.7.443

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



NOTE:

1. This sheet presents geotechnical data and recommendations. Refer to project plans, profiles, and cross sections for final alignment and grade.
2. Auger Refusal indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.
3. Surface elevations are referenced to Mean Sea Level.

NOTE:

This section is outside of the project limits but is still included for completeness. For stability analyses information, refer to SB I-71\I-75 Aux. Entrance Lane Embankment Stability Section Sta. 435+50, as this is the same section.

I-75/I-71 RAMP C
EMBANKMENT STABILITY SECTION
STA. 326+50

Addendum 2 -- 7-11-19

FILE NAME: $$$$DGNSPEC$$

USER: $$$$USER$$$$
DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.7.443

Attachment #2

***New*** **Geotechnical Drawings**

GEOTECHNICAL NOTES

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

LIGHTWEIGHT FILL FOR CULVERT EXTENSIONS @ I-75/I-71 STA 435+53, US 25 STA 32+06:

29. Place lightweight fill material as shown in the plans and in accordance with the Special Note for Cellular Concrete Fill OR the Special Note for EPS Foam Block Embankments, and the appropriate Lightweight Fill Detail Sheet. These documents provide additional detail on the construction of the lightweight fill. The fill shall extend perpendicular to the culvert to the minimum limits shown on the detail sheets.

30. Lightweight fill shall be covered with a minimum two (2)-foot of soil cap when it is not directly beneath pavement and base aggregate. The soil shall consist of clay classified as either CL or CH in the Unified Soil Classification System (USCS) and placed and compacted in accordance with Section 206 of the current Standard Specifications for Road and Bridge Construction.

31. When EPS geofoam fill is within five (5) feet of the proposed road grade, a concrete load distributor is required above the top layer of geofoam blocks. The Special Note for EPS Foam Block Embankments provides details for the concrete load distributor.

32. Temporary sheeting or shoring may be required for construction of the lightweight fill. The specific designs for any necessary sheeting and shoring shall be performed by the Contractor and approved by the Engineer. Construction and stability of temporary slopes required for lightweight fill placement are the responsibility of the Contractor. Caution should be used with sheeting/shoring or temporary slopes adjacent to existing roadways. The time any temporary cut slopes are left open should be minimized to reduce the likely of slope instability.

33. Any changes in lightweight fill configuration and material type from the applicable Lightweight Fill Detail Sheet and Special Note will require additional design and analysis by the Contractor or Supplier, meeting the approval of the Engineer.

34. A proposed soundwall will be constructed in the area of the 8X5 culvert extension at I-75/I-71 Station 435+53. Drilled shaft soundwall foundations should be considered prior to lightweight fill placement to prevent negative impact to the lightweight fill materials. For any drilled shafts within the lightweight fill zone, drilling should not be performed through geofoam materials. Drilled shaft side capacity should be neglected in lightweight fill materials, unless updated designs are provided by the Contractor and approved by the Department.

DESIGNED BY:
DATE SUBMITTED:

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY OF

BOONE

PROJECT NUMBERS: FD52 008 0075 175-176

GEOTECHNICAL NOTES

Addendum 2 -- 7-11-19

EPS GEOFOAM FILL DETAILS (GENERAL CONFIGURATION) 8X5 RCBC CULVERT EXTENSION STA 435+53.9 I-71 / I-75

NOTE: THIS IS ONLY A TYPICAL EPS GEOFOAM FILL CONFIGURATION. ALL MEASUREMENTS AND SLOPES EXPLICITLY GIVEN ON THIS SHEET MUST BE FOLLOWED AND THE INDICATED MINIMUM LIGHTWEIGHT FILL VOLUME MUST BE MAINTAINED.

NOTES:

1) EXCAVATING THE EMBANKMENT FOR THE EPS GEOFOAM FILL INSTALLATION WILL INVOLVE SOME RISK. THEREFORE, TO PREVENT POTENTIAL DAMAGE TO THE ROADWAY, THE CONTRACTOR WILL BE ALLOWED 21 CONTINUOUS DAYS FROM BEGINNING OF THE REMOVAL OF THE EMBANKMENT SLOPE TO REPLACING THE EMBANKMENT SLOPE ON THE PROPOSED FINAL RECOMMENDED SLOPE. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE SOIL CUT DURING CONSTRUCTION. SHEETING AND SHORING MAY BE REQUIRED TO EXCAVATE AND CONSTRUCT THE EPS GEOFOAM FILL. THE DESIGNS OF ANY REQUIRED SHEETING OR SHORING SHALL BE PERFORMED BY THE CONTRACTOR'S ENGINEER.

2) PRIOR TO GEOFOAM BLOCK PLACEMENT CONSTRUCT A SAND LEVELING PAD MEETING ALL REQUIREMENTS OF THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS. A GEOMEMBRANE SHALL BE PLACED OVER THE TOP AND SIDES OF THE OUTER BLOCKS. THE GEOMEMBRANE MATERIAL PROPERTIES AND PLACEMENT SHALL BE IN ACCORDANCE WITH THE THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS. THE MATERIAL COST AND PLACEMENT OF THE SAND LEVELING PAD AND GEOMEBRANE WILL BE INCIDENTAL TO THE UNIT BID PRICE FOR "EPS FOAM BLOCK".

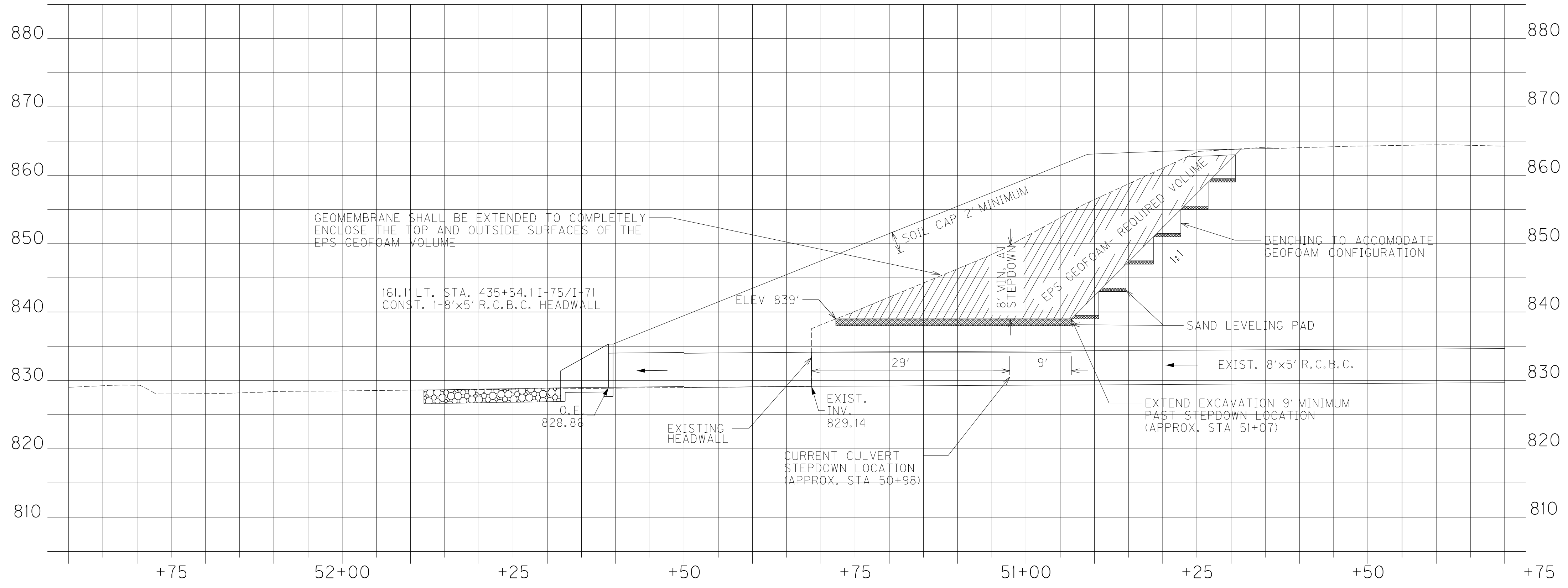
3) PLACE THE EPS GEOFOAM FILL MATERIAL AS SHOWN IN THE PLANS AND IN ACCORDANCE WITH THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS.

4) A PROPOSED SOUNDWALL WILL BE CONSTRUCTED IN THE AREA OF THE CULVERT EXTENSION. DRILLED SHAFT SOUNDWALL FOUNDATIONS SHOULD BE CONSIDERED PRIOR TO LIGHTWEIGHT FILL PLACEMENT TO PREVENT NEGATIVE IMPACT TO THE LIGHTWEIGHT FILL. DRILLING FOR THE DRILLED SHAFTS SHOULD NOT BE PERFORMED THROUGH GEOFOAM MATERIALS. DRILLED SHAFT SIDE CAPACITY SHOULD BE NEGLECTED IN LIGHTWEIGHT FILL MATERIALS, UNLESS UPDATED DESIGNS ARE PROVIDED BY THE CONTRACTOR AND APPROVED BY THE DEPARTMENT.

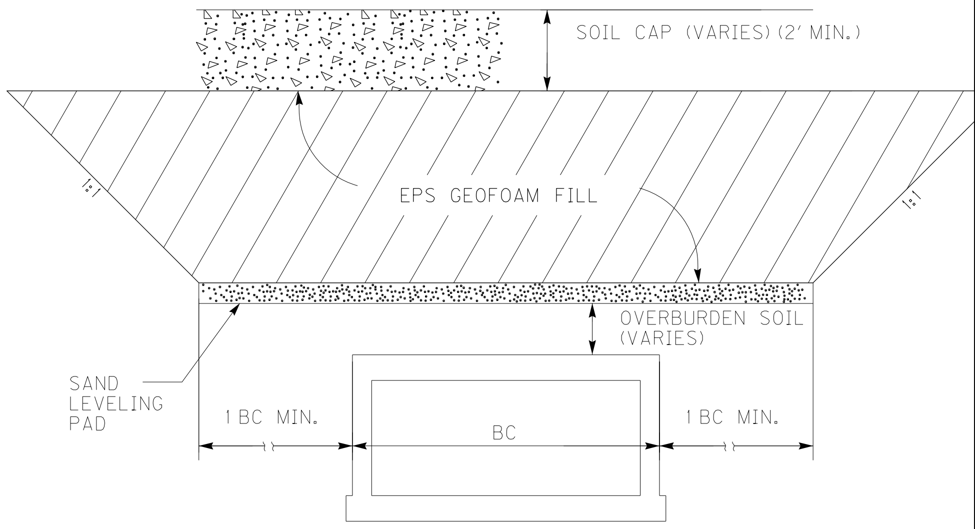
5) PAYMENT FOR THE EPS GEOFOAM FILL WILL BE MADE ON THE BASIS OF THE PLAN QUANTITIES. NO SEPARATE FIELD MEASUREMENT FOR EPS FOAM BLOCK SHALL BE MADE. THE FINAL QUANITIES WILL BE THE DESIGN PLAN QUANTITIES INCREASED OR DECREASED BY AUTHORIZED CHANGES. THE UNIT PRICE BID FOR "EPS FOAM BLOCK" SHALL BE FULL COMPENSATION FOR ALL ENGINEERING, MATERIALS, LABOR AND INCIDENTAL ITEMS NECESSARY TO CONSTRUCT THE EPS GEOFOAM FILL IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS.

6) EPS GEOFOAM FILL SHALL BE CONSTRUCTED OF MATERIAL APPROVED FOR USE BY THE KENTUCKY TRANSPORTATION CABINET. DETAILS SHOWN IN THESE PLANS FOR EPS GEOFOAM FILL REPRESENT LIMITS OF FILL WHERE THE DESIRED WEIGHT (PRESSURE) REDUCTION IS REQUIRED. IF THE CONTRACTOR PROPOSES TO USE THE UNIT WEIGHT SPECIFIED IN THE PLANS, A MATERIAL DATA SHEET WILL BE SUFFICIENT FOR VERIFICATION OF THE PROPOSED MATERIAL (NO ADDITIONAL CALCULATIONS WILL BE REQUIRED UNLESS REQUESTED BY THE ENGINEER). IF THE CONTRACTOR PROPOSES TO USE A UNIT WEIGHT DIFFERENT THAN WHAT WAS USED IN THE INITIAL CONFIGURATION, CONSTRUCTION DETAILS AND SEALED ENGINEERING CALCULATIONS SHOWING MATERIALS, METHODS AND MEANS PROPOSED TO PRODUCE THE DESIRED WEIGHT REDUCTION ON THE EXISTING CULVERT USING "EPS FOAM BLOCK" SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS SUBMISSION SHALL BE MADE 30 DAYS PRIOR TO ORDERING MATERIAL OR BEGINNING EXCAVATION FOR PLACEMENT OF EPS GEOFOAM FILL.

7) PROVIDE A GEOFOAM BLOCK WITH A UNIT WEIGHT OF 2.85 LBS/CUBIC FOOT OR LESS. SEE SECTION 2 OF THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS.



CULVERT PIPE PROFILE



TYPICAL CULVERT SECTION SHOWING MINIMUM LATERAL LIMITS OF LIGHTWEIGHT FILL

DATE: 3-MARCH-2019
CHECKED BY
DESIGNED BY: ____________________
DETAILED BY: M. Carpenter
E. Scott

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–71 / I–75
CROSSING
EPS GEOFOAM EMBANKMENT DETAIL

SUBSURFACE DATA

ITEM NUMBER
06–0018.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

Addendum 2 - 7-11-19

SHEET NO.
____

DRAWING NO.
0000

LIGHTWEIGHT CELLULAR CONCRETE FILL DETAILS (GENERAL CONFIGURATION) 8X5 RCBC CULVERT EXTENSION STA 435+53.9 I-71 / I-75

Note: This is only a typical Lightweight Cellular Concrete fill configuration. All measurements and slopes explicitly given on this sheet must be followed and the indicated minium lightweight fill volume must be maintained.

NOTES:

1) EXCAVATING THE EMBANKMENT FOR THE LIGHTWEIGHT CELLULAR CONCRETE FILL INSTALLATION WILL INVOLVE SOME RISK. THEREFORE, TO PREVENT POTENTIAL DAMAGE TO THE ROADWAY, THE CONTRACTOR WILL BE ALLOWED 21 CONTINUOUS DAYS FROM BEGINNING OF THE REMOVAL OF THE EMBANKMENT SLOPE TO REPLACING THE EMBANKMENT SLOPE ON THE PROPOSED FINAL RECOMMENDED SLOPE. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE SOIL CUT DURING CONSTRUCTION. TEMPORARY BACK SLOPE EXCAVATION LIMITS. SHEETING AND SHORING MAY BE REQUIRED TO EXCAVATE AND CONSTRUCT THE LIGHTWEIGHT CELLULAR CONCRETE FILL. THE DESIGNS OF ANY REQUIRED SHEETING OR SHORING SHALL BE PERFORMED BY THE CONTRACTOR'S ENGINEER.

2) A ONE-FOOT COARSE AGGREGATE ROCK DRAINAGE BLANKET, IN ACCORDANCE WITH SECTION 805 OF THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SHALL BE PLACED ON THE EXCAVATED EMBANKMENT SIDE SLOPE FOR A DRAINAGE BLANKET. THE DRAINAGE BLANKET SHALL BE WRAPPED WITH TYPE IV GEOTEXTILE FABRIC IN ACCORDANCE WITH SECTIONS 214 AND 843 OF THE CURRENT STANDARDS SPECIFICATIONS. THE DRAINAGE BLANKET CONSTRUCTION WILL BE INCIDENTAL TO THE UNIT BID PRICE FOR "CELLULAR CONCRETE FILL".

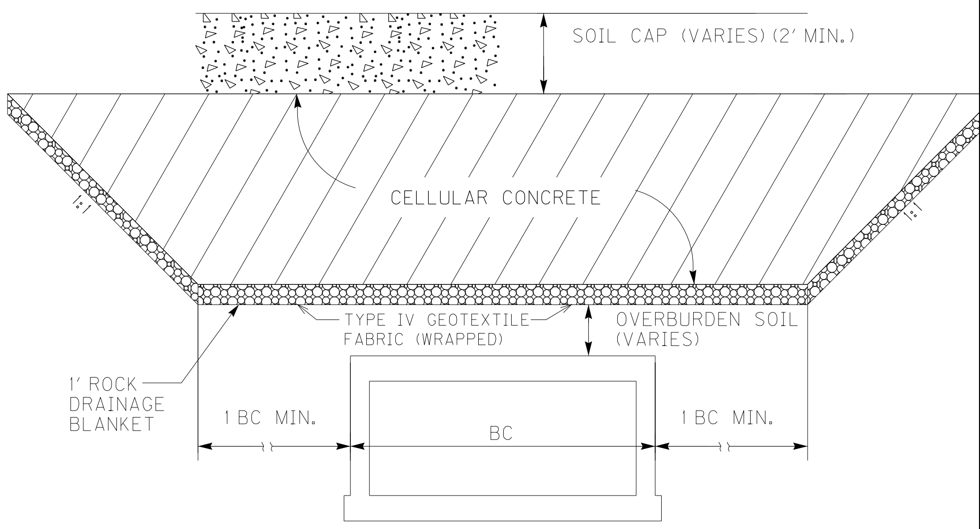
3) PLACE THE CELLULAR CONCRETE FILL MATERIAL AS SHOWN IN THE PLANS AND IN ACCORDANCE WITH THE SPECIAL NOTE FOR CELLULAR CONCRETE FILL.

4) A PROPOSED SOUNDWALL WILL BE CONSTRUCTED IN THE AREA OF THE CULVERT EXTENSION. DRILLED SHAFT SOUNDWALL FOUNDATIONS SHOULD BE CONSIDERED PRIOR TO LIGHTWEIGHT FILL PLACEMENT TO PREVENT NEGATIVE IMPACT TO THE LIGHTWEIGHT FILL. DRILLED SHAFT SIDE CAPACITY SHOULD BE NEGLECTED IN LIGHTWEIGHT FILL MATERIALS, UNLESS UPDATED DESIGNS ARE PROVIDED BY THE CONTRACTOR AND APPROVED BY THE DEPARTMENT.

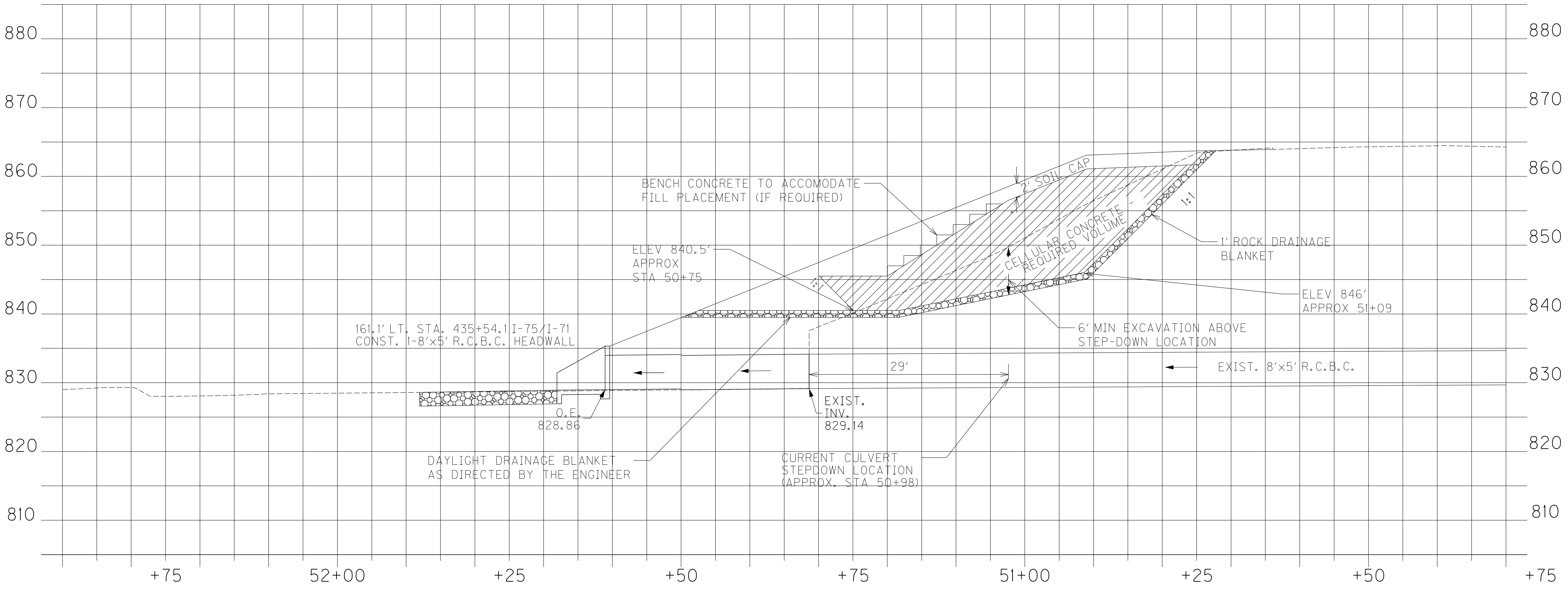
5) PAYMENT FOR THE CELLULAR CONCRETE FILL WILL BE MADE ON THE BASIS OF THE PLAN QUANTITIES. NO SEPARATE FIELD MEASUREMENT FOR CELLULAR CONCRETE FILL SHALL BE MADE. THE FINAL QUANTITIES WILL BE THE DESIGN PLAN QUANTITIES INCREASED OR DECREASED BY AUTHORIZED CHANGES. THE UNIT PRICE BID FOR "CELLULAR CONCRETE FILL" SHALL BE FULL COMPENSATION FOR ALL ENGINEERING, MATERIALS, LABOR AND INCIDENTAL ITEMS NECESSARY TO CONSTRUCT THE LIGHTWEIGHT CELLULAR CONCRETE FILL IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS.

6) CELLULAR CONCRETE SHALL BE CONSTRUCTED OF MATERIAL APPROVED FOR USE BY THE KENTUCKY TRANSPORTATION CABINET. DETAILS SHOWN IN THESE PLANS FOR CELLULAR CONCRETE FILL REPRESENT LIMITS OF FILL WHERE THE DESIRED WEIGHT (PRESSURE) REDUCTION IS REQUIRED. IF THE CONTRACTOR PROPOSES TO USE THE UNIT WEIGHT SPECIFIED IN THE PLANS, A MATERIAL DATA SHEET WILL BE SUFFICIENT FOR VERIFICATION OF THE PROPOSED MATERIAL (NO ADDITIONAL CALCULATIONS WILL BE REQUIRED UNLESS REQUESTED BY THE ENGINEER). IF THE CONTRACTOR USES A DIFFERENT UNIT WEIGHT, CONSTRUCTION DETAILS AND SEALED ENGINEERING CALCULATIONS SHOWING MATERIALS, METHODS AND MEANS PROPOSED TO PRODUCE THE DESIRED WEIGHT REDUCTION ON THE EXISTING CULVERT USING "CELLULAR CONCRETE FILL" SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS SUBMISSION SHALL BE MADE 30 DAYS PRIOR TO ORDERING MATERIAL OR BEGINNING EXCAVATION FOR PLACEMENT OF LIGHTWEIGHT CELLULAR CONCRETE FILL.

7) PROVIDE A MATERIAL WITH A CAST UNIT WEIGHT OF 40 LBS/CUBIC FOOT OR LESS.



TYPICAL CULVERT SECTION SHOWING MINIMUM LATERAL LIMITS OF LIGHTWEIGHT FILL



CULVERT PIPE PROFILE

DATE: 3-MARCH-2019	CHECKED BY
DESIGNED BY: ______	______
DETAILED BY: M. Carpenter	E. Scott

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–71 / I–75

CROSSING
CELLULAR CONCRETE FILL DETAIL

SUBSURFACE DATA

ITEM NUMBER
06–0018.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

Addendum 2 - 7-31-19

SHEET NO.
_____

DRAWING NO.
00000

EPS GEOFOAM FILL DETAILS (GENERAL CONFIGURATION) 4X4 RCBC EXTENSION LT & RT OF US 25 STA 32+06.4

NOTE: THIS IS ONLY A TYPICAL EPS GEOFOAM FILL CONFIGURATION. ALL MEASUREMENTS AND SLOPES EXPLICITLY GIVEN ON THIS SHEET MUST BE FOLLOWED AND THE INDICATED MINIMUM LIGHTWEIGHT FILL VOLUME MUST BE MAINTAINED.

NOTES:

1) EXCAVATING THE EMBANKMENT FOR THE EPS GEOFOAM FILL INSTALLATION WILL INVOLVE SOME RISK. THEREFORE, TO PREVENT POTENTIAL DAMAGE TO THE ROADWAY, THE CONTRACTOR WILL BE ALLOWED 21 CONTINUOUS DAYS FROM BEGINNING OF THE REMOVAL OF THE EMBANKMENT SLOPE TO REPLACING THE EMBANKMENT SLOPE ON THE PROPOSED FINAL RECOMMENDED SLOPE. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE SOIL CUT DURING CONSTRUCTION. SHEETING AND SHORING MAY BE REQUIRED TO EXCAVATE AND CONSTRUCT THE EPS GEOFOAM FILL. THE DESIGNS OF ANY REQUIRED SHEETING OR SHORING SHALL BE PERFORMED BY THE CONTRACTOR'S ENGINEER.

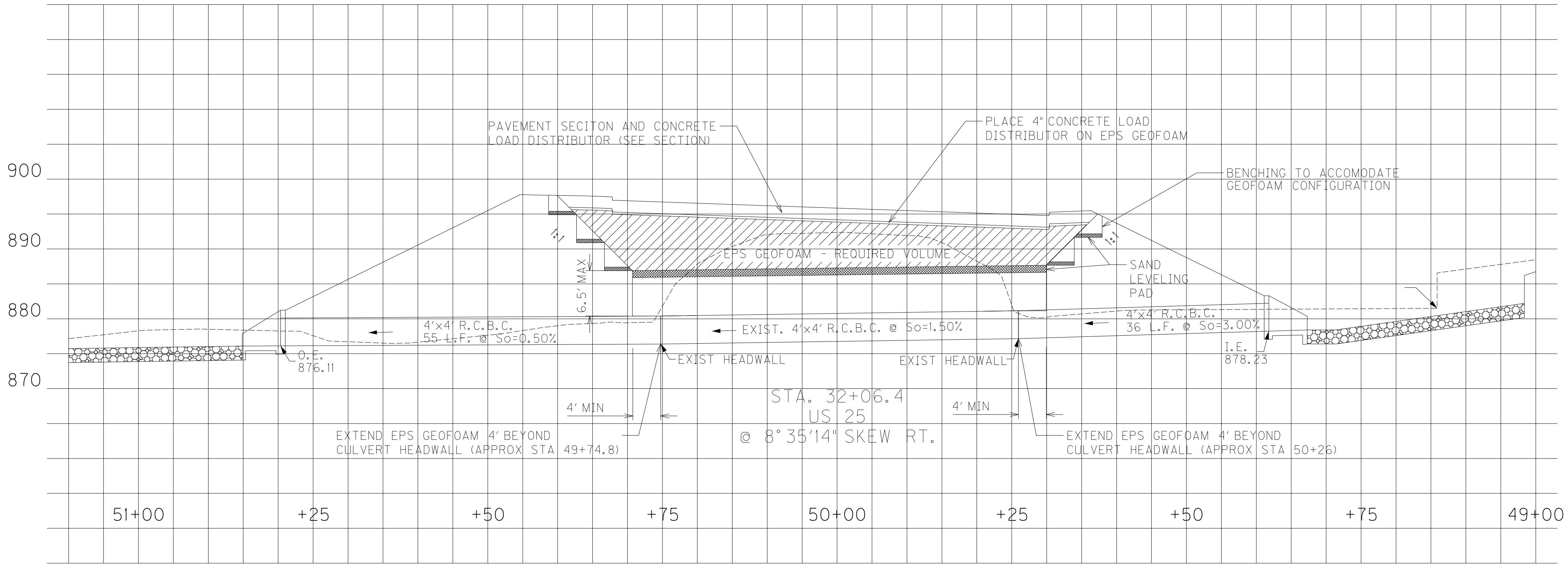
2) PRIOR TO GEOFOAM BLOCK PLACEMENT CONSTRUCT A SAND LEVELING PAD MEETING ALL REQUIREMENTS OF THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS. A GEOMEMBRANE SHALL BE PLACED OVER THE TOP AND SIDES OF THE OUTER BLOCKS. THE GEOMEMBRANE MATERIAL PROPERTIES AND PLACEMENT SHALL BE IN ACCORDANCE WITH THE THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS. THE MATERIAL COST AND PLACEMENT OF THE SAND LEVELING PAD AND GEOMEBRANE WILL BE INCIDENTAL TO THE UNIT BID PRICE FOR "EPS FOAM BLOCK".

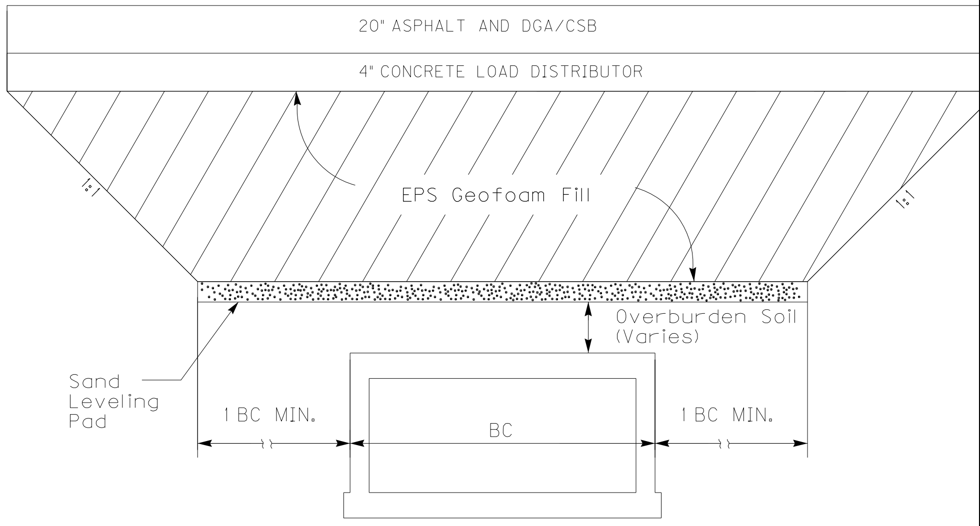
3) PLACE THE EPS GEOFOAM FILL MATERIAL AS SHOWN IN THE PLANS AND IN ACCORDANCE WITH THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS.

4) PAYMENT FOR THE EPS GEOFOAM FILL WILL BE MADE ON THE BASIS OF THE PLAN QUANTITIES. NO SEPARATE FIELD MEASUREMENT FOR EPS FOAM BLOCK SHALL BE MADE. THE FINAL QUANITIES WILL BE THE DESIGN PLAN QUANTITIES INCREASED OR DECREASED BY AUTHORIZED CHANGES. THE UNIT PRICE BID FOR "EPS FOAM BLOCK" SHALL BE FULL COMPENSATION FOR ALL ENGINEERING, MATERIALS, LABOR AND INCIDENTAL ITEMS NECESSARY TO CONSTRUCT THE EPS GEOFOAM FILL IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS.

5) EPS GEOFOAM FILL SHALL BE CONSTRUCTED OF MATERIAL APPROVED FOR USE BY THE KENTUCKY TRANSPORTATION CABINET. DETAILS SHOWN IN THESE PLANS FOR EPS GEOFOAM FILL REPRESENT LIMITS OF FILL WHERE THE DESIRED WEIGHT (PRESSURE) REDUCTION IS REQUIRED. IF THE CONTRACTOR PROPOSES TO USE THE UNIT WEIGHT SPECIFIED IN THE PLANS, A MATERIAL DATA SHEET WILL BE SUFFICIENT FOR VERIFICATION OF THE PROPOSED MATERIAL (NO ADDITIONAL CALCULATIONS WILL BE REQUIRED UNLESS REQUESTED BY THE ENGINEER). IF THE CONTRACTOR PROPOSES TO USE A UNIT WEIGHT DIFFERENT THAN WHAT WAS USED IN THE INITIAL CONFIGURATION, CONSTRUCTION DETAILS AND SEALED ENGINEERING CALCULATIONS SHOWING MATERIALS, METHODS AND MEANS PROPOSED TO PRODUCE THE DESIRED WEIGHT REDUCTION ON THE EXISTING CULVERT USING "EPS FOAM BLOCK" SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS SUBMISSION SHALL BE MADE 30 DAYS PRIOR TO ORDERING MATERIAL OR BEGINNING EXCAVATION FOR PLACEMENT OF EPS GEOFOAM FILL.

6) PROVIDE A GEOFOAM BLOCK WITH A UNIT WEIGHT OF 2.85 LBS/CUBIC FOOT OR LESS. SEE SECTION 2 OF THE SPECIAL NOTE FOR EPS FOAM BLOCK EMBANKMENTS.





TYPICAL CULVERT SECTION SHOWING MINIMUM LATERAL LIMITS OF LIGHTWEIGHT FILL

DATE: 3-MARCH-2019
CHECKED BY
DESIGNED BY: ______
DETAILED BY: M. Carpenter
E. Scott

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US–25
CROSSING
EPS GEOFOAM EMBANKMENT DETAIL

SUBSURFACE DATA

ITEM NUMBER
06–0018.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH
Addendum 2 - 7-31-19

SHEET NO.
____
DRAWING NO.
00000

LIGHTWEIGHT CELLULAR CONCRETE FILL DETAILS (GENERAL CONFIGURATION) 4X4 RCBC EXTENSION LT & RT OF US 25 STA 32+06.4

Note: This is only a typical Lightweight Cellular Concrete fill configuration. All measurements and slopes explicitly given on this sheet must be followed and the indicated minium lightweight fill volume must be maintained.

NOTES:

1) EXCAVATING THE EMBANKMENT FOR THE LIGHTWEIGHT CELLULAR CONCRETE FILL INSTALLATION WILL INVOLVE SOME RISK. THEREFORE, TO PREVENT POTENTIAL DAMAGE TO THE ROADWAY, THE CONTRACTOR WILL BE ALLOWED 21 CONTINUOUS DAYS FROM BEGINNING OF THE REMOVAL OF THE EMBANKMENT SLOPE TO REPLACING THE EMBANKMENT SLOPE ON THE PROPOSED FINAL RECOMMENDED SLOPE. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE SOIL CUT DURING CONSTRUCTION. TEMPORARY BACK SLOPE EXCAVATION LIMITS. SHEETING AND SHORING MAY BE REQUIRED TO EXCAVATE AND CONSTRUCT THE LIGHTWEIGHT CELLULAR CONCRETE FILL. THE DESIGNS OF ANY REQUIRED SHEETING OR SHORING SHALL BE PERFORMED BY THE CONTRACTOR'S ENGINEER.

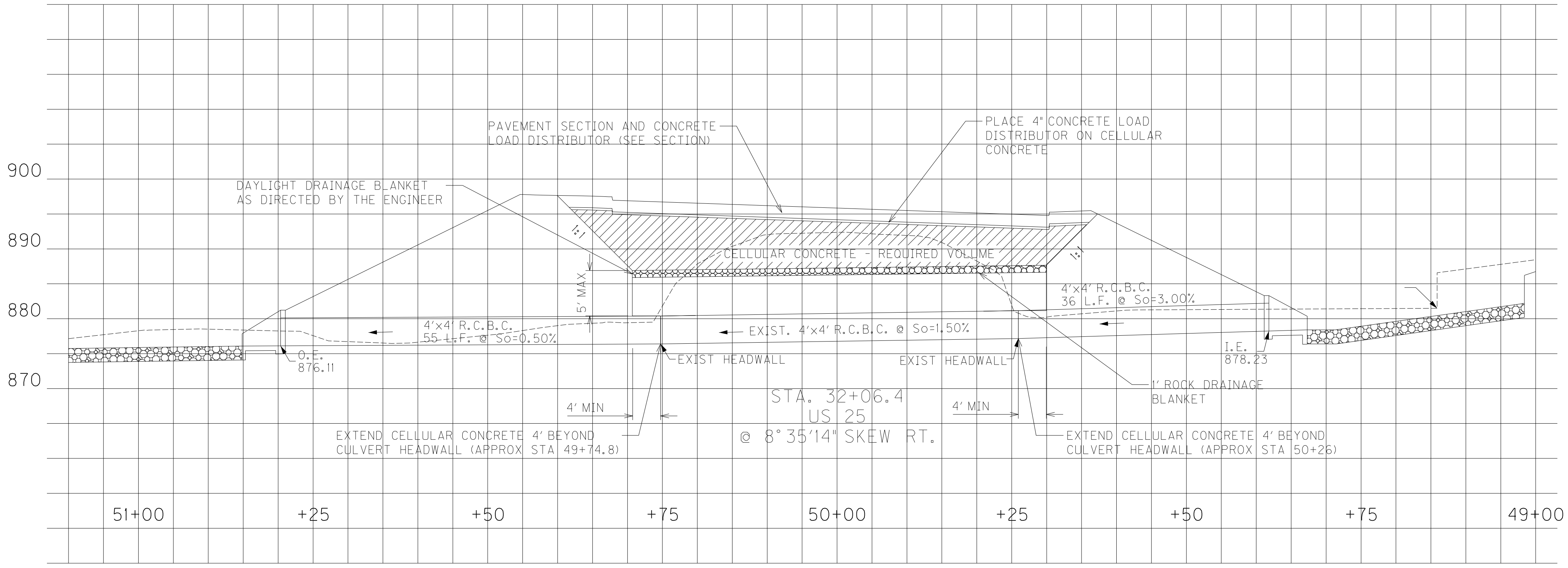
2) A ONE-FOOT COARSE AGGREGATE ROCK DRAINAGE BLANKET, IN ACCORDANCE WITH SECTION 805 OF THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SHALL BE PLACED ON THE EXCAVATED EMBANKMENT SIDE SLOPE FOR A DRAINAGE BLANKET. THE DRAINAGE BLANKET SHALL BE WRAPPED WITH TYPE IV GEOTEXTILE FABRIC IN ACCORDANCE WITH SECTIONS 214 AND 843 OF THE CURRENT STANDARDS SPECIFICATIONS. THE DRAINAGE BLANKET CONSTRUCTION WILL BE INCIDENTAL TO THE UNIT BID PRICE FOR "CELLULAR CONCRETE FILL".

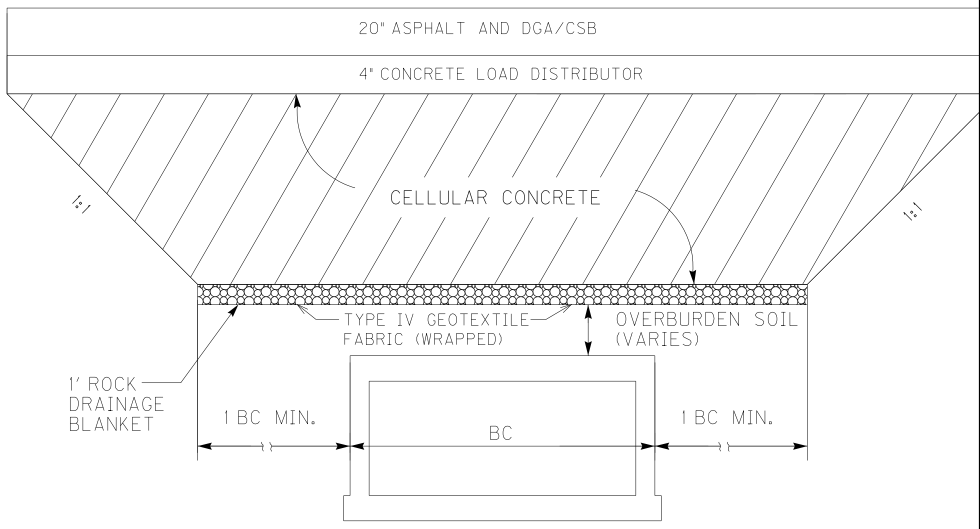
3) PLACE THE CELLULAR CONCRETE FILL MATERIAL AS SHOWN IN THE PLANS AND IN ACCORDANCE WITH THE SPECIAL NOTE FOR CELLULAR CONCRETE FILL.

4) PAYMENT FOR THE CELLULAR CONCRETE FILL WILL BE MADE ON THE BASIS OF THE PLAN QUANTITIES. NO SEPARATE FIELD MEASUREMENT FOR CELLULAR CONCRETE FILL SHALL BE MADE. THE FINAL QUANTITIES WILL BE THE DESIGN PLAN QUANTITIES INCREASED OR DECREASED BY AUTHORIZED CHANGES. THE UNIT PRICE BID FOR "CELLULAR CONCRETE FILL" SHALL BE FULL COMPENSATION FOR ALL ENGINEERING, MATERIALS, LABOR AND INCIDENTAL ITEMS NECESSARY TO CONSTRUCT THE LIGHTWEIGHT CELLULAR CONCRETE FILL IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS.

5) CELLULAR CONCRETE SHALL BE CONSTRUCTED OF MATERIAL APPROVED FOR USE BY THE KENTUCKY TRANSPORTATION CABINET. DETAILS SHOWN IN THESE PLANS FOR CELLULAR CONCRETE FILL REPRESENT LIMITS OF FILL WHERE THE DESIRED WEIGHT (PRESSURE) REDUCTION IS REQUIRED. IF THE CONTRACTOR PROPOSES TO USE THE UNIT WEIGHT SPECIFIED IN THE PLANS, A MATERIAL DATA SHEET WILL BE SUFFICIENT FOR VERIFICATION OF THE PROPOSED MATERIAL (NO ADDITIONAL CALCULATIONS WILL BE REQUIRED UNLESS REQUESTED BY THE ENGINEER). IF THE CONTRACTOR USES A DIFFERENT UNIT WEIGHT, CONSTRUCTION DETAILS AND SEALED ENGINEERING CALCULATIONS SHOWING MATERIALS, METHODS AND MEANS PROPOSED TO PRODUCE THE DESIRED WEIGHT REDUCTION ON THE EXISTING CULVERT USING "CELLULAR CONCRETE FILL" SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. THIS SUBMISSION SHALL BE MADE 30 DAYS PRIOR TO ORDERING MATERIAL OR BEGINNING EXCAVATION FOR PLACEMENT OF LIGHTWEIGHT CELLULAR CONCRETE FILL.

6) PROVIDE A MATERIAL WITH A CAST UNIT WEIGHT OF 40 LBS/CUBIC FOOT OR LESS.





TYPICAL CULVERT SECTION SHOWING MINIMUM LATERAL LIMITS OF LIGHTWEIGHT FILL

DATE: 3-MARCH-2019
CHECKED BY
DESIGNED BY: ______
DETAILED BY: M. Carpenter
E. Scott

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US–25

CROSSING
CELLULAR CONCRETE FILL DETAIL

SUBSURFACE DATA

ITEM NUMBER
06–0018.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH
Addendum 2 - 7-11-19

SHEET NO.
____
DRAWING NO.
00000

Attachment #3

Revised Coordinate Data Sheet

(updated boring locations)

COORDINATE DATA SUBMISSION FORM

KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone **Date** 4/2/2019

Road Number I-71/75 Richwood

Survey Crew / Consultant ____

Contact Person ____

Item # ____

Mars # ____

Project # ____

Notes: Updated Stations/Offsets for Best Pal Road realignment.

(circle one)

Elevation Datum [✓ NAVD88] Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	OLD STATION	OLD OFFSET	ELEVATION (ft)	NEW STATION	NEW OFFSET
18	38.917891736N	84.625250001W	18	21+00	60 R	928.158	21+02.28	59.38 R
158	38.917747684N	84.625292161W	158	20+50	40 R	928.641	20+50.26	38.75 R
159	38.918304938N	84.625361262W	159	22+50	52 R	917.811	22+49.08	51.42 R
160	38.918593836N	84.626075491W	160	24+50	33 L	905.203	24+50.95	31.88 L
161	38.919155505N	84.626281244W	161	26+50	17 R	902.655	26+52.30	17.00 R
162	38.919676840N	84.626539425W	162	28+50	17 R	913.989	28+55.76	3.61 L
163	38.920067555N	84.626543319W	163	30+50	17 R	910.055	29+78.57	43.75 L
164	38.920402534N	84.625986324W	164	32+50	17 R	920.734	*	*

* Beyond new construction limits

COORDINATE DATA SUBMISSION FORM

KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone **Date** 4/2/2019

Road Number I-71/75 Richwood

Survey Crew / Consultant ______

Contact Person ______

Item # ______

Mars # ______

Project # ______

Notes: Updated Stations/Offsets for old Ramp C borings now on I-75/I-71.

Elevation Datum (circle one) [✓ NAVD88] Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	OLD STATION	OLD OFFSET	ELEVATION (ft)	NEW STATION	NEW OFFSET
90	38.913172712N	84.629015382W	90	319+00	28.0' Rt.	878.731	443+49.1	141.1' Rt.
91	38.912627523N	84.628920521W	91	321+00	23.0' Rt.	867.263	441+49.8	122.9' Rt.
92	38.912083467N	84.628848322W	92	323+00	23.0' Rt.	864.604	439+50.5	110.1' Rt.
93	38.911534963N	84.628812465W	93	325+00	30.0' Rt.	851.739	437+49.0	108.4' Rt.

M E M O R A N D U M

cc: J. VanZee
C. VanZee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
W. Hagerman (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch
Division of Structural Design

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundations Section

DATE: December 12, 2018

SUBJECT: **Boone County**
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton
Retaining Wall #1, KY 338 at Triple Crown Blvd
Left Sta. 103+88 to 106+10
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for use in development of structure plans. The drilling for the project was performed by the consulting firm of Horn and Associates, Inc.

The proposed structure is part of an interchange reconstruction project at the interchange between I-75 and KY 338 in Richwood, KY. The proposed structure is located along KY 338 at approximate mile point 0.75, just west of the intersection with Triple Crown Blvd.

2.0 SITE GEOLOGIC CONDITIONS

This structure is located in the Union Geologic Quadrangle (GQ# 779). The geologic mapping indicates that the bedrock at this site consists primarily of the Fairview formation.

3.0 FIELD INVESTIGATION

Five (5) borings were taken for this structure. Two (2) of the borings were sample and core holes and three (3) were mechanical rockline soundings. The drill crew delivered the rock core and soil samples to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores. The soil samples were classified and tested by HDR, Inc.

4.0 LABORATORY TESTING

The soil samples obtained from the borings were determined to consist of inorganic low-plasticity clays. The soil samples were designated CL using the Unified Soil Classification System.

5.0 SUBSURFACE CONDITIONS

Depths to rock/refusal varied from 1.0 ft to 3.0 ft. Rock/refusal elevations varied from 814.0 to

817.7 ft. Rock cores obtained for this project revealed brown and gray, clayey and silty shale interbedded with medium to coarse grained fossiliferous limestone. The shales encountered in these rock cores were determined to be nondurable. The KY RQD values for the rock cores taken at this proposed bridge location ranged 0% to 28% and core recoveries ranged from 80% to 100%.

6.0 ENGINEERING ANALYSIS

Analyses indicate that a Standard Gravity Wall may be utilized at this location. The wall shall comply with Case III of Standard Drawing No. RGX-002-09. By following these requirements, LRFD checks for eccentricity (overturning), bearing capacity, and sliding were satisfied. Native soil may be used as backfill behind the wall. Because of the low heights of the wall and the subsurface conditions, slope stability and settlement analyses were not required.

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternative.

7.0 RECOMMENDATIONS

7.1 The wall shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

7.2 Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

7.3 The following parameters shall be utilized for design of the wall:

Unit weight of soil embankment backfill:	127 pcf
Friction angle of soil embankment backfill:	28°
Cohesion of soil embankment backfill:	0 psf
Unit weight of existing foundation soils:	125 pcf
Friction angle of existing foundation soils:	0°
Cohesion of existing foundation soils:	1375 psf

7.3.1 Use wall dimensions in accordance with Case III of Standard Drawing RGX-002-09.

7.3.2 Embedment of the footing must be a minimum of 2 feet below final grade or ¼ total wall height, whichever is greater.

7.3.3 The backfill behind the wall may consist of native soils. The materials shall be compacted in accordance with Section 206 in the Standard Specifications for Road and Bridge Construction, current edition.

7.3.4 If alternate wall types other than the planned Gravity Retaining Wall are utilized, size the wall footings at Service Limit State using Factored Nominal Bearing Resistances given below. For checking bearing resistance at Strength and Extreme Limit States, use Resistance Factors of 0.55 and 1.0, respectively, applied to the Nominal Bearing Resistance.

Bearing Surface	**Factored Nominal Bearing Resistance at Service Limit State**	**Nominal Bearing Resistance**
Existing Soil	2.3 ksf	7.0 ksf

7.3.5 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.
7.3.6 Solid rock excavation may be required for installation of this retaining wall.
7.3.7 The wall designer shall verify wall stability based on final wall design dimensions.
7.3.8 Refer to the attached plan sheet "Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls" for additional details.

7.4 Plan Notes

Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls," at the appropriate locations in the plans.

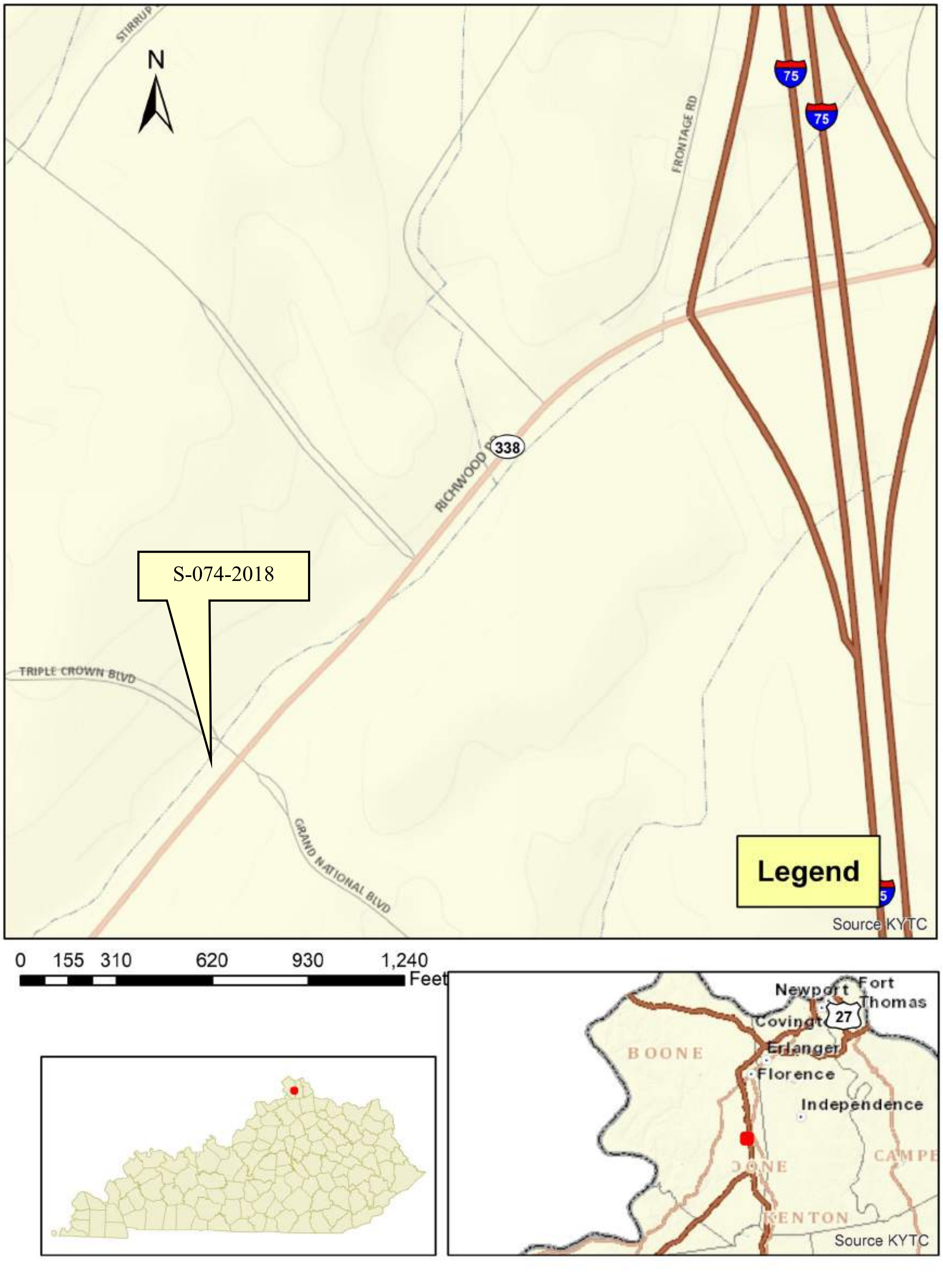
The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls**
- **Coordinate Data Sheet**

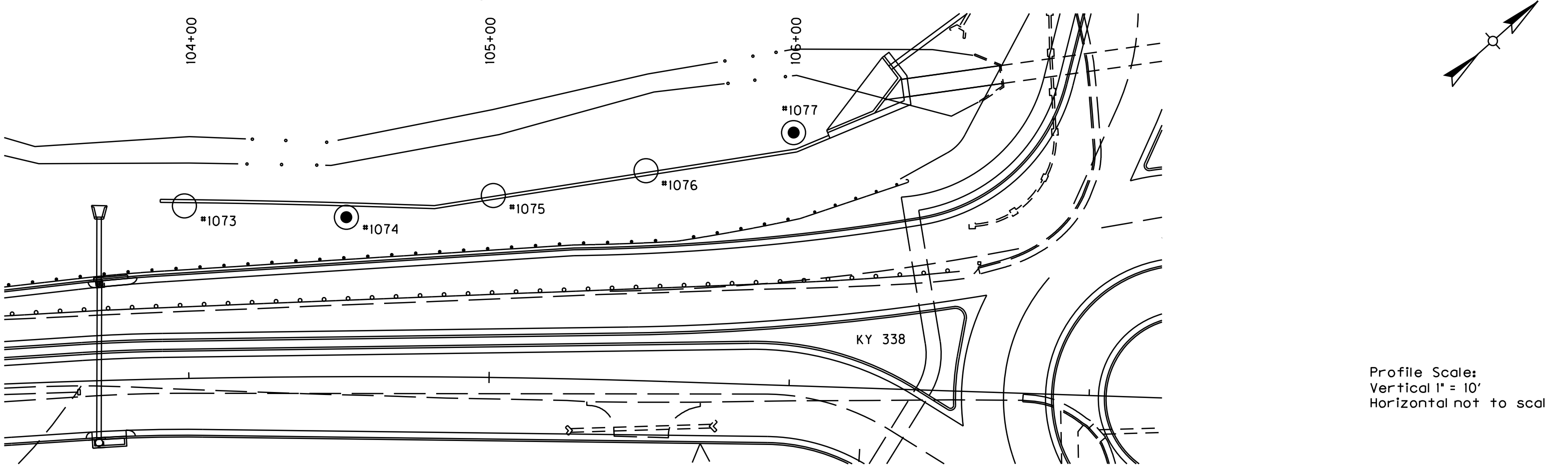
S-074-2018
Boone Co., KY 338
December 12, 2018
Item #: 6-18.00

Project Location Map:



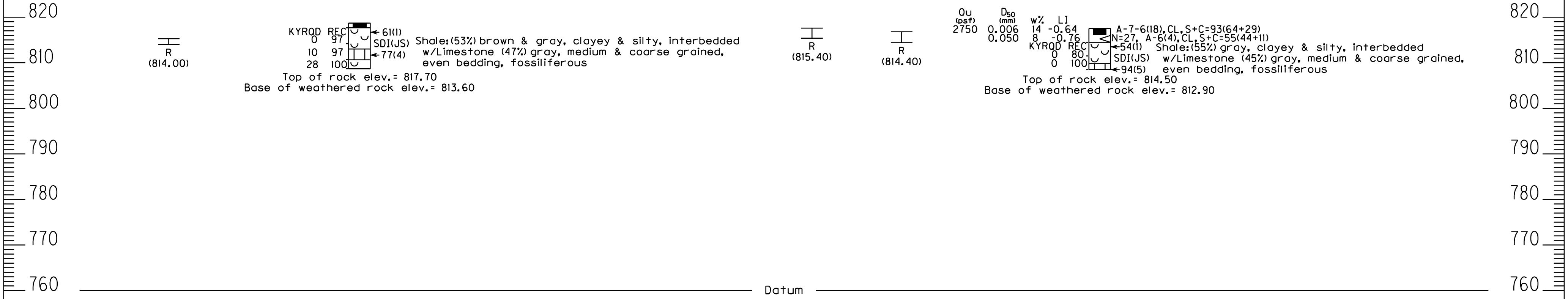
SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1073	1074	1075	1076	1077
Station	103+99.70	104+52.60	105+00.60	105+50.20	105+98.70
Offset	57.50 ft. Lt.	53.10 ft. Lt.	60.60 ft. Lt.	70.00 ft. Lt.	84.30 ft. Lt.
Elev. (NAVD 88 datum)	815.30	818.70	817.60	816.80	817.50



Hole 1074:

KYRQD	REC
0	97
10	97
28	100

61(1)
SDI(JS)
77(4)

Shale:(53%) brown & gray, clayey & silty, interbedded w/Limestone (47%) gray, medium & coarse grained, even bedding, fossiliferous

Top of rock elev.= 817.70
Base of weathered rock elev.= 813.60

Hole 1077:

Qu (psf)	D_{50} (mm)	w%	LI
2750	0.006	14	-0.64
	0.050	8	-0.76

A-7-6(18), CL, S+C=93(64+29)
N=27, A-6(4), CL, S+C=55(44+11)

KYRQD	REC
0	80
0	100

54(1)
SDI(JS)
94(5)

Shale:(55%) gray, clayey & silty, interbedded w/Limestone (45%) gray, medium & coarse grained, even bedding, fossiliferous

Top of rock elev.= 814.50
Base of weathered rock elev.= 812.90

Datum

The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	T. SHEFFIELD

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS
COUNTY
BOONE
ROUTE KY 338
CROSSING Retaining Wall #1
SUBSURFACE DATA
PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH
SHEET NO.
DRAWING NO. 00000

S-074-18
ITEM NUMBER
6-18.00

SHEET LOCATION:
FILE NAME: $$$$design$file$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. or 1/4 total wall height, whichever is greater, from finished grade in front of the wall to bottom of wall.

Use wall dimensions in accordance with Case III of the Standard Drawing RGX-002-09. For walls with heights (H) exceeding 12 ft., the base width (B) shall be B=0.5H+1.

Backfill all walls with Insitu Soil material as outlined on this sheet.

Bearing Surface	Nominal Bearing Resistance	Factored Nominal Bearing Resistance at the Service Limit State
Soil	7.0 ksf	2.3 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Existing Soil	0	28	127
Foundation Soils			
Existing	1375	0	125

The wall designer shall verify wall stability based on final wall design dimensions.

Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

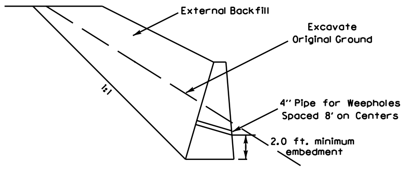
Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

A large block Retaining Wall without Geogrid or Geotextile Reinforcement may be suitable at this location.

Solid rock excavation may be required for installation of this retaining wall. If the bedrock becomes softened at bearing elevation, the softened material shall be undercut to suitable bearing material prior to placing the concrete.

EXCAVATION AND BACKFILL REPLACEMENT

Cast-In-Place Retaining Wall



DATE: 16-OCT-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: T. SHEFFIELD	D. GREER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 338

CROSSING
KY 338 at Triple Crown Blvd

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

S–074–2018

ITEM NUMBER
6–18.00

Addendum 2 -- 7-11-19

S-074-2018 06-0018.00 Kentucky Transportation Cabinet

ID	Latitude	Longitude	Hole	Station	Offset	Elevation(ft)	Comments
1	38.91288198	-84.63673681	1073	103+99.7	-57.5	815.34	
2	38.91298073	-84.63659531	1074	104+52.6	-53.1	818.74	
3	38.91308983	-84.63649582	1075	105+00.6	-60.6	817.61	
4	38.91320519	-84.63639763	1076	105+50.2	-70	816.77	
5	38.91332798	-84.63631442	1077	105+98.7	-84.3	817.49	

M E M O R A N D U M

cc: J. VanZee
C. VanZee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
W. Hagerman (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch
Division of Structural Design

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundations Section

DATE: March 15, 2019

SUBJECT: **Boone County**
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton
Retaining Wall #1, KY 338 at Triple Crown Blvd
Left Sta. 103+88 to 106+10
Geotechnical Engineering Structure Foundation Report Addendum

This report addendum serves to address the changes to the wall configuration provided by the designer in an email dated Friday, March 8, 2019. To summarize the changes; the retaining wall no longer ties into the proposed headwall of the adjacent 72” culvert extension, but continues on to wrap around the proposed 72” headwall, resulting in an additional length of about 105 ft.

The recommendations from the original report (S-074-2018) still apply from wall station 2103+90 to 2106+00. The recommendations contained in this addendum apply from wall station 2106+00 to 2107+20. The special note sheet attached to this report will replace the special note sheet issued with report S-074-2018 and contains all necessary notes for the entire length of the wall.

1.0 ENGINEERING ANALYSIS

Analyses indicate that a Standard Gravity Wall bearing on Granular Embankment extended to bedrock may be utilized at this location. The wall shall comply with Case III of Standard Drawing No. RGX-002-09. By following these requirements, LRFD checks for eccentricity (overturning), bearing capacity, and sliding were satisfied. Native soil may be used as backfill behind the wall. Because of the low heights of the wall and the subsurface conditions, slope stability and settlement analyses were not required.

Excavation of the existing soil down to bedrock and replacing with Granular Embankment up to the bearing elevation of the retaining wall is recommended to serve several purposes. Doing so reduces the lateral loads from the retaining wall and retained soil applied to the adjacent proposed 72” culvert headwall. The granular embankment material also reduces the loads applied to the proposed culvert pipe extension on top of which the retaining wall is being placed. Additionally, the granular replacement reduces some uncertainty concerning the bearing capacity of typical compacted fill material on which this portion of the retaining wall would otherwise be placed.

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternative.

2.0 RECOMMENDATIONS

2.1 The wall shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

2.2 Excavate existing overburden soil down to bedrock and replace with Granular Embankment up to the bearing elevation.

2.3 Where granular replacement of the bearing material is required, use granular material meeting the requirements of "Granular Embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size shall be 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment in accordance with Section 214 and 843 of the Standard Specifications, current edition.

2.4 Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

2.5 The following parameters shall be utilized for design of the wall:

Unit weight of soil embankment backfill:	127 pcf
Friction angle of soil embankment backfill:	28°
Cohesion of soil embankment backfill:	0 psf
Unit weight of Granular Embankment foundation:	115 pcf
Friction angle of Granular Embankment foundation:	38°
Cohesion of Granular Embankment foundation:	0 psf

2.5.1 Use wall dimensions in accordance with Case III of Standard Drawing RGX-002-09.

2.5.2 Embedment of the footing must be a minimum of 2 feet below finished grade.

2.5.3 The backfill behind the wall may consist of native soils. The materials shall be compacted in accordance with Section 206 in the Standard Specifications for Road and Bridge Construction, current edition.

2.5.4 If alternate wall types other than the planned Gravity Retaining Wall are utilized, size the wall footings at Service Limit State using Factored Nominal Bearing Resistances given below. For checking bearing resistance at Strength and Extreme Limit States, use Resistance Factors of 0.55 and 1.0, respectively, applied to the Nominal Bearing Resistance.

Bearing Surface	**Factored Nominal Bearing Resistance at Service Limit State**	**Nominal Bearing Resistance**
Existing Soil	6.7 ksf	20.1 ksf

2.5.5 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

2.5.6 The wall designer shall verify wall stability based on final wall design dimensions.

2.5.7 Refer to the attached plan sheet "Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls" for additional details.

2.6 Plan Notes

Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls," at the appropriate locations in the plans.

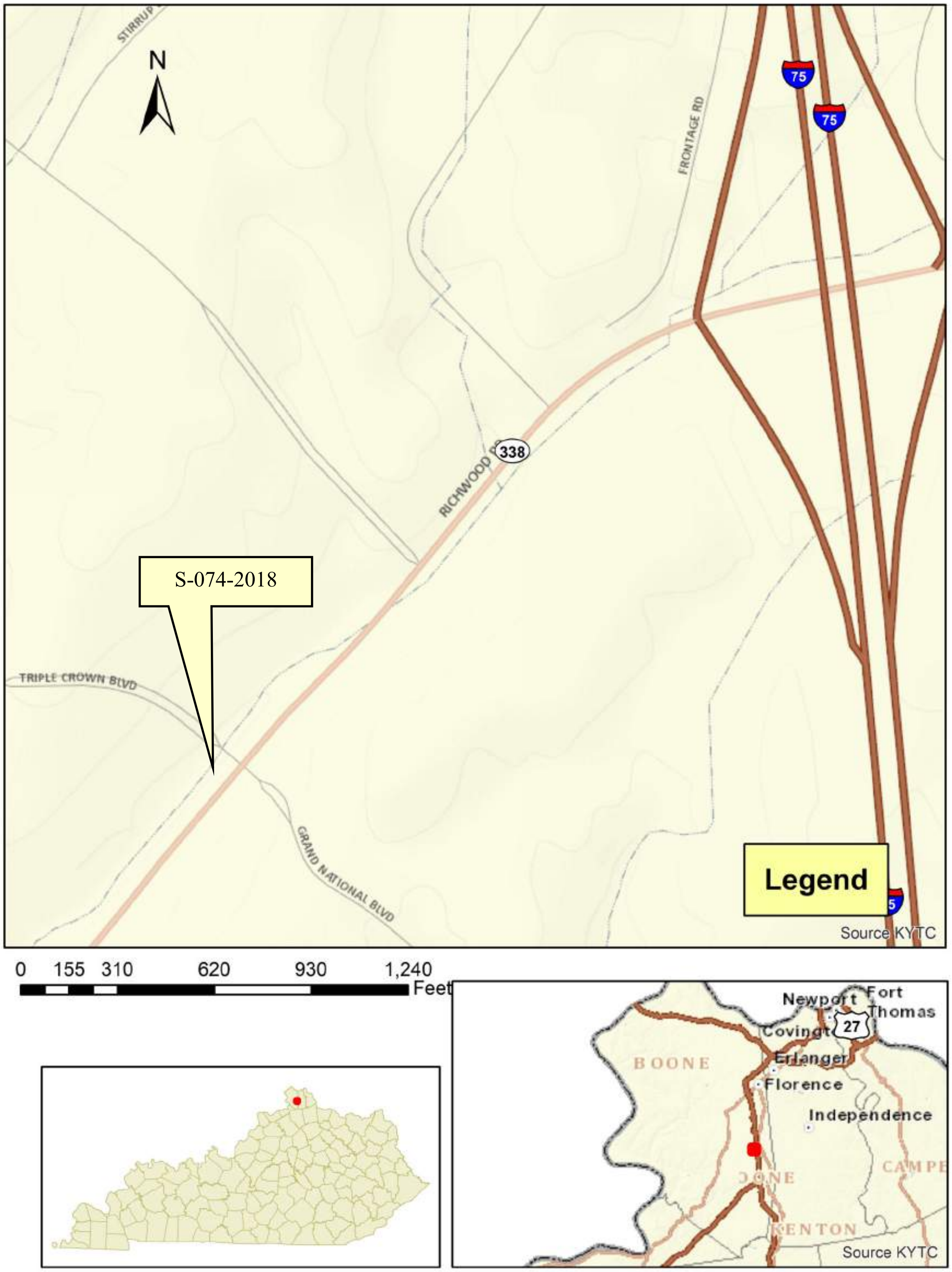
The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls**
- **Retaining Wall Profile**
- **Coordinate Data Sheet**

SA-003-2019
Boone Co., KY 338
March 15, 2019
Item #: 6-18.00

Project Location Map:



SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

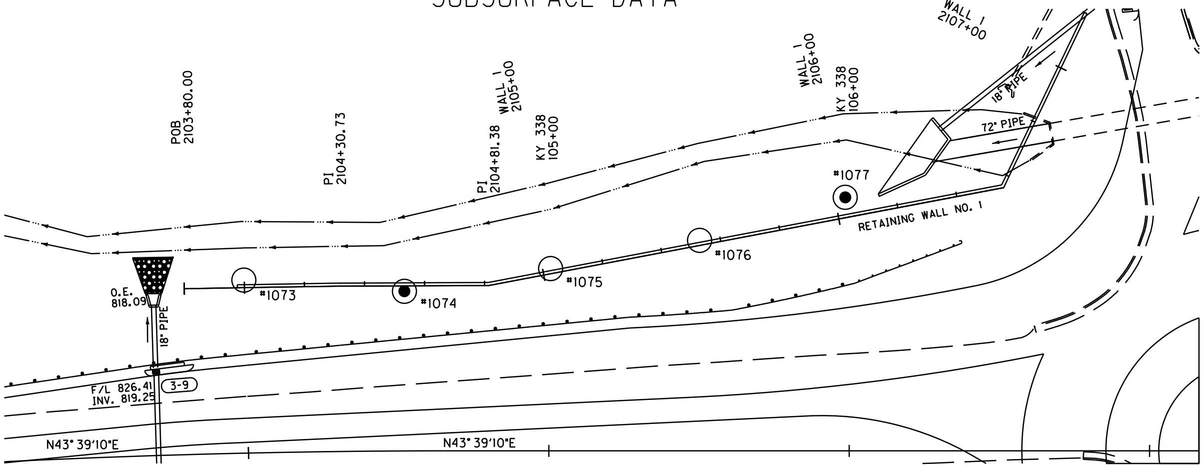
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

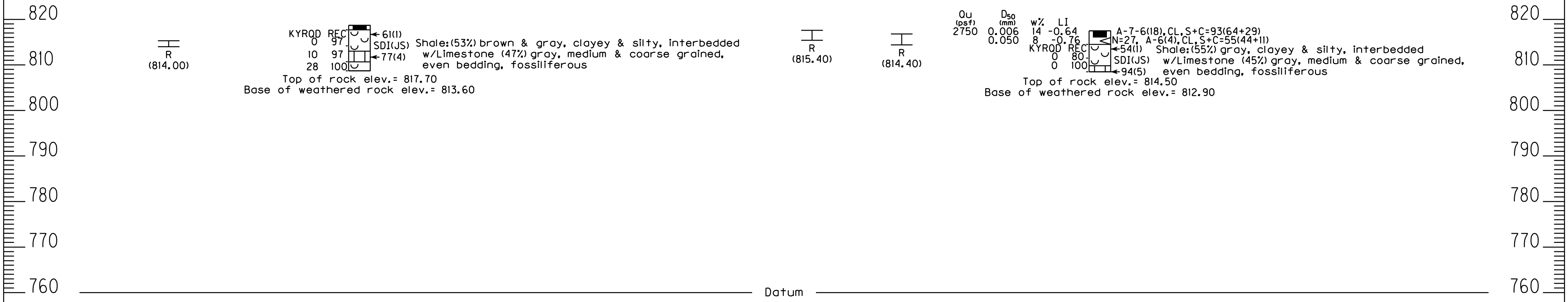
SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1073	1074	1075	1076	1077
Station	103+99.70	104+52.60	105+00.60	105+50.20	105+98.70
Offset	57.50 ft. Lt.	53.10 ft. Lt.	60.60 ft. Lt.	70.00 ft. Lt.	84.30 ft. Lt.
Elev. (NAVD 88 datum)	815.30	818.70	817.60	816.80	817.50



The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE: 15-MARCH-2019	CHECKED BY
DESIGNED BY:	
DETAILED BY: T. SHEFFIELD	D. GREER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 338

CROSSING
Retaining Wall #1

SA–003–19

SUBSURFACE DATA

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Wall #1
KY 338 at Triple Crown Blvd

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Use wall dimensions in accordance with Case III of the Standard Drawing RGX-002-09.

Backfill all walls with Insitu Soil material as outlined on this sheet.

Wall Station	Bearing Surface	Nominal Bearing Resistance	Factored Nominal Bearing Resistance at the Service Limit State
2103+90 to 2106+00	Soil	7.0 ksf	2.3 ksf
2106+00 to 2107+20	Granular Embankment	20.1 ksf	6.7 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Existing Soil	0	28	127
Foundation Material			
Granular Embankment	0	38	115
Existing Soil	1375	0	125

The wall designer shall verify wall stability based on final wall design dimensions.

Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

A large block Retaining Wall without Geogrid or Geotextile Reinforcement may be suitable at this location.

Excavate existing overburden soil down to bedrock and replace with Granular Embankment up to the bearing elevation, as shown on this sheet.

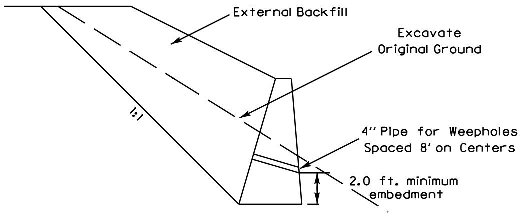
Where granular replacement of the bearing material is required, use granular material meeting the requirements of "Granular Embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size shall be 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment in accordance with Section 214 and 843 of the Standard Specifications, current edition.

Solid rock excavation may be required for installation of this retaining wall. If the bedrock becomes softened at bearing elevation, the softened material shall be undercut to suitable bearing material prior to placing the concrete.

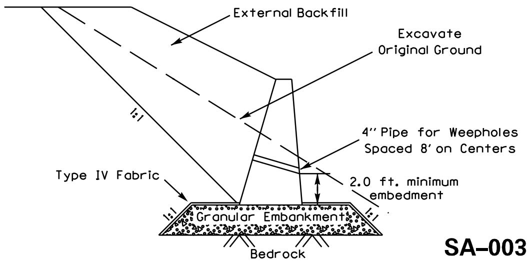
EXCAVATION AND BACKFILL REPLACEMENT

Cast-In-Place Retaining Wall

2103+90 to 2106+00



2106+00 to 2107+20



SA–003–2019

ITEM NUMBER
6–18.00

DATE: 16-MAR-2019
CHECKED BY
DESIGNED BY:
DETAILED BY: T. SHEFFIELD
D. GREER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 338
CROSSING
KY 338 at Triple Crown Blvd

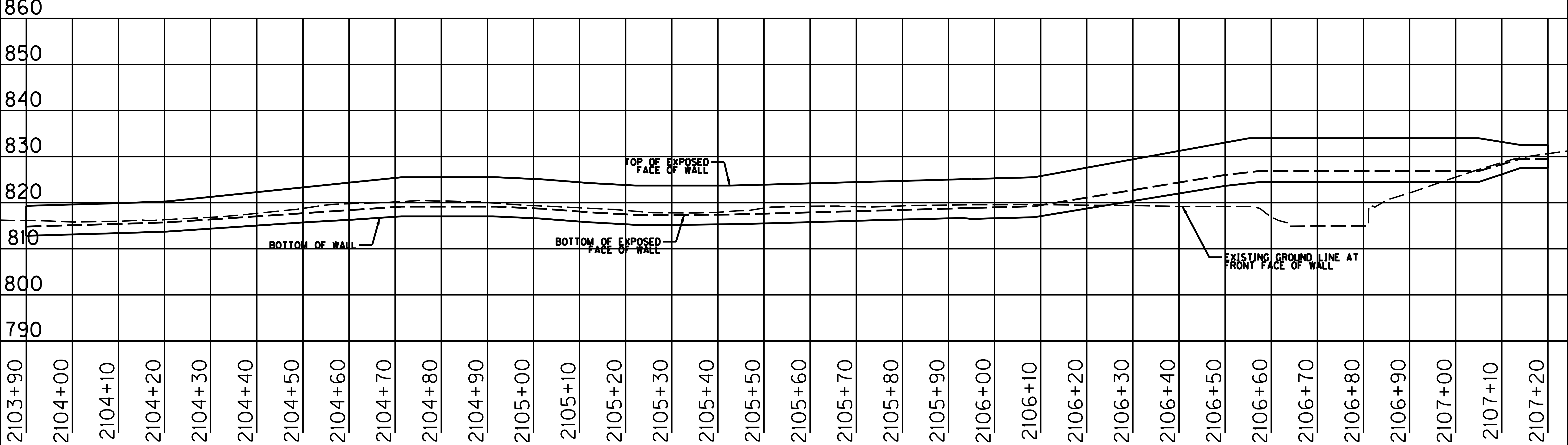
SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.
DRAWING NO.
00000

SHEET LOCATION:
FILE NAME: $$$$design$file$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

WALL 1


860
850
840
830
820
810
800
790
TOP OF EXPOSED FACE OF WALL
BOTTOM OF WALL
BOTTOM OF EXPOSED FACE OF WALL
EXISTING GROUND LINE AT FRONT FACE OF WALL
2103+90
2104+00
2104+10
2104+20
2104+30
2104+40
2104+50
2104+60
2104+70
2104+80
2104+90
2105+00
2105+10
2105+20
2105+30
2105+40
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2105+60
2105+70
2105+80
2105+90
2106+00
2106+10
2106+20
2106+30
2106+40
2106+50
2106+60
2106+70
2106+80
2106+90
2107+00
2107+10
2107+20

S-074-2018 06-0018.00 Kentucky Transportation Cabinet

ID	Latitude	Longitude	Hole	Station	Offset	Elevation(ft)	Comments
1	38.91288198	-84.63673681	1073	103+99.7	-57.5	815.34	
2	38.91298073	-84.63659531	1074	104+52.6	-53.1	818.74	
3	38.91308983	-84.63649582	1075	105+00.6	-60.6	817.61	
4	38.91320519	-84.63639763	1076	105+50.2	-70	816.77	
5	38.91332798	-84.63631442	1077	105+98.7	-84.3	817.49	

M E M O R A N D U M

cc: J. VanZee
C. VanZee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
W. Hagerman (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch
Division of Structural Design

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundations Section

DATE: March 20, 2019

SUBJECT: **Boone County**
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton
Retaining Wall #1A, KY 338 at Triple Crown Blvd
Left Sta. 107+72 to 108+28
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for use in development of structure plans. The drilling for the project was performed by the consulting firm of Horn and Associates, Inc.

The proposed structure is part of an interchange reconstruction project at the interchange between I-75 and KY 338 in Richwood, KY. The proposed structure is located along KY 338 at approximate mile point 0.75, just east of the intersection with Triple Crown Blvd.

2.0 SITE GEOLOGIC CONDITIONS

This structure is located in the Union Geologic Quadrangle (GQ# 779). The geologic mapping indicates that the bedrock at this site consists primarily of the Fairview formation.

3.0 FIELD INVESTIGATION

No drilling was performed for this particular structure. Drilling was performed, however, for a nearby retaining wall located along KY 338 on the west side of the intersection with Triple Crown Blvd. The results from this drilling can be found in the previously issued structure report S-074-2018.

To supplement the adjacent drilling information, hand driven rod soundings were taken by members of the KYTC Geotechnical Branch in the vicinity of the proposed wall.

4.0 LABORATORY TESTING

The soil samples obtained from the adjacent retaining wall consisted of inorganic low-plasticity clays. The soil samples were designated CL using the Unified Soil Classification System.

5.0 SUBSURFACE CONDITIONS

When drilling for the nearby retaining wall, depths to rock/refusal varied from 1.0 ft to 3.0 ft. Rock/refusal elevations varied from 814.0 to 817.7 ft. Rock cores obtained for that structure revealed brown and gray, clayey and silty shale interbedded with medium to coarse grained fossiliferous limestone. The shales encountered in these rock cores were determined to be nondurable. The KY RQD values for the rock cores taken at this proposed bridge location ranged 0% to 28% and core recoveries ranged from 80% to 100%.

Depths to refusal for the hand driven rod soundings taken at this proposed structure location were approximately 1.0 ft. Refusal elevations for these rod soundings were approximately 814 ft.

6.0 ENGINEERING ANALYSIS

Analyses indicate that a Standard Gravity Wall may be utilized at this location. The wall shall comply with Case II of Standard Drawing No. RGX-002-09. By following these requirements, LRFD checks for eccentricity (overturning), bearing capacity, and sliding were satisfied. Native soil may be used as backfill behind the wall. Because of the low heights of the wall and the subsurface conditions, slope stability and settlement analyses were not required.

The existing overburden should be excavated down to bedrock and replaced with **Granular Embankment** up to the bearing elevation of the wall from **Wall Station 2051+00 to 2051+35**. Doing so reduces the lateral loads from the retaining wall and retained soil applied to the adjacent proposed 72" culvert headwall. The granular embankment material also reduces the loads applied to the proposed culvert pipe extension on top of which the retaining wall is being placed. Additionally, the granular replacement reduces some uncertainty concerning the bearing capacity of typical compacted fill material on which this portion of the retaining wall would otherwise be placed.

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternative.

7.0 RECOMMENDATIONS

7.1 The wall shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

7.2 Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

7.3 Where granular replacement of the bearing material is required, use granular material meeting the requirements of "Granular Embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size shall be 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment in accordance with Section 214 and 843 of the Standard Specifications, current edition.

7.4 The following parameters shall be utilized for design of the wall:

Unit weight of soil embankment backfill:	127 pcf
Friction angle of soil embankment backfill:	28°
Cohesion of soil embankment backfill:	0 psf
Unit weight of existing foundation soils:	125 pcf
Friction angle of foundation soils:	0°
Cohesion of foundation soils:	1300 psf
Unit weight of Granular Embankment:	115 pcf
Friction angle of Granular Embankment:	38°
Cohesion of Granular Embankment:	0 psf

7.4.1 Use wall dimensions in accordance with Case II of Standard Drawing RGX-002-09.

7.4.2 Embedment of the footing must be a minimum of 2 feet below final grade.

7.4.3 The backfill behind the wall may consist of native soils. The materials shall be compacted in accordance with Section 206 in the Standard Specifications for Road and Bridge Construction, current edition.

7.4.4 If alternate wall types other than the planned Gravity Retaining Wall are utilized, size the wall footings at Service Limit State using Factored Nominal Bearing Resistances given below. For checking bearing resistance at Strength and Extreme Limit States, use Resistance Factors of 0.55 and 1.0, respectively, applied to the Nominal Bearing Resistance.

Bearing Surface	**Factored Nominal Bearing Resistance at Service Limit State**	**Nominal Bearing Resistance**
Existing Soil	2.2 ksf	6.6 ksf
Granular Embankment	6.7 ksf	20.1 ksf

7.4.5 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

7.4.6 The wall designer shall verify wall stability based on final wall design dimensions.

7.4.7 Refer to the attached plan sheet "Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls" for additional details.

7.5 Plan Notes

Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls," at the appropriate locations in the plans.

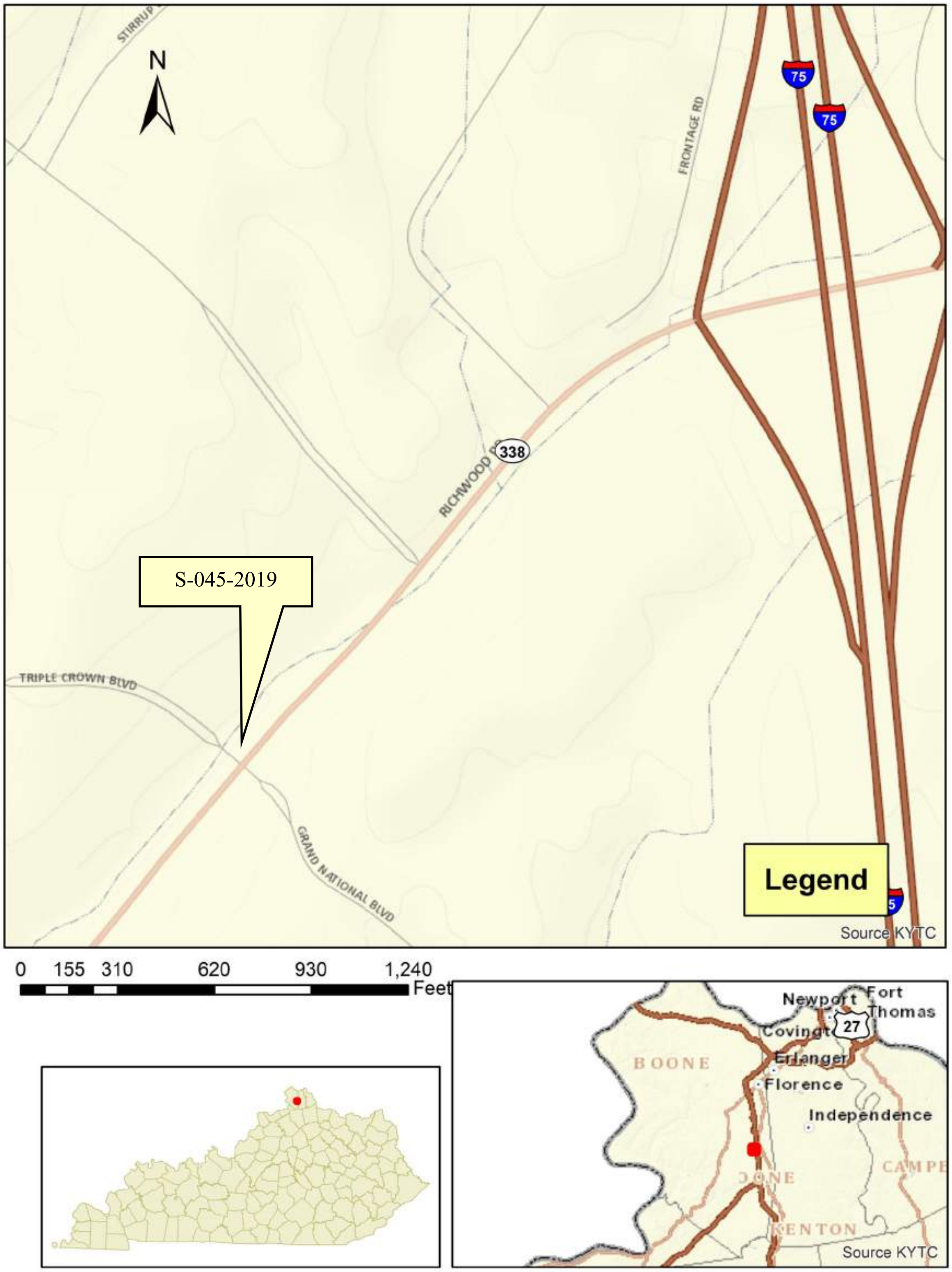
The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Geotechnical Notes for Cast-In-Place Non-Reinforced Gravity Walls**
- **Retaining Wall Profile**

S-045-2019
Boone Co., KY 338
March 20, 2019
Item #: 6-18.00

<u>Project Location Map</u>:



SHEET LOCATION:

FILE NAME: $$$$designfile$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Wall #1A
KY 338 at Triple Crown Blvd

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Use wall dimensions in accordance with Case II of the Standard Drawing RGX-002-09.

Backfill all walls with Insitu Soil material as outlined on this sheet.

Wall Station	Bearing Surface	Nominal Bearing Resistance	Factored Nominal Bearing Resistance at the Service Limit State
2050+60 to 2051+00 and 2051+35 to 2051+70	Soil	6.6 ksf	2.2 ksf
2051+00 to 2051+35	Granular Embankment	20.1 ksf	6.7 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Existing Soil	0	28	127
Foundation Material			
Granular Embankment	0	38	115
Existing Soil	1300	0	125

The wall designer shall verify wall stability based on final wall design dimensions.

Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

A large block Retaining Wall without Geogrid or Geotextile Reinforcement may be suitable at this location.

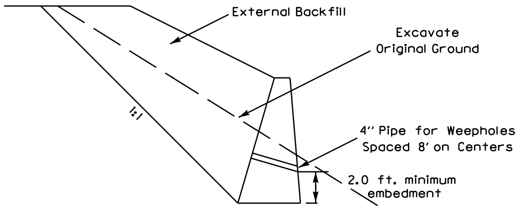
Excavate existing overburden soil down to bedrock and replace with Granular Embankment up to the bearing elevation, as shown on this sheet.

Where granular replacement of the bearing material is required, use granular material meeting the requirements of "Granular Embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size shall be 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place a Type IV Geotextile Fabric between the contact points of the soil and granular embankment in accordance with Section 214 and 843 of the Standard Specifications, current edition.

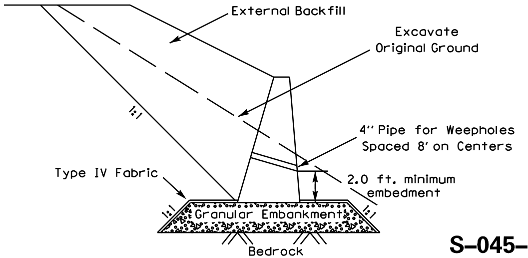
EXCAVATION AND BACKFILL REPLACEMENT

Cast-In-Place Retaining Wall

2050+60 to 2051+00
and
2051+35 to 2051+70



2051+00 to 2051+35



DATE: 16-MAR-2019
CHECKED BY
DESIGNED BY:
DETAILED BY: T. SHEFFIELD
D. GREER

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 338
CROSSING
KY 338 at Triple Crown Blvd

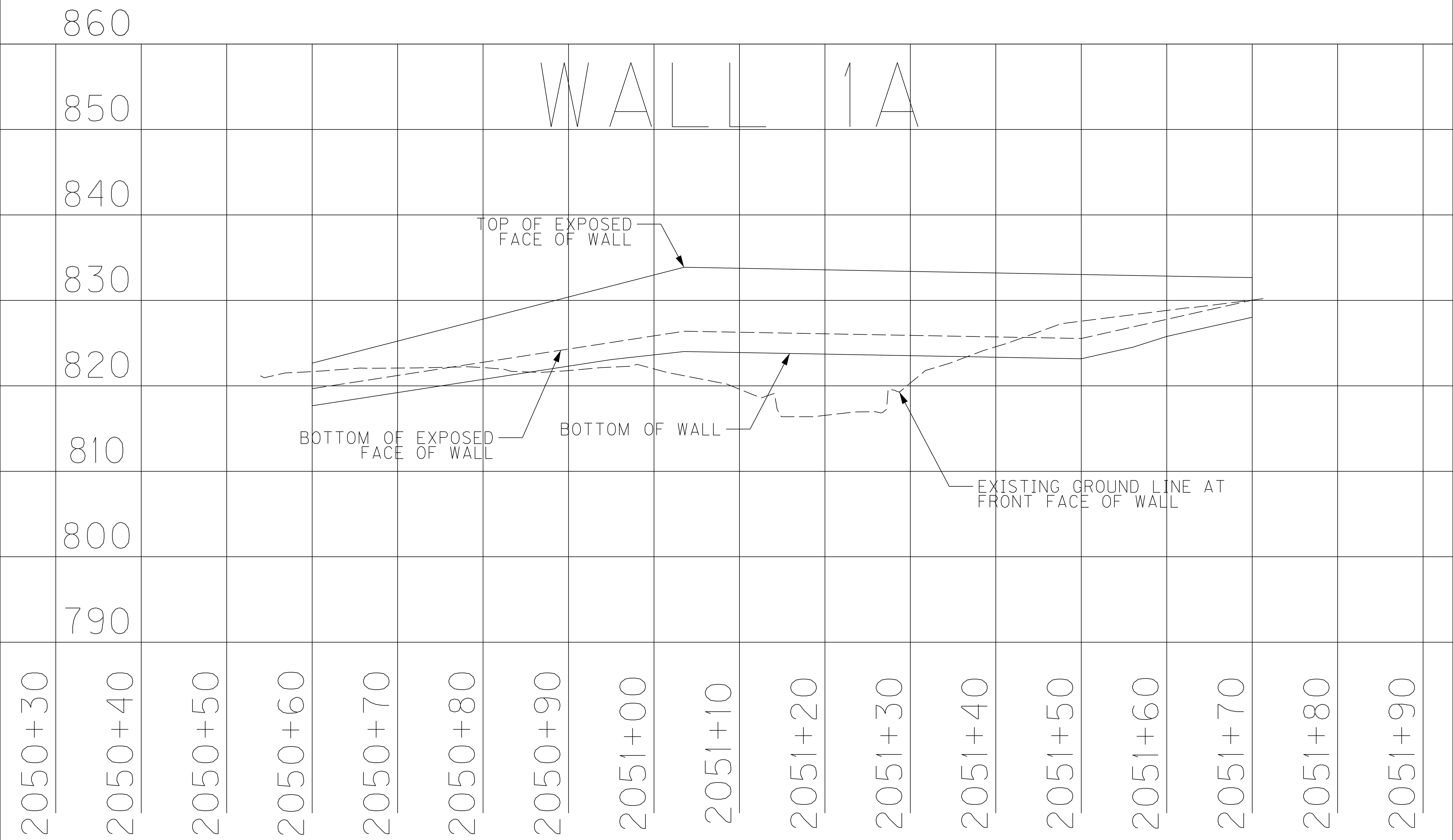
SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.
DRAWING NO.
00000

S-045-2019
ITEM NUMBER
6-18.00

Addendum 2 -- 7-11-19



Addendum 2 -- 7-11-19

M E M O R A N D U M

cc: J. VanZee
C. VanZee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
W. Hagerman (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch
Division of Structural Design

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundations Section

DATE: March 20, 2019

SUBJECT: **Boone County**
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton
Retaining Wall #3, I-75/I-71 Ramp A to WB KY 338
Left Sta. 201+13 to 202+73
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for use in development of structure plans. The drilling for the project was performed by the consulting firm of Horn and Associates, Inc.

The proposed structure is part of an interchange reconstruction project at the interchange between I-75 and KY 338 in Richwood, KY. The proposed structure is located along KY 338 at approximate mile point 0.40.

2.0 SITE GEOLOGIC CONDITIONS

This structure is located in the Union Geologic Quadrangle (GQ# 779). The geologic mapping indicates that the bedrock at this site consists primarily of the Bellevue Tongue of the Grant Lake formation.

3.0 FIELD INVESTIGATION

Four (4) borings were taken for this structure. Two (2) of the borings were sample and core holes and two (2) were mechanical rockline soundings. The drill crew delivered the rock core and soil samples to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores. The soil samples were classified and tested by HDR, Inc.

4.0 LABORATORY TESTING

The soil samples obtained from the borings were determined to consist of inorganic low-plasticity clays, high plasticity clays, high and low plasticity silts, and clayey gravel. The soil samples were designated CL, CH, MH, ML, and GC using the Unified Soil Classification System.

5.0 SUBSURFACE CONDITIONS

Depths to rock/refusal varied from 4.0 ft to 16.0 ft. Rock/refusal elevations varied from 847.7 to 853.6 ft. Rock cores obtained for this structure revealed gray, medium and coarse grained, fossiliferous limestone with gray silty shale laminations and partings. The shales encountered in these rock cores were determined to be nondurable. The KY RQD values for the rock cores taken at this proposed structure location were 0% and core recoveries ranged from 69% to 100%.

6.0 ENGINEERING ANALYSIS

Due to construction limit constraints, it was decided that a Non-gravity Cantilever Wall (Soldier Pile Wall) drilled into bedrock should be utilized at this location. The wall shall comply with the AASHTO LRFD Bridge Design Specifications, current edition. The structural analysis of the wall should be completed using the geotechnical soil and bedrock properties outlined in the attached Unfactored Earth Pressure Diagram for Permanent Nongravity Cantilevered walls with Discrete Vertical Wall Elements Embedded in Bedrock. Native soil may be used as backfill behind the wall. Settlement and global stability will not be a concern at this location due to the proposed wall type and configuration. Preliminary analyses indicate that a wall with HP 14x89 piles spaced 5.5 feet apart with at least 9.5 ft of embedment into rock will be sufficient for this location however, the final design pile size and rock socket depth will depend on final pile spacing.

For the portion of the pile embedded in bedrock, the nominal lateral rock socket resistance pressure is 16 ksf and can be applied over one socket diameter beginning at the top of sound bedrock. This rock socket shall be filled with Class B concrete conforming to Section 601 of the Standard Specifications; however, provide a mix with a 6 to 10 inch slump at the time of placement. High range water reducing and retarding admixtures and Class F fly ash may be used to obtain this slump. Additional construction and design recommendations can be found in the Recommendations section of this report.

7.0 RECOMMENDATIONS

7.1 The wall shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

7.2 Temporary shoring and sheeting may be required to facilitate wall construction.

7.3 For soil and bedrock design parameters, see the attached Unfactored Earth Pressure Diagram for Permanent Nongravity Cantilevered walls with Discrete Vertical Wall Elements Embedded in Bedrock.

7.4 Use drilled-in H-piles with either permanent facing composed of pre-cast or cast in place concrete.

7.5 The rock socket shall be filled with Class B concrete conforming to Section 601 of the Standard Specifications; however, provide a mix with a 6 to 10 inch slump at the time of placement; high range water reducing and retarding admixtures and Class F fly ash may be used to obtain this slump. The drilled H-piles shall be centered in rock socket and the class B concrete will, at a minimum, be extended to the top of the rock socket.

7.6 Class B concrete may be extended beyond the limits of the rock socket, however; it shall not be extended beyond the planned design grade elevation. This would result in difficulties when excavating for placement of the lagging and/or concrete facing.

7.7 In order to prevent the buildup of hydrostatic pressure behind H-pile walls that have pre-cast or cast in place facing construct weep holes conforming to section 613.03.06 of the Standard Specifications.

7.8 For the portion of the pile embedded in bedrock the nominal lateral rock socket resistance pressure is 16 ksf and can be applied over one socket diameter beginning at the from the top of the rock socket.

7.9 Lagging and/or facing is required to extend to top of rock. If applicable, require geocomposite wall drains between temporary lagging and the permanent facing.

7.10 The cost of all materials, labor, and equipment needed to pre-drill and backfill the holes shall be included in the price per linear foot for "Pre-drilling for Piles".

7.11 The wall designer shall verify wall stability based on final wall design dimensions.

7.12 A live load surcharge of 250 psf shall be used to model traffic loads behind the wall.

8.0 Plan Notes

Include the notes below at the appropriate locations in the plans:

8.1 Lagging and/ or facing is required to extend to top of rock.

8.2 Temporary sheeting, shoring, and dewatering may be required during construction of the Cantilever H-pile Wall.

8.3 The rock socket will be filled with Class B concrete conforming to Section 601 of the Standard Specifications; however, provide a mix with a 6 to 10 inch slump at the time of placement. High range water reducing and retarding admixtures and Class F fly ash may be used to obtain this slump. The drilled H-piles shall be centered in rock socket and the class B concrete will, at a minimum, be extended to the top of the rock socket.

8.4 The cost of all materials, labor, and equipment needed to pre-drill and backfill the holes shall be included in the price per linear foot for "Pre-drilling for Piles", except lagging and its installation cost shall be in a separate bid item.

8.5 The cost of lagging, labor and equipment needed to install, shall be bid by the square foot wall face.

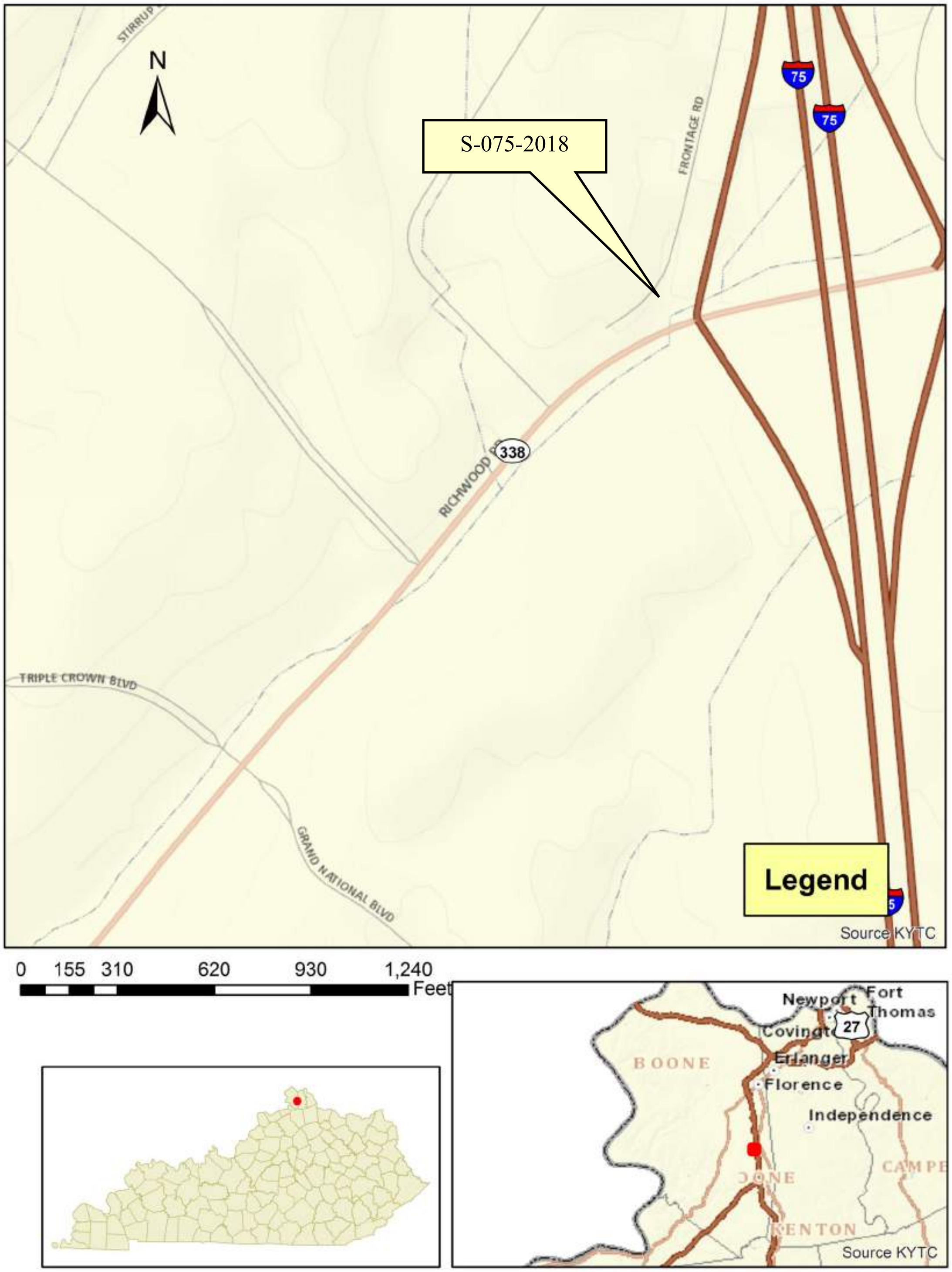
The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Unfactored Earth Pressure Diagram for Permanent Nongravity Cantilevered Walls with Discrete Vertical Wall Elements Embedded in Bedrock**
- **Coordinate Data Sheet**

S-075-2018
Boone Co., KY 338
March 20, 2019
Item #: 6-18.00

<u>Project Location Map</u>:



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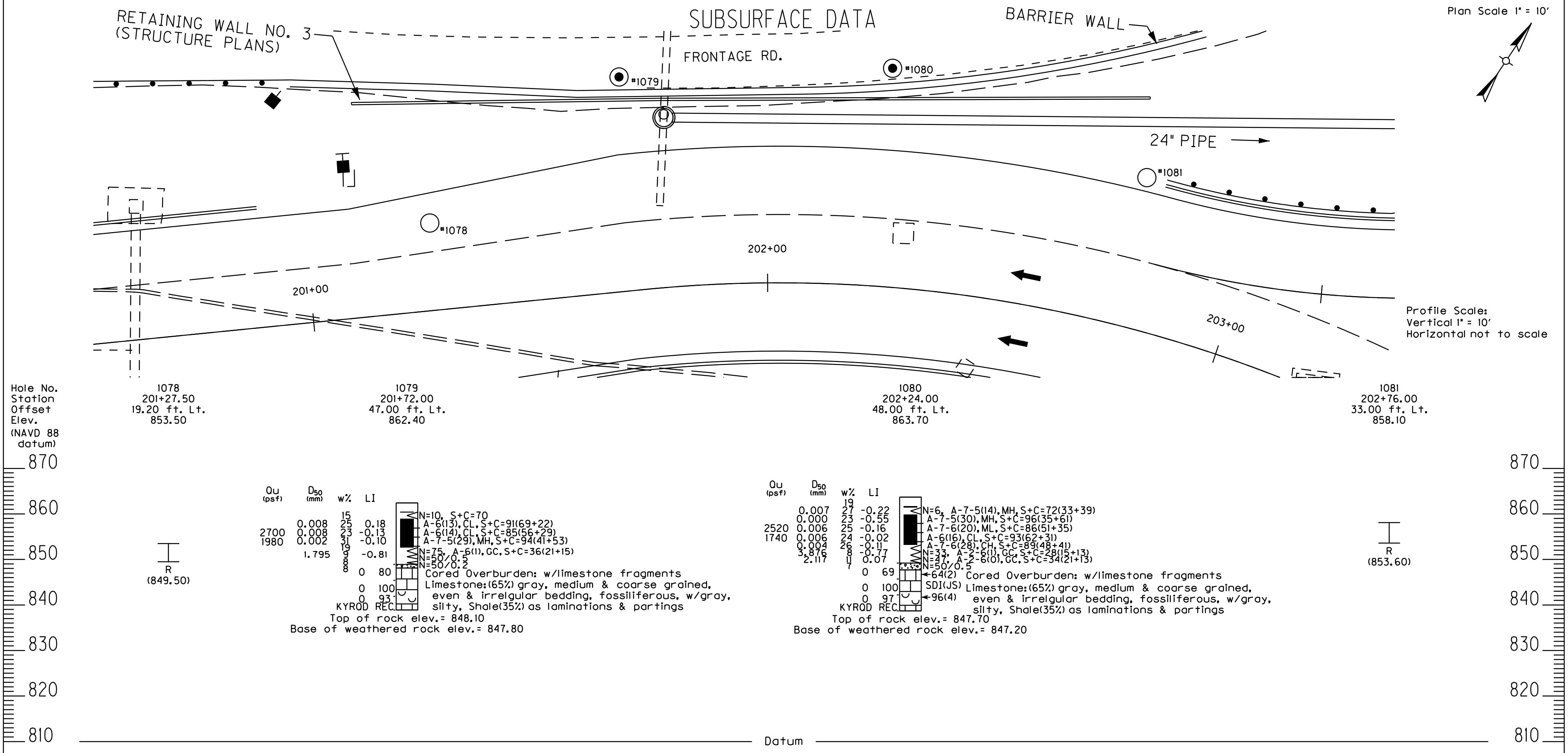
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:



Hole No.	1078	1079	1080	1081
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Offset	19.20 ft. Lt.	47.00 ft. Lt.	48.00 ft. Lt.	33.00 ft. Lt.
Elev. (NAVD 88 datum)	853.50	862.40	863.70	858.10

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	T. SHEFFIELD

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
WB KY 338

CROSSING
Retaining Wall #3

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

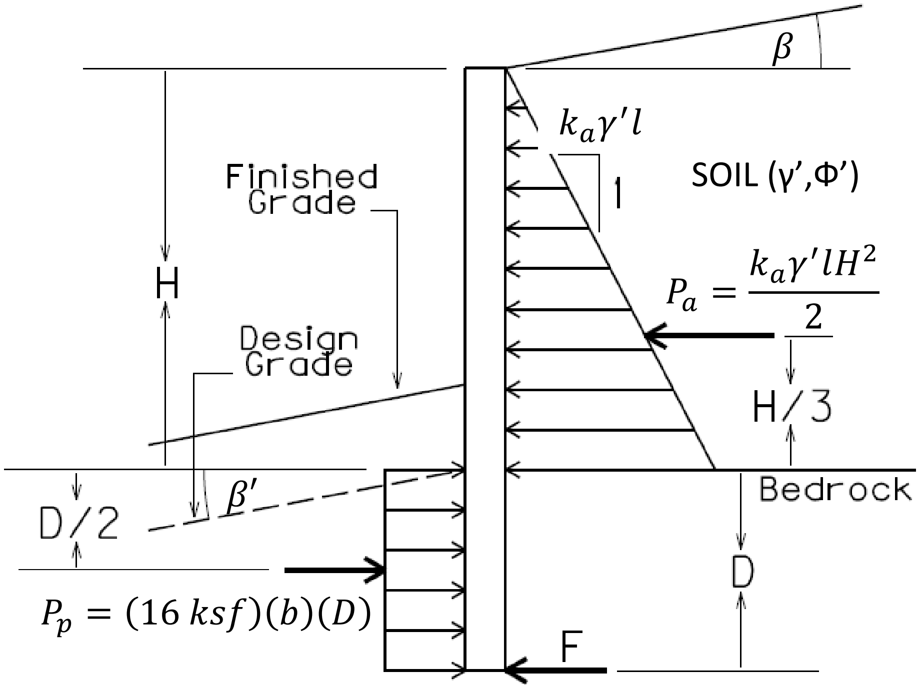
S–075–18

ITEM NUMBER
6–18.00

Addendum 2 -- 7-11-19

UNFACTORED EARTH PRESSURE DIAGRAM FOR PERMANENT NONGRAVITY CANTILEVERED WALLS WITH DISCRETE VERTICAL WALL ELEMENTS EMBEDDED IN BEDROCK

(SOLDIER PILE WALL)



H = wall height measured to Design Grade (ft)

D = depth of embedment into sound unweathered bedrock (ft), determined from lateral load analysis

b = diameter of concrete filled hole for soldier pile embedded in bedrock below design grade (ft)

β = slope of backfill behind retaining wall (positive for slope up from wall) = 0.0°

β' = slope of ground surface in front of retaining wall (positive for slope up from wall) = 0°

γ' = effective soil unit weight = 125 pcf

Φ' = effective friction angle of retained soil = 28°

k_a = coefficient of active lateral earth pressure = 0.36

l = on center spacing of soldier piles (ft)

P_a = active earth force (kip)

F = force at base of wall required to provide force and moment equilibrium (kip)

P_p = passive force in sound unweathered bedrock (kip). Ignore all passive force from fill, native soil, or weathered bedrock

***A live load surcharge of 250 psf shall be used to model traffic loads behind the wall.**

Bedrock Parameters for L-Pile Lateral Load Analysis

Strata: shale/limestone (weak rock)

Unit Weight, γ =	150 pcf
Initial Modulus of Rock Mass =	13,000 psi
Strain Factor, k rm=	0.0005
RQD =	25
Compressive Strength, qu =	750 psi

S-075-2018 06-0018.00 Kentucky Transportation Cabinet

ID	Latitude	Longitude	Hole	Station	Offset	Elevation(ft)	Comments
1	38.91715788	-84.63161549	1078	201+27.5	-19.2	853.52	
2	38.9172938	-84.63155471	1079	201+72	-47	862.35	
3	38.91738813	-84.6313817	1080	202+24	-48	863.69	
4	38.91741659	-84.63117112	1081	202+76	-33	858.05	Occasional float below 2.0 ft

M E M O R A N D U M **S-067-2018**

TO:	Bart Asher, P.E. Director Division of Structural Design	cc:	J. Van Zee C. Van Zee M. Bezold (D-6) R. Franxman (D-6) E. Drury R. Turner B. Yeager C. Callan-Ramler (D-6) W. Hagerman (HDR) K. Meyer (HDR) K. Chism (Parsons)
FROM:	Michael Carpenter, P.E. TEBM Geotechnical Branch		
BY:	Clayton S. Cook, P.E. Geotechnical Branch		
DATE:	January 7, 2019		

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton;
Norfolk Southern Railway Bridge Over KY 338,
Retaining Wall #7, KY 338 to SB US 25 Ramp G, US 25 Left Station 42+25 to 46+68.52
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed retaining wall be part of the new proposed Single Point Urban Interchange (SPUI) between US 25 and KY 338. The wall will allow for increasing grade of US 25 to meet the proposed bridge that will be spanning over KY 338. The proposed wall will be 450 feet long and run along the left side of US 25 and along ramp G.

2.0 SITE GEOLOGIC CONDITIONS

The structure is located in the Independence Quadrangle (GQ-785). The geologic mapping indicated that the bedrock in this location is part of the Bull Fork Formation. This formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

3.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of three sample and core holes and four soundings were drilled. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples.

4.0 SUBSURFACE CONDITIONS

The soil encountered at the site included mostly lean and fat clay. The soil samples were designated as CL, CH, and GC by the USCS, and A-7-6 and A-6 by the AASHTO classification system. A large amount of limestone float rock was present in the overburden soil which resulted in higher standard penetration testing (SPT) blow counts in areas that were above the start of bedrock. Soil strength testing included eight unconfined compression tests with an average value of 3485 psf.

Top of weathered rock elevations ranged from 884.8 to 909.1 ft. with increasing rock elevations as you move upstation along the wall. The bedrock layers at the structure location consisted of interbedded dark grey shale with limestone, with generally increasing percentages of limestone with increasing depth. The core recovered percentages were generally in the 90's except in the upper layers of the bedrock due to the degraded nature of the material. KY Rock Quality Designation (RQD) values ranged from 0 to 20. The SDI testing indicated that interbedded shale and limestone bedrock was overall non-durable. Four rock unconfined tests were conducted with an average unconfined compressive strength of 755 psi.

5.0 ENGINEERING ANALYSIS AND FOUNDATION RECOMMENDATIONS

One retaining wall type, a mechanically stabilized earth (MSE) wall, was considered for this location. Due to the sloping rockline, part of the beginning wall will be bearing either on soil and will transition to bearing on bedrock as the wall approaches the US 25 bridge. The transition from soil to rock is estimated at US 25 Station 45+40 along the centerline of the proposed wall location. See attached Retaining Wall #7 Profile Sheet for estimated rockline elevation along the wall profile.

Additionally the wall will be tying into End Bent #1 of the US 25 Bridge Spanning KY 338, S-065-2018. H-Piles, placed in pre-drilled holes, backfilled with sand or pea gravel, and then seated before the beginning of the MSE wall construction and corresponding backfill operations are recommended. As the internal backfill is being placed within the reinforced zone of the MSE Wall, the H-Piles shall be isolated from the internal backfill by installing cans as the wall is constructed. H-piles cannot be driven or drilled through the MSE reinforced zone. The annular space between the cans and the H-piles must be filled with sand or pea-gravel.

Pre-drilling will be required for installation of the piling and to insure their vertical placement. 24-inch diameter holes shall be drilled to a depth that ensure adequate lateral stability of the H-piles during construction of the MSE Wall. The holes shall be backfilled with sand or pea gravel once the pile is in place. Piles shall then be driven to refusal. Include the cost of all materials, labor and equipment needed for pre-dill, backfilling the holes and driving the piles to refusal in the price per linear foot for "Pre-drilling for Piles".

MSE Wall Design Parameters for US 25 Station 42+25 to 45+40 (Bearing on Soil)

- Base of footing must be a minimum of two feet below final grade
- Friction angle of retained backfill (behind reinforced zone): 21 degrees
- Friction angle of internal reinforced backfill: 34 degrees
- Cohesion of foundation soils: 1750 psf
- Unit weight of in-situ soil backfill and foundation soils: 120 pcf
- Unit weight of MSE internal backfill: 120 pcf
- Factored nominal bearing resistance at the strength limit state on soil: 5800 psf
- Minimum strap length = 8 feet or 70% of wall height
- Cohesion for sliding calculation = 1750 psf
- Equivalent depth of surcharge = 2 feet

MSE Wall Design Parameters for US 25 Station 45+40 to 46+68.52 (Bearing On Rock)

- Base of footing must be a minimum of two feet below final grade
- Friction angle of retained backfill (behind reinforced zone): 21 degrees
- Friction angle of internal reinforced backfill: 34 degrees
- Unit weight of in-situ soil backfill and foundation soils: 120 pcf
- Unit weight of MSE internal backfill: 120 pcf
- Factored nominal bearing resistance at the strength limit state on bedrock: 21.6 ksf
- Minimum strap length = 8 feet or 70% of wall height
- Friction angle for sliding calculation = 34 degrees
- Equivalent depth of surcharge = 2 feet

It is currently assumed that material that will be used behind the MSE wall construction will be engineered native fill material. If the native bedrock is excavated and compacted back for fill material behind the MSE wall use a friction angle of retained backfill (behind reinforced zone) of 23 degrees. If granular embankment is used behind the MSE wall use a friction angle of retained backfill (behind reinforced zone) of 34 degrees.

Global stability for the structure was analyzed for varied assumed configurations and was found to be acceptable. Settlement was not considered to be an issue due to the structure bearing on soil that is being cut to below grade and then bearing on bedrock.

It is likely that some type of dewatering method will be needed to construct the wall foundation.

6.0 MSE WALL RECOMMENDATIONS

6.1 Wall shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition. The wall designer shall verify wall stability based on final wall design dimensions.

6.2 Live load surcharges shall be applied in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

6.3 The MSE wall must also be in accordance with the requirements of the Special Note for MSE Walls.

6.4 The minimum reinforcement length is 0.7 times the wall height or 8 feet, whichever is greater.

6.5 Survey control is the front face of the MSE Wall

6.6 The internal backfill shall extend a minimum of 1 foot beyond the end of the reinforcements.

6.7 Embedment of the footings must be a minimum of 2 feet below final grade.

6.8 Place a Type IV Geotextile Fabric between the contact points of the soil and internal backfill. The Geotextile fabric shall be in accordance with Sections 214 and 843 of the Standard Specifications for Road and Bridge Construction, current edition.

6.9 The wall analyses assumed that the retained backfill (behind reinforced zone) will consist of engineered native fill material. A value of 21 degrees was used or the friction angle to determine lateral earth pressures. Using this value, overturning and sliding external stability requirements will be satisfied.

6.10 Soil parameters to be utilized for design of the walls are included on the attached Geotechnical Note Sheets for MSE Walls.

6.11 Backfill behind the wall shall consist of native soils. The materials shall be compacted in accordance with Section 206 of the Standard Specifications for Road and Bridge Construction, current edition.

6.12 Horizontal stresses induced on the MSE wall by the H-Piles must be accounted for in the wall design. The information in regards to lateral pressure distribution from deep foundations on the face of the MSE Walls can be found in FHWA manual NHI-10-024 Volume 1, Chapter 6, Section 6.1.2.

6.13 The reinforcement straps shall be splayed around the piles as the wall is built.

6.14 If the placement of an obstruction in the all reinforcement zone (such as drainage structures, signal or sign foundations, guardrail posts, etc.) cannot be avoided, the design of the wall near the obstruction shall be modified using one of the following alternatives (reinforcement layers shall not be structurally connected to any obstructions):

6.14.1 Place a structural frame (collar or yoke) around the obstruction that is capable of carrying the load from the reinforcement in front of the obstruction to the reinforcement connected to the structural frame behind the obstruction.

6.14.2 If the soil reinforcements consist of discrete strips or bar mats instead of continuous sheets, it may be possible to splay the reinforcements around the obstruction, depending on its overall size.

6.15 The internal design of the MSE wall shall be in accordance with Section 5 of the AASHTO Specifications for Highway and Bridges, current edition. The pullout resistance shall be based on a $\phi = 34°$. The internal granular backfill shall be in accordance with Reinforced Fill Material in Section 805 of Kentucky Standard Specifications for Road and Bridge Construction, current edition.

6.16 MSE walls using only inextensible reinforcement shall be used.

6.17 MSE wall facing shall be resistant to salts and sulfides.

6.18 Earth reinforcement elements in MSE walls shall be designed to have a corrosion resistance/durability to ensure a minimum design life of 100 years.

6.19 Use bearing pads between facing units where the height of the wall (H) exceeds 15 feet. The thickness of the compression member shall be determined by the wall design engineer.

6.20 Slip joints shall be utilized in the wall facing elements where the structure transitions to being on soil to bearing on rock to minimize facial cracking from differential settlement.

7.0 PLAN NOTES

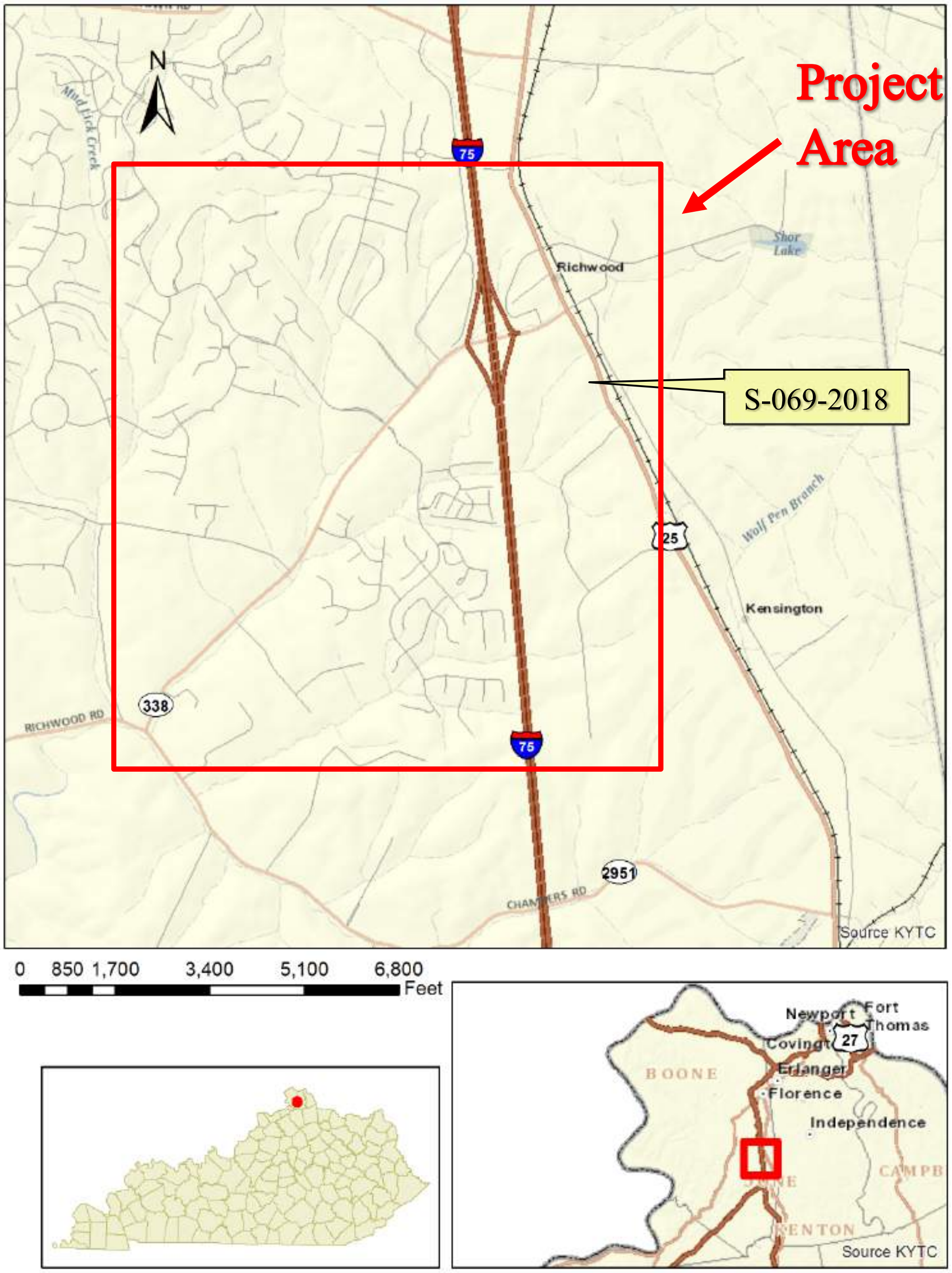
The attached “Geotechnical Notes” plan sheets include required information needed to design the recommended wall type.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Geotechnical Notes Sheet**
- **Coordinate Data Sheet**
- **Retaining Wall #7 Profile Sheet with Estimated Rockline**

Project Location Map



SHEET LOCATION:

FILE NAME: $$$$design$file$$specification$$$$

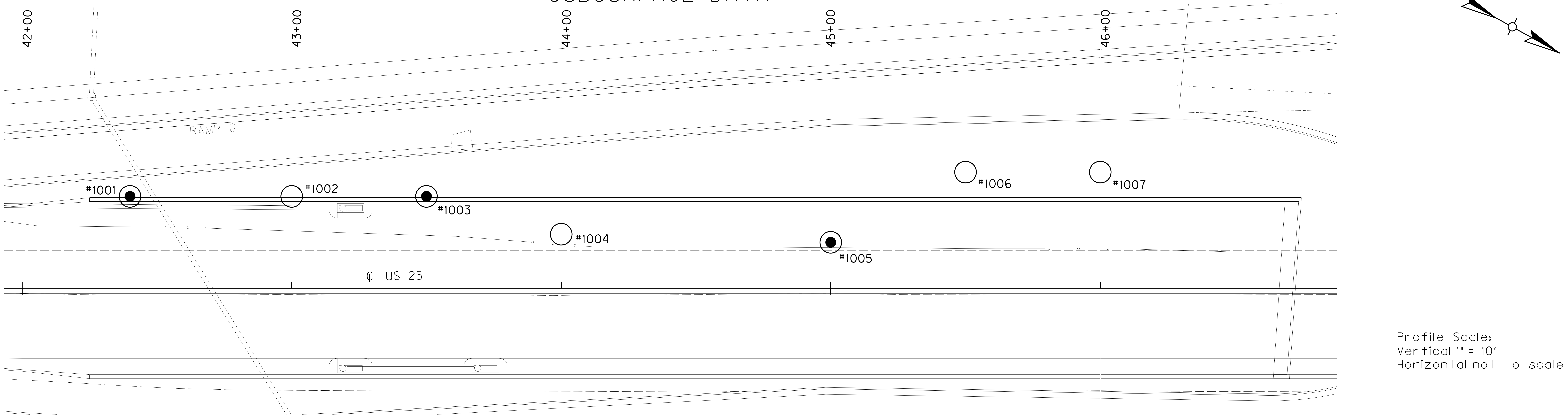
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1001	1002	1003	1004
Station	42+40.00	43+00.00	43+50.00	44+00.00
Offset	34.00 ft. Lt.	34.00 ft. Lt.	34.00 ft. Lt.	20.00 ft. Lt.
Elev. (NAVD 88 datum)	919.10	919.80	920.40	920.80

QU (psi)	Qu (psf)	D_{50} (mm)	w%	LI	
		0.009	18	-0.29	A-7-6(13),CL,S+C=72(38+34)
		0.014	14	-0.42	A-6(11),CL,S+C=69(41+28)
	5280	0.000	26	0.09	A-7-6(28),CH,S+C=95(35+60)
	1918	0.005	27	0.18	A-7-6(19),CL,S+C=90(52+38)
	2839	0.001	26	0.05	A-7-6(24),CL,S+C=91(38+53)
	2225	0.004	33	0.33	A-7-6(23),CH,S+C=80(38+42)

QU (psi)	KYRQD	REC	
	0	67	SDI(JS)
			← 71(1)
	0	80	
586	0	100	← 74(3)

Cored Overburden: stiff residual clay w/limestone fragments
Shale:(60%) brown, clayey, extremely weathered, interbedded w/Limestone (40%) gray, fossiliferous
Limestone:(55%) gray, coarse grained, fossiliferous, interbedded w/Shale (45%) dark gray, silty, calcareous

Top of rock elev.= 887.20
Base of weathered rock elev.= 884.80

QU (psi)	Qu (psf)	D_{50} (mm)	w%	LI	
		0.004	26	0.20	A-7-6(17),CL,S+C=79(36+43)
	2683	0.002	30	0.21	A-7-6(25),CH,S+C=83(35+48)
	3820	0.006	23	0.13	A-6(18),CL,S+C=90(56+34)
	4058	0.000	18	-0.21	A-7-6(24),CL,S+C=95(37+58)

N=50/0.1

QU (psi)	KYRQD	REC	
	0	70	SDI(JS)
			← 38(1)
	0	86	
	20	100	← 54(3)
	11	97	← 84(4)
1286	0	100	
	0	100	← 65(3)

Limestone:(70%) light gray, coarse grained, even & irregular bedding, fossiliferous, w/brown & gray, weathered, silty Shale (30%) & laminations & partings
Limestone:(55%) light gray, coarse grained, fossiliferous, interbedded w/Shale (45%) dark gray, silty, calcareous

Top of rock elev.= 895.90
Base of weathered rock elev.= 891.30

DATE: 25-OCTOBER-2018
CHECKED BY
DESIGNED BY:
DETAILED BY: E. BAILEY
C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Retaining Wall #7

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

S–067–18

ITEM NUMBER
6–18.00

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

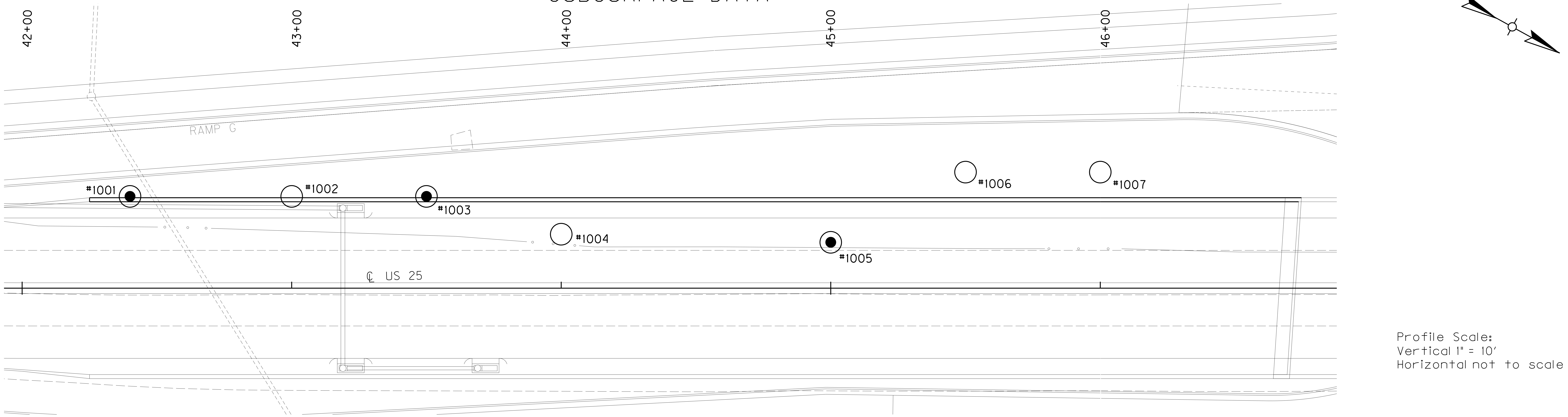
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

QU (psi)	Qu (psf)	D_{50} (mm)	w%	LI	
	5060	0.000	32	0.02	A-7-5(46),CH,S+C=93(25+68)
		0.827	36	1.07	A-6(3),GC,S+C=40(21+19)
		0.016	26	0.22	N=32, A-7-6(11),CL,S+C=66(37+29)
		0.007	13	-0.37	A-6(12),CL,S+C=74(38+36)

	KYRQD	REC	
			N=50/0.1
	0	80	74(3)
	0	97	SDI(JS)
395	0	97	82(3)
	0	100	
			56(3)
	0	100	
752	0	100	60(2)

Shale:(73%) brown, clayey & silty, calcareous, weathered, interbedded w/Limestone (27%) light gray, coarse grained, fossiliferous

Shale:(73%) gray, silty & calcareous, weathered, interbedded w/Limestone (27%) light gray, coarse grained, fossiliferous

Limestone:(70%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (30%) as laminations & partings

Top of rock elev.= 909.10
Base of weathered rock elev.= 904.20

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Retaining Wall #7

SUBSURFACE DATA

S–067–18

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

GEOTECHNICAL NOTES

for MSE Walls

Design the wall in accorance with the AASHTO Standard Specifications for Highway Bridges, current edition, and the Special Note for MSE Walls. The Contract Documents control where a requirement which is not covered by, or is contrary to, AASHTO exists. The wall designer shall verify wall stability based on final wall design dimensions.

The base of the wall, or any wall footing must be a minimum of 2 feet below final exterior grades.

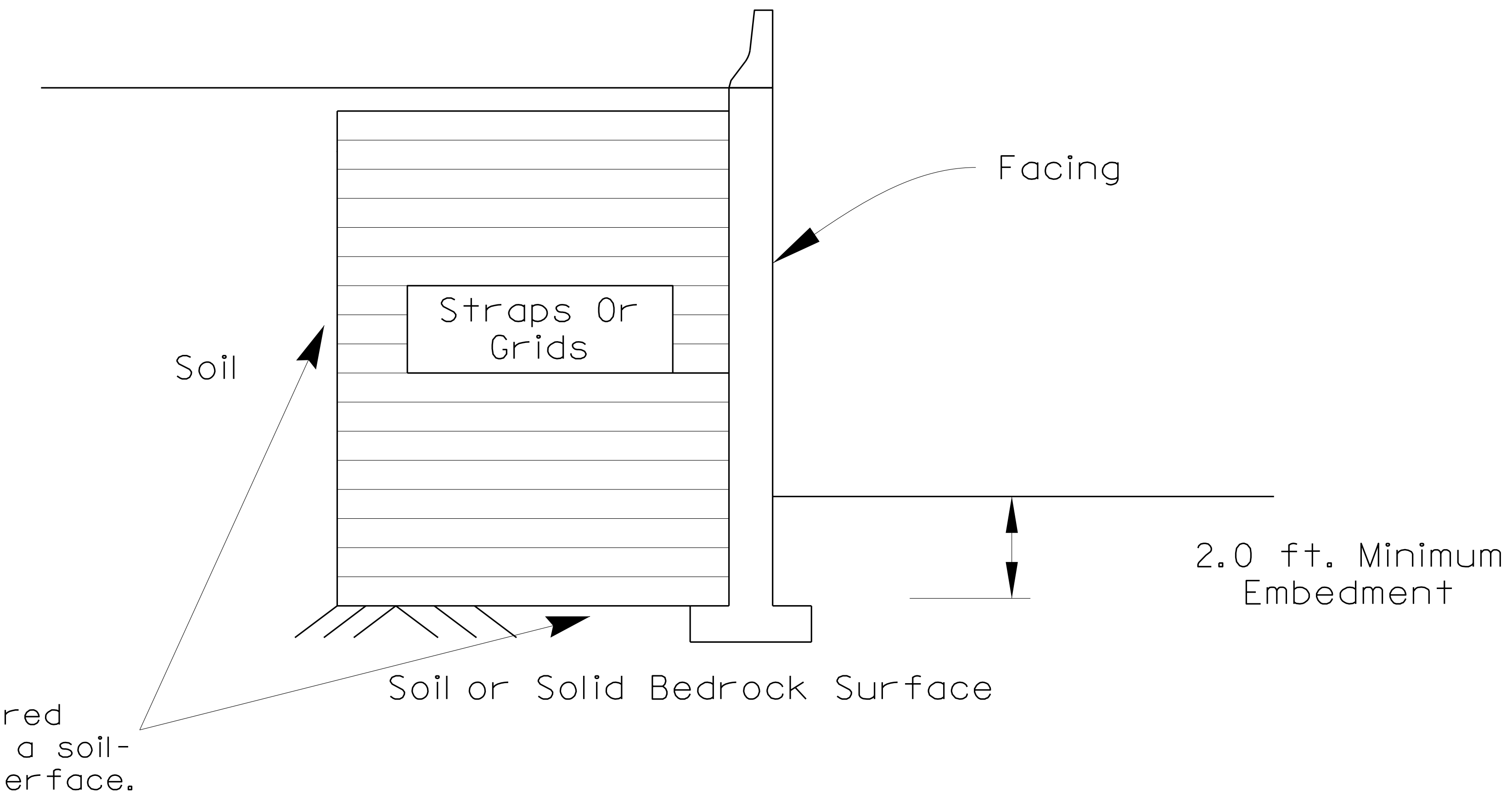
The wall shall include only inextensible (metal) reinforcement.

Size the wall footings at Strength Limit State using a Factored Nominal Bearing Resistance given below for Foundations Bearing On Soil and Bedrock. For checking the Service and Extreme Limit States, use Resistance Factors of 0.33 and 1.0, respectively.

Bearing Surface	Factored Nominal Bearing Resistance @ Service Limit State	Nominal Bearing Resistance
Soil	5.8 ksf	8.9 ksf
Bedrock	21.6 ksf	48 ksf

A Type IV Geotextile fabric shall be placed between the contact of any existing soil and the crushed stone Granular Embankment. The Geotextile Fabric shall be in accordance with Sections 214 and 843 of the current edition of the Standard Specifications for Road and Bridge Construction.

EXCAVATION AND HORIZONTAL BACKFILL BEARING ON SOIL OR BEDROCK



Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
Internal Backfill (in reinforced volume)	0	34	120
External Backfill	0	21	120
Foundation Material			
Native Soil	1750	0	120
Bedrock	0	34 (Sliding Only)	130

The Internal Backfill shall be permanently drained.

Internal Backfill shall consist of granular material meeting the requirements of "Reinforced Fill Material" in Section 805 of the Standard Specifications, Current Edition. Internal Backfill shall extend a minimum of 1 foot beyond the end of the reinforcements.

Survey control shall be the front face of the MSE wall.

Horizontal stresses induced on the MSE wall by the H-Piles must be accounted for in the wall design. The information in regards to lateral pressure distribution from deep foundations on the face of the MSE wall can be found in FHWA manual NHI-10-024 Volume 1, Chapter 6, Section 6.1.2

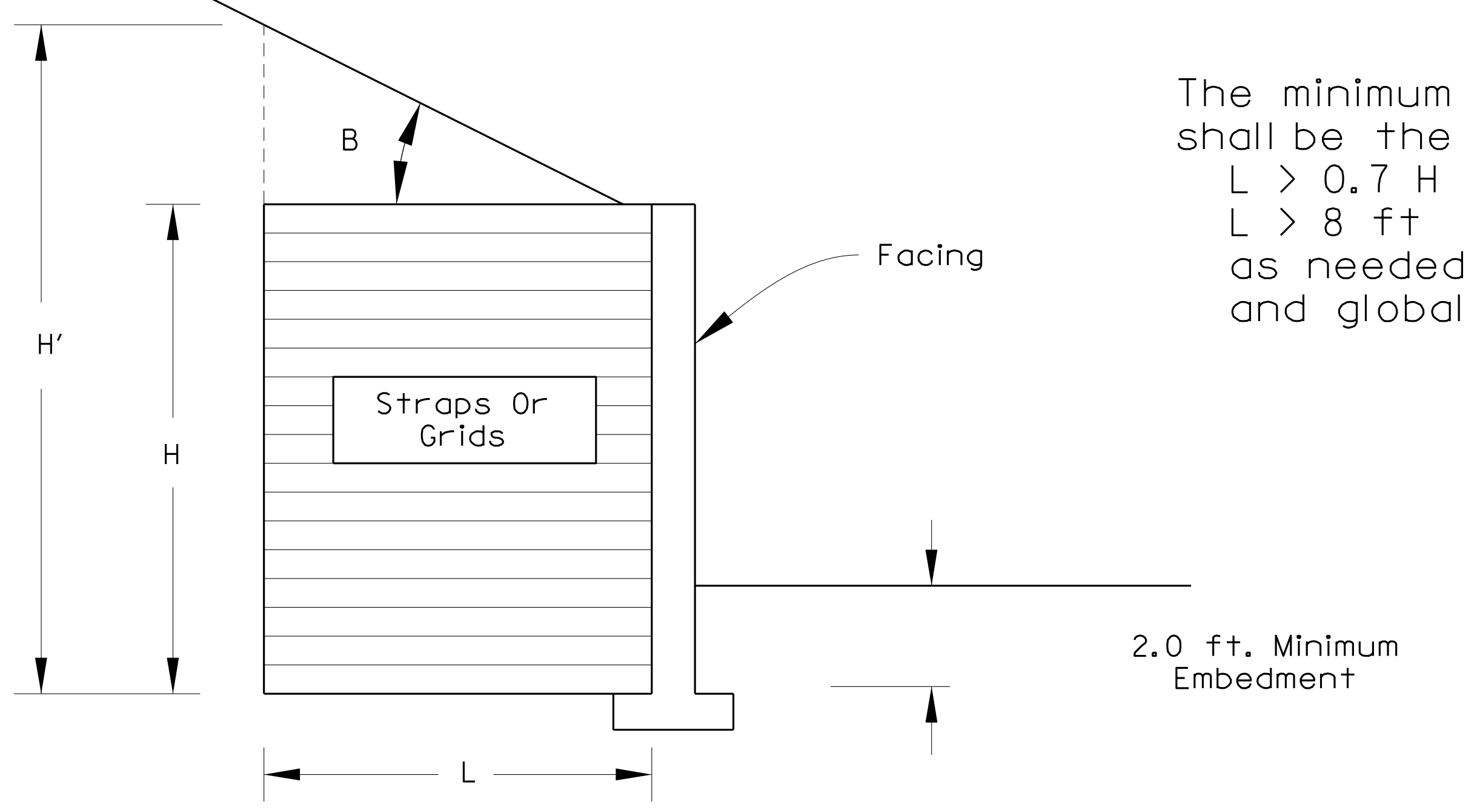
Prior to placing Granular Embankment for MSE wall construction, piles shall be driven to refusal. After piles have been driven, cans shall be placed over the piles. The annular space between the pile and cans shall be backfilled with pea gravel or equivalent. After which, the Granular Embankment materials my be placed and the MSE wall constructed.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

Structure preparation for the wall will require excavation of bedrock at some locations

The bedrock exposed during construction will be suceptable to weathering and softening in the presence of water. Water must be kept out of the footing excavataions. If bedrock becomes softened at bearing elevations, the softened material should be undercut to unweathered material prior to placing the MSE wall.

MINIMUM REINFORCEMENT LENGTH



The minimum reinforcement length (L) shall be the greater of:

L > 0.7 H
L > 8 ft
as needed to satisfy internal, external, and global stability design requirements.

DATE: 12-DEC-2018
CHECKED BY
DESIGNED BY:
DETAILED BY: C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Retaining Wall #7

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

S–067–18

ITEM NUMBER
6–18.00

Addendum 2 -- 7-11-19

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-067-2018

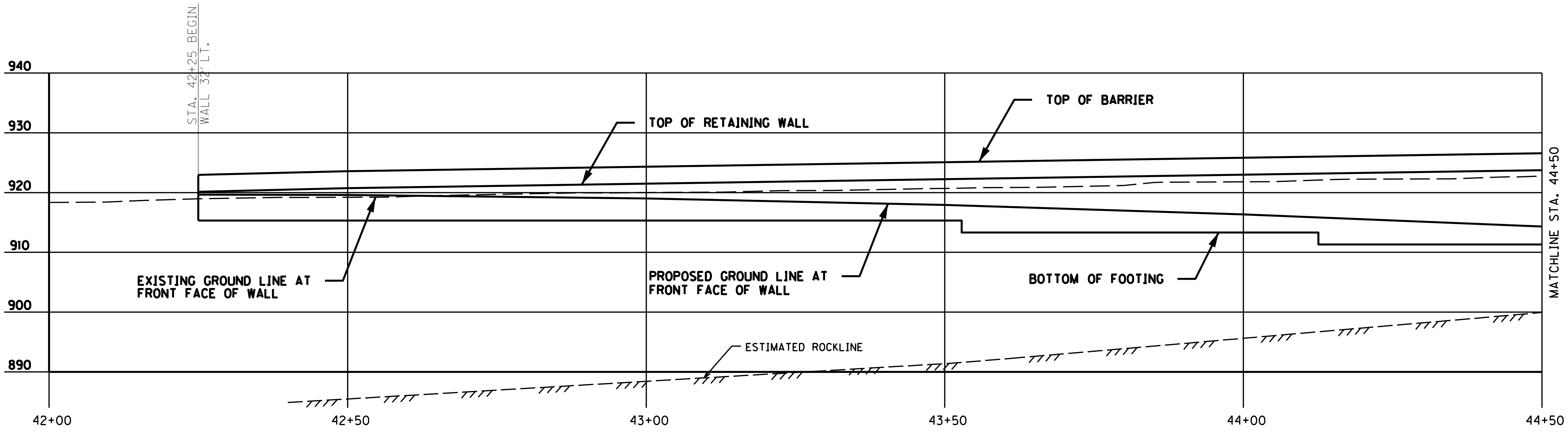
Notes:

(circle one)

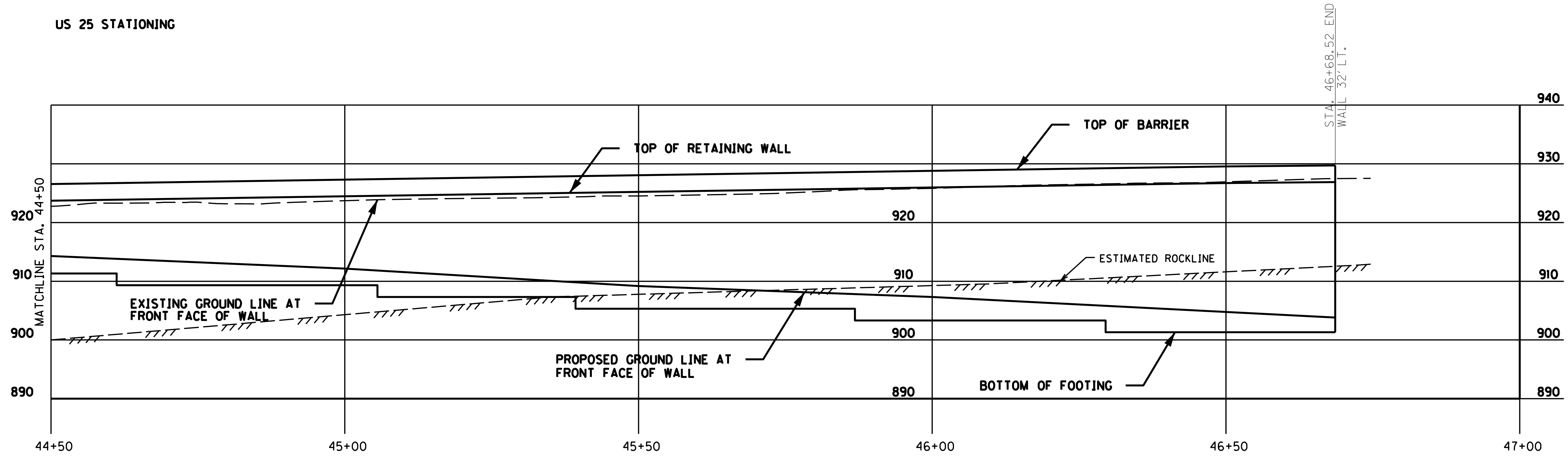
Elevation Datum (NAVD88) Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-067-2018						
1001	38.91689641	84.62306182	1001	US 25 42+40	34' Lt.	919.05
1002	38.91704165	84.62316128	1002	US 25 43+00	34' Lt.	919.78
1003	38.91716269	84.62324416	1003	US 25 43+50	34' Lt.	920.38
1004	38.91730186	84.62328367	1004	US 25 44+00	20' Lt.	920.83
1005	38.91754783	84.62344014	1005	US 25 45+00	17' Lt.	922.20
1006	38.91763519	84.62360359	1006	US 25 45+50	43' Lt.	923.69
1007	38.91775623	84.62368648	1007	US 25 46+00	43' Lt.	925.06

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



US 25 STATIONING



US 25 STATIONING

FILE NAME: N:\GEOTECH\BOONE RICHWOOD EXIT S-065-2018 THRU S-080-2018\DGNFILES\2018-11-16 E-MAIL FILES FROM JOE (HDR)\RETAININGWALL#7PROFILESHEE

USER: Clayton.Cook
DATE PLOTTED: January 1, 0001

E-SHEET NAME:

MicroStation v8.11.9.832

SCALE: 1"=10'

RETAINING WALL #7
LT. STA. 42+25 LT. TO 46+68.52 US 25

Addendum 2 -- 7-11-19

MEMORANDUM **S-070-2018**

TO: Bart Asher, P.E.
Director
Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM
Geotechnical Branch

BY: Clayton S. Cook, P.E.
Geotechnical Branch

DATE: January 9, 2019

cc: J. Van Zee
C. Van Zee
M. Bezold (D-6)
R. Franxman (D-6)
E. Drury
R. Turner
B. Yeager
C. Callan-Ramler (D-6)
W. Hagerman (HDR)
K. Meyer (HDR)
K. Chism (Parsons)

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton;
Norfolk Southern Railway Bridge Over KY 338,
Retaining Wall #8, SB US 25 to KY 338 Ramp E, US 25 Left Station 49+57.27 to 55+25
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed retaining wall be part of the new proposed Single Point Urban Interchange (SPUI) between US 25 and KY 338. The wall will allow for increasing grade of US 25 to meet the proposed bridge that will be spanning over KY 338. The proposed wall will be 568 feet and run along the left side of US 25 and along Ramp E.

2.0 SITE GEOLOGIC CONDITIONS

The structure is located in the Independence Quadrangle (GQ-785). The geologic mapping indicated that the bedrock in this location is part of the Bull Fork Formation. This formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

3.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of two sample and core holes and four soundings were drilled. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples.

4.0 SUBSURFACE CONDITIONS

The soil encountered at the site included mostly lean and fat clay. The soil samples were designated as CL, CH, and MH by the USCS, and A-7-6 and A-6 by the AASHTO classification system. Soil strength testing included eight unconfined compression tests with an average value of 1988 psf.

Top of weathered rock elevations ranged from 907.4 to 906.6 ft. with varying rock elevations as you move upstation along the wall. The bedrock layers at the structure location consisted of interbedded dark grey shale with limestone. The core recovered percentages were above the 90's. KY Rock Quality Designation (RQD) values ranged from 0 to 13. The SDI testing indicated that interbedded shale and limestone bedrock was overall non-durable. Three rock unconfined tests were conducted with an average unconfined compressive strength of 564 psi.

5.0 ENGINEERING ANALYSIS AND FOUNDATION RECOMMENDATIONS

One retaining wall type, a mechanically stabilized earth (MSE) wall, was considered for this location. Due to the sloping rockline, part of the beginning wall will be bearing either on soil and will transition to bearing on bedrock as the wall approaches the US 25 bridge. The transition from rock to soil is estimated at US 25 Station 51+75 along the centerline of the proposed wall location. See attached Retaining Wall #8 Profile Sheet for estimated rockline elevation along the wall profile.

Additionally the wall will be tying into End Bent #2 of the US 25 Bridge Spanning KY 338, S-065-2018. H-Piles, placed in pre-drilled holes, backfilled with sand or pea gravel, and then seated before the beginning of the MSE wall construction and corresponding backfill operations are recommended. As the internal backfill is being placed within the reinforced zone of the MSE Wall, the H-Piles shall be isolated from the internal backfill by installing cans as the wall is constructed. H-piles cannot be driven or drilled through the MSE reinforced zone. The annular space between the cans and the H-piles must be filled with sand or pea-gravel.

Pre-drilling will be required for installation of the piling and to insure their vertical placement. 24-inch diameter holes shall be drilled to a depth that ensure adequate lateral stability of the H-piles during construction of the MSE Wall. The holes shall be backfilled with sand or pea gravel once the pile is in place. Piles shall then be driven to refusal. Include the cost of all materials, labor and equipment needed for pre-dill, backfilling the holes and driving the piles to refusal in the price per linear foot for "Pre-drilling for Piles".

MSE Wall Design Parameters for US 25 Station 42+25 to 45+40 (Bearing on Soil)

- Base of footing must be a minimum of two feet below final grade
- Friction angle of retained backfill (behind reinforced zone): 21 degrees
- Friction angle of internal reinforced backfill: 34 degrees
- Cohesion of foundation soils: 1750 psf
- Unit weight of in-situ soil backfill and foundation soils: 120 pcf
- Unit weight of MSE internal backfill: 120 pcf
- Factored nominal bearing resistance at the strength limit state on soil: 5800 psf
- Minimum strap length = 8 feet or 70% of wall height
- Cohesion for sliding calculation = 1750 psf
- Equivalent depth of surcharge = 2 feet

MSE Wall Design Parameters for US 25 Station 45+40 to 46+68.52 (Bearing On Rock)

- Base of footing must be a minimum of two feet below final grade
- Friction angle of retained backfill (behind reinforced zone): 21 degrees
- Friction angle of internal reinforced backfill: 34 degrees
- Unit weight of in-situ soil backfill and foundation soils: 120 pcf
- Unit weight of MSE internal backfill: 120 pcf
- Factored nominal bearing resistance at the strength limit state on bedrock: 21.6 ksf
- Minimum strap length = 8 feet or 70% of wall height
- Friction angle for sliding calculation = 34 degrees
- Equivalent depth of surcharge = 2 feet

It is currently assumed that material that will be used behind the MSE wall construction will be engineered native fill material. If the native bedrock is excavated and compacted back for fill material behind the MSE wall use a friction angle of retained backfill (behind reinforced zone) of 23 degrees. If granular embankment is used behind the MSE wall use a friction angle of retained backfill (behind reinforced zone) of 34 degrees.

Global stability for the structure was analyzed for varied assumed configurations and was found to be acceptable. Settlement was not considered to be an issue due to the structure bearing on soil that is being cut to below grade and then bearing on bedrock.

It is likely that some type of dewatering method will be needed to construct the wall foundation.

6.0 MSE WALL RECOMMENDATIONS

6.1 Wall shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition. The wall designer shall verify wall stability based on final wall design dimensions.

6.2 Live load surcharges shall be applied in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

6.3 The MSE wall must also be in accordance with the requirements of the Special Note for MSE Walls.

6.4 The minimum reinforcement length is 0.7 times the wall height or 8 feet, whichever is greater.

6.5 Survey control is the front face of the MSE Wall

6.6 The internal backfill shall extend a minimum of 1 foot beyond the end of the reinforcements.

6.7 Embedment of the footings must be a minimum of 2 feet below final grade.

6.8 Place a Type IV Geotextile Fabric between the contact points of the soil and internal backfill. The Geotextile fabric shall be in accordance with Sections 214 and 843 of the Standard Specifications for Road and Bridge Construction, current edition.

6.9 The wall analyses assumed that the retained backfill (behind reinforced zone) will consist of engineered native fill material. A value of 21 degrees was used or the friction angle to determine lateral earth pressures. Using this value, overturning and sliding external stability requirements will be satisfied.

6.10 Soil parameters to be utilized for design of the walls are included on the attached Geotechnical Note Sheets for MSE Walls.

6.11 Backfill behind the wall shall consist of native soils. The materials shall be compacted in accordance with Section 206 of the Standard Specifications for Road and Bridge Construction, current edition.

6.12 Horizontal stresses induced on the MSE wall by the H-Piles must be accounted for in the wall design. The information in regards to lateral pressure distribution from deep foundations on the face of the MSE Walls can be found in FHWA manual NHI-10-024 Volume 1, Chapter 6, Section 6.1.2.

6.13 The reinforcement straps shall be splayed around the piles as the wall is built.

6.14 If the placement of an obstruction in the all reinforcement zone (such as drainage structures, signal or sign foundations, guardrail posts, etc.) cannot be avoided, the design of the wall near the obstruction shall be modified using one of the following alternatives (reinforcement layers shall not be structurally connected to any obstructions):

6.14.1 Place a structural frame (collar or yoke) around the obstruction that is capable of carrying the load from the reinforcement in front of the obstruction to the reinforcement connected to the structural frame behind the obstruction.

6.14.2 If the soil reinforcements consist of discrete strips or bar mats instead of continuous sheets, it may be possible to splay the reinforcements around the obstruction, depending on its overall size.

6.15 The internal design of the MSE wall shall be in accordance with Section 5 of the AASHTO Specifications for Highway and Bridges, current edition. The pullout resistance shall be based on a $\phi = 34°$. The internal granular backfill shall be in accordance with Reinforced Fill Material in Section 805 of Kentucky Standard Specifications for Road and Bridge Construction, current edition.

6.16 MSE walls using only inextensible reinforcement shall be used.

6.17 MSE wall facing shall be resistant to salts and sulfides.

6.18 Earth reinforcement elements in MSE walls shall be designed to have a corrosion resistance/durability to ensure a minimum design life of 100 years.

6.19 Use bearing pads between facing units where the height of the wall (H) exceeds 15 feet. The thickness of the compression member shall be determined by the wall design engineer.

6.20 Slip joints shall be utilized in the wall facing elements where the structure transitions to being on soil to bearing on rock to minimize facial cracking from differential settlement.

7.0 PLAN NOTES

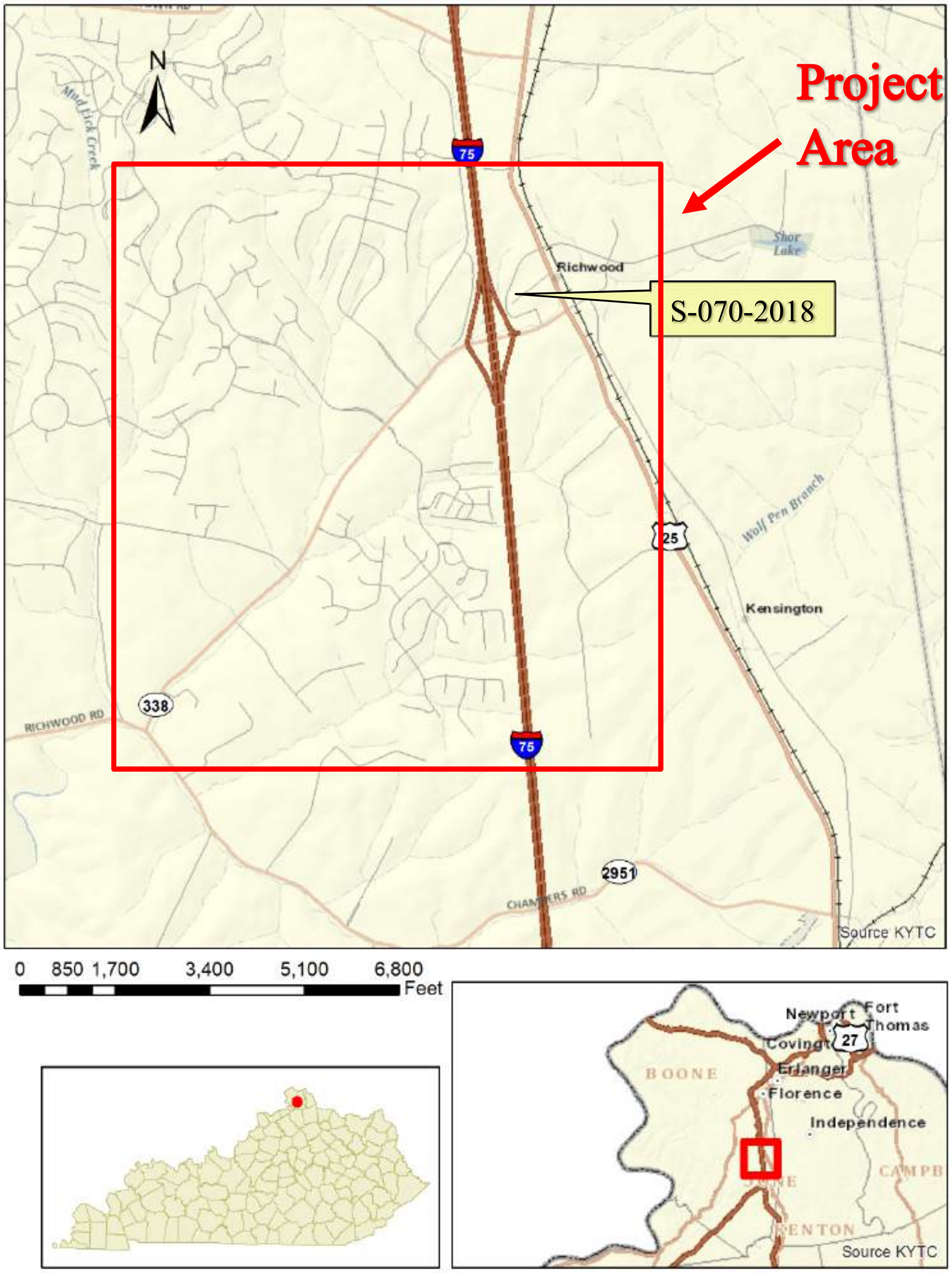
The attached "Geotechnical Notes" plan sheets include required information needed to design the recommended wall type.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Geotechnical Notes Sheet**
- **Coordinate Data Sheet**
- **Retaining Wall #8 Profile Sheet And Estimated Rockline**

Project Location Map



SHEET LOCATION:

FILE NAME: $$$$design$file$$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Hole No.	1032	1033	1034	1035	1036	1037
Station	51+27.50	51+79.50	52+50.00	53+50.00	54+50.00	55+00.00
Offset	94.00 ft. Lt.	65.50 ft. Lt.	34.00 ft. Lt.	34.00 ft. Lt.	34.00 ft. Lt.	34.00 ft. Lt.
Elev.	923.50	923.50	927.50	927.30	927.70	928.00

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Retaining Wall #8

SUBSURFACE DATA

S–070–18

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

GEOTECHNICAL NOTES

for MSE Walls

Design the wall in accorance with the AASHTO Standard Specifications for Highway Bridges, current edition, and the Special Note for MSE Walls. The Contract Documents control where a requirement which is not covered by, or is contrary to, AASHTO exists. The wall designer shall verify wall stability based on final wall design dimensions.

The base of the wall, or any wall footing must be a minimum of 2 feet below final exterior grades.

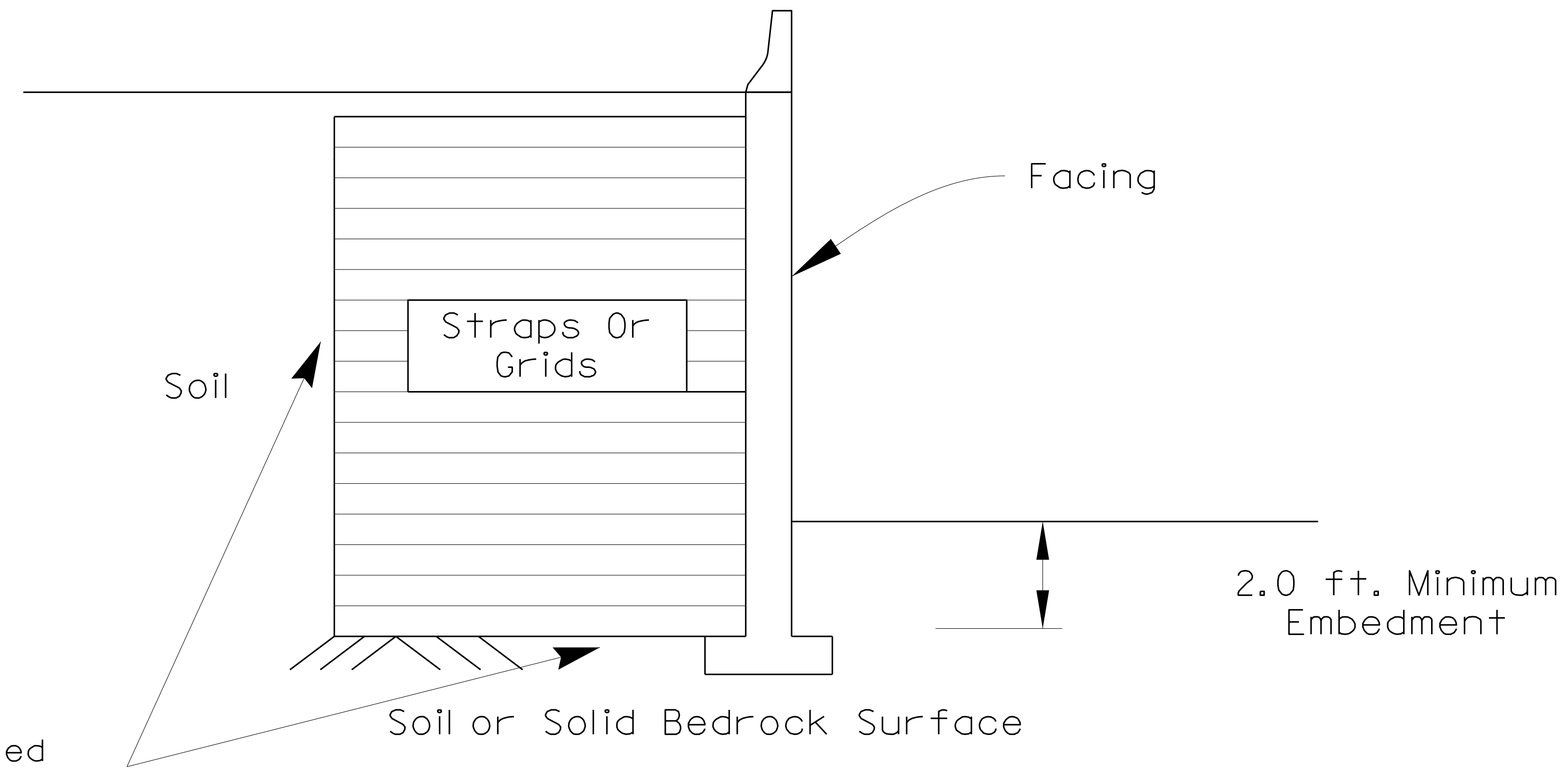
The wall shall include only inextensible (metal) reinforcement.

Size the wall footings at Strength Limit State using a Factored Nominal Bearing Resistance given below for Foundations Bearing On Soil and Bedrock. For checking the Service and Extreme Limit States, use Resistance Factors of 0.33 and 1.0, respectively.

Bearing Surface	Factored Nominal Bearing Resistance @ Service Limit State	Nominal Bearing Resistance
Soil	5.8 ksf	8.9 ksf
Bedrock	21.6 ksf	48 ksf

A Type IV Geotextile fabric shall be placed between the contact of any existing soil and the crushed stone Granular Embankment. The Geotextile Fabric shall be in accordance with Sections 214 and 843 of the current edition of the Standard Specifications for Road and Bridge Construction.

EXCAVATION AND HORIZONTAL BACKFILL BEARING ON SOIL OR BEDROCK



Type IV Fabric required only where there is a soil-granular material interface.

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
Internal Backfill (in reinforced volume)	0	34	120
External Backfill	0	21	120
Foundation Material			
Native Soil	1750	0	120
Bedrock	0	34 (Sliding Only)	130

The Internal Backfill shall be permanently drained.

Internal Backfill shall consist of granular material meeting the requirements of "Reinforced Fill Material" in Section 805 of the Standard Specifications, Current Edition. Internal Backfill shall extend a minimum of 1 foot beyond the end of the reinforcements.

Survey control shall be the front face of the MSE wall.

Horizontal stresses induced on the MSE wall by the H-Piles must be accounted for in the wall design. The information in regards to lateral pressure distribution from deep foundations on the face of the MSE wall can be found in FHWA manual NHI-10-024 Volume 1, Chapter 6, Section 6.1.2

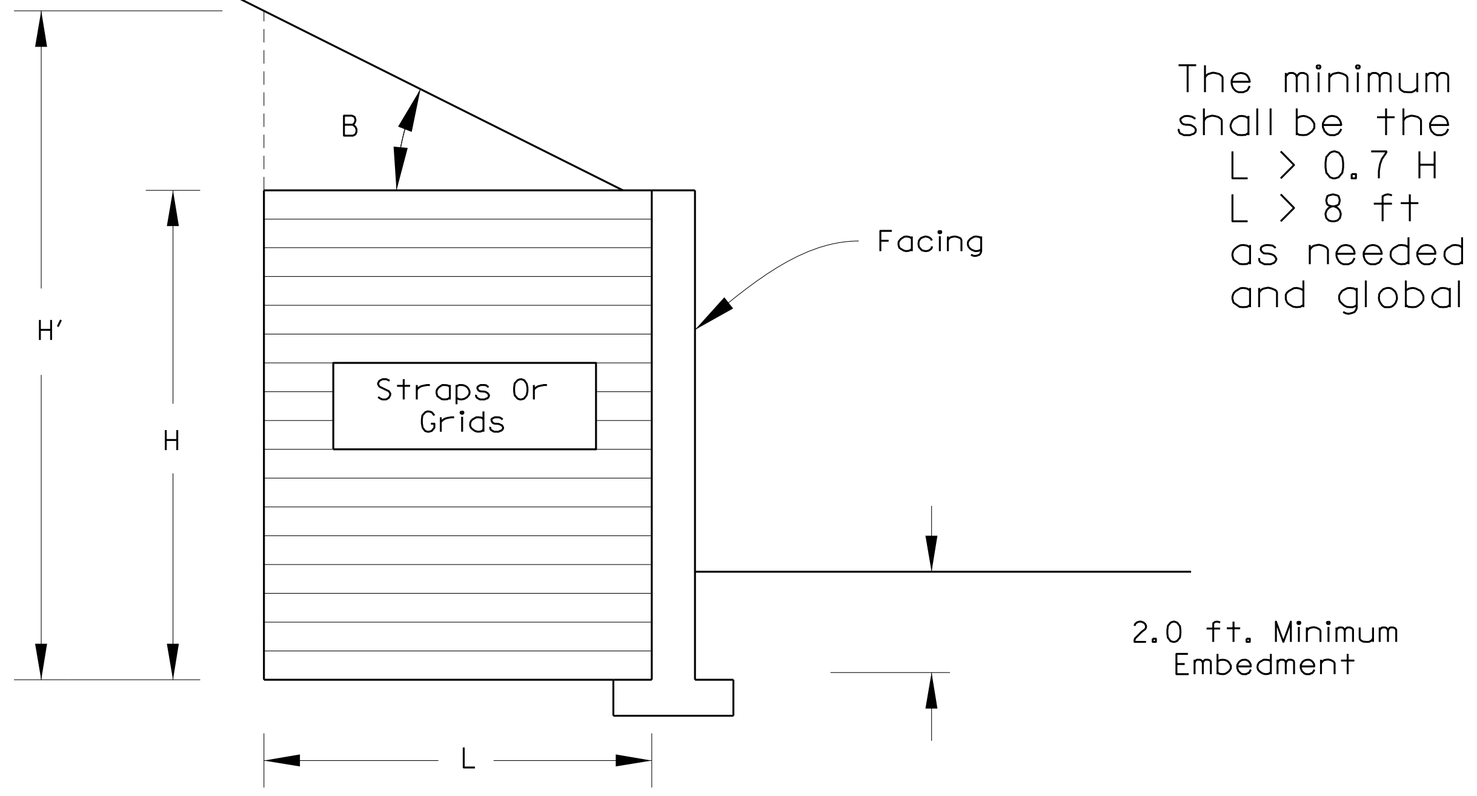
Prior to placing Granular Embankment for MSE wall construction, piles shall be driven to refusal. After piles have been driven, cans shall be placed over the piles. The annular space between the pile and cans shall be backfilled with pea gravel or equivalent. After which, the Granular Embankment materials my be placed and the MSE wall constructed.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

Structure preparation for the wall will require excavation of bedrock at some locations

The bedrock exposed during construction will be suceptable to weathering and softening in the presence of water. Water must be kept out of the footing excavataions. If bedrock becomes softened at bearing elevations, the softened material should be undercut to unweathered material prior to placing the MSE wall.

MINIMUM REINFORCEMENT LENGTH



The minimum reinforcement length (L) shall be the greater of:
- L > 0.7 H
- L > 8 ft
- as needed to satisfy internal, external, and global stability design requirements.

DATE: 12-DEC-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: C. COOK	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE **US 25**
CROSSING **Retaining Wall #8**

SUBSURFACE DATA

S–070–18

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:
FILE NAME: $$$$designfile$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-070-2018

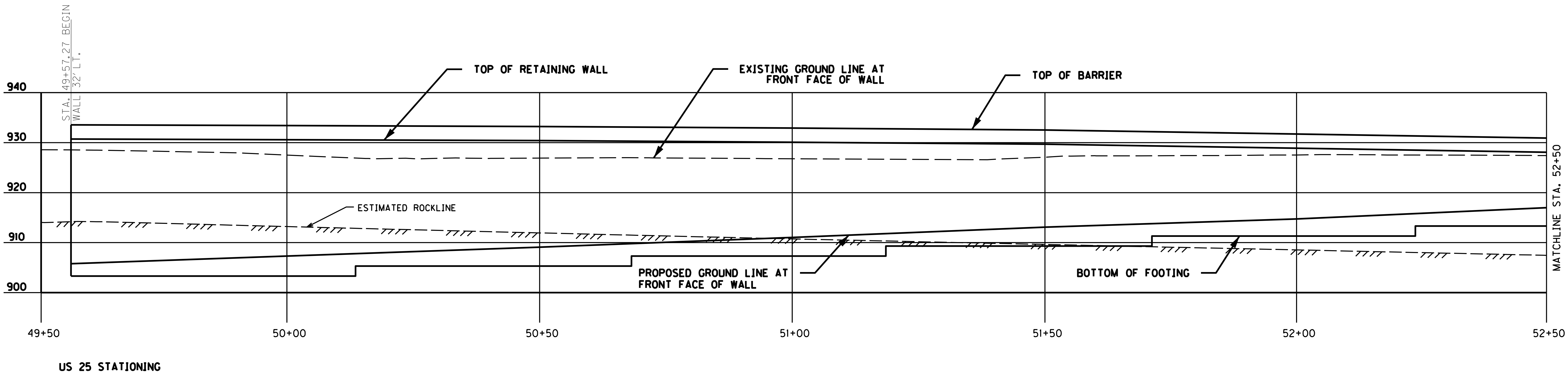
Notes:

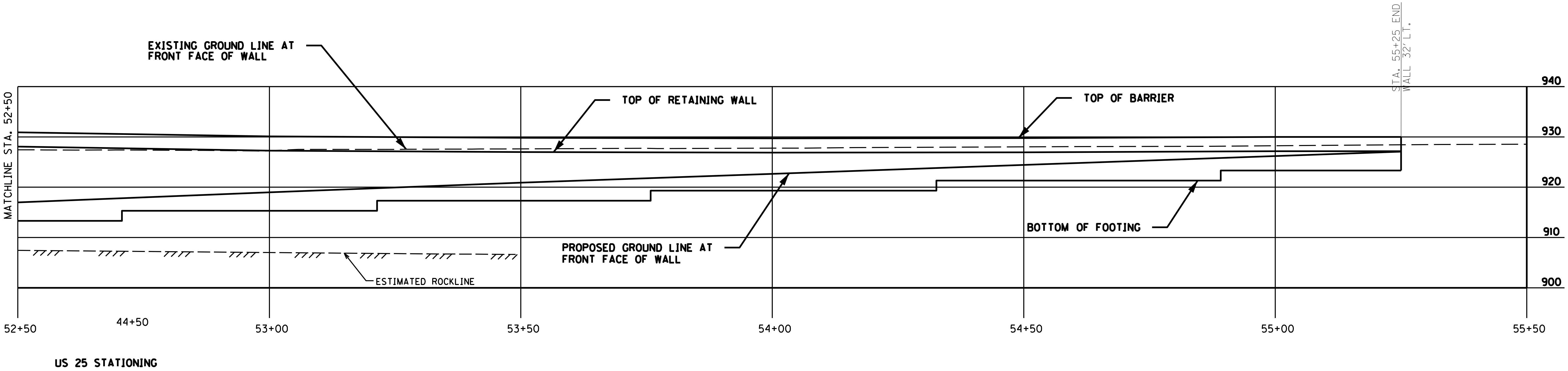
(circle one)

Elevation Datum (NAVD88) Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-070-2018						
1032	38.91901559	84.62467575	1032	US 25 51+27.5	94' Lt.	923.51
1033	38.91918054	84.62465046	1033	US 25 51+79.5	65.5' Lt.	923.45
1034	38.91939225	84.62463474	1034	US 25 52+50	34' Lt.	927.51
1035	38.91964899	84.62475923	1035	US 25 53+50	34' Lt.	927.32
1036	38.91990573	84.62488372	1036	US 25 54+50	34' Lt.	927.70
1037	38.92003410	84.62494597	1037	US 25 55+00	34' Lt.	928.00

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	





FILE NAME: N:\GEOTECH\BOONE RICHWOOD EXIT S-065-2018 THRU S-080-2018\DGNFILES\2018-11-16 E-MAIL FILES FROM JOE (HDR)\RETAININGWALL#8PROFILESHEE

USER: Clayton.Cook
DATE PLOTTED: December 11, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

SCALE: 1"=10'

RETAINING WALL #8
LT. STA. 49+57.27 LT. TO 55+25 US 25

Addendum 2 - 7-11-19

M E M O R A N D U M **S-068-2018**

TO:	Bart Asher, P.E. Director Division of Structural Design	cc:	J. Van Zee C. Van Zee M. Bezold (D-6) R. Franxman (D-6) E. Drury R. Turner B. Yeager C. Callan-Ramler (D-6) W. Hagerman (HDR) K. Meyer (HDR) K. Chism (Parsons)
FROM:	Michael Carpenter, P.E. TEBM Geotechnical Branch		
BY:	Clayton S. Cook, P.E. Geotechnical Branch		
DATE:	January 9, 2019		

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton;
Norfolk Southern Railway Bridge Over KY 338,
Retaining Wall #9, NB US 25 to KY 338 Ramp A, US 25 Right Station 42+25 to 46+64.28
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed retaining wall be part of the new proposed Single Point Urban Interchange (SPUI) between US 25 and KY 338. The wall will allow for increasing grade of US 25 to meet the proposed bridge that will be spanning over KY 338. The proposed wall will be 440 feet and run along the right side of US 25 and along Ramp A.

2.0 SITE GEOLOGIC CONDITIONS

The structure is located in the Independence Quadrangle (GQ-785). The geologic mapping indicated that the bedrock in this location is part of the Bull Fork Formation. This formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

3.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of three sample and core holes and three soundings were drilled. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples.

4.0 SUBSURFACE CONDITIONS

The soil encountered at the site included mostly lean and fat clay. The soil samples were designated as CL and CH by the USCS, and A-7-6 and A-6 by the AASHTO classification system. Soil strength testing included eight unconfined compression tests with an average value of 3910 psf.

Top of weathered rock elevations ranged from 889.2 to 906.4 ft. with increasing rock elevations as you move upstation along the wall. The bedrock layers at the structure location consisted of interbedded dark grey shale with limestone. The core recovered percentages were generally above the 90's except in the upper layers of the bedrock due to the degraded nature of the material. KY Rock Quality Designation (RQD) values ranged from 0 to 29. The SDI testing indicated that interbedded shale and limestone bedrock was overall non-durable. Four rock unconfined tests were conducted with an average unconfined compressive strength of 1635 psi.

5.0 ENGINEERING ANALYSIS AND FOUNDATION RECOMMENDATIONS

One retaining wall type, a mechanically stabilized earth (MSE) wall, was considered for this location. Due to the sloping rockline, part of the beginning wall will be bearing either on soil and will transition to bearing on bedrock as the wall approaches the US 25 bridge. The transition from soil to rock is estimated at US 25 Station 45+00 along the centerline of the proposed wall location. See attached Retaining Wall #9 Profile Sheet for estimated rockline elevation along the wall profile.

Additionally the wall will be tying into End Bent #1 of the US 25 Bridge Spanning KY 338, S-065-2018. H-Piles, placed in pre-drilled holes, backfilled with sand or pea gravel, and then seated before the beginning of the MSE wall construction and corresponding backfill operations are recommended. As the internal backfill is being placed within the reinforced zone of the MSE Wall, the H-Piles shall be isolated from the internal backfill by installing cans as the wall is constructed. H-piles cannot be driven or drilled through the MSE reinforced zone. The annular space between the cans and the H-piles must be filled with sand or pea-gravel.

Pre-drilling will be required for installation of the piling and to insure their vertical placement. 24-inch diameter holes shall be drilled to a depth that ensure adequate lateral stability of the H-piles during construction of the MSE Wall. The holes shall be backfilled with sand or pea gravel once the pile is in place. Piles shall then be driven to refusal. Include the cost of all materials, labor and equipment needed for pre-dill, backfilling the holes and driving the piles to refusal in the price per linear foot for "Pre-drilling for Piles".

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- Unit weight of MSE internal backfill: 120 pcf
- Factored nominal bearing resistance at the strength limit state on soil: 5800 psf
- Minimum strap length = 8 feet or 70% of wall height
- Cohesion for sliding calculation = 1750 psf
- Equivalent depth of surcharge = 2 feet

MSE Wall Design Parameters for US 25 Station 45+40 to 46+68.52 (Bearing On Rock)

- Base of footing must be a minimum of two feet below final grade
- Friction angle of retained backfill (behind reinforced zone): 21 degrees
- Friction angle of internal reinforced backfill: 34 degrees
- Unit weight of in-situ soil backfill and foundation soils: 120 pcf
- Unit weight of MSE internal backfill: 120 pcf
- Factored nominal bearing resistance at the strength limit state on bedrock: 21.6 ksf
- Minimum strap length = 8 feet or 70% of wall height
- Friction angle for sliding calculation = 34 degrees
- Equivalent depth of surcharge = 2 feet

It is currently assumed that material that will be used behind the MSE wall construction will be engineered native fill material. If the native bedrock is excavated and compacted back for fill material behind the MSE wall use a friction angle of retained backfill (behind reinforced zone) of 23 degrees. If granular embankment is used behind the MSE wall use a friction angle of retained backfill (behind reinforced zone) of 34 degrees.

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>
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7.0 PLAN NOTES

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The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

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- **Subsurface Data Sheet**
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- **Coordinate Data Sheet**
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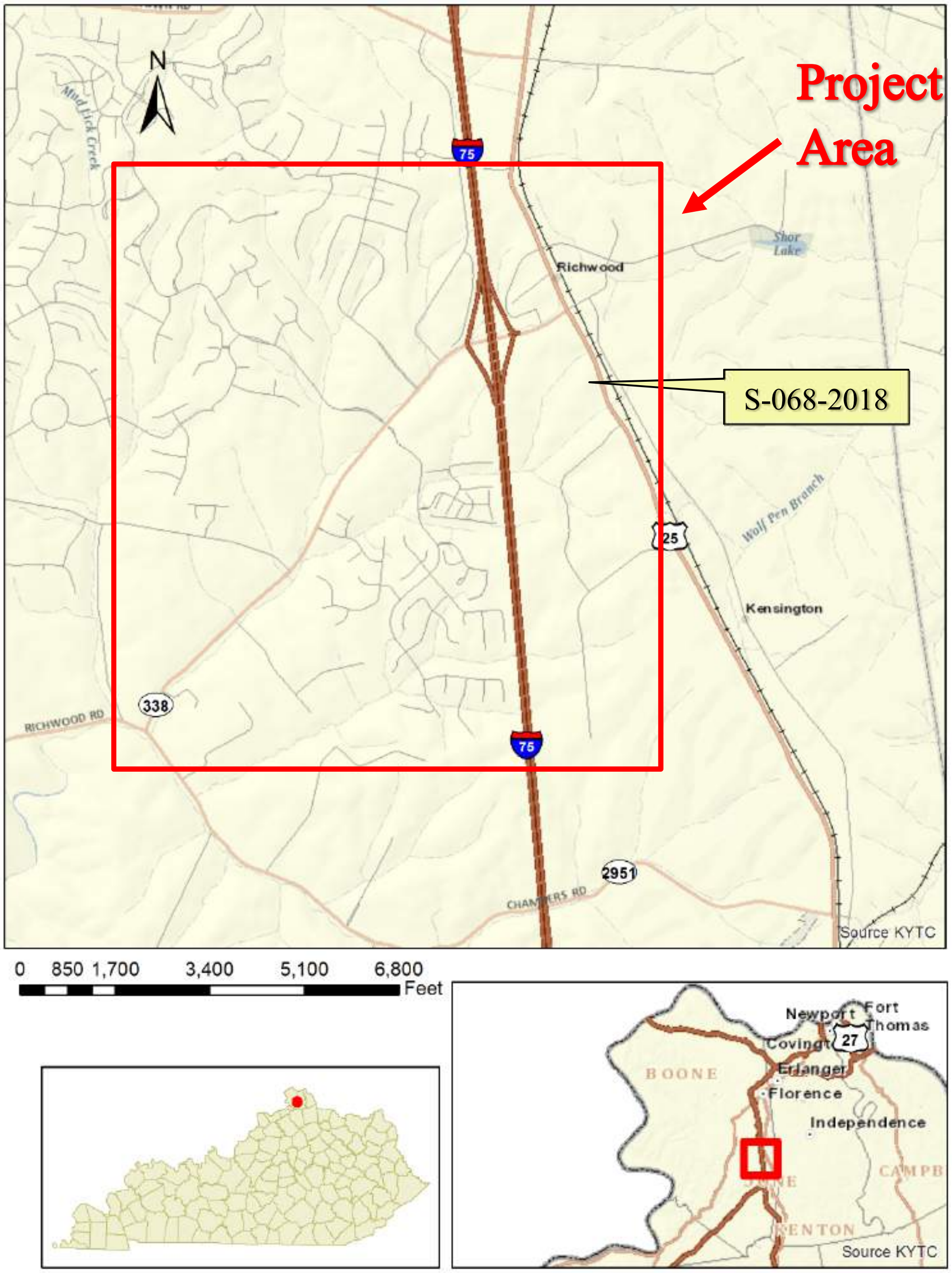
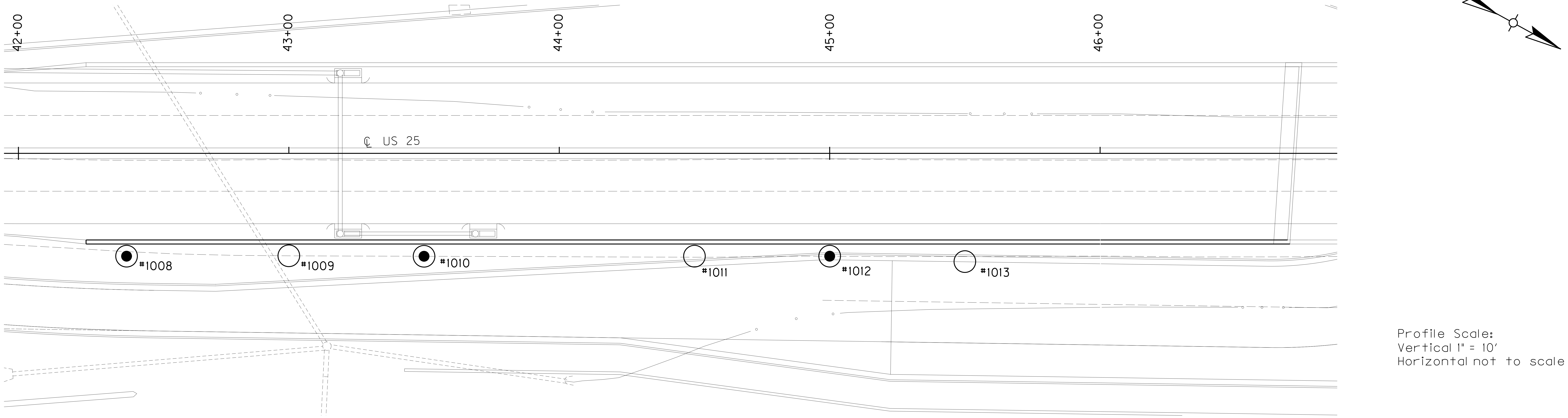
Project Location Map



SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1008	1009	1010
Station	42+40.00	43+00.00	43+50.00
Offset	38.00 ft. Rt.	38.00 ft. Rt.	38.00 ft. Rt.
Elev. (NAVD 88 datum)	921.30	922.00	922.70

Hole 1008:

QU (psi)	Qu (psf)	D_{50} (mm)	w%	LI	
	4891	0.008	17	-0.19	A-6(14),CL,S+C=80(48+32)
		0.006	24	0.13	A-6(18),CL,S+C=97(66+31)
		0.012	19	-0.13	A-7-6(16),CH,S+C=62(24+38)
	5332	0.020	29	0.45	A-6(9),CL,S+C=62(32+30)
		0.004	26	0.12	N=6, A-7-6(24),CH,S+C=83(42+41)
		0.044	11	-0.36	A-6(7),CL,S+C=54(24+30)
					N=30

QU (psi)	KYRQD	REC	
1229	0	100	93(4)
	0	100	SDI(JS)
			87(5)
1316	0	100	

Limestone:(55%) light gray, coarse grained, fossiliferous, interbedded w/Shale (45%) dark gray, silty, calcareous

Top of rock elev.= 889.90
Base of weathered rock elev.= 889.20

Hole 1010:

QU (psi)	Qu (psf)	D_{50} (mm)	w%	LI	
		0.004	23	0.04	A-7-6(22),CL,S+C=87(45+42)
		0.003	21	-0.06	N=5, A-7-6(23),CL,S+C=85(39+46)
	2397	0.001	26	0.05	A-7-6(32),CH,S+C=93(38+55)
	3379	0.003	21	-0.07	A-7-6(24),CL,S+C=88(44+44)
	4761	0.023	18	-0.17	A-7-6(10),CL,S+C=62(38+24)

QU (psi)	KYRQD	REC	
	0	70	SDI(JS)
	0	94	61(2)
757	0	100	80(4)
	26	100	
	23	100	68(3)
2203	13	100	75(4)

Limestone:(70%) light gray, coarse grained, even & irregular bedding, fossiliferous w/brown & gray, weathered, silty Shale (30%) & laminations & partings

Limestone:(70%) light gray, coarse grained, even & irregular bedding, fossiliferous w/gray, silty Shale (30%) & laminations & partings

Limestone:(55%) light gray, coarse grained, fossiliferous, interbedded w/Shale (45%) gray, silty, calcareous

Top of rock elev.= 898.70
Base of weathered rock elev.= 894.20

SHEET LOCATION:
FILE NAME: $$$$design$file$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

DATE: 25-OCTOBER-2018
CHECKED BY
DESIGNED BY:
DETAILED BY: E. BAILEY
C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25
CROSSING
Retaining Wall #9

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.
DRAWING NO.
00000

S–068–18
ITEM NUMBER
6–18.00

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$$specification$$$$

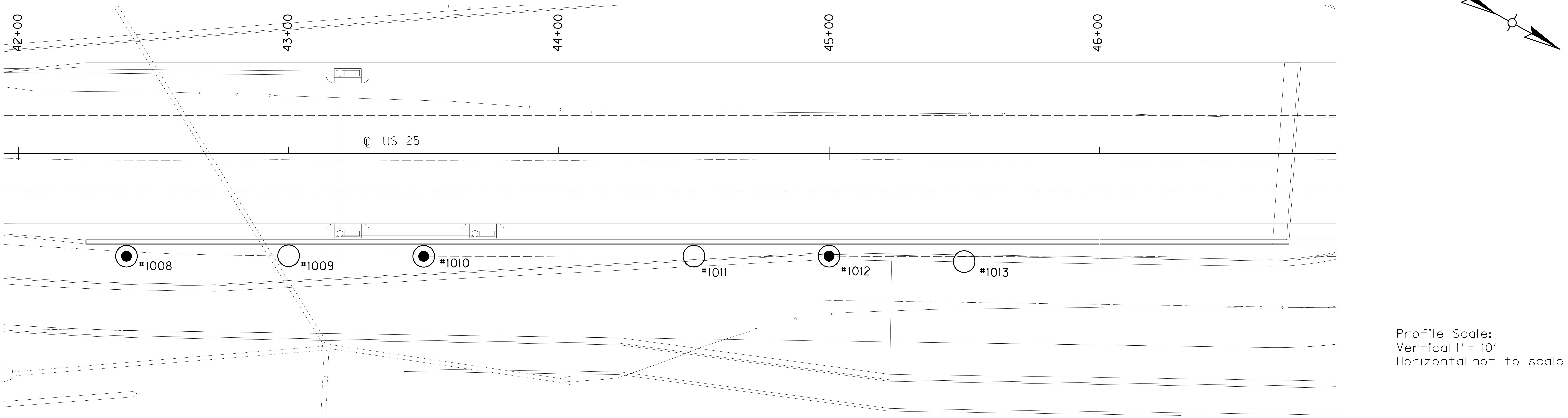
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1011	1012	1013
Station	44+50.00	45+00.00	45+50.00
Offset	38.00 ft. Rt.	38.00 ft. Rt.	40.00 ft. Rt.
Elev. (NAVD 88 datum)	924.20	924.80	925.10

QU (psi)	Qu (psf)	D_{50} (mm)	w%	LI	
	2701	0.004	26	0.24	A-7-6(20),CL,S+C=94(56+39)
		0.012	20	0.03	N=27, A-6(12),CL,S+C=73(44+29)
		0.015	14	-0.43	A-6(8),CL,S+C=67(37+30)

N=50/0.3

QU (psi)	KYRQD	REC
	0	63
3507	11	86
1635	0	100
	11	91
	0	100
417	0	100
	0	100
3156	29	100
	17	100

Limestone:(50%) light gray, coarse grained, fossiliferous, interbedded w/Shale (50%) brown & gray, silty, calcareous, weathered

Limestone:(52%) light gray, coarse grained, fossiliferous, interbedded w/Shale (48%) gray, silty, calcareous

Limestone:(70%) light gray, coarse grained, even & irregular bedding, fossiliferous w/gray, silty Shale (30%) & laminations & partings

Top of rock elev.= 911.50
Base of weathered rock elev.= 906.40

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Retaining Wall #9

SUBSURFACE DATA

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Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

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ITEM NUMBER

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Addendum 2 -- 7-11-19

GEOTECHNICAL NOTES

for MSE Walls

Design the wall in accorance with the AASHTO Standard Specifications for Highway Bridges, current edition, and the Special Note for MSE Walls. The Contract Documents control where a requirement which is not covered by, or is contrary to, AASHTO exists. The wall designer shall verify wall stability based on final wall design dimensions.

The base of the wall, or any wall footing must be a minimum of 2 feet below final exterior grades.

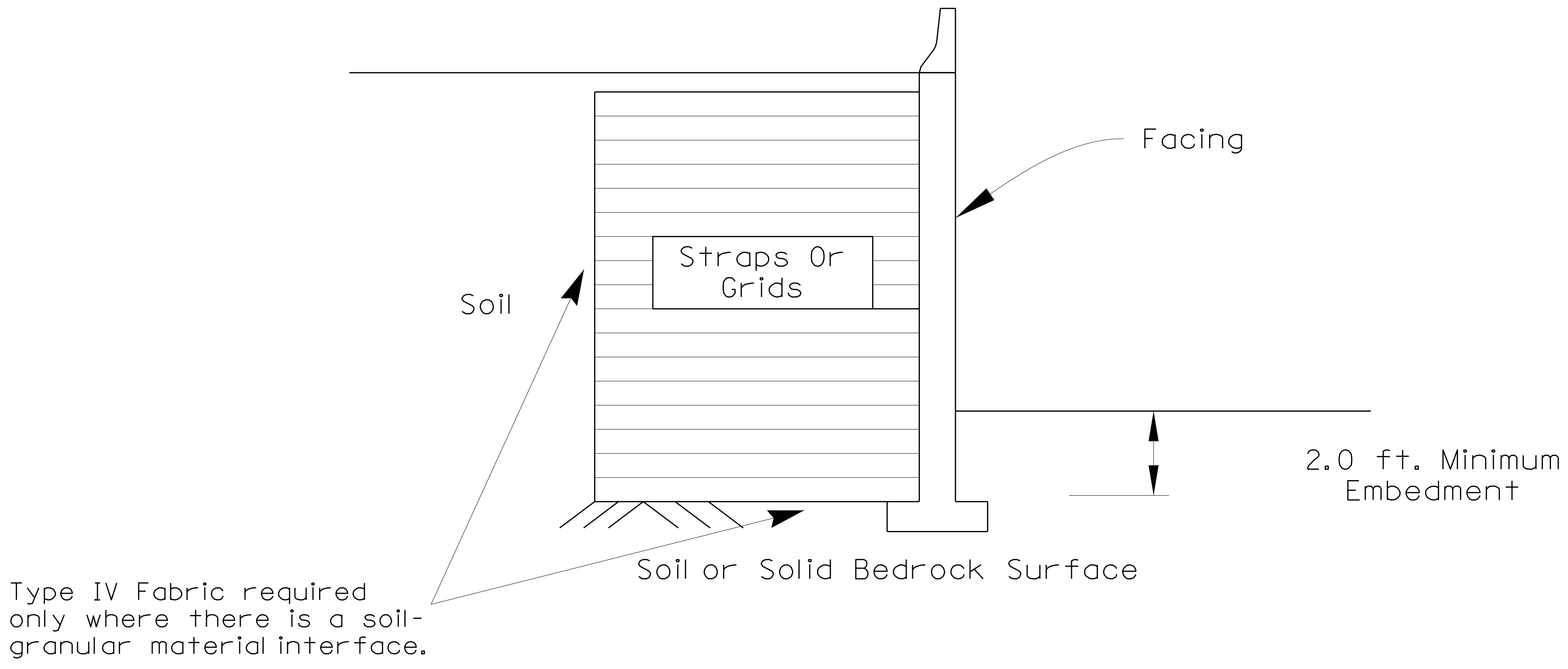
The wall shall include only inextensible (metal) reinforcement.

Size the wall footings at Strength Limit State using a Factored Nominal Bearing Resistance given below for Foundations Bearing On Soil and Bedrock. For checking the Service and Extreme Limit States, use Resistance Factors of 0.33 and 1.0, respectively.

Bearing Surface	Factored Nominal Bearing Resistance @ Service Limit State	Nominal Bearing Resistance
Soil	5.8 ksf	8.9 ksf
Bedrock	21.6 ksf	48 ksf

A Type IV Geotextile fabric shall be placed between the contact of any existing soil and the crushed stone Granular Embankment. The Geotextile Fabric shall be in accordance with Sections 214 and 843 of the current edition of the Standard Specifications for Road and Bridge Construction.

EXCAVATION AND HORIZONTAL BACKFILL BEARING ON SOIL OR BEDROCK



Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
Internal Backfill (in reinforced volume)	0	34	120
External Backfill	0	21	120
Foundation Material			
Native Soil	1750	0	120
Bedrock	0	34 (Sliding Only)	130

The Internal Backfill shall be permanently drained.

Internal Backfill shall consist of granular material meeting the requirements of "Reinforced Fill Material" in Section 805 of the Standard Specifications, Current Edition. Internal Backfill shall extend a minimum of 1 foot beyond the end of the reinforcements.

Survey control shall be the front face of the MSE wall.

Horizontal stresses induced on the MSE wall by the H-Piles must be accounted for in the wall design. The information in regards to lateral pressure distribution from deep foundations on the face of the MSE wall can be found in FHWA manual NHI-10-024 Volume 1, Chapter 6, Section 6.1.2

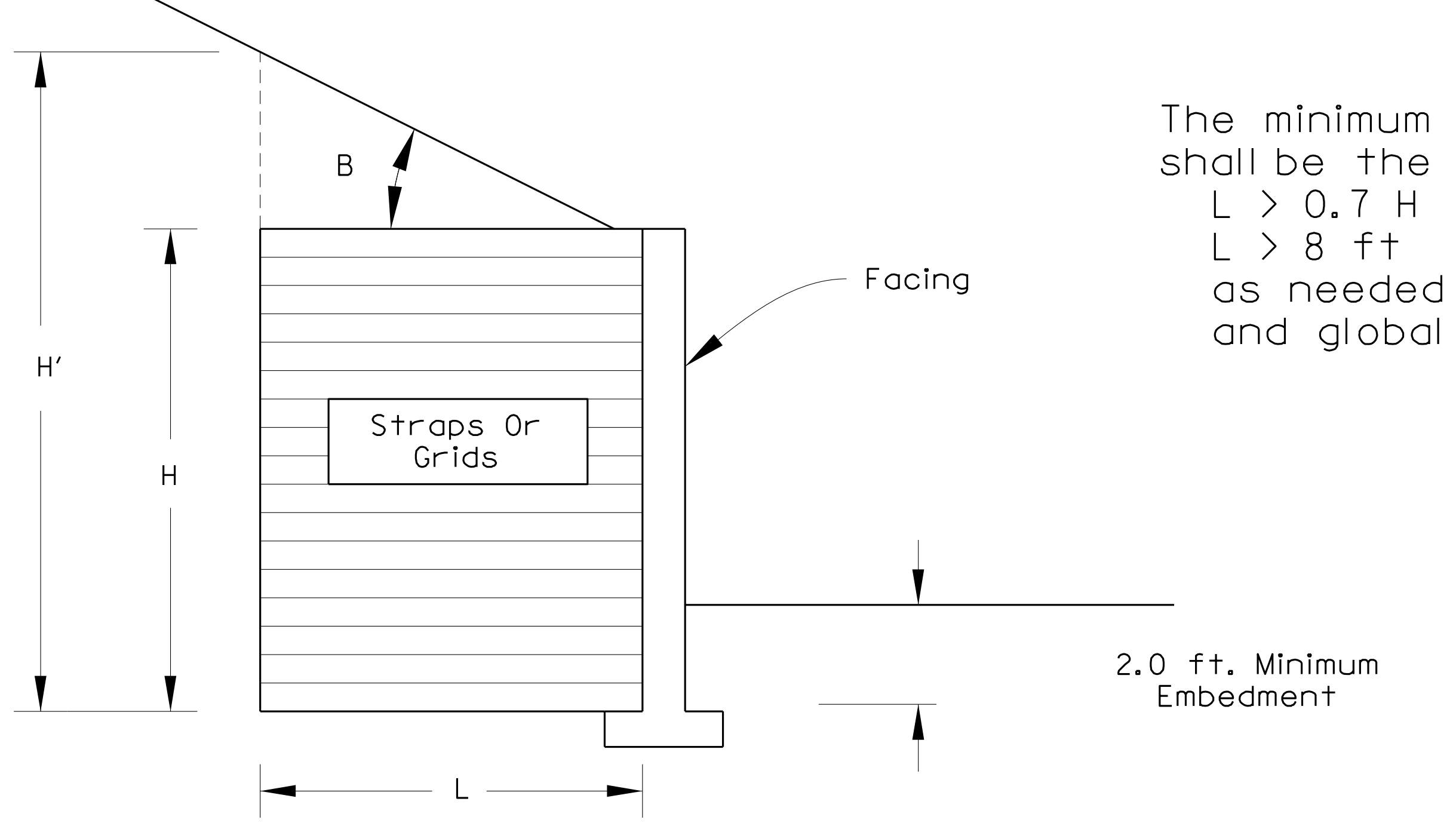
Prior to placing Granular Embankment for MSE wall construction, piles shall be driven to refusal. After piles have been driven, cans shall be placed over the piles. The annular space between the pile and cans shall be backfilled with pea gravel or equivalent. After which, the Granular Embankment materials my be placed and the MSE wall constructed.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

Structure preparation for the wall will require excavation of bedrock at some locations

The bedrock exposed during construction will be suceptable to weathering and softening in the presence of water. Water must be kept out of the footing excavataions. If bedrock becomes softened at bearing elevations, the softened material should be undercut to unweathered material prior to placing the MSE wall.

MINIMUM REINFORCEMENT LENGTH



The minimum reinforcement length (L) shall be the greater of:

$L > 0.7\ H$

$L > 8$ ft

as needed to satisfy internal, external, and global stability design requirements.

S–068–18

ITEM NUMBER
6–18.00

DATE: 12-DEC-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: C. COOK	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE **US 25**
CROSSING **Retaining Wall #9**

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO. **00000**

Addendum 2 -- 7-11-19

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-068-2018

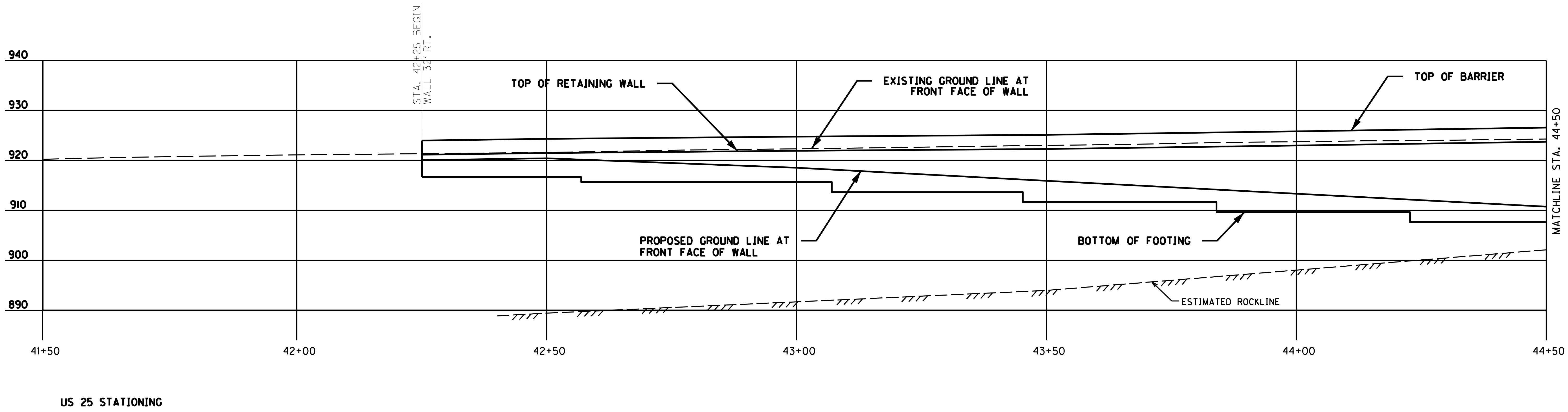
Notes:

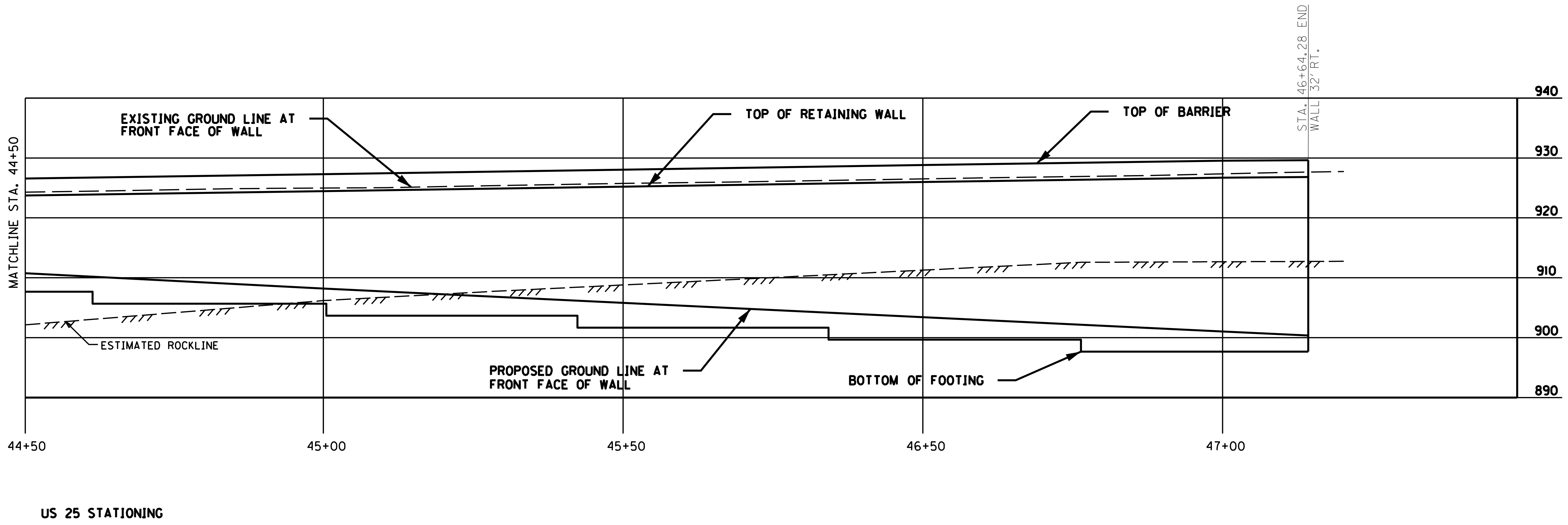
(circle one)

Elevation Datum (NAVD88) Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-068-2018						
1008	38.91698965	84.62283871	1008	US 25 42+40	38' Rt.	921.29
1009	38.91713490	84.62293818	1009	US 25 43+00	38' Rt.	922.04
1010	38.91725594	84.62302106	1010	US 25 43+50	38' Rt.	922.69
1011	38.91749801	84.62318683	1011	US 25 44+50	38' Rt.	924.19
1012	38.91761905	84.62326971	1012	US 25 45+00	38' Rt.	924.83
1013	38.91774268	84.62334640	1013	US 25 45+50	40' Rt.	925.05

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	





SCALE: 1"=10'

RETAINING WALL #9
RT. STA. 42+25 RT. TO 46+64.28 US 25

Addendum 2 -- 7-11-19

FILE NAME: N:\GEOTECH\BOONE RICHWOOD EXIT S-065-2018 THRU S-080-2018\DGNFILES\2018-11-16 E-MAIL FILES FROM JOE (HDR)\RETAININGWALL#9PROFILESHEET

USER: Clayton.Cook
DATE PLOTTED: December 11, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

M E M O R A N D U M **S-071-2018**

TO: Bart Asher, P.E.
Director
Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM
Geotechnical Branch

BY: Clayton S. Cook, P.E.
Geotechnical Branch

DATE: January 9, 2019

cc: J. Van Zee
C. Van Zee
M. Bezold (D-6)
R. Franxman (D-6)
E. Drury
R. Turner
B. Yeager
C. Callan-Ramler (D-6)
W. Hagerman (HDR)
K. Meyer (HDR)
K. Chism (Parsons)

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton;
Norfolk Southern Railway Bridge Over KY 338,
Retaining Wall #10, KY 338 to NB US 25 Ramp C, US 25 Right Station
49+56.52 to 54+25
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed retaining wall be part of the new proposed Single Point Urban Interchange (SPUI) between US 25 and KY 338. The wall will allow for increasing grade of US 25 to meet the proposed bridge that will be spanning over KY 338. The proposed wall will be 468 feet and run along the right side of US 25 and along Ramp C.

2.0 SITE GEOLOGIC CONDITIONS

The structure is located in the Independence Quadrangle (GQ-785). The geologic mapping indicated that the bedrock in this location is part of the Bull Fork Formation. This formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

3.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of three sample and core holes and two soundings were drilled. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples.

4.0 SUBSURFACE CONDITIONS

The soil encountered at the site included mostly lean and fat clay. The soil samples were designated as CL, CH, and MH by the USCS, and A-7-6 and A-6 by the AASHTO classification system.

Top of weathered rock elevations ranged from 912.4 to 917.1 ft. with varying rock elevations as you move upstation along the wall. The bedrock layers at the structure location consisted of interbedded dark grey shale with limestone. The core recovered percentages were above the 90's except in the upper portion of Hole 1042 where degraded bedrock was present. KY Rock Quality Designation (RQD) values ranged from 0 to 36. The SDI testing indicated that interbedded shale and limestone bedrock was overall non-durable. Five rock unconfined tests were conducted with an average unconfined compressive strength of 1188 psi.

5.0 ENGINEERING ANALYSIS AND FOUNDATION RECOMMENDATIONS

One retaining wall type, a mechanically stabilized earth (MSE) wall, was considered for this location. Due to the sloping rockline, part of the beginning wall will be bearing either on soil and will transition to bearing on bedrock as the wall approaches the US 25 bridge. The transition from rock to soil is estimated at US 25 Station 52+25 along the centerline of the proposed wall location. See attached Retaining Wall #10 Profile Sheet for estimated rockline elevation along the wall profile.

Additionally the wall will be tying into End Bent #2 of the US 25 Bridge Spanning KY 338, S-065-2018. H-Piles, placed in pre-drilled holes, backfilled with sand or pea gravel, and then seated before the beginning of the MSE wall construction and corresponding backfill operations are recommended. As the internal backfill is being placed within the reinforced zone of the MSE Wall, the H-Piles shall be isolated from the internal backfill by installing cans as the wall is constructed. H-piles cannot be driven or drilled through the MSE reinforced zone. The annular space between the cans and the H-piles must be filled with sand or pea-gravel.

Pre-drilling will be required for installation of the piling and to insure their vertical placement. 24-inch diameter holes shall be drilled to a depth that ensure adequate lateral stability of the H-piles during construction of the MSE Wall. The holes shall be backfilled with sand or pea gravel once the pile is in place. Piles shall then be driven to refusal. Include the cost of all materials, labor and equipment needed for pre-dill, backfilling the holes and driving the piles to refusal in the price per linear foot for "Pre-drilling for Piles".

MSE Wall Design Parameters for US 25 Station 42+25 to 45+40 (Bearing on Soil)

- Base of footing must be a minimum of two feet below final grade
- Friction angle of retained backfill (behind reinforced zone): 21 degrees
- Friction angle of internal reinforced backfill: 34 degrees
- Cohesion of foundation soils: 1750 psf
- Unit weight of in-situ soil backfill and foundation soils: 120 pcf
- Unit weight of MSE internal backfill: 120 pcf
- Factored nominal bearing resistance at the strength limit state on soil: 5800 psf
- Minimum strap length = 8 feet or 70% of wall height
- Cohesion for sliding calculation = 1750 psf
- Equivalent depth of surcharge = 2 feet

MSE Wall Design Parameters for US 25 Station 45+40 to 46+68.52 (Bearing On Rock)

- Base of footing must be a minimum of two feet below final grade
- Friction angle of retained backfill (behind reinforced zone): 21 degrees
- Friction angle of internal reinforced backfill: 34 degrees
- Unit weight of in-situ soil backfill and foundation soils: 120 pcf
- Unit weight of MSE internal backfill: 120 pcf
- Factored nominal bearing resistance at the strength limit state on bedrock: 21.6 ksf
- Minimum strap length = 8 feet or 70% of wall height
- Friction angle for sliding calculation = 34 degrees
- Equivalent depth of surcharge = 2 feet

It is currently assumed that material that will be used behind the MSE wall construction will be engineered native fill material. If the native bedrock is excavated and compacted back for fill material behind the MSE wall use a friction angle of retained backfill (behind reinforced zone) of 23 degrees. If granular embankment is used behind the MSE wall use a friction angle of retained backfill (behind reinforced zone) of 34 degrees.

Global stability for the structure was analyzed for varied assumed configurations and was found to be acceptable. Settlement was not considered to be an issue due to the structure bearing on soil that is being cut to below grade and then bearing on bedrock.

It is likely that some type of dewatering method will be needed to construct the wall foundation.

6.0 MSE WALL RECOMMENDATIONS

6.1 Wall shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition. The wall designer shall verify wall stability based on final wall design dimensions.

6.2 Live load surcharges shall be applied in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

6.3 The MSE wall must also be in accordance with the requirements of the Special Note for MSE Walls.

6.4 The minimum reinforcement length is 0.7 times the wall height or 8 feet, whichever is greater.

6.5 Survey control is the front face of the MSE Wall

6.6 The internal backfill shall extend a minimum of 1 foot beyond the end of the reinforcements.

6.7 Embedment of the footings must be a minimum of 2 feet below final grade.

6.8 Place a Type IV Geotextile Fabric between the contact points of the soil and internal backfill. The Geotextile fabric shall be in accordance with Sections 214 and 843 of the Standard Specifications for Road and Bridge Construction, current edition.

6.9 The wall analyses assumed that the retained backfill (behind reinforced zone) will consist of engineered native fill material. A value of 21 degrees was used or the friction angle to determine lateral earth pressures. Using this value, overturning and sliding external stability requirements will be satisfied.

6.10 Soil parameters to be utilized for design of the walls are included on the attached Geotechnical Note Sheets for MSE Walls.

6.11 Backfill behind the wall shall consist of native soils. The materials shall be compacted in accordance with Section 206 of the Standard Specifications for Road and Bridge Construction, current edition.

6.12 Horizontal stresses induced on the MSE wall by the H-Piles must be accounted for in the wall design. The information in regards to lateral pressure distribution from deep foundations on the face of the MSE Walls can be found in FHWA manual NHI-10-024 Volume 1, Chapter 6, Section 6.1.2.

6.13 The reinforcement straps shall be splayed around the piles as the wall is built.

6.14 If the placement of an obstruction in the all reinforcement zone (such as drainage structures, signal or sign foundations, guardrail posts, etc.) cannot be avoided, the design of the wall near the obstruction shall be modified using one of the following alternatives (reinforcement layers shall not be structurally connected to any obstructions):

6.14.1 Place a structural frame (collar or yoke) around the obstruction that is capable of carrying the load from the reinforcement in front of the obstruction to the reinforcement connected to the structural frame behind the obstruction.

6.14.2 If the soil reinforcements consist of discrete strips or bar mats instead of continuous sheets, it may be possible to splay the reinforcements around the obstruction, depending on its overall size.

6.15 The internal design of the MSE wall shall be in accordance with Section 5 of the AASHTO Specifications for Highway and Bridges, current edition. The pullout resistance shall be based on a $\phi = 34°$. The internal granular backfill shall be in accordance with Reinforced Fill Material in Section 805 of Kentucky Standard Specifications for Road and Bridge Construction, current edition.

6.16 MSE walls using only inextensible reinforcement shall be used.

6.17 MSE wall facing shall be resistant to salts and sulfides.

6.18 Earth reinforcement elements in MSE walls shall be designed to have a corrosion resistance/durability to ensure a minimum design life of 100 years.

6.19 Use bearing pads between facing units where the height of the wall (H) exceeds 15 feet. The thickness of the compression member shall be determined by the wall design engineer.

6.20 Slip joints shall be utilized in the wall facing elements where the structure transitions to being on soil to bearing on rock to minimize facial cracking from differential settlement.

7.0 PLAN NOTES

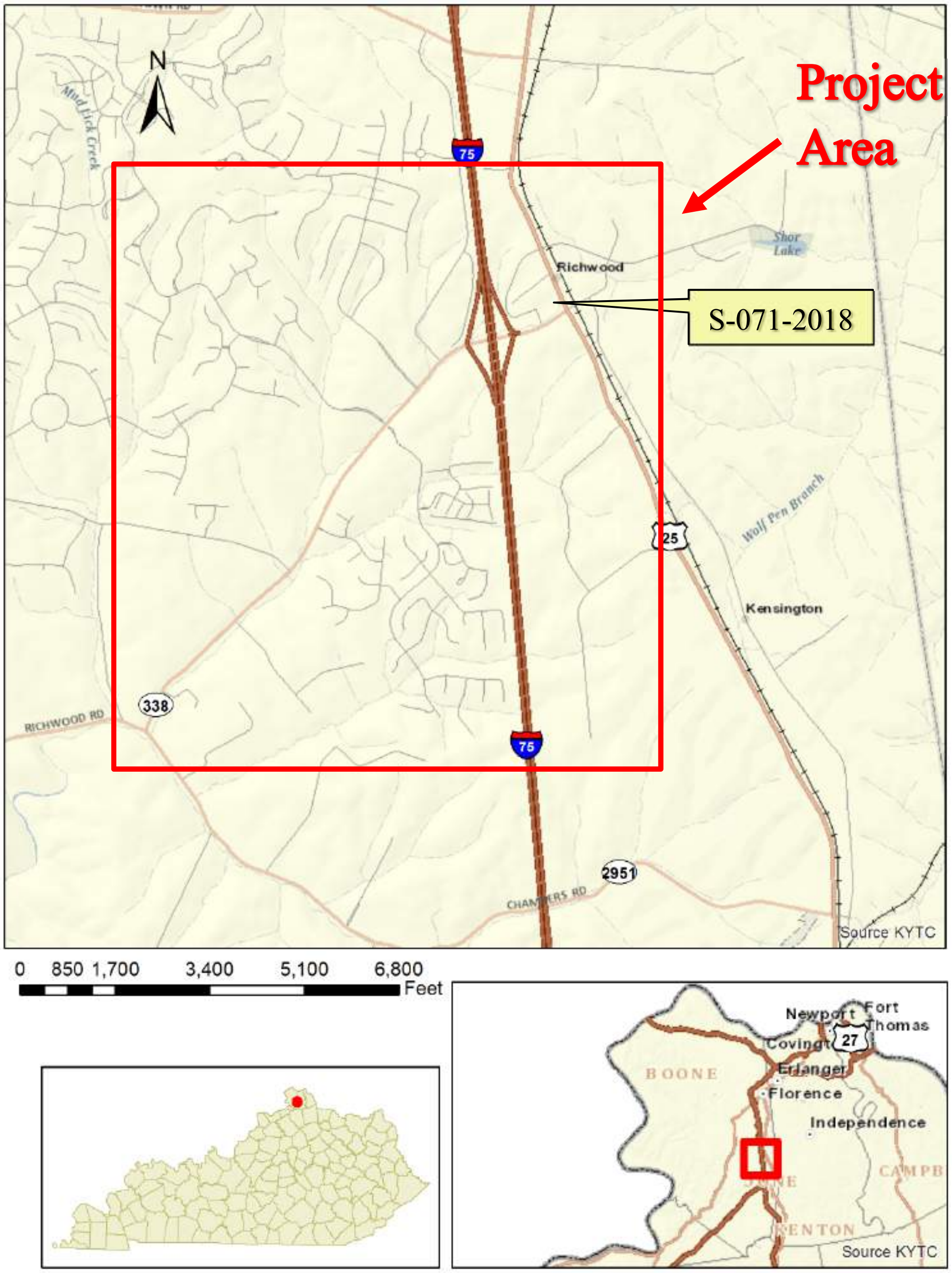
The attached “Geotechnical Notes” plan sheets include required information needed to design the recommended wall type.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

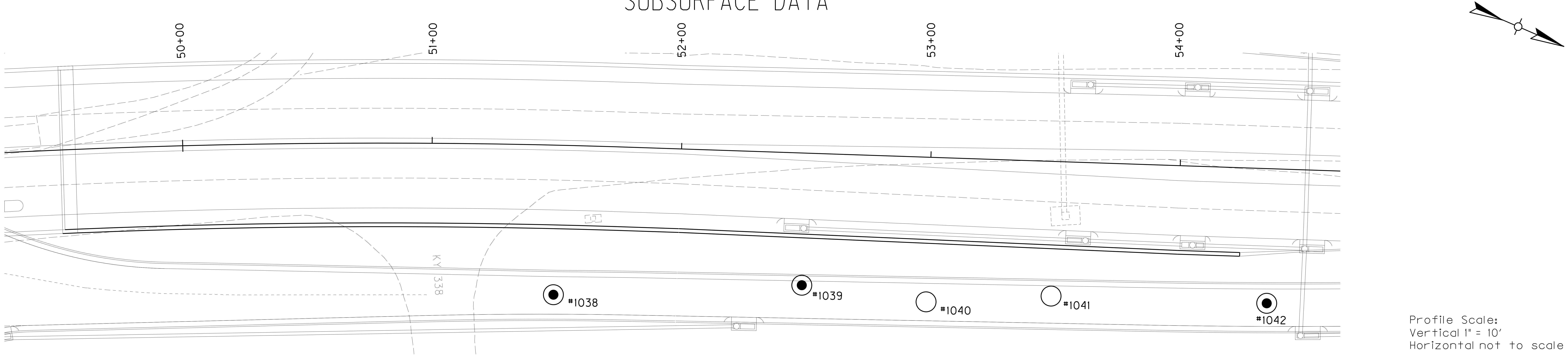
- **Project Location Map**
- **Subsurface Data Sheet**
- **Geotechnical Notes Sheet**
- **Coordinate Data Sheet**
- **Retaining Wall #10 Profile Sheet And Estimated Rockline**

Project Location Map



SUBSURFACE DATA

Plan Scale 1" = 20'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1038	1039	1040	1041	1042
Station	51+50.00	52+50.00	53+00.00	53+50.00	54+36.50
Offset	60.00 ft. Rt.	53.00 ft. Rt.	58.00 ft. Rt.	54.00 ft. Rt.	54.00 ft. Rt.
Elev. (NAVD 88 datum)	926.40	925.50	925.50	925.40	926.00

The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Retaining Wall #10

S–071–18

SUBSURFACE DATA

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:
FILE NAME: $$$$design$file$$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

GEOTECHNICAL NOTES

for MSE Walls

Design the wall in accorance with the AASHTO Standard Specifications for Highway Bridges, current edition, and the Special Note for MSE Walls. The Contract Documents control where a requirement which is not covered by, or is contrary to, AASHTO exists. The wall designer shall verify wall stability based on final wall design dimensions.

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Bearing Surface	Factored Nominal Bearing Resistance @ Service Limit State	Nominal Bearing Resistance
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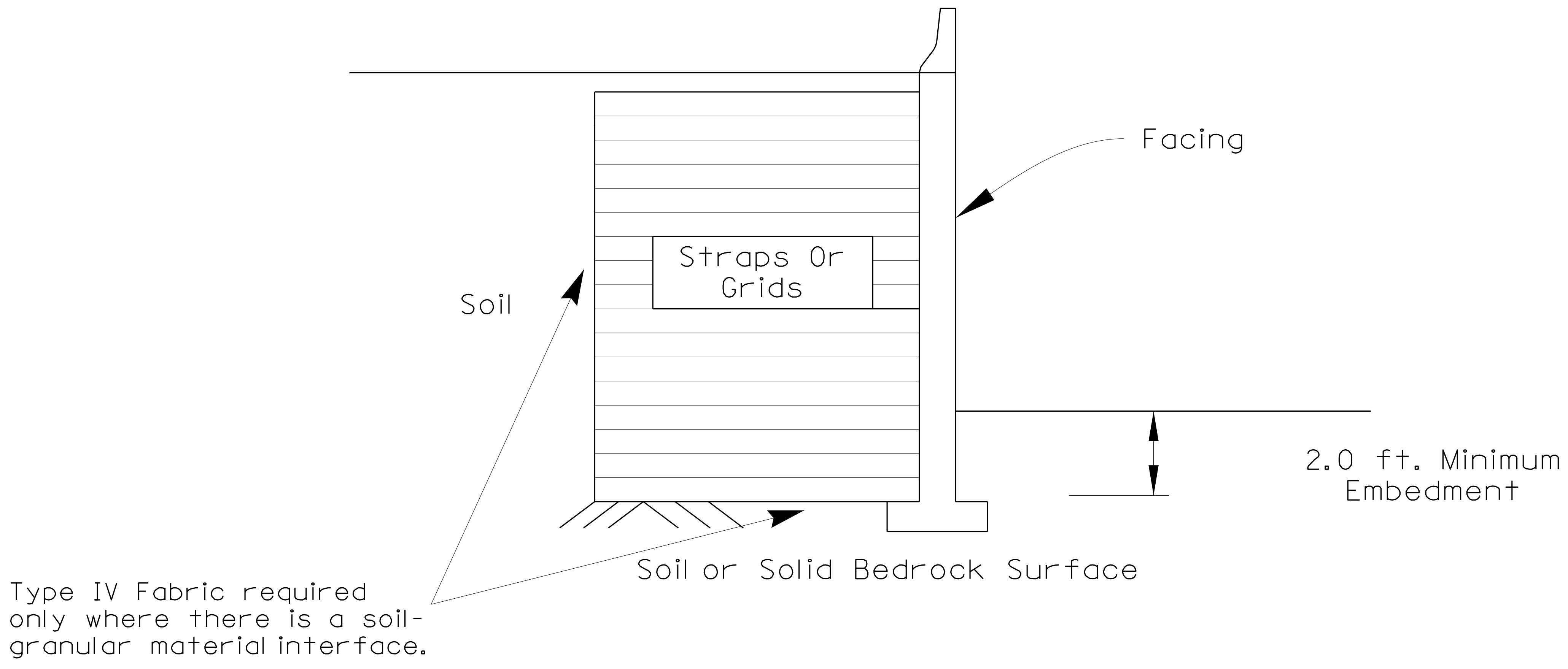
Bedrock	21.6 ksf	48 ksf

A Type IV Geotextile fabric shall be placed between the contact of any existing soil and the crushed stone Granular Embankment. The Geotextile Fabric shall be in accordance with Sections 214 and 843 of the current edition of the Standard Specifications for Road and Bridge Construction.

EXCAVATION AND HORIZONTAL BACKFILL BEARING ON SOIL OR BEDROCK



Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
Internal Backfill (in reinforced volume)	0	34	120
External Backfill	0	21	120
Foundation Material			
Native Soil	1750	0	120
Bedrock	0	34 (Sliding Only)	130

The Internal Backfill shall be permanently drained.

Internal Backfill shall consist of granular material meeting the requirements of "Reinforced Fill Material" in Section 805 of the Standard Specifications, Current Edition. Internal Backfill shall extend a minimum of 1 foot beyond the end of the reinforcements.

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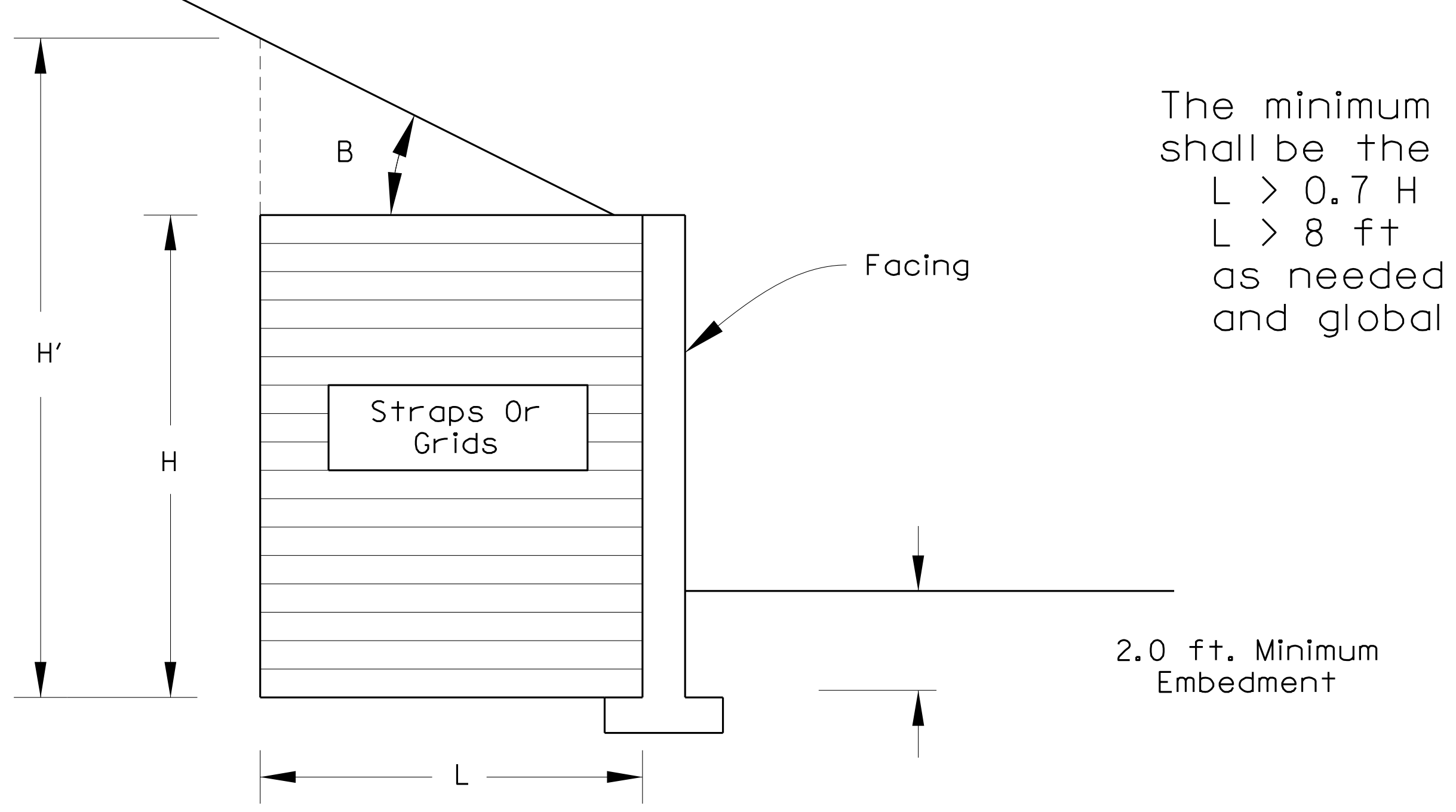
Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

Structure preparation for the wall will require excavation of bedrock at some locations

The bedrock exposed during construction will be suceptable to weathering and softening in the presence of water. Water must be kept out of the footing excavataions. If bedrock becomes softened at bearing elevations, the softened material should be undercut to unweathered material prior to placing the MSE wall.

MINIMUM REINFORCEMENT LENGTH



The minimum reinforcement length (L) shall be the greater of:
- L > 0.7 H
- L > 8 ft
- as needed to satisfy internal, external, and global stability design requirements.

DATE: 12-DEC-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: C. COOK	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE **US 25**
CROSSING **Retaining Wall #10**

SUBSURFACE DATA

S–071–18

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-071-2018

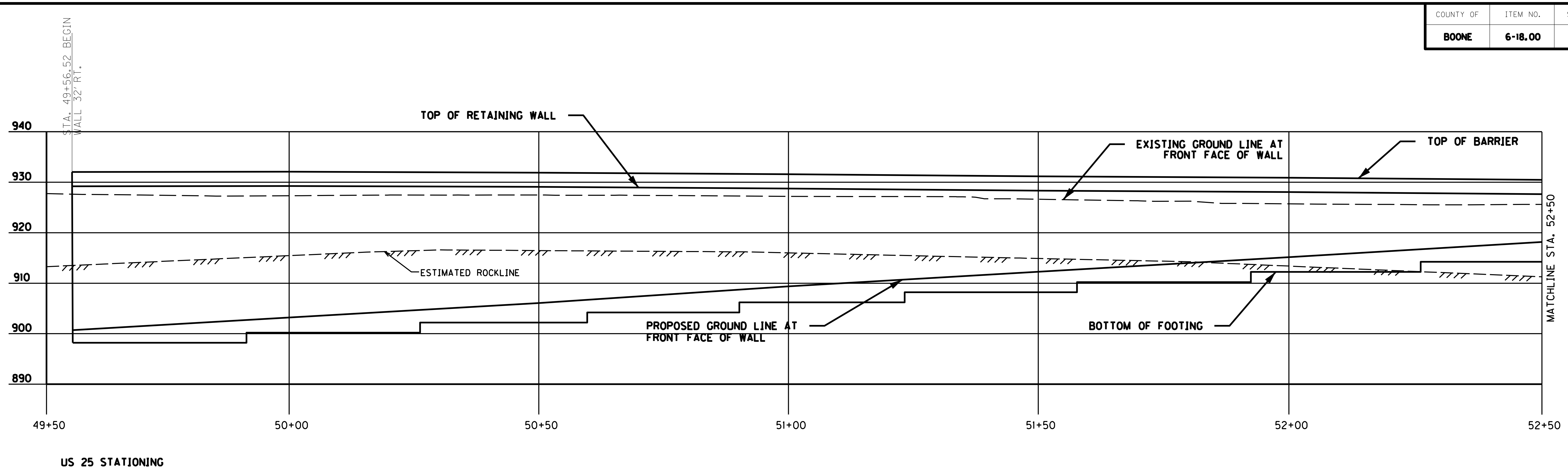
Notes:

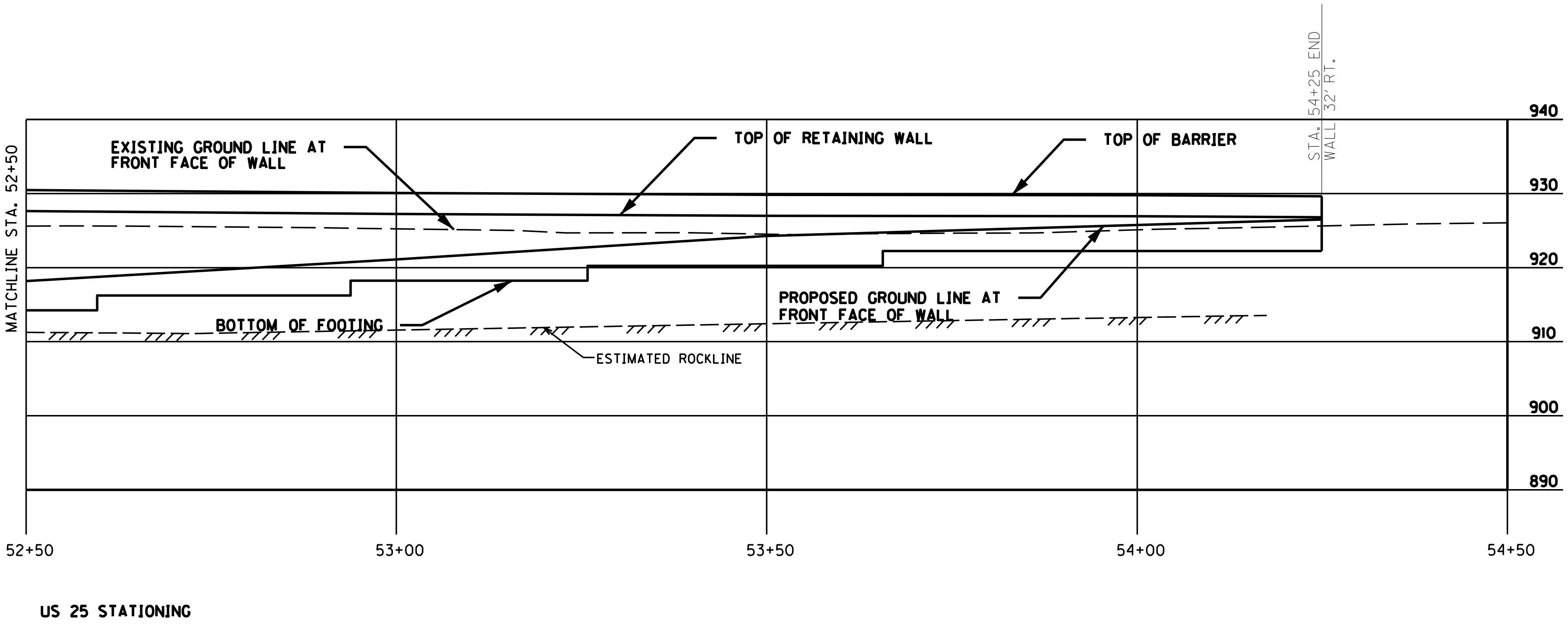
(circle one)

Elevation Datum (NAVD88) Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-071-2018						
1038	38.91922866	84.62420158	1038	US 25 51+50	60' Rt.	926.37
1039	38.91947686	84.62434882	1039	US 25 52+50	53' Rt.	925.51
1040	38.91961009	84.62439463	1040	US 25 53+00	58' Rt.	925.53
1041	38.91973457	84.62447002	1041	US 25 53+50	54' Rt.	925.42
1042	38.91995665	84.62457771	1042	US 25 54+36.5	54' Rt.	925.98

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	





SCALE: 1"=10'

RETAINING WALL #10
RT. STA. 49+56.52 RT. TO 54+25 US 25
Addendum 2 - 7-11-19

FILE NAME: N:\GEOTECH\BOONE RICHWOOD EXIT S-065-2018 THRU S-080-2018\DGNFILES\2018-11-16 E-MAIL FILES FROM JOE (HDR)\RETAININGWALL#10PROFILESHEE

USER: Clayton.Cook
DATE PLOTTED: December 11, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

M E M O R A N D U M **S-069-2018**

TO: Bart Asher, P.E.
Director
Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM
Geotechnical Branch

BY: Clayton S. Cook, P.E.
Geotechnical Branch

cc:
J. Van Zee
C. Van Zee
M. Bezold (D-6)
R. Franxman (D-6)
E. Drury
R. Turner
B. Yeager
C. Callan-Ramler (D-6)
W. Hagerman (HDR)
K. Meyer (HDR)

DATE: December 11, 2018

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton;
Norfolk Southern Railway Bridge Over KY 338,
Retaining Wall #11, Northbound US 25 Ramp A to KY 338 And Norfolk Southern Railroad
Ramp A Right Station 13+50 to Ramp B Right 20+60.93
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed retaining wall will be retaining material to the right of ramp A and ramp B off of US 25 that connects traffic to KY 338. It also serves as a grade separation between the US 25 ramp and the Norfolk Southern Railroad that is to the east. The proposed retaining wall will be 413 feet long and will connect to the Norfolk Southern Bridge (S-066-2018). The proposed construction sequence is for the Norfolk Southern railroad line to be moved onto the temporary shoofly location. Then the Norfolk Southern bridge drilled shafts will be installed and then superstructure completed. Once in place the railroad will be moved back onto the bridge. Then construction of Retaining Wall #11 will begin with the excavation underneath the bridge for KY 338. Special consideration will need to be considered for the excavation and installation of Retaining Wall #11 with the presence of live traffic on the Norfolk Southern Railroad at close proximity.

2.0 SITE GEOLOGIC CONDITIONS

The structure is located in the Independence Quadrangle (GQ-785). The geologic mapping indicated that the bedrock in this location is part of the Bull Fork Formation. This formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

3.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of four sample and core holes and three soundings were drilled. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples.

4.0 SUBSURFACE CONDITIONS

The soil encountered at the site included mostly lean and fat clay. The soil samples were designated as CL, CH, and GC by the USCS, and A-7-6 and A-6 by the AASHTO classification system. A large amount of limestone float rock was present in the overburden soil which resulted in high standard penetration testing (SPT) blow counts in areas that were above the start of bedrock. Soil strength testing included an unconfined compression test on one sample from hole 1020 with a value of 4889 psf.

Top of weathered rock elevations ranged from 893.0 to 912.1 ft with increasing rock elevations as you move upstation along the wall. The bedrock layers at the structure location consisted of interbedded dark grey shale with limestone, with increasing percentages of limestone with increasing depth. The core recovered percentages were generally in the 90's except in the upper layers of the bedrock due to the degraded nature of the material. KY Rock Quality Designation (RQD) values ranged from 0 to 39. The SDI testing indicated that interbedded shale and limestone bedrock was overall non-durable. Eleven rock unconfined tests were conducted with an average unconfined compressive strength of 1107 psi.

Observation wells were installed in holes 1015 and 1019. Seven day water table readings were obtained and are shown in Table 1.

Table 1. Water Table Readings

Hole	7-Day Water Elevation (ft)	Date Reading Was Collected
1015	913.2	9/11/2018
1019	916.6	8/10/2018

5.0 ENGINEERING ANALYSIS

Retaining Wall Type Selection

In order to assess what wall types were applicable along the length of the wall the bedrock elevation was estimated and needed length for excavation behind the wall was calculated for a cast in place cantilever retaining wall. For excavation it was assumed that the length behind the wall was half the wall height, plus 1.5 feet for forming. Additionally, a ½:1 slope cut was used for the bedrock in this area with a 2:1 slope cut assumed for the overburden soil. The full calculation sheet is shown in appendix "S-069-2018 Estimated Excavation Space", while a summary is shown in Table 2. The resultant line was then plotted on plan sheet "Estimated Excavation for Retaining Wall No. 11".

Table 2. S-069-2018 Estimated Excavation

Wall Station	Footing Base Elev (ft)	Est. Rockline (ft)	Est. Length Behind Wall For Excavation (ft)
Ramp B 20+61	896.0	911.7	51.0
Ramp A 17+00	896.0	911.9	53.6
Ramp A 16+50	896.0	912.0	54.7
Ramp A 16+00	900.0	912.0	50.3
Ramp A 15+50	902.0	910.5	49.7
Ramp A 15+00	904.1	907.2	47.6
Ramp A 14+50	906.1	903.0	36.8
Ramp A 14+00	910.0	897.9	19.7
Ramp A 13+50	912.1	893.4	16.1

Based on this estimated excavation limits it is recommended for part of the wall to continue with the drilled shaft substructure beneath the Norfolk Southern bridge and then transition if desired into a cantilevered gravity wall. In order for no temporary shoring to be required during installation of the cantilevered gravity wall, it was estimated that the drilled shaft cantilever wall would have to be continued to wall station 17+00.

The estimated bedrock elevation changes from 893.4' to 911.7' across the length of the wall. Please see Retaining Wall #11 Profile Sheet for estimated bedrock elevations across the wall stationing. This change in bedrock elevation will result in the beginning portion of the retaining wall bearing on soil and then transition to bedrock bearing at an estimated Ramp A Station 14+84. A slip joint should be utilized at the transition between the portion of the wall bearing on soil and bearing on rock so that differential settlement between the two portions of the wall do not cause cracking in the wall.

Slope stability for the wall was evaluated at station 17+00. This analysis indicated adequate factors of safety for short-term and long-term scenarios.

It is likely that some type of dewatering method will be needed to construct the wall foundation.

6.0 FOUNDATION RECOMMENDATIONS

6.1 Walls shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition, and applicable AREMA Specifications.

6.2 Temporary shoring, sheeting, and/or dewatering methods may be required to facilitate foundation construction

6.3 The following parameters shall be utilized for design of the wall from Ramp A Station 13+50 to Station 15+00

6.3.1 Use a reinforced concrete cantilever retaining wall with footing widths equal to no less than 2/3 of the total wall height including embedment.

6.3.2 Base of footing must be a minimum of 2 feet below final grade

6.3.3 Granular replacement will be used for replacement of native material as shown in the attached plan sheet “Geotechnical Notes for Reinforced Concrete Retaining Walls”

6.3.4 Backfill slope: 0°

6.3.5 Unit Weight of granular backfill: 110 pcf

6.3.6 Friction angle of granular backfill: 35°

6.3.7 Size the wall footings at Service Limit State using Factored Nominal Bearing Resistance given below. For checking bearing resistance at Strength and Extreme Limit States, use Resistance Factors of 0.55 and 1.0, respectively, applied to the Nominal Resistances.

Bearing Surface	Factored Nominal Bearing Resistance at Service Limit State	Nominal Bearing Resistance
Existing Soil	2780 psf	8300 psf

6.3.8 Drainage system behind the wall will be necessary. Provide weep holes at specified intervals.

6.3.9 Refer to the attached plan sheet “Geotechnical Notes for Reinforced Concrete Cantilever Retaining Walls” for more details.

6.4 The Following parameters shall be utilized for design of the wall from Ramp A Station 15+00 to end of wall

6.4.1 Use a reinforced concrete cantilever retaining wall with footing widths equal to no less than 55% of the total wall height including embedment.

6.4.2 Base of footing must be a minimum of 2 feet below final grade

6.4.3 Granular replacement will be used for replacement of native material as shown in the attached plan sheet “Geotechnical Notes for Reinforced Concrete Retaining Walls”

6.4.4 Backfill slope: 14°

6.4.5 Unit Weight of granular backfill: 110 pcf

6.4.6 Friction angle of granular backfill: 35°

6.4.7 Size the wall footings at Service Limit State using Factored Nominal Bearing Resistance given below. For checking bearing resistance at Strength and Extreme Limit States, use Resistance Factors of 0.45 and 1.0, respectively, applied to the Nominal Resistances.

Bearing Surface	Factored Nominal Bearing Resistance at Service Limit State	Nominal Bearing Resistance
Bedrock	16 ksf	48 ksf

6.4.8 Drainage system behind the wall will be necessary. Provide weep holes at specified intervals.

6.4.9 Refer to the attached plan sheet "Geotechnical Notes for Reinforced Concrete Cantilever Retaining Walls" for more details.

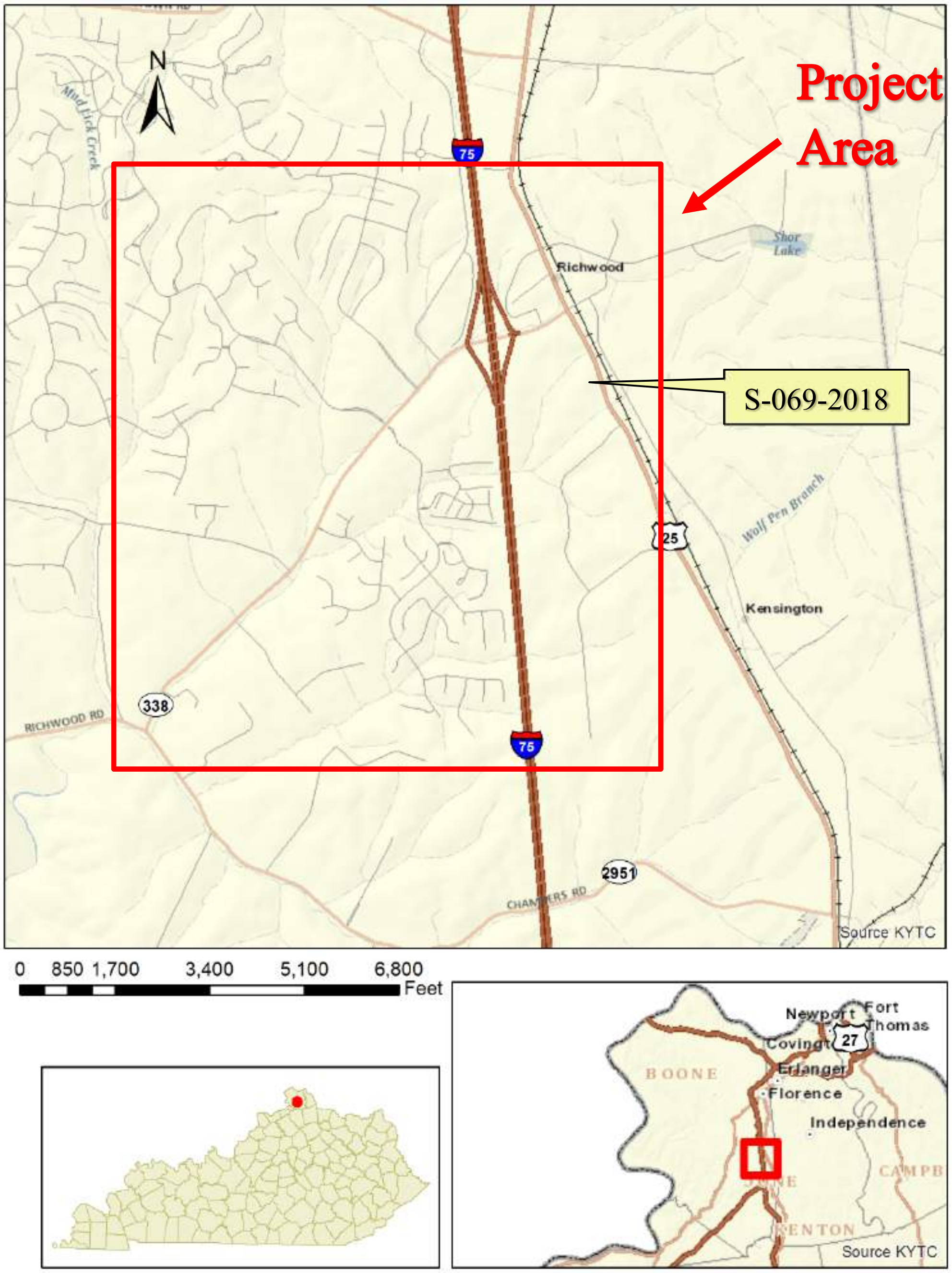
7.0 PLAN NOTES

The attached "Geotechnical Notes" plan sheets include required information needed to design the recommended wall type.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:
- **Project Location Map**
- **Subsurface Data Sheet**
- **Estimated Excavation For Retaining Wall #11**
- **S-069-2018 Estimated Excavation Space**
- **Coordinate Data Sheet**
- **Retaining Wall #11 Profile Sheet**

Project Location Map



SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25

CROSSING
Retaining Wall #11

S–069–18

SUBSURFACE DATA

ITEM NUMBER

6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:

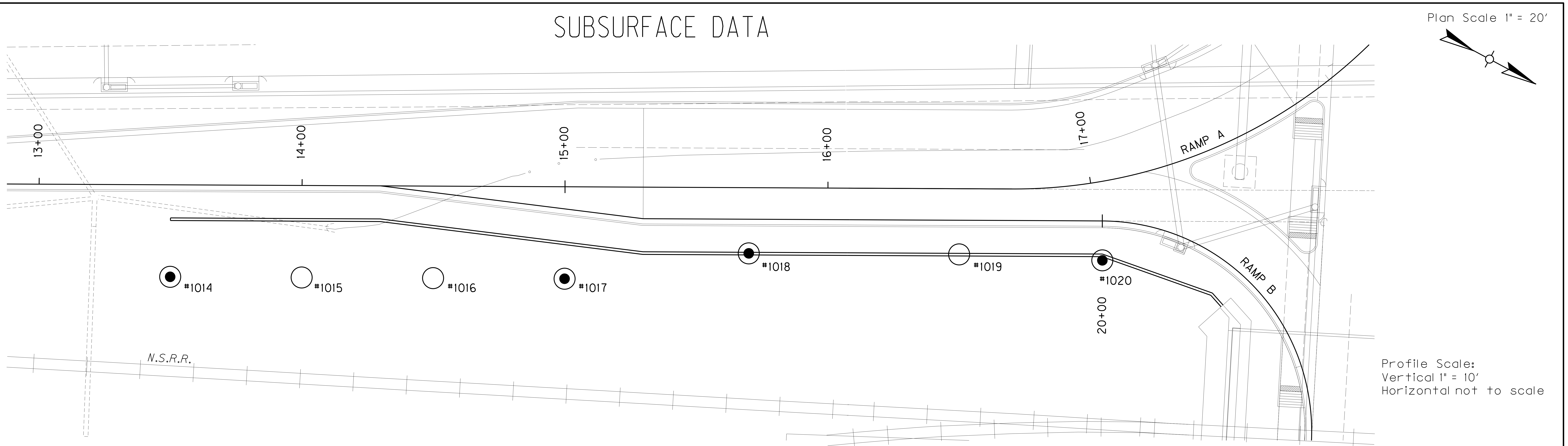
FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA



Shale:(66%) brown & gray, clayey & silty, calcareous, interbedded w/Limestone (34%) gray, medium & coarse grained, even bedding, fossiliferous

Limestone:(70%) gray, coarse grained, even & irregular bedded, fossiliferous, w/gray, silty, calcareous Shale (30%) as laminations & partings

Top of rock elev.= 916.80
Base of weathered rock elev.= 912.10

Cored Overburden: w/limestone fragments

Shale:(68%) gray, silty, calcareous, interbedded w/Limestone (32%) gray, coarse grained, even w/some irregular bedding, fossiliferous

Limestone:(70%) gray, coarse grained, even & irregular bedding, fossiliferous, w/gray, silty, calcareous Shale (30%) as laminations & partings

Top of rock elev.= 912.50
Base of weathered rock elev.= 911.90

The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
US 25	**Retaining Wall #11**

SUBSURFACE DATA

S–069–18

ITEM NUMBER

6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

GEOTECHNICAL NOTES

for Reinforced Concrete Cantilever Retaining Walls

The minimum embedment shall be 2 ft below final grade or any adjacent ditchline elevation to the bottom of footing for cast in place walls.

Walls shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

Size the wall footings at Service Limit State using a Factored Nominal Bearing Resistance given below for Foundations Bearing On Soil and Bedrock. For checking the Strength and Extreme Limit States, use Resistance Factors of 0.55 and 1.0, respectively, for soil and 0.45 and 1.0, respectively, for beadrock.

Bearing Surface	Factored Nominal Bearing Resistance @ Service Limit State	Nominal Bearing Resistance
Soil	2.78 ksf	8.3 ksf
Bedrock	16 ksf	48 ksf

Drainage System behind the Wall will be necessary. Provide Weep Holes at specified intervals.

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Granular Backfill	0	35	110

Footing widths shall be no less than 66% of the total wall height including embedment for portions of the wall bearing on soil and 55% of the total wall height including embedment for portions of the wall bearing on bedrock.

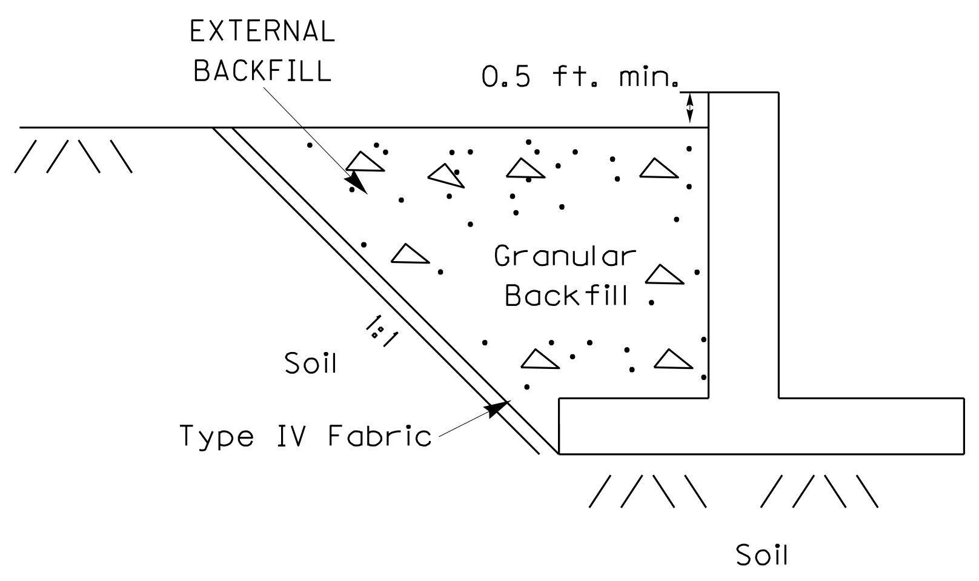
The wall designer shall verify wall stability based on final wall design dimensions.

Where granular replacement of exisiting materials is required, excavtate the exisiting soil and rock and replace with granular material as shown below. Use granular material meeting the requirements of "Granular Embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric in accordance with Section 214 & 843 of the Standard Specifications for Road and Bridge Consruction, surrent edition, as shown below. Granular replacement should follow a 1/2:1 back slope for excavation in bedrock and 1:1 back slope in in-situ soil.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

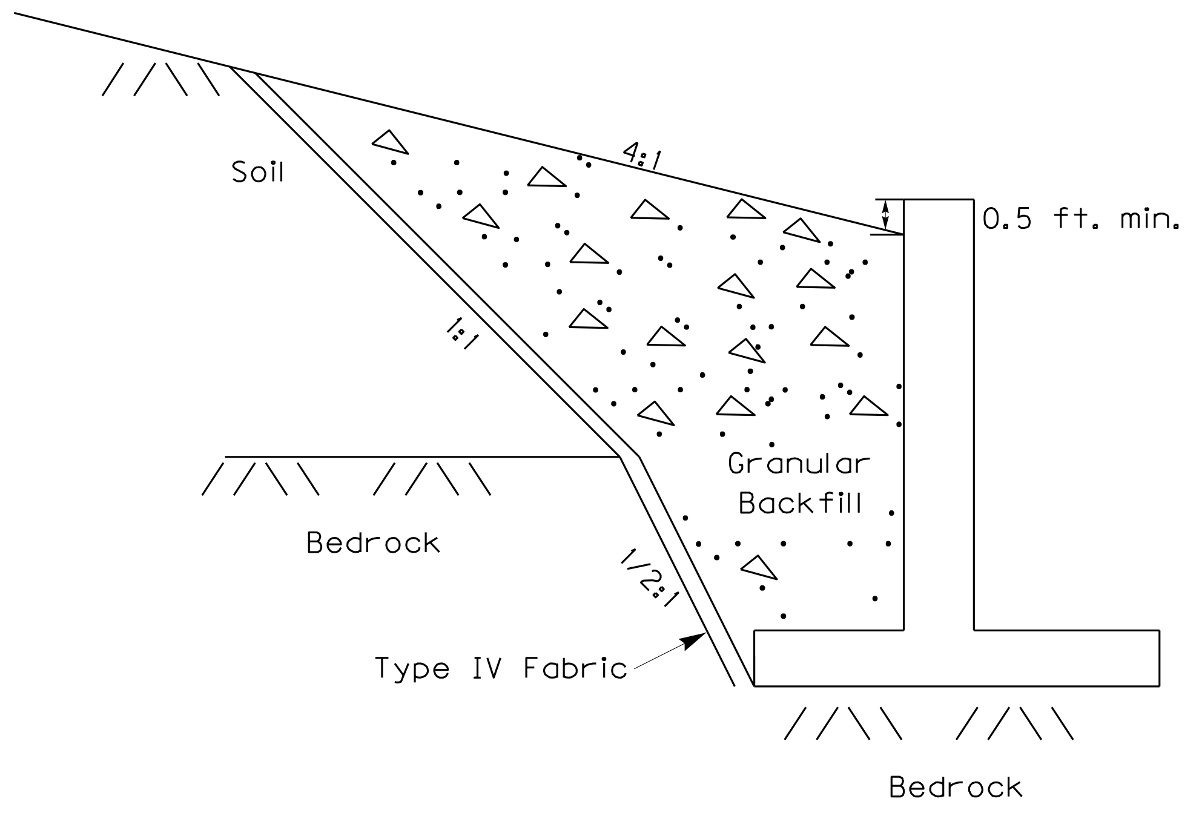
EXCAVATION AND HORIZONTAL BACKFILL
GRANULAR BACKFILL REPLACEMENT
BEARING ON SOIL

Cast-in-Place Retaining Wall



EXCAVATION AND 4:1 BACKFILL
GRANULAR BACKFILL REPLACEMENT

Cast-in-Place Retaining Wall



DATE: 07-DEC-2018
CHECKED BY
DESIGNED BY:
DETAILED BY: C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
US 25
CROSSING
Retaining Wall #11

SUBSURFACE DATA

S–069–18

ITEM NUMBER
6–18.00

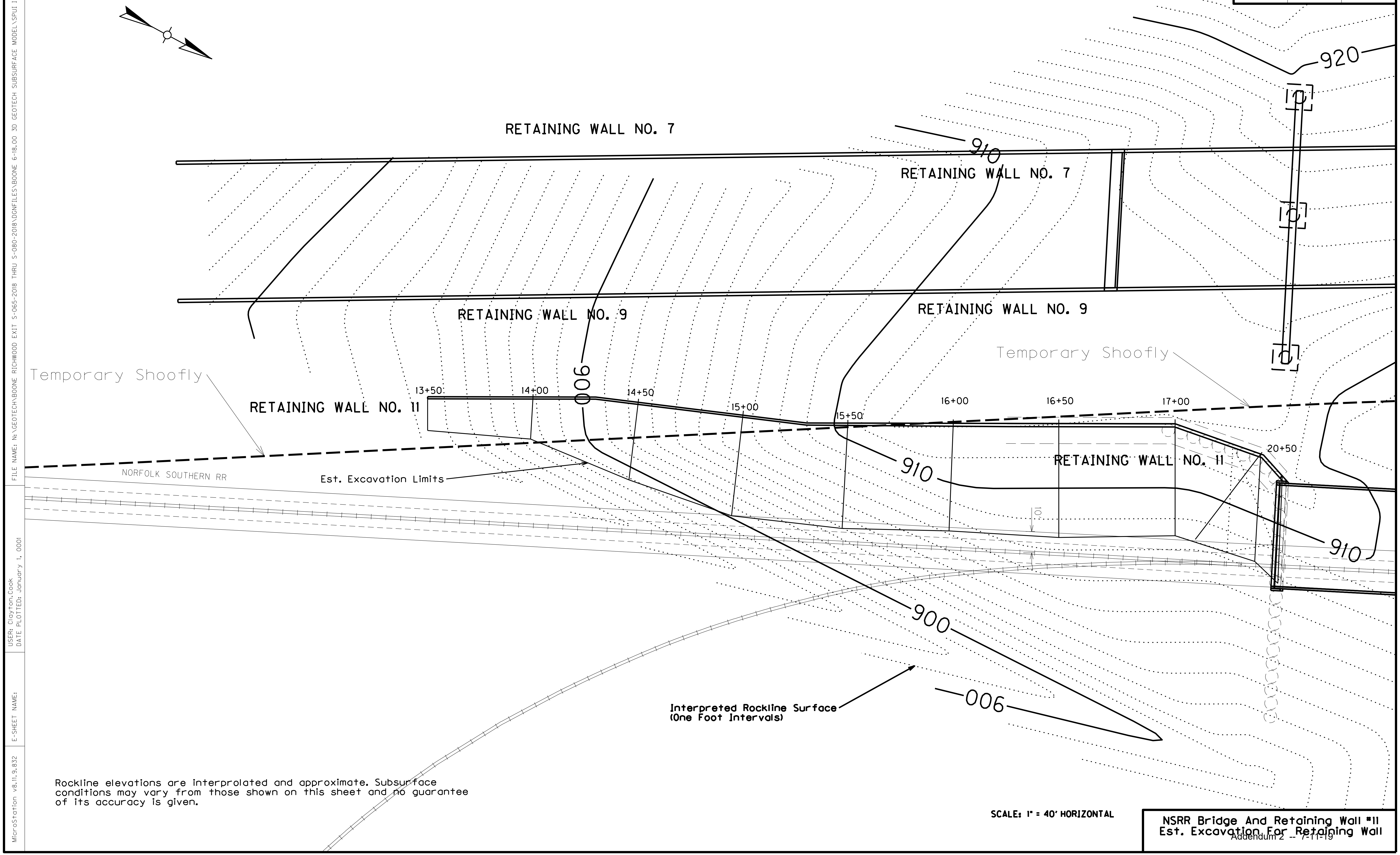
PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



Rockline elevations are interprolated and approximate. Subsurface conditions may vary from those shown on this sheet and no guarantee of its accuracy is given.

SCALE: 1" = 40' HORIZONTAL

NSRR Bridge And Retaining Wall #11
Est. Excavation For Retaining Wall

Addendum 2 -- 7-11-19

FILE NAME: N:\GEOTECH\BOONE RICHWOOD EXIT S-065-2018 THRU S-080-2018\DGNFILES\BOONE 6-18.00 3D GEOTECH SUBSURFACE MODEL\SPUI INTERCHANGE ROC

USER: Clayton.Cook
DATE PLOTTED: January 1, 0001

E-SHEET NAME:

MicroStation v8.11.9.832

S-069-2018 Excavation Needed Space

Wall Station	Footing Base Elevation ft	Top of Wall ft	Est Groudline ft	Est. Rockline ft	Wall Weight ft	Footing Base Width Behind Face ft	Required Length Behind Wall For Excavation ft
Ramp B 20+61	896.0	924.6	925.4	911.7	28.6	14.3	51.0
Ramp A 17+00	896.0	924.3	926.9	911.9	28.3	14.2	53.6
Ramp A 16+50	896.0	923.9	927.6	912.0	27.9	14.0	54.7
Ramp A 16+00	900.0	923.5	927.5	912.0	23.5	11.8	50.3
Ramp A 15+50	902.0	923.5	927.1	910.5	21.5	10.8	49.7
Ramp A 15+00	904.1	922.9	924.8	907.2	18.8	9.4	47.6
Ramp A 14+50	906.1	920.2	920.2	903.0	14.1	7.1	36.8
Ramp A 14+00	910.0	917.3	917.3	897.9	7.3	3.6	19.7
Ramp A 13+50	912.1	917.6	918.0	893.4	5.5	2.8	16.1

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone **Date**

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-069-2018

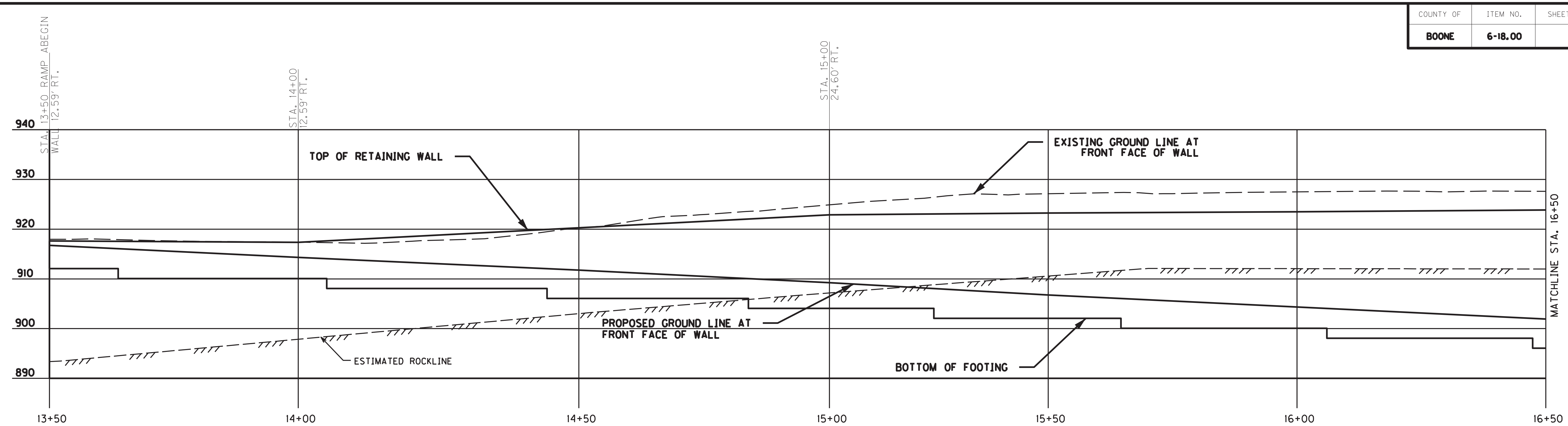
Notes:

(circle one)

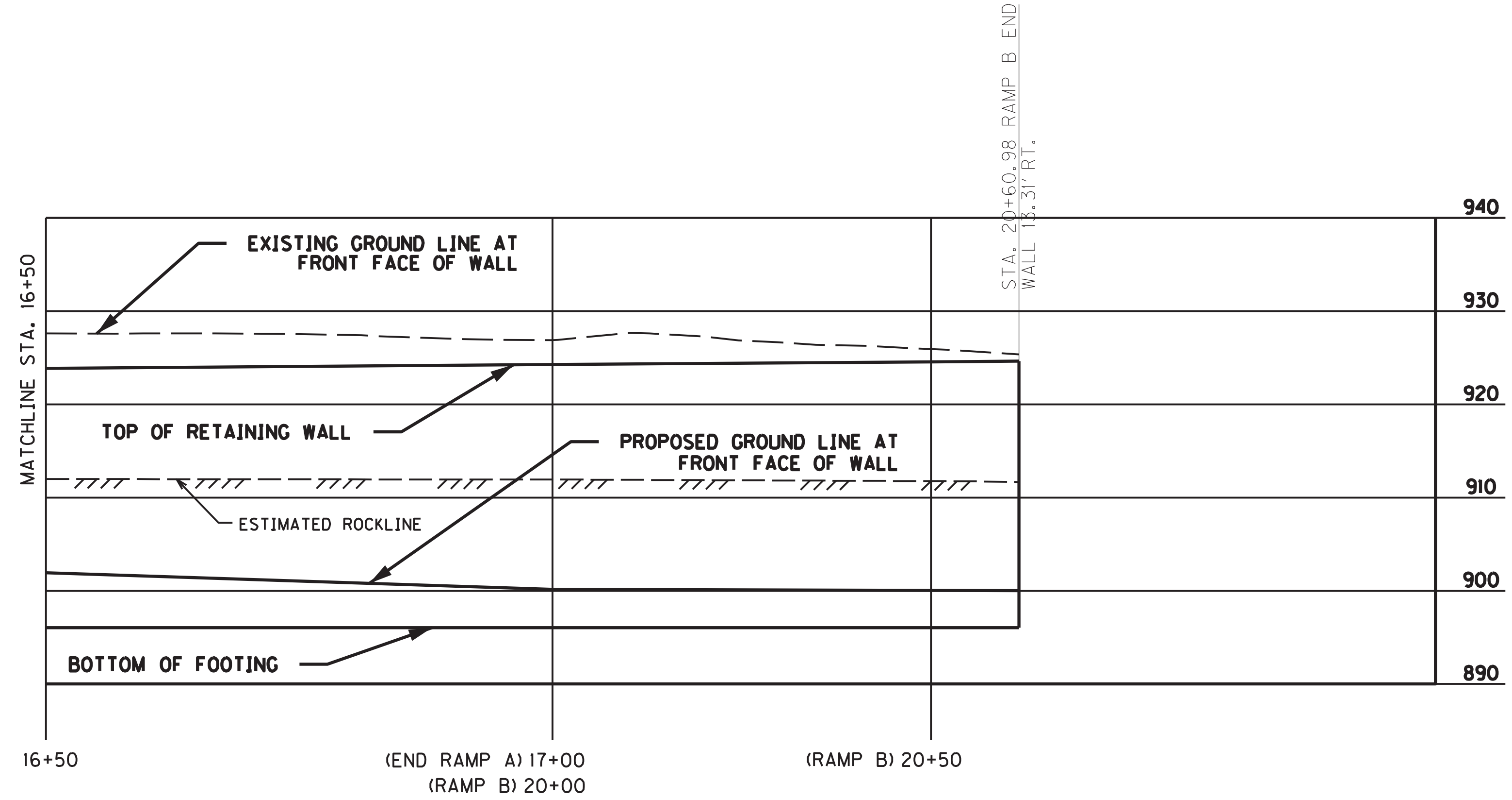
Elevation Datum (NAVD88) Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-069-2018						
1014	38.91732055	84.62281019	1014	US 25 Ramp A 13+50	35' Rt.	917.75
1015	38.91744253	84.62289077	1015	US 25 Ramp A 14+00	35' Rt.	917.43
1016	38.91756452	84.62297135	1016	US 25 Ramp A 14+50	35' Rt.	920.76
1017	38.91768650	84.62305193	1017	US 25 Ramp A 15+00	35' Rt.	923.71
1018	38.91784469	84.62319597	1018	US 25 Ramp A 15+70	25' Rt.	926.78
1019	38.91803987	84.62332490	1019	US 25 Ramp A 16+50	25' Rt.	927.29
1020	38.91817514	84.62340634	1020	US 25 Ramp B 20+00	15' Rt.	926.60

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



RAMP A STATIONING



RAMP A & B STATIONING

SCALE: 1"=10'

RETAINING WALL #11
RT. STA. 13+50 RAMP A RT. TO
20+60.93 RAMP B

Addendum 2 - 7-11-19

FILE NAME: N:\GEOTECH\BOONE RICHWOOD EXIT S-065-2018 THRU S-080-2018\DGNFILES\2018-11-16 E-MAIL FILES FROM JOE (HDR)\RETAININGWALL#11PROFILESHEE

USER: Clayton.Cook
DATE PLOTTED: December 11, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

M E M O R A N D U M **S-072-2018**

TO: Bart Asher, P.E.
Director
Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM
Geotechnical Branch

BY: Clayton S. Cook, P.E.
Geotechnical Branch

cc: J. Van Zee
C. Van Zee
M. Bezold (D-6)
R. Franxman (D-6)
E. Drury
R. Turner
B. Yeager
C. Callan-Ramler (D-6)
W. Hagerman (HDR)
K. Meyer (HDR)

DATE: December 11, 2018

SUBJECT: Boone County
Item No. 6-18.00
FD52 12F0 008 0075 175-176; IMSTP0757129
MARS No. 8433801D
Reconstruct I-75/KY 338 Interchange North of Walton;
Norfolk Southern Railway Bridge Over KY 338,
Retaining Wall #12, KY 338 to NB US 25 Ramp C and Norfolk Southern
Railroad, Ramp C Right Station 30+45.8 to 31+50
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed retaining wall will be an extended wingwall starting at the Northwest corner of the Norfolk Southern Railroad bridge and extending around with the right hand side of Ramp C. The proposed wall will be 104 feet long and will help with the tie in of the 2:1 slope. The proposed construction sequence is for the Norfolk Southern railroad line to be moved onto the temporary shoofly location. Then the Norfolk Southern bridge drilled shafts will be installed and then superstructure completed. Once in place the railroad will be moved back onto the bridge. Then construction of the Retaining Wall 12 will begin with the excavation underneath the bridge for KY 338. Special consideration will need to be considered for the excavation and installation of Retaining Wall #12 with the presence of live traffic on the Norfolk Southern Railroad at close proximity.

2.0 SITE GEOLOGIC CONDITIONS

The structure is located in the Independence Quadrangle (GQ-785). The geologic mapping indicated that the bedrock in this location is part of the Bull Fork Formation. This formation consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

3.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of three sample and core holes, three sample holes and two soundings were drilled. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch's lab conducted testing on the samples. Also, a three point consolidated undrained (CU) triaxial testing set was performed by HDR on samples extruded by the Branch's soil lab.

Drilling was performed at the proposed 2:1 slope from Ramp C right station 31+50 to 36+00 since this section was originally proposed as a retaining wall during the drilling for roadway holes and then changed to a roadway cut in order to ensure adequate design of the slope cut or facilitate further design changes if the original plan for a retaining structure was restored. Soil data was collect in this area.

4.0 SUBSURFACE CONDITIONS

The soil encountered at the site included mostly lean and fat clay. The soil samples were designated as CL and CH by the USCS, and A-7-6 and A-6 by the AASHTO classification system. A large amount of limestone float rock was present in the overburden soil which resulted in high standard penetration testing (SPT) blow counts in areas that was above the start of bedrock.

Soil strength testing included one CU Triaxial testing set. Soil CU triaxial testing was conducted from lean and fat clay samples in holes 1044 and 1043 and yielded effective soil strength parameters of $\phi' = 20.4°$ and $c' = 2938$ psf.

Top of weathered rock elevations ranged from 907.6 to 917.6 ft across holes 1043, 1044 and 1046. The bedrock layers at the structure location consisted of interbedded dark grey shale with limestone, with increasing percentages of limestone with increasing depth. The core recovered percentages were generally in the 90's, but the KY Rock Quality Designation (RQD) values ranged from 0 to 41. The SDI testing indicated that interbedded shale and limestone bedrock was non-durable. Eight rock unconfined tests were conducted with an average unconfined compressive strength of 956 psi.

Observation wells were installed in holes 1045, 1047, and 1049. Seven day water table readings were obtained and are shown in the Table 1.

Table 1. Water Table Readings

Hole	7-Day Water Elevation (ft)	Date Reading Was Collected
1045	921.5	9/13/2018
1047	921.3	9/13/2018
1049	923.4	9/13/2018

5.0 ENGINEERING ANALYSIS

Retaining Wall Type Selection

In order to assess what wall types were applicable along the length of the wall the bedrock elevation was estimated and needed length for excavation behind the wall was calculated for a cast in place cantilever retaining wall. For excavation it was assumed that the length behind the wall was half the wall height, plus 1.5 feet for forming. Additionally, a ½:1 slope cut was used for the bedrock in this area with a 2:1 slope cut assumed for the overburden soil. The full calculation sheet is shown in appendix “S-072-2018 Estimated Excavation Space”, while a summary is shown in Table 2. The resultant line was then plotted on plan sheet “Est. Excavation for Retaining Wall # 12”.

Table 2. S-072-2018 Estimated Excavation

Wall Station	Footing Base Elev (ft)	Est. Rockline (ft)	Est. Length Behind Wall For Excavation (ft)
30+50	896.1	906.8	55
31+00	896.1	907.5	54
31+50	896.1	911.4	43

Based on this estimated excavation limits it is recommended for part of the wall to continue with the drilled shaft substructure beneath the Norfolk Southern bridge and then transition if desired into a cantilevered gravity wall. In order for no temporary shoring to be required during installation of the standard gravity wall, it was estimated that the drilled shaft cantilever wall would have to be continued to wall station 30+75. From this point excavation could made without further shoring. Refer to foundation engineering report S-066-2018 for design parameters for the drilled shaft cantilever wall.

Slope stability for the wall was evaluated at station 30+50. This analysis indicated adequate factors of safety for short-term and long-term scenarios.

It is likely that some type of dewatering method will be needed to construct the wall foundation.

6.0 FOUNDATION RECOMMENDATIONS

6.1 Walls shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition, and applicable AREMA Specifications.

6.2 Temporary shoring, sheeting, and/or dewatering methods may be required to facilitate foundation construction

6.3 The following parameters shall be utilized for design of the wall at critical section 30+50

6.3.1 Use a reinforced concrete cantilever retaining wall with footing widths equal to no less than ½ of the total wall height including embedment.

6.3.2 Base of footing must be a minimum of 2 feet below final grade

6.3.3 Granular replacement will be used for replacement of native material as shown in the attached plan sheet "Geotechnical Notes for Reinforced Concrete Retaining Walls"

6.3.4 Backfill slope: 0°

6.3.5 Unit Weight of granular backfill: 110 pcf

6.3.6 Friction angle of granular backfill: 35°

6.3.7 Size the wall footings at Service Limit State using Factored Nominal Bearing Resistance given below. For checking bearing resistance at Strength and Extreme Limit States, use Resistance Factors of 0.45 and 1.0, respectively, applied to the Nominal Resistances.

Bearing Surface	Factored Nominal Bearing Resistance at Service Limit State	Nominal Bearing Resistance
Bedrock	16 ksf	48 ksf

6.3.8 Drainage system behind the wall will be necessary. Provide weep holes at specified intervals.

6.3.9 Refer to the attached plan sheet "Geotechnical Notes for Reinforced Concrete Cantilever Retaining Walls" for more details.

6.4 The Following parameters shall be utilized for design of the wall at critical section 31+00

6.4.1 Use a reinforced concrete cantilever retaining wall with footing widths equal to no less than 2/3 of the total wall height including embedment.

6.4.2 Base of footing must be a minimum of 2 feet below final grade

6.4.3 Granular replacement will be used for replacement of native material as shown in the attached plan sheet "Geotechnical Notes for Reinforced Concrete Retaining Walls"

6.4.4 Backfill slope: 26.6°

6.4.5 Unit Weight of granular backfill: 110 pcf

6.4.6 Friction angle of granular backfill: 35°

6.4.7 Size the wall footings at Service Limit State using Factored Nominal Bearing Resistance given below. For checking bearing resistance at Strength and Extreme Limit States, use Resistance Factors of 0.45 and 1.0, respectively, applied to the Nominal Resistances.

Bearing Surface	Factored Nominal Bearing Resistance at Service Limit State	Nominal Bearing Resistance
Bedrock	16 ksf	48 ksf

6.4.8 Drainage system behind the wall will be necessary. Provide weep holes at specified intervals.

6.4.9 Refer to the attached plan sheet "Geotechnical Notes for Reinforced Concrete Cantilever Retaining Walls" for more details.

7.0 PLAN NOTES

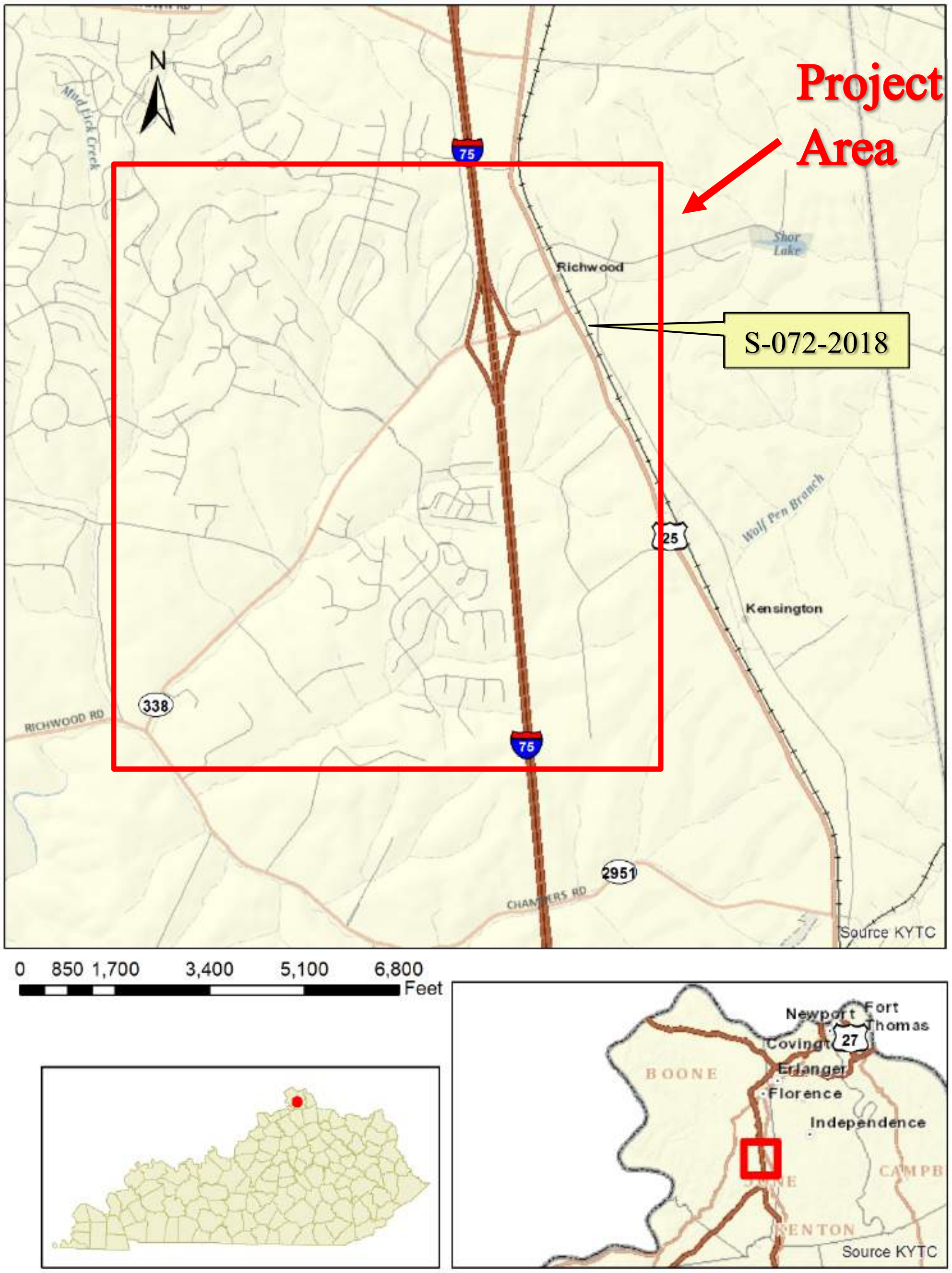
The attached "Geotechnical Notes" plan sheets include the required information needed to design the recommended wall type.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Estimated Excavation For Retaining Wall #12**
- **S-072-2018 Estimated Excavation Space**
- **Coordinate Data Sheet**
- **Retaining Wall #12 Profile Sheet**

Project Location Map



SHEET LOCATION:

FILE NAME: $$$$design$file$$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1043	1044	1045
Station	31+06.00	31+77.50	31+77.50
Offset	22.50 ft. Rt.	18.00 ft. Rt.	60.00 ft. Rt.
Elev. (NAVD 88 datum)	925.20	926.80	926.50

1043:
0.008 19 -0.26 A-7-6(16),CL,S+C=81(51+30)
0.002 21 -0.11 A-7-6(26),CH,S+C=88(40+48)
0.003 17 -0.25 A-7-6(24),CL,S+C=91(45+46)
0.021 12 -0.47 N=81/0.9, A-6(8),CL,S+C=62(34+28)
Cored Overburden: No recovery
KYRQD REC: 0 83; 0 100; 0 100; 34 100; 19 100; 41 100; 0 100; 11 100; 11 100; 29 100
UU (psi): 932; 796; 1034
SDI(JS): 46(2); 66(3); 84(3); 58(3); 55(2); 79(3)
Shale:(64%) dark gray, silty, calcareous, interbedded w/Limestone (36%) light gray, medium & coarse grained, mostly even bedded, fossiliferous
Limestone:(65%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (35%) as laminations & partings
Top of rock elev.= 909.00
Base of weathered rock elev.= 907.60

1044:
0.000 28 -0.05 A-7-5(39),CH,S+C=90(28+62)
0.006 21 -0.07 A-7-6(21),CH,S+C=74(34+40)
0.005 17 -0.15 N=27, A-6(16),CL,S+C=82(43+39)
KYRQD REC: 0 100; 0 100; 30 100; 0 100; 26 100; 11 97; 24 100; 24 100; 0 100; 0 100; 40 100
UU (psi): 1042; 1094
SDI(JS): 46(3); 63(3); 54(3); 84(4); 56(3); 44(3); 12(1); 65(3)
Shale:(66%) dark gray, silty, calcareous, interbedded w/Limestone (34%) light gray, medium & coarse grained, mostly even bedded, fossiliferous
Limestone:(60%) light gray, coarse grained, even & irregular bedded, fossiliferous, w/dark gray, silty, calcareous Shale (40%) as laminations & partings
Shale:(55%) dark gray, silty, w/irregular fossiliferous Limestone (45%) partings
Top of rock elev.= 914.30
No weathered rock

1045:
9-13-18
921.45
0.007 22 0.01 A-7-6(18),CL,S+C=83(49+34)
0.001 18 -0.27 N=4, A-7-6(32),CH,S+C=91(36+55)
0.004 22 0.02 A-7-6(17),CL,S+C=82(40+42)
0.007 27 0.04 N=74/0.8, A-7-6(25),CH,S+C=78(43+35)
R
(916.50)

The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 338

CROSSING
Retaining Wall #12

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

S–072–18

ITEM NUMBER
6–18.00

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1046	1047	1048	1049	1050
Station	32+75.16	33+54.00	34+38.50	35+00.00	36+00.00
Offset	3.70 ft. Rt.	46.00 ft. Rt.	50.00 ft. Rt.	50.00 ft. Rt.	30.00 ft. Rt.
Elev. (NAVD 88 datum)	927.20	927.80	927.60	927.20	926.10

The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
KY 338

CROSSING
Retaining Wall #12

SUBSURFACE DATA

S–072–18

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

GEOTECHNICAL NOTES

for Reinforced Concrete Cantilever Retaining Walls

The minimum embedment shall be 2 ft below final grade or any adjacent ditchline elevation to the bottom of footing for cast in place walls.

Walls shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

Size the wall footings at Service Limit State using a Factored Nominal Bearing Resistance given below. For checking the Strength and Extreme Limit States, use Resistance Factors of 0.45 and 1.0, respectively.

Bearing Surface	Factored Nominal Bearing Resistance @ Service Limit State	Nominal Bearing Resistance
Bedrock	16 ksf	48 ksf

Drainage System behind the Wall will be necessary. Provide Weep Holes at specified intervals.

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Soil	0	35	110

Footing widths shall be no less than 55% of the total wall height including embedment in areas of horizontal backfill and 66% of the total wall height including embedment in areas of 2:1 backfill slopes.

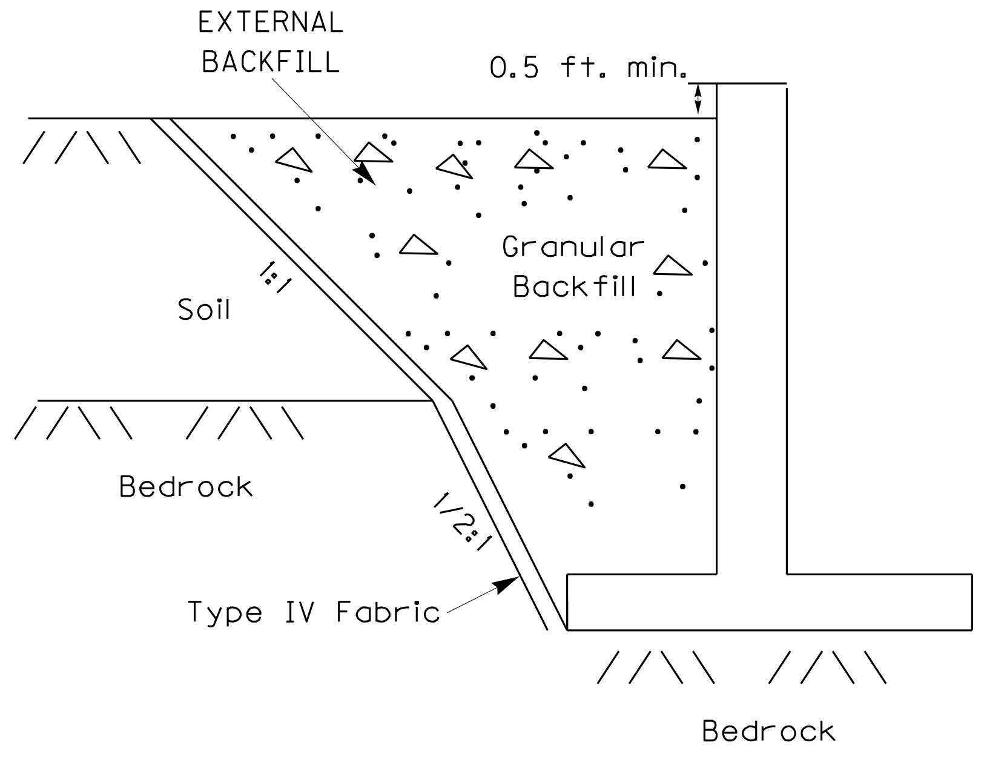
The wall designer shall verify wall stability based on final wall design dimensions.

Where granular replacement of exisiting materials is required, excavtate the exisiting soil and rock and replace with granular material as shown below. Use granular material meeting the requirements of "Granular Embankment" in Section 805 of the Standard Specifications, current edition, except that the maximum size is 4 inches. Use material that is classified as non-erodible as defined in Section 805 of the Standard Specifications, current edition. Place Type IV fabric in accordance with Section 214 & 843 of the Standard Specifications for Road and Bridge Consruction, surrent edition, as shown below. Granular replacement should follow a 1/2:1 back slope for excavation in bedrock and 1:1 back slope in in-situ soil.

Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

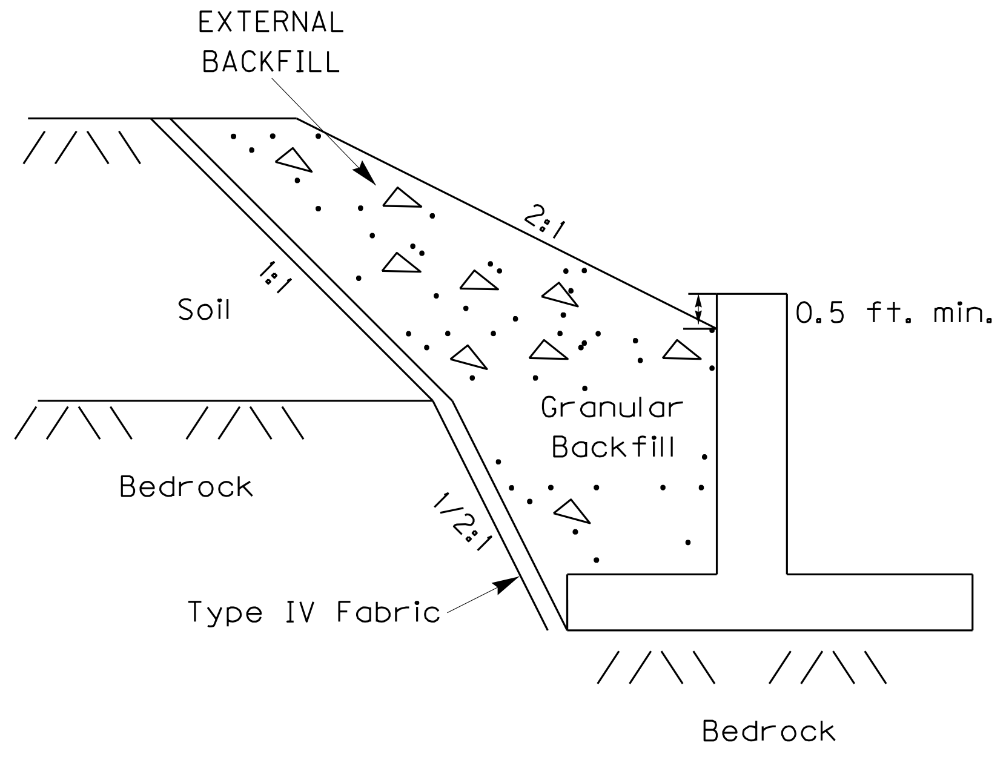
EXCAVATION AND HORIZONTAL BACKFILL GRANULAR BACKFILL REPLACEMENT

Cast-in-Place Retaining Wall



EXCAVATION AND 2:1 BACKFILL GRANULAR BACKFILL REPLACEMENT

Cast-in-Place Retaining Wall



DATE: 07-DEC-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: C. COOK	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE	CROSSING
KY 338	Retaining Wall Sta. 30+45–31+50

SUBSURFACE DATA

S–072–18

ITEM NUMBER
6–18.00

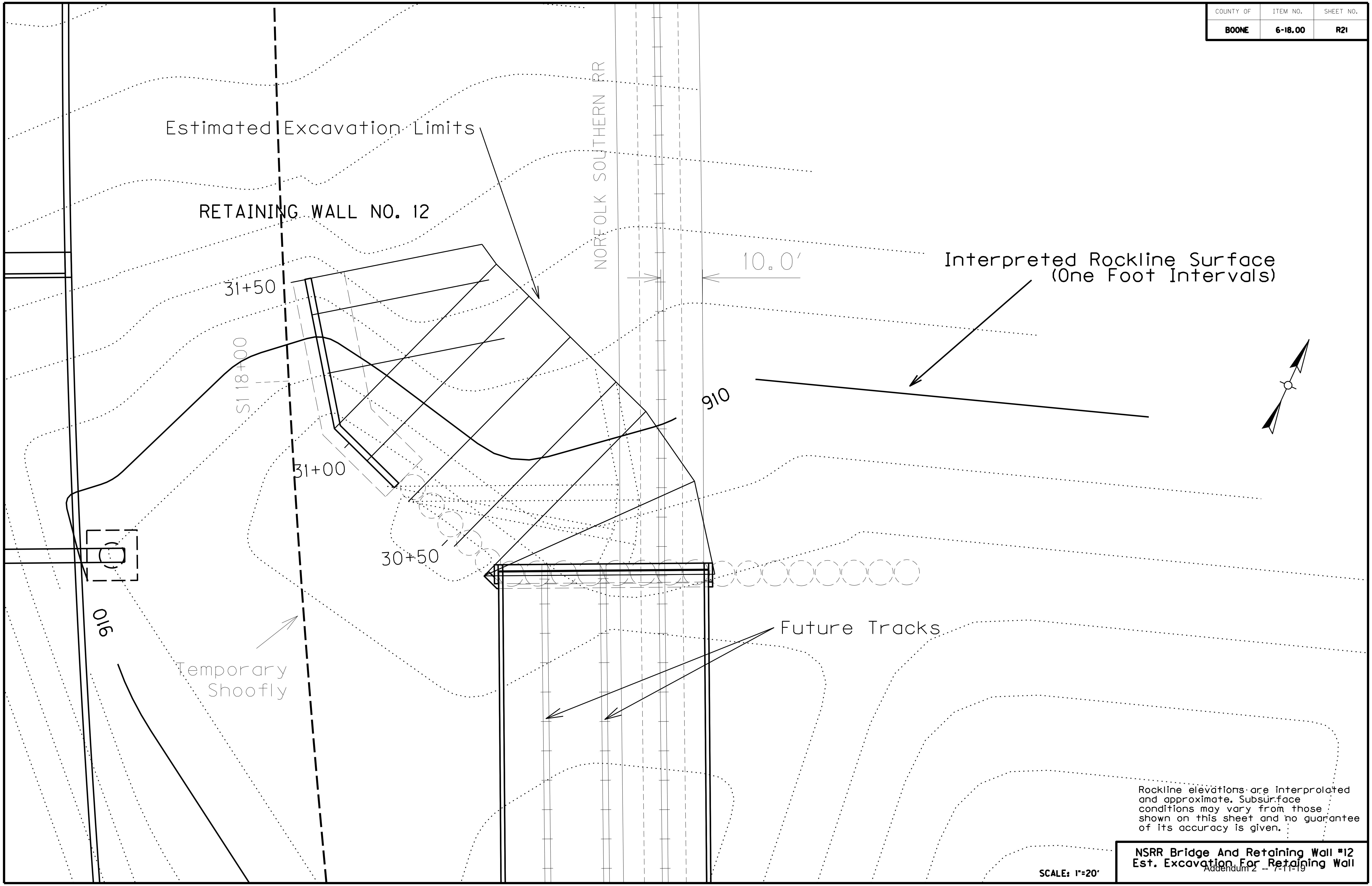
PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	R21



Rockline elevations are interprolated and approximate. Subsurface conditions may vary from those shown on this sheet and no guarantee of its accuracy is given.

SCALE: 1"=20'

NSRR Bridge And Retaining Wall #12
Est. Excavation For Retaining Wall

Addendum 2 -- 7-11-19

S-072-2018 Estimated Excavation Space

Wall Station	Footing Base Elevation	Top of Wall	Est Groudline	Est. Rockline	Wall Weight	Footing Base Width Behind Face	Required Length Behind Wall For Excavation
	ft	ft	ft	ft	ft	ft	ft
30+50	896.1	923.8	923.8	906.8	27.7	13.9	54.7
31+00	896.1	914.9	926.1	907.5	18.8	9.4	53.8
31+50	896.1	905.3	926.1	911.4	9.2	4.6	43.2

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-072-2018

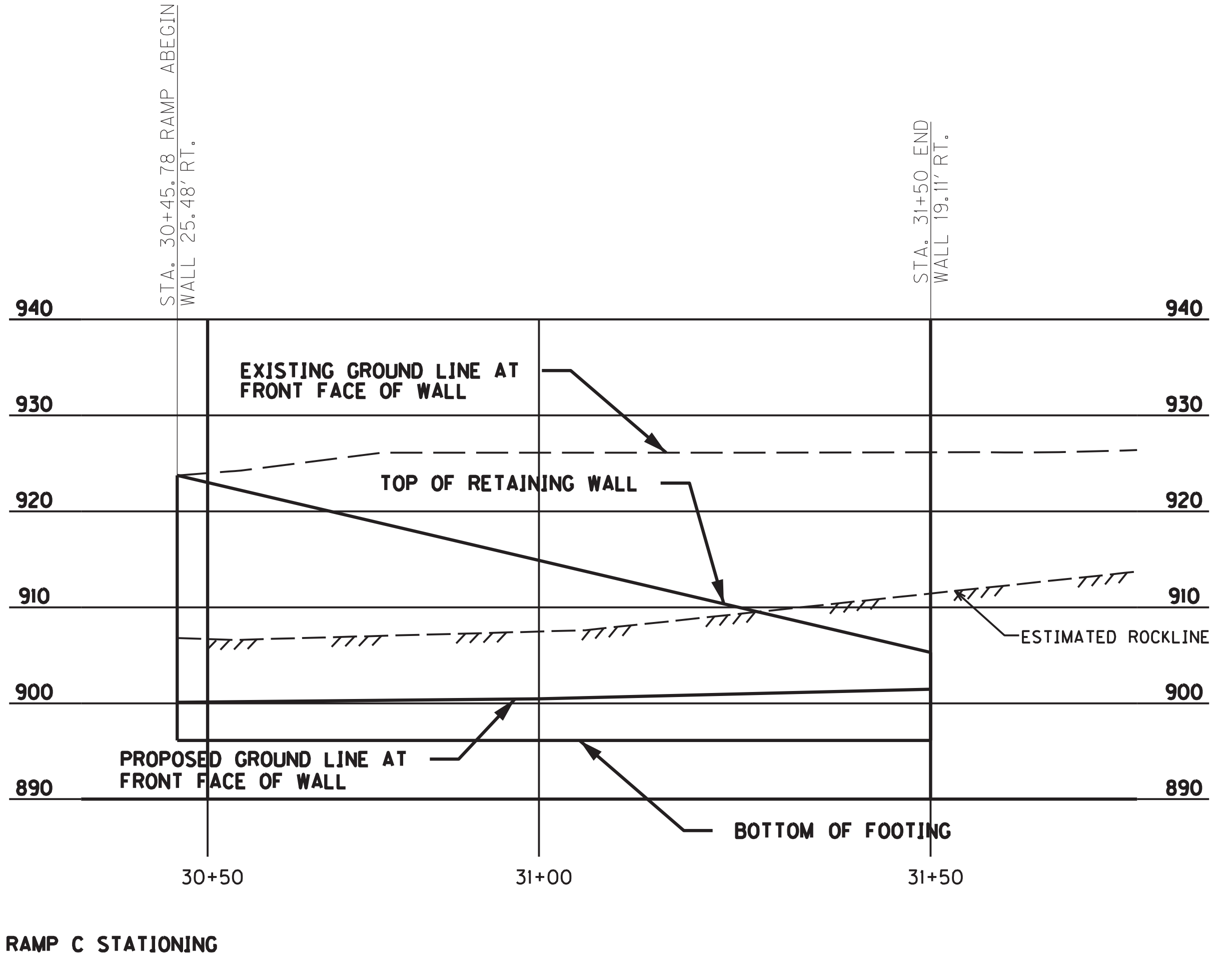
Notes:

(circle one)

Elevation Datum (NAVD88) Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-072-2018						
1043	38.91868454	-84.62376079	1043	US 25 Ramp C 31+06	22.5' Rt.	925.16
1044	38.91883275	-84.62387834	1044	US 25 Ramp C 31+77.5	18' Rt.	926.77
1045	38.91887983	-84.62374360	1045	US 25 Ramp C 31+77.5	60' Rt.	926.54
1046	38.91906149	-84.62406430	1046	US 25 Ramp C 32+75.16	3.7' Rt.	927.19
1047	38.91930383	-84.62403670	1047	US 25 Ramp C 33+54	46' Rt.	927.79
1048	38.91952199	-84.62413249	1048	US 25 Ramp C 34+38.5	50' Rt.	927.67
1049	38.91967902	-84.62421191	1049	US 25 Ramp C 35+00	50' Rt.	927.15
1050	38.91993498	-84.62434153	1050	US 25 Ramp C 36+00	30' Rt.	926.09

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	



FILE NAME: N:\GEOTECH\BOONE RICHWOOD EXIT S-065-2018 THRU S-080-2018\DGNFILES\2018-11-16 E-MAIL FILES FROM JOE (HDR)\RETAININGWALL#12PROFILESHEE

USER: Clayton.Cook
DATE PLOTTED: December 11, 2018

E-SHEET NAME:

MicroStation v8.11.9.832

SCALE: 1"=10'

RETAINING WALL #12
RT. STA. 30+45.78 RT. TO 31+50 RAMP C

Addendum 2 - 7-11-19

M E M O R A N D U M

cc: J. Van Zee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundation Section

DATE: March 26, 2019

SUBJECT: **Boone County**
FD52 12F0 008 0075 175-176; IMSTP0757129
Mars #: 8433801D
Item #: 6-0018.00
I-71/75, Reconstruct Interchange at KY 338 (Richwood Road)
EB KY 338 under I-75/I-71
Retaining Wall #14, Lt. Sta. 107+85 to Sta. 109+58
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on Projectwise and through email for use in development of structure plans. The onsite geotechnical exploration for the project was performed by Horn and Associates.

The proposed retaining wall will be utilized as part of the proposed reconstruction of the interchange between KY 338 and I-71/75 in Boone County. The structure is located on the north side of KY 338 at approximate M.P. 0.28 as it passes under I-71/75 as part of the proposed double crossover diamond interchange. The project is in Richwood, KY.

2.0 SITE GEOLOGIC CONDITIONS

This structure is located in the Union Geologic Quadrangle (GQ# 779). The geologic mapping indicates that the bedrock at this site consists primarily of the Bellevue Tongue of Grant Lake Limestone Formation. Artificial fill materials are also present as part of the I-71/75 embankment.

3.0 FIELD INVESTIGATION

Three (3) sample and core holes were taken at this structure's location. After drilling, the rock cores were delivered to the KYTC Geotechnical Branch in Frankfort, KY, where a geologist logged the rock cores.

4.0 LABORATORY TESTING AND SUBSURFACE CONDITIONS

4.1 **Soil Conditions** - The Consolidated Undrained Triaxial soil testing was performed by HDR, Inc. The unconfined compression testing, Unconsolidated Undrained Triaxial testing, and soil classifications were performed by the Geotechnical Branch's laboratory. The soil samples obtained from the borings were determined to consist of low and high plasticity clays, clayey sands, and clayey gravels. The soil samples were designated as CL, CH, SC, and GC by the Unified Soil Classification System. Shot rock fill material and natural limestone floaters were encountered in the overburden soils during drilling.

4.2 Bedrock Conditions - Depth to rock/refusal varied from 11.6 ft to 34.5 ft. The top of rock/auger refusal elevations at this site varied from 855.3 ft to 857.0 ft. The rock cores taken at this site consisted of light gray, medium and coarse grained, even and irregularly bedded, fossiliferous limestone with dark gray silty shale laminations and partings. The KY RQD values for the rock cores taken at this proposed structure location varied from 0% to 13% and core recoveries ranged from 74% to 100%. Slake Durability Index values varied from 38 to 95.

4.3 Groundwater Conditions – Observation wells were not installed when drilling for this structure. Observation well data from previous work performed at this location to widen the bridge in 1988 was reviewed. Based on this historical data and knowledge of groundwater present at similar soil nail wall projects in the general area, it is determined that there is potential for groundwater in the embankment.

4.4 Soil Strength Testing

4.4.1 Unconsolidated Undrained Triaxial Test – One UU Triaxial Test was conducted to evaluate the undrained shear strength of the area soils. The test resulted in an Undrained Shear Strength of 1440 psf at a confining pressure of 3600 psf (25 psi).

4.4.2 Unconfined Compression Tests – Three unconfined compression tests were conducted to evaluate the undrained shear strength of the area soils. A summary of the tests results are in the Table 1.

Table 1
Summary of Unconfined Compression Test Data

Hole #	Station	Offset (ft)	Depth (ft)	Unified Classification	Plasticity Index, PI	Unconfined Compressive Strength, Q_u (psf)	Undrained Shear Strength, S_u or c_u (psf)
1087	107+38	6.0 Lt.	6.2-8.2	CL	18	2940	1470
1089 off	108+62.40	49.3 Lt.	2.5-4.5	CL	23	3195	1597
			23.1-25.1	CL	22	2660	1330

4.4.3 Consolidated Undrained Triaxial Tests – Two sets of CU Triaxial Tests with pore pressure measurements were conducted to evaluate the drained shear strength of the area soils. A summary of the test results are in the Table 2.

Table 2
Summary of CU Triaxial Test Results

Hole #	**Station**	**Offset (ft)**	**Depth (ft)**	**Unified Classification**	**c' (psf)**	**Φ' (deg)**
1088	109+55	47.0 Lt.	6.9-8.9	CL	72	26.7
			8.9-10.9	CL		
			14.9-16.3	CL		
1089 off	108+62.4	49.3 Lt.	25.1-27.1	CL	907.2	19.1
			27.1-29.1	CL		
			29.1-31.1	CH		

4.4.4 Estimates of Soil Strength Based on Classification – The soils at this location are mostly classified as CL or CH. Typical properties for compacted soils are provided by NAVFAC (1982) and are shown in the Table 3.

Table 3
Typical Properties of Compacted CL and CH Soils

Unified Classification	CL	CH
Effective Angle of Internal Friction, ϕ' (deg)	28	19
Effective Cohesion, c' (psf)	270	230
Undrained Shear Strength, Su or cu (psf)	1800	2150

4.4.5 Recommended Parameters for Design – After reviewing the previous tables, the following soil strength parameters in Table 4 were selected to be used for design of the wall.

Table 4
Design Soil Strength Parameters

Total Unit Weight (pcf)	125
Effective Angle of Internal Friction, Φ' (deg)	20
Effective Cohesion, c' (psf)	200
Undrained Shear Strength, S_u or c_u (psf)	1400

5.0 ENGINEERING ANALYSIS

5.1 Evaluation of Ground Conditions for Soil Nailing – Ground conditions for a soil nail wall were evaluated. The following conditions were noted:

- The existing soils are stiff and fine-grained.
- The groundwater table is at an elevation that should not adversely impact the face of the excavation or the soil nails.
- Some rock fragments and boulders were noted in the soils, which could lead to excessive grout take. Also, a past soil nail wall project in this area experienced excessive grout take.
- To minimize long-term lateral displacements of a soil nail wall, Plasticity Indices (PI) should be less than 15. The soils at this site do not meet that criterion.

In general, the ground conditions at this site are not ideal, but are acceptable for soil nailing.

5.2 **Contracting Approach** – Based on previous experience with specialized retaining walls, it is our opinion that a design-build approach with performance specifications for soil nail installation is appropriate for this structure. A qualified Soil Nail Wall Contractor should be required to perform this work. The approach is to provide certain information in the contract documents including geotechnical data, basic design parameters, and design criteria. The Soil Nail Wall Contractor will then be required to develop the detailed structural design and soil nail configurations within the constraints provided.

5.3 **Wall Configuration** – Information provided by Parsons shows that the proposed wall has a maximum design height of approximately 17 feet and a batter of 1H:12V (4.8° from vertical) in the section under the bridge. Due to the bridge abutments, there is approximately 8 feet of fill above the wall to achieve I-71/75 grade. A live load surcharge of 250 psf will be used to model traffic loads.

5.4 **Corrosion Potential** – Chemical testing to determine potential for corrosion was not performed. Due to the potential for corrosion from the presence of deicing chemicals, corrosion protection should be specified for the soil nails. This corrosion protection should include epoxy coating in addition to the Class A Corrosion Protection method of encapsulation.

5.5 **Wall Deformation Considerations** – Most soil nail wall deformation occurs during or shortly after excavation, and post construction deformation is related to stress relaxation and creep movements. The potential for creep is related to the soil properties discussed below:

- Fine-grained soils with a Liquid Limit (LL) > 50. Of the 44 samples tested, 3 had LL values equal or greater than 50.
- Fine-grained soils with a Plasticity Index (PI) > 20. 23 of the 44 samples tested had a PI greater than 20.
- Fine-grained soils with undrained shear strengths (Su) < 1000 psf. Of the 3 samples tested, none had Su values less than 1000 psf.
- Soils with a Liquidity Index (LI) > 0.2. None of the 44 samples tested had a LI > 0.2
- Organic Soils. We are not aware of any significant presence of organic soils at this site.

Based on the above considerations, it appears that some potential for long-term deformation from creep exists. Extended creep testing should be specified as a part of the testing program for this structure. Bridge foundations such as the ones that support this bridge are typically designed to accommodate some deflection, and deflections on the order of 1 inch or less should not adversely affect the structural integrity of the bridge. Because other factors such as global and external stability are the most significant aspects of soil nail walls, we recommend that prudent but not extraordinary measures be taken to reduce wall deformation.

5.6 **Groundwater Control** – Due to the potential for groundwater in the embankment, horizontal drains should be installed at an elevation of **2 ft** above the final grade of the adjacent roadway. These drains should be incorporated into a drainage system behind the wall that outlets at one end of the wall to prevent seepage onto the roadway.

5.7 **Wall Design Requirements** – The design of the wall should be in accordance with methods outlined in FHWA GEC 007, Soil Nail Walls Reference Manual, current edition. We recommend implementing the following methods and/or design requirements for design of this wall:

- Require a 1.5 long-term global factor of safety. A "global" failure surface is defined as one that intersects one or more rows of nails.
- Require a 1.6 long-term external factor of safety. An "external" failure is defined as one that does not intersect any nails.
- Require at least 4 rows of nails in the critical section. The critical section is defined as the tallest section of the soil nail wall under the bridge.
- Limit the vertical spacing of the nails to no more than **5 feet**.
- Limit the distance from the top of the wall to the top row of nails to 3 feet and the distance from the lower row of nails to the bottom of permanent facing to 5 feet.
- Limit the nail inclination to a maximum of 15°.
- Require a minimum nail length of **25 feet,** with the nail length of any row no shorter than the row below it, to meet External Stability target factors of safety in Table 6, while still meeting all other requirements in Table 5.
- Limit the maximum bar stress to 40% of the yield strength at the service limit state in the top two rows.
- Require "extended" creep testing as part of the nail testing program and acceptance criteria.
- Instrument the existing end bents with survey monuments in order to monitor lateral movement of the substructures.
- Require the contractor to exercise caution not to damage the existing foundation of the bridges.

5.8 **External Failure Modes** – The design cases listed in the following table need to be considered as described in FHWA GEC 007. Exceptions and clarifications for External Failure Modes are provided in Table 5.

Table 5
Minimum Required Factors of Safety for External Failure Modes

Case. No.	Design Case	Temporary/Short Term	Permanent/Long Term
1	Excavation Stability[1]	1.3	N/A
2	Global Stability[2]	1.3	1.5
3	External Stability[3]	1.3	1.6
4	Sliding	1.3	1.5

[1] Excavation Stability analyses consider excavation lifts left unsupported for up to 24 hours before nails are installed.
[2] In Global Stability analyses, failure surfaces intersect some or all nails.
[3] In External Stability analyses, failure surfaces do not intersect the nails.

5.9 Preliminary Wall Design and Analyses – A preliminary soil nail design was performed and it was estimated that soil nail lengths of approximately 25 feet will be required to achieve the External Stability factors of safety. The results of these analyses are presented in Table 6 along with KYTC's Target Factors of Safety for Slopes Adjacent to Structures. As part of the wall design, the Soil Nail Wall Contractor's designer will be required to perform analyses to verify that the required factors of safety are achieved for all failure modes noted above for the proposed soil nail configuration. These additional analyses may indicate that nails longer than the minimum of 25 feet are necessary.

For these analyses, the following assumptions were made:

- Water table was positioned at Elevation 867'.
- Strength of the bedrock was not considered as it was not anticipated that the soil nails would intersect the bedrock.
- Support from the bridge substructure was not considered.
- The nominal (i.e. ultimate) soil nail bond stress was assumed to be 6 psi.

Table 6
Factors of Safety for "External" Stability Analyses Based on Preliminary Wall Design

Condition	External Factor of Safety	KYTC Target Factors of Safety for Slopes Adjacent to Structures
Short Term	2.1	1.2-1.4
Long Term	1.8	1.6-1.8

Additional analyses will be required during the final design.

Because little to no additional fill will be placed, settlement is not considered to be a concern. Refer to Geotechnical Roadway Report R-049-2015 for specific recommendations regarding embankment construction.

6.0 RECOMMENDATIONS

6.1 Use the geotechnical design parameters in Table 4 to design the wall.
6.2 Require the wall designer to verify wall stability based on final wall design dimensions.
6.3 Require the external factors of safety in Table 5.
6.4 Require the walls to be designed neglecting any resistance from the bridge.
6.5 Design for a traffic surcharge in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.
6.6 Require soil nail analyses to be performed using either GOLDNAIL, SNAIL, or SNAP2. The use of other design software may not be utilized without prior approval of the KYTC Geotechnical Branch.
6.7 Require that analyses for the temporary condition to be performed assuming the excavation will be at least 1 foot below the subgrade elevation or to the elevation the contractor will need to excavate, whichever is deeper.
6.8 Require at least 4 rows of nails in the critical section as defined as the tallest section of the soil nail wall under the bridge.
6.9 Limit vertical and horizontal spacing of the nails to no more than **5** feet.
6.10 Limit the distance from the top of the wall to the top row of nails to 3 feet and the

distance from the lower row of nails to the bottom of permanent facing to 5 feet.

6.11 Limit the nail inclination to a maximum of 15°.

6.12 Require a minimum nail length of **25 feet** with the nail length of any row no shorter than the row below it.

6.13 Limit the maximum bar stress to 40% of the yield strength at the service limit state in the top two rows.

6.14 Limit the nominal (i.e. ultimate) soil nail bond stress to 6 psi.

6.15 Require drainage systems behind the wall. This drainage system shall be outlet at one end of the wall to prevent seepage onto the ramp pavement.

6.16 Require the analyses to be performed with the groundwater table positioned no lower than 2 ft above final grade of the adjacent roadway.

6.17 Require permanent facing consisting of either cast-in-place facing or shotcrete facing sculpted to match the project specific form liner.

6.18 Design all components not addressed herein in accordance with FHWA GEC 007 and applicable sections of the AASHTO LRFD Bridge Design Specifications, current edition.

6.19 Require "extended" creep testing (300 minutes) as part of the nail testing program and acceptance criteria.

6.20 Instrument the existing end bents with survey monuments in order to monitor lateral movement of the substructures.

6.21 Require the contractor to exercise caution not to damage the existing foundation of the bridges.

6.22 Require Epoxy Coating Meeting ASTM A775/A775M standards in addition to Class A Corrosion Protection (Encapsulation) in accordance to GEC 007 for the soil nails.

6.23 Require the Contractor to determine the elevations of the pile caps and not excavate below them except as needed to install a given row of soil nails and temporary facing. Excavation for the next lowest row of soil nails shall not be conducted until the row of soil nails immediately above that row has been installed, tested, and temporary facing constructed.

6.24 Require the permanent facing to be completed within 3 months of nail installation.

6.25 Require the contractor to include horizontal drains to control ground water in the design.

6.26 All soil excavation to the front face of the wall required to construct the wall will be paid at the unit bid price for "Roadway Excavation." Other incidental excavation and additional effort beyond what is necessary for normal roadway excavation will be paid at the lump sum bid price for "Foundation Preparation."

6.27 Require the soil nail wall to be designed, constructed, and tested by a qualified Soil Nail Wall Contractor in accordance with the Special Note for Soil Nail Walls.

6.28 Include cross-sections, plan views, and other details in the structure plans to facilitate soil nail wall design.

6.29 Require quality control to be performed by a company other than the prime contractor or Soil Nail Wall Contractor using personnel with experience performing construction inspection for soil nails, tiebacks, or similar construction in accordance with the Special Note for Soil Nail Wall Quality Control.

6.30 The maximum time that temporary excavations can be left open is 24 hours.

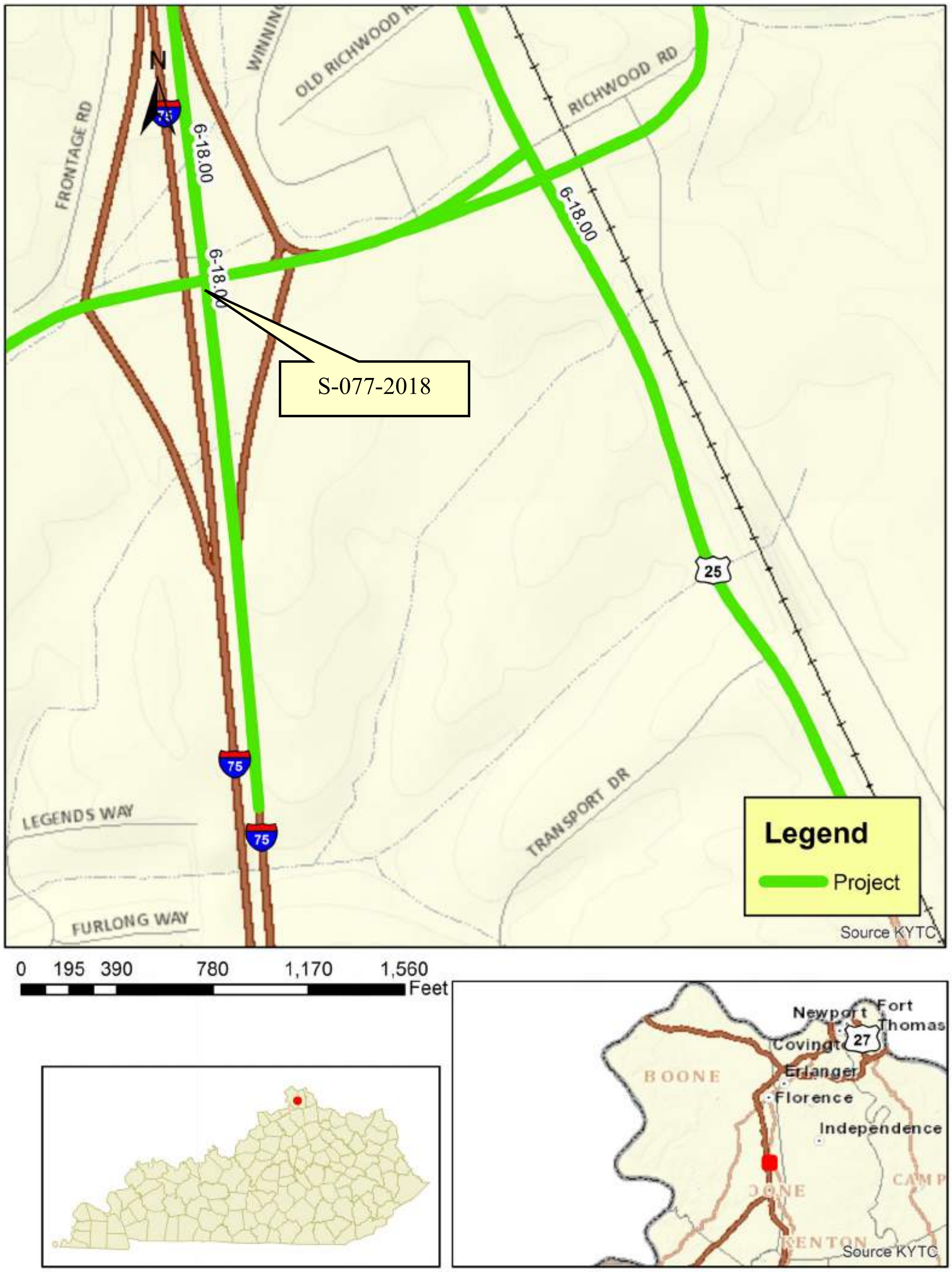
6.31 Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

The designer should feel free to contact the Geotechnical Branch for further recommendations, or for any additional questions that arise pertaining to this project, at (502)564-2374.

Attachments:

- Project Location Map
- Subsurface Data Sheet
- EB KY 338 Wall #14 Profile
- Special Note for Soil Nail Walls
- Special Note for Soil Nail Wall Quality Control
- Coordinate Data Sheet

Structure Location Map:



SHEET LOCATION:

FILE NAME: $$$$design$file$$specification$$$$

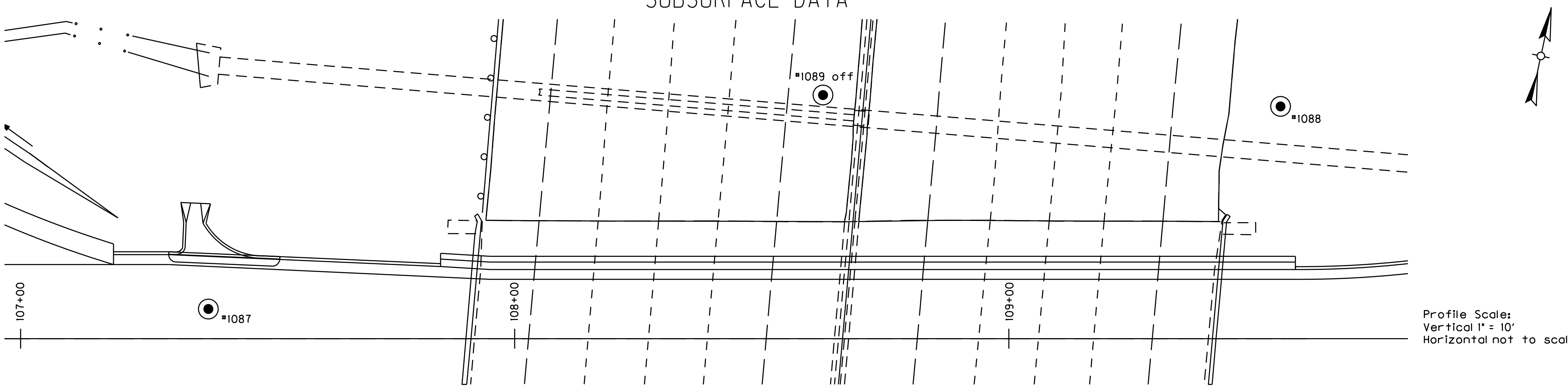
USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

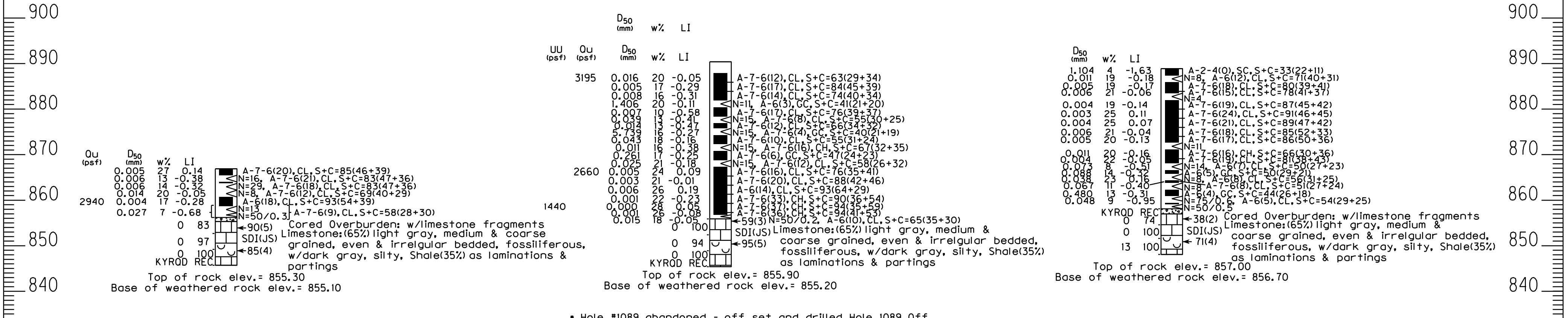
SUBSURFACE DATA

Plan Scale 1" = 10'



Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1087	1089 off •	1088
Station	107+38.00	108+62.40	109+55.00
Offset	6.00 ft. Lt.	49.30 ft. Lt.	47.00 ft. Lt.
Elev. (NAVD 88 datum)	866.90	890.40	888.90



1087

Qu (psf)	D_{50} (mm)	w%	LI	
	0.005	27	0.14	A-7-6(20),CL,S+C=85(46+39)
	0.006	13	-0.38	N=16, A-7-6(21),CL,S+C=83(47+36)
	0.006	14	-0.32	N=29, A-7-6(18),CL,S+C=83(47+36)
	0.014	20	-0.05	N=8, A-7-6(12),CL,S+C=69(40+29)
2940	0.004	17	-0.28	A-6(18),CL,S+C=93(54+39)
	0.027	7	-0.68	N=13 N=50/0.3 A-7-6(9),CL,S+C=58(28+30)

KYRQD	REC	
0	83	←90(5)
0	97	SDI(JS)
0	100	←85(4)

Cored Overburden: w/limestone fragments
Limestone:(65%) light gray, medium & coarse grained, even & irrelgular bedded, fossiliferous, w/dark gray, silty, Shale(35%) as laminations & partings

Top of rock elev.= 855.30
Base of weathered rock elev.= 855.10

1089 off

UU (psf)	Qu (psf)	D_{50} (mm)	w%	LI	
	3195	0.016	20	-0.05	A-7-6(12),CL,S+C=63(29+34)
		0.005	17	-0.29	A-7-6(17),CL,S+C=84(45+39)
		0.008	16	-0.31	A-7-6(14),CL,S+C=74(40+34)
		1.406	20	-0.11	N=11, A-6(3),GC,S+C=41(21+20)
		0.007	10	-0.58	A-7-6(17),CL,S+C=76(39+37)
		0.039	13	-0.41	N=15, A-7-6(8),CL,S+C=55(30+25)
		0.014	13	-0.47	A-7-6(12),CL,S+C=66(34+32)
		5.739	16	-0.27	N=15, A-7-6(4),GC,S+C=40(21+19)
		0.043	18	-0.16	A-7-6(10),CL,S+C=55(31+24)
		0.011	16	-0.38	N=15, A-7-6(16),CH,S+C=67(32+35)
		0.261	17	-0.25	A-7-6(6),GC,S+C=47(24+23)
		0.025	21	-0.18	N=15, A-7-6(12),CL,S+C=58(26+32)
	2660	0.005	24	0.09	A-7-6(16),CL,S+C=76(35+41)
		0.003	21	-0.01	A-7-6(20),CL,S+C=88(42+46)
		0.006	26	0.19	A-6(14),CL,S+C=93(64+29)
		0.001	22	-0.23	A-7-6(33),CH,S+C=90(36+54)
1440		0.000	28	0.05	A-7-6(37),CH,S+C=94(35+59)
		0.001	26	-0.08	A-7-6(36),CH,S+C=94(41+53)
		0.015	18	-0.05	N=50/0.2, A-6(10),CL,S+C=65(35+30)

KYRQD	REC	
		←59(3)
0	100	SDI(JS)
0	94	←95(5)
0	100	

Limestone:(65%) light gray, medium & coarse grained, even & irrelgular bedded, fossiliferous, w/dark gray, silty, Shale(35%) as laminations & partings

Top of rock elev.= 855.90
Base of weathered rock elev.= 855.20

1088

D_{50} (mm)	w%	LI	
1.104	4	-1.63	A-2-4(0),SC,S+C=33(22+11)
0.011	19	-0.18	N=8, A-6(12),CL,S+C=71(40+31)
0.005	19	-0.17	A-7-6(18),CL,S+C=80(39+41)
0.006	21	-0.06	A-7-6(15),CL,S+C=78(41+37)
			N=4
0.004	19	-0.14	A-7-6(19),CL,S+C=87(45+42)
0.003	25	0.11	A-7-6(24),CL,S+C=91(46+45)
0.004	25	0.07	A-7-6(21),CL,S+C=89(47+42)
0.006	21	-0.04	A-7-6(18),CL,S+C=85(52+33)
0.005	20	-0.13	A-7-6(17),CL,S+C=86(50+36)
			N=11
0.011	20	-0.16	A-7-6(16),CH,S+C=66(30+36)
0.004	22	-0.05	A-7-6(19),CL,S+C=81(38+43)
0.073	8	-0.51	N=14, A-6(7),CL,S+C=50(27+23)
0.088	14	-0.32	A-6(5),GC,S+C=50(29+21)
0.038	23	0.16	N=8, A-6(8),CL,S+C=56(31+25)
0.067	11	-0.40	N=8 A-7-6(8),CL,S+C=51(27+24)
0.480	13	-0.31	A-6(4),GC,S+C=44(26+18)
0.048	9	-0.95	N=75/0.6, A-6(5),CL,S+C=54(29+25)
			N=50/0.5

KYRQD	REC	
0	74	←38(2)
0	100	SDI(JS)
13	100	←71(4)

Cored Overburden: w/limestone fragments
Limestone:(65%) light gray, medium & coarse grained, even & irrelgular bedded, fossiliferous, w/dark gray, silty, Shale(35%) as laminations & partings

Top of rock elev.= 857.00
Base of weathered rock elev.= 856.70

• Hole #1089 abandoned - off set and drilled Hole 1089 Off

850
840 Datum 840
850

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	T. SHEFFIELD

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE KY 338
CROSSING Retaining Wall #14

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

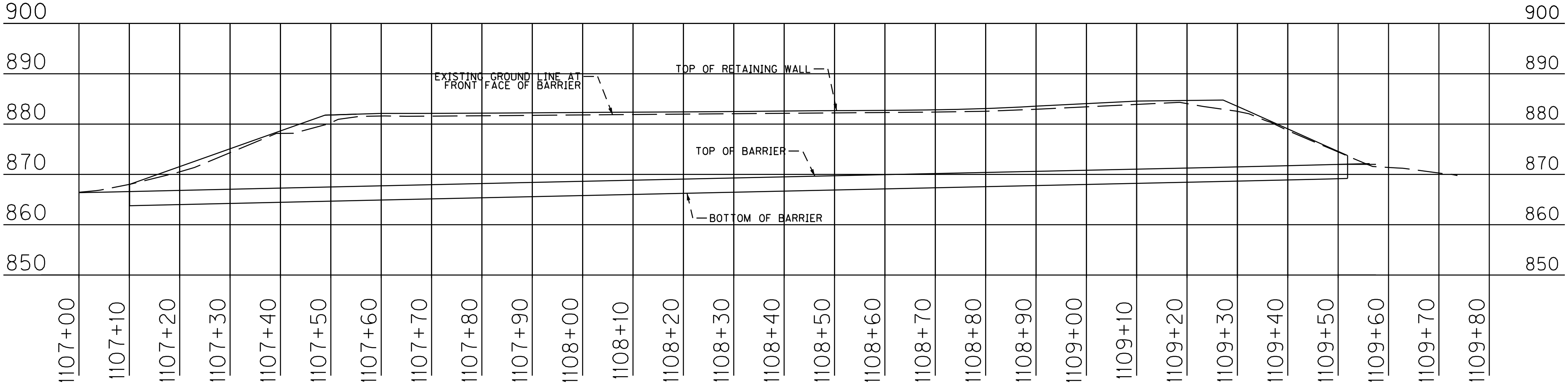
SHEET NO.
DRAWING NO. 00000

S–077–18

ITEM NUMBER
6–18.00

Addendum 2 -- 7-11-19

WALL PROFILE CUT ON WALL BASE LINE



Addendum 2 -- 7-11-19

S-077-2018 06-0018.00 Kentucky Transportation Cabinet

ID	Latitude	Longitude	Hole	Station	Offset	Elevation(ft)	Comments
1	38.91769132	-84.62955963	1087	107+38	-6	866.91	
3			1089	108+61	-30	889.89	Hole abandoned - offset and drilled hole 1089 Off
4	38.9178753	-84.62916097	1089 Off	108+62.4	-49.3	890.41	
2	38.9179191	-84.6288404	1088	109+55	-47	888.91	

M E M O R A N D U M

cc:
J. Van Zee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundation Section

DATE: April 9, 2019

SUBJECT: **Boone County**
FD52 12F0 008 0075 175-176; IMSTP0757129
Mars #: 8433801D
Item #: 6-0018.00
I-71/75, Reconstruct Interchange at KY 338 (Richwood Road)
EB KY 338 under I-75/I-71
Retaining Wall #14, Lt. Sta. 107+85 to Sta. 109+58
Geotechnical Engineering Structure Foundation Report Addendum

This report addendum is to address the changes made to the retaining wall facing specifications and batter provided by the designer in an email dated Friday April 5th, 2019. The recommendations from the original report S-077-2018 still apply, but with the following changes:

- The front batter of the wall noted in **Section 5.3** is changed from 1H:12V (4.8° from vertical) to **7H:36V (11.0° degrees from vertical).**
- **Section 6.17** is changed from "Require permanent facing consisting of either cast-in-place facing or shotcrete facing sculpted to match the project specific form liner." to **"Require permanent facing consisting of either cast-in-place concrete or shotcrete with either a smooth finish or architectural treatment to match the project specific form liner as specified by the contract plans."**

The attached Special Note for Soil Nail Walls with appendices reflect these changes and will supersede the previously issued special note.

Attachments:

- Special Note For Soil Nail Walls

M E M O R A N D U M

cc:
J. Van Zee
C. Van Zee
M. Bezold
R. Franxman
R. Turner
E. Drury
C. Callan-Ramler
K. Sperry (HMB)
K. Meyer (HDR)
K. Chism (Parsons)
D. McElmurray

TO: Bart Asher, P.E., P.L.S.
Director, Division of Structural Design

FROM: Michael Carpenter, P.E.
TEBM, Geotechnical Branch

BY: Tyler Sheffield, E.I.T.
Geotechnical Branch, Structure Foundation Section

DATE: January 10, 2019

SUBJECT: **Boone County**
FD52 12F0 008 0075 175-176; IMSTP0757129
Mars #: 8433801D
Item #: 6-0018.00
I-71/75, Reconstruct Interchange at KY 338 (Richwood Road)
WB KY 338 under I-75/I-71
Retaining Wall #15, Rt. Sta. 207+80 to Sta. 209+45
Geotechnical Engineering Structure Foundation Report

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on Projectwise and through email for use in development of structure plans. The onsite geotechnical exploration for the project was performed by the consulting firm of Horn and Associates.

The proposed retaining wall will be utilized as part of the proposed reconstruction of the interchange between KY 338 and I-71/75 in Boone County. The structure is located on KY 338 at approximate M.P. 0.28 as it passes under I-71/75. The project is in Richwood, KY.

2.0 SITE GEOLOGIC CONDITIONS

This structure is located in the Union Geologic Quadrangle (GQ# 779). The geologic mapping indicates that the bedrock at this site consists primarily of the Bull Fork Formation. Artificial fill materials are also present as part of the I-71/75 embankment.

3.0 FIELD INVESTIGATION

Two (2) sample and core holes were taken at this structure's location. After drilling, the rock cores were delivered to the KYTC Geotechnical Branch in Frankfort, KY, where a geologist logged the rock cores.

4.0 LABORATORY TESTING AND SUBSURFACE CONDITIONS

4.1 **Soil Conditions** - The triaxial soil testing was performed by the consulting firm of HDR, Inc. The unconfined compression testing and soil classifications were performed by the Branch's laboratory. The soil samples obtained from the borings were determined to consist of low to high plasticity clays, silty sand, and clayey gravel. The soil samples were designated as CL, CH, SM, and GC by the Unified

Soil Classification System. Shot rock fill material and natural limestone floaters were encountered in the overburden soils during drilling.

4.2 **Bedrock Conditions** - Depth to rock/refusal varied from 14.8 ft to 15.0 ft. The top of rock/auger refusal elevations at this site varied from 871.8 ft to 871.9 ft. The rock cores taken at this site consisted of gray, clayey and silty, calcareous shale interbedded with gray, medium and coarse grained, limestone. This shale layer was underlain by gray, medium to coarse grained, fossiliferous limestone with gray, silty, calcareous shale partings and laminations. The KY RQD values for the rock cores taken at this proposed structure location varied from 0% to 10% and core recoveries ranged from 94% to 100%.

4.3 Soil Strength Testing

4.3.1 **Unconfined Compression Tests** – Three unconfined compression tests were conducted to evaluate the undrained shear strength of the area soils. A summary of the tests results are in the table below.

Summary of Unconfined Compression Test Data

Hole #	Station	Offset (ft)	Depth(ft)	Unified Classification	Plasticity Index, PI	Unconfined Compressive Strength, Q_u (psf)	Undrained Shear Strength, S_u or c_u (psf)
1090	207+83	89.0 Rt.	4.0-6.0	CL	20	5243	2621
			6.0-7.8	CH	29	5023	2511
1091	209+48	84.0 Rt.	10.0-11.5	CL	24	1972	986

4.3.2 **Consolidated Undrained Triaxial Tests** – One set of CU Triaxial Tests with pore pressure measurements were conducted to evaluate the drained shear strength of the area soils. A summary of the test results are in the table below.

Summary of CU Triaxial Test Results

Hole #	Station	Offset (ft)	Depth (ft)	Unified Classification	c' (psf)	Φ' (deg)
1091	209+48	84.0 Rt.	4.0-6.0	CL	115	26.0
			6.0-8.0	CL		
			8.0-10.0	CL		

4.3.3 **Estimates of Soil Strength Based on Classification** – The soils at this location are mostly classified as CL or CH. Typical properties for compacted soils are provided by NAVFAC (1982) and are shown in the table below.

Typical Properties of Compacted CL and CH Soils

Unified Classification	CL	CH
Effective Angle of Internal Friction, ϕ' (deg)	28	19
Effective Cohesion, c' (psf)	270	230
Undrained Shear Strength, Su or cu (psf)	1800	2150

5.0 ENGINEERING ANALYSIS

Analyses indicate that a Standard Gravity Wall may be utilized at this location. The wall shall comply with Case III of Standard Drawing No. RGX-002-09, except that the base width (B) shall be increased by 0.5 feet. By following these requirements, LRFD checks for eccentricity (overturning), bearing capacity, and sliding were satisfied. Native soil may be used as backfill behind the wall. Because of the low heights of the wall and the subsurface conditions, slope stability and settlement analyses were not required.

A large block retaining wall without geogrid or geotextile reinforcement may be suitable at this location. The attached Geotechnical Note Sheet contains sufficient design information if this type of wall is submitted as an alternative.

6.0 RECOMMENDATIONS

6.1 The wall shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, current edition.

6.2 Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction.

6.3 The following parameters shall be utilized for design of the wall:

Unit weight of soil embankment backfill:	125 pcf
Friction angle of soil embankment backfill:	26°
Cohesion of soil embankment backfill:	0 psf
Unit weight of existing foundation soils:	125 pcf
Friction angle of existing foundation soils:	0°
Cohesion of existing foundation soils:	950 psf

6.3.1 Use wall dimensions in accordance with Case III of Standard Drawing RGX-002-09, except that the base width (B) shall be increased by **0.5 feet**.

6.3.2 Embedment of the footing must be a minimum of 2 feet below final grade.

6.3.3 The backfill behind the wall may consist of native soils. The material shall be compacted in accordance with Section 206 in the current edition of the Standard Specifications for Road and Bridge Construction.

6.3.4 If alternate wall types other than the planned Gravity Retaining Wall are utilized, size the wall footings at Service Limit State using Factored Nominal Bearing Resistances given below. For checking bearing resistance at Strength and Extreme Limit States, use Resistance Factors of 0.55 and 1.0, respectively, applied to the Nominal Bearing Resistance.

Bearing Surface	Factored Nominal Bearing Resistance at Service Limit State	Nominal Bearing Resistance
Existing Soil	1.6 ksf	4.8 ksf

6.3.5 Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

6.3.6 Solid rock excavation may be required for installation of this retaining wall.

6.3.7 The wall designer shall verify wall stability based on final wall design dimensions.

6.3.8 Refer to the attached plan sheet "Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls" for additional details.

6.0 Plan Notes

Add the attached plan sheet, "Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls," at the appropriate locations in the plans.

The designer should feel free to contact the Geotechnical Branch for further recommendations, or for any additional questions that arise pertaining to this project, at (502)564-2374.

Attachments:
- Project Location Map
- Subsurface Data Sheet
- WB KY 338 Wall #15 Profile
- Geotechnical Notes for Cast-In-Place Concrete Non-Reinforced Gravity Walls
- Coordinate Data Sheet

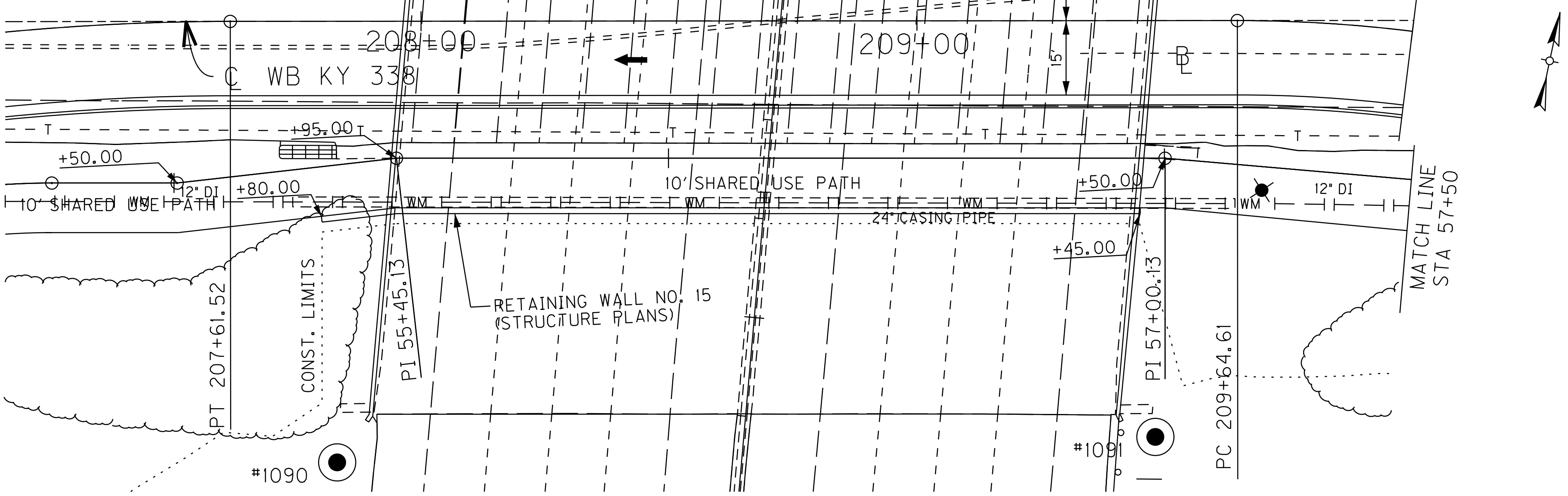
S-076-2018
Boone Co., KY 338 (Richwood Rd.)
January 10, 2019
Item #: 6-18.00

Structure Location Map:

SHEET LOCATION:
FILE NAME: $$$$designfile$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

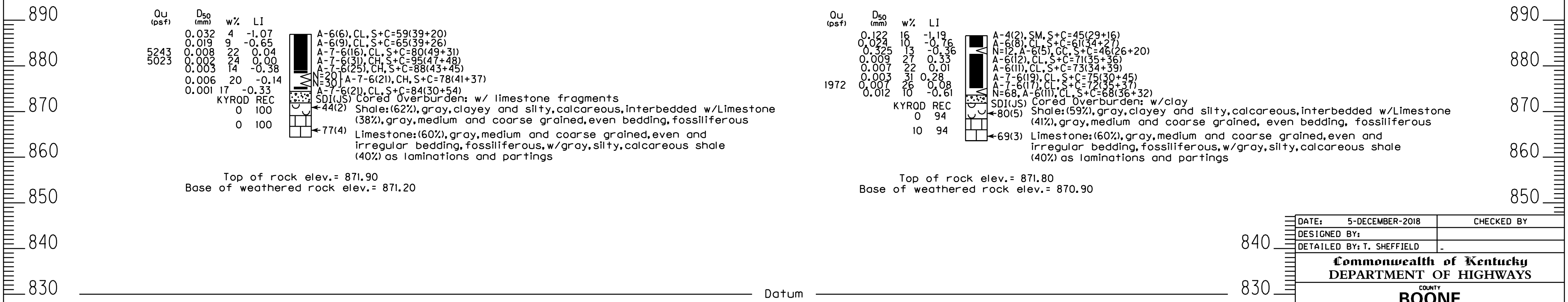
SUBSURFACE DATA

Plan Scale 1" = 10'



Hole No.	1090	1091
Station	207+83.00	209+48.00
Offset	89.00 ft. Rt.	84.00 ft. Rt.
Elev. (NAVD 88 datum)	886.90	886.60

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale



1090

Qu (psf)	D_{50} (mm)	w%	LI	
	0.032	4	-1.07	A-6(6),CL,S+C=59(39+20)
	0.019	9	-0.65	A-6(9),CL,S+C=65(39+26)
5243	0.008	22	0.04	A-7-6(16),CL,S+C=80(49+31)
5023	0.002	24	0.00	A-7-6(31),CH,S+C=95(47+48)
	0.003	14	-0.38	A-7-6(25),CH,S+C=88(43+45)
	0.006	20	-0.14	N=20 N=30 A-7-6(21),CH,S+C=78(41+37)
	0.001	17	-0.33	A-7-6(21),CL,S+C=84(30+54)

KYRQD	REC
0	100
0	100

SDI(JS) Cored Overburden: w/ limestone fragments

Shale:(62%),gray,clayey and silty,calcareous,interbedded w/Limestone (38%),gray,medium and coarse grained,even bedding,fossiliferous

Limestone:(60%),gray,medium and coarse grained,even and irregular bedding,fossiliferous,w/gray,silty,calcareous shale (40%) as laminations and partings

Top of rock elev.= 871.90
Base of weathered rock elev.= 871.20

1091

Qu (psf)	D_{50} (mm)	w%	LI	
	0.122	16	-1.19	A-4(2),SM,S+C=45(29+16)
	0.024	10	-0.76	A-6(8),CL,S+C=61(34+27)
	0.325	13	-0.36	N=12,A-6(5),GC,S+C=46(26+20)
	0.009	27	0.33	A-6(12),CL,S+C=71(35+36)
	0.007	22	0.01	A-6(11),CL,S+C=73(34+39)
	0.003	31	0.28	A-7-6(19),CL,S+C=75(30+45)
1972	0.007	26	0.08	A-7-6(17),CL,S+C=72(35+37)
	0.012	10	-0.61	N=68,A-6(11),CL,S+C=68(36+32)

KYRQD	REC
0	94
10	94

SDI(JS) Cored Overburden: w/clay

Shale:(59%),gray,clayey and silty,calcareous,interbedded w/Limestone (41%),gray,medium and coarse grained, even bedding, fossiliferous

Limestone:(60%),gray,medium and coarse grained,even and irregular bedding,fossiliferous,w/gray,silty,calcareous shale (40%) as laminations and partings

Top of rock elev.= 871.80
Base of weathered rock elev.= 870.90

The Presumptive Factored Bearing Resistance at the Service Limit State is
16 ksf for Spread Footings on Competent Unweathered Bedrock

S–076–18
ITEM NUMBER
6–0018.00

DATE: 5-DECEMBER-2018
CHECKED BY
DESIGNED BY:
DETAILED BY: T. SHEFFIELD
-

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

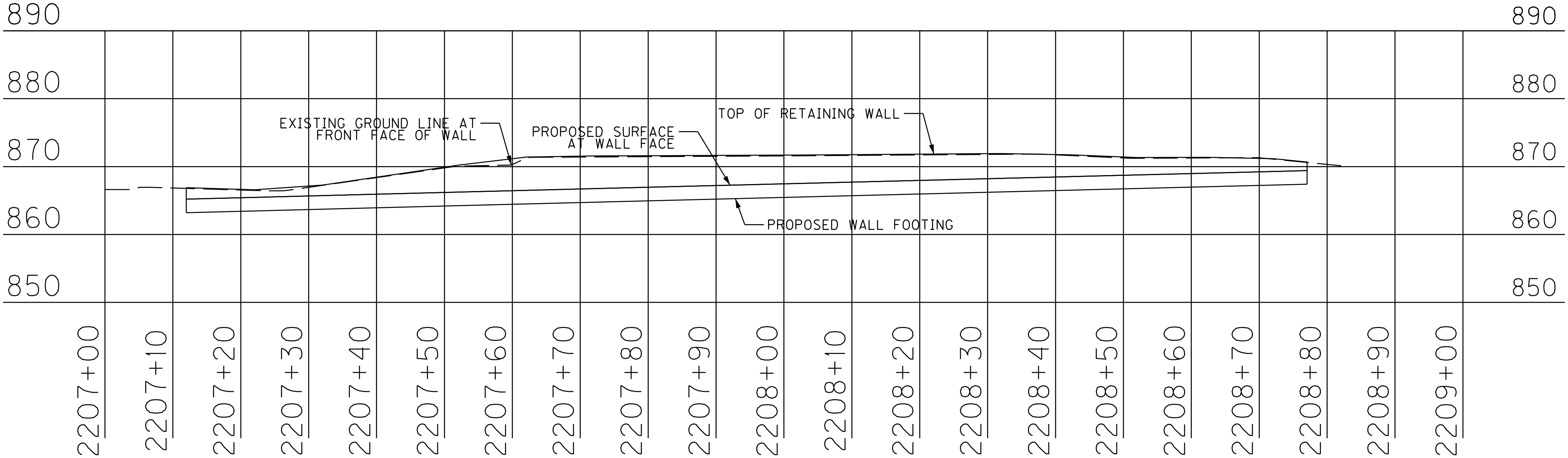
ROUTE
KY 338
CROSSING
WB KY 338 Retaining Wall

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.
DRAWING NO.
00000

Addendum 2 -- 7-11-19



Addendum 2 -- 7-11-19

GEOTECHNICAL NOTES

for Cast-In-Place Concrete Non-Reinforced Gravity Walls

The minimum embedment shall be 2 ft. from finished grade in front of the wall to bottom of wall.

Use wall dimensions in accordance with Case III of the Standard Drawing RGX-002-09, except that the base width (B) shall be increased by 0.5 ft.

Backfill wall with Insitu Soil materal as outlined on this sheet.

Bearing Surface	Nominal Bearing Resistance	Factored Nominal Bearing Resistance at the Service Limit State
Soil	4.8 ksf	1.6 ksf

Use the following soil strength parameters for design:

	Cohesion (psf)	Friction Angle (degrees)	Unit Weight (pcf)
External Backfill			
Existing Soil	0	26	125
Foundation Soils			
Existing	950	0	125

The wall designer shall verify wall stability based on final wall design dimensions.

Drainage systems behind the wall will be necessary. Provide weep holes at specified intervals.

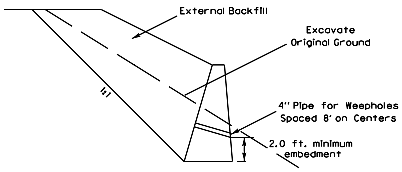
Temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate wall construction.

A large block Retaining Wall without Geogrid or Geotextile Reinforcement may be suitable at this location.

Solid rock excavation may be required for installation of this retaining wall. If the bedrock becomes softened at bearing elevation, the softened material shall be undercut to suitable bearing material prior to placing the concrete.

EXCAVATION AND BACKFILL REPLACEMENT

Cast-In-Place Retaining Wall



DATE: 10-JAN-2019	CHECKED BY
DESIGNED BY:	
DETAILED BY: T. SHEFFIELD	

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE KY 338
CROSSING Retaining Wall #15

SUBSURFACE DATA

S–076–2018

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

SHEET LOCATION:
FILE NAME: $$$$design$file$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

S-076-2018 06-0018.00 Kentucky Transportation Cabinet

ID	Latitude	Longitude	Hole	Station	Offset	Elevation(ft)	Comments
1	38.91730482	-84.62933858	1090	207+83	89	886.9	
2	38.91740757	-84.62877357	1091	209+48	84	886.56	

MEMORANDUM **S-073-2018**

TO:	Bart Asher, P.E. Director Division of Structural Design	cc:	J. Van Zee C. Van Zee M. Bezold (D-6) R. Franxman (D-6) E. Drury R. Turner B. Yeager C. Callan-Ramler (D-6) W. Hagerman (HDR) K. Meyer (HDR) K. Chism (Parsons)
FROM:	Michael Carpenter, P.E. TEBM Geotechnical Branch		
BY:	Clayton S. Cook, P.E. Geotechnical Branch		
DATE:	January 9, 2019		
SUBJECT:	Boone County Item No. 6-18.00 FD52 12F0 008 0075 175-176; IMSTP0757129 MARS No. 8433801D Reconstruct I-75/KY 338 Interchange North of Walton; Noise Wall Along 1-75/I-71, Left Station 421+70.50 to 441+55.10 Geotechnical Engineering Structure Foundation Report		

1.0 LOCATION AND DESCRIPTION

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on ProjectWise and through email for the use in development of structure plans.

The proposed sound wall will run along the west side of I-75/I-71 at the southbound on ramp for KY 338 at Exit 175 of I75/I-71. This wall will be approximately 1988 feet long. The structure is located in the Union Quadrangle (GQ-779). The geologic mapping indicates that the bedrock at the side consists of three rock formations; Bull Fork Formation, Grant Lake Limestone, and Fairview Formation. The majority of the wall will be located in the Bull Fork Formation which consists of interbedded shale and limestone layers with increasing shale percentages as you approach the top of the layer.

2.0 FIELD INVESTIGATION

The drilling for this structure was performed by Horn & Associates. A total of seven sample and core holes, one core hole and eight soundings were drilled. Both rock core and soil samples were then delivered to the KYTC Geotechnical Branch in Frankfort, where a geologist logged the rock cores and the Branch’s lab conducted testing on the samples.

3.0 SUBSURFACE CONDITIONS

The soil samples were designated as CL, CH, GC, MH, GM, SC, and ML by the USCS, and A-4, A-7-5, A-6, A-7-6, A-2-6 and A-7-6 by the AASHTO classification system. Top of rock elevations ranged greatly along the centerline of the sound wall. With depths of one to six feet in the shallower sections and maximum depth of thirty five feet in and around where the culverts are located underneath I-75/I-71. Four unconfined tests were conducted on soil samples with yielded an average unconfined value of 3665 psf.

The bedrock along the sound wall consists of limestone and shale. The core recovered percentages were generally above the 70's except in some cases where they were 45 to 60 in the soil/rock transition zone. KY Rock Quality Designations (RQD) values were all zero and SDI's were 59 to 94 indicating that the bedrock in this location is all non-durable interbedded shale and limestone. See the estimated rockline in the attachments for rockline elevation estimates along the sound wall centerline.

4.0 ENGINEERING ANALYSIS

Drilled shafts are proposed for the noise barrier wall foundations. The Idealized Soil and Bedrock Profile Sheet and the Drilled Shaft Axial Tables are attached. Because of the structure type and pre-existing site conditions embankment and settlement analyses were not required.

5.0 FOUNDATION RECOMMENDATIONS

Use drilled shafts with a minimum socket length of 15 feet or minimum tip embedment of 3 feet in sound bedrock. Lower tip elevations may be necessary in order to satisfy lateral capacity or other structural requirements. For shafts not anticipated to tip into bedrock allowable axial capacities may be evaluated using the table below. Otherwise, evaluate the allowable axial capacities using the attached Drilled Shaft Axial Capacity Tables provided at the end of the report. Axial capacities obtained through soil may not be combined with capacities through bedrock. Refer to General Recommendation 6.1 and Plan Note 7.3 below for a discussion of variability in the rockline and its impact on shaft design and construction.

Summary of Capacities in Soil for 15' Drilled Shafts Plus Incremental Nominal Side Resistance per Additional Foot of Embedment

Shaft Diameter	End Bearing	Side Resistance	Factored End Bearing	Factored Side Resistance	Total Factored Uplift Resistance	Additional Factored Side Resistance Per Foot of Additional Embedment	
						Side	Uplift
(ft)	(kips)	(kips)	(kips)	(kips)	(kips)	(kips)	(kips)
1.5	28.63	46.65	11.45	20.99	16.33	2.10	1.63
2	50.89	62.20	20.36	27.99	21.77	2.80	2.18
2.5	79.52	77.75	31.81	34.99	27.21	3.50	2.72
3	114.51	93.31	45.80	41.99	32.66	4.20	3.27
Calculation Notes: Top 5 (feet) are neglected. Capacities through soil must be neglected if rock socket is utilized Resistance Factors: Side = 0.45; End = 0.40; Uplift = 0.35							

6.0 GENERAL RECOMMENDATIONS

6.1 The rocklines along the portions of the proposed wall were found to be variable. It is possible that interpolated rock depths during design may not be encountered in the field. The potential for an unexpectedly high or low rockline should be addressed in the wall plans. The designer may choose to establish minimum embedment depths for lateral support. Criteria for axial capacity can be addressed in the plans based on the following:

Soil Supported Shafts:
If the shaft is to be supported in soil and bedrock is encountered above the anticipated tip elevation, the contractor shall provide a 3 foot rock socket. In these cases the design axial capacities of the shafts can be conservatively assumed to be met. Lateral support conditions should still be verified and approved by the wall design consultant.

Bedrock Supported Shafts:
If the shaft is to be supported in bedrock and bedrock is encountered below the anticipated tip elevation the contractor must extend the shaft to bedrock in order to provide the required socket length unless the wall design consultant considers and approves the corresponding reduction in axial and lateral capacity

6.2 The drilled shafts shall be constructed in accordance with the Special Note for Drilled Shafts, current edition, except that subsurface exploration borings in accordance with Section 3.5 of the Special Note is not required.

6.3 The top 5 feet of the soils shall be neglected for lateral support or axial resistance of the drilled shafts

6.4 Perform lateral analyses using the geotechnical parameters provided in the attached Idealized Soil and Bedrock Profile. These parameters maybe used to perform analyses using LPILE Plus or similar software. Some of the parameters may not be required to be input, depending on the version of the program being used.

6.5 At the designer's discretion the overburden soils maybe utilized for lateral support; however, for shafts embedded less than 15 feet a minimum rock socket depth of 3 feet is required for axial support.

6.6 Noise Walls should not be subjected to differential earth loading. Reinforced panels may shift or crack and the entire wall could potentially have an overturning failure if it is subjected to earth loads. Special pane and foundation designs are required in order to safely construct a hybrid Retaining/Noise Wall. In walls constructed in newly placed fill areas it should not be assumed that construction will be phased in a manner to avoid imposing earth loads. The walls should either be designed to withstand the maximum potential earth load or construction phasing must be specified to prevent differential loading conditions. Wall design loads should be determined using Soil Type 3 of Exhibit 413 in the Division of Structural Design Guidance Manual.

7.0 PLAN NOTES

7.1 Permanent casing is not required. The contractor may elect to use temporary casing in deeper soil areas. Temporary casing may be omitted if the contractor can demonstrate the ability to maintain an open excavation without collapse of the side walls, fall back material into the excavation, or fall back into and contamination of the freshly placed concrete. In shall overburden, unsupported excavation or some other shoring method maybe utilized at the contractor's discretion.

7.2 Except as permitted by special design Noise Walls shall not be subjected to differential earth loading. Temporary or permanent soil loads placed on the sound barrier walls are only permitted as noted in the sound barrier wall plans.

7.3 Due to variability in the rockline the potential for field adjustment in shaft lengths shall be addressed in the following manner:

Soil Supported Shafts:
If the shaft is to be supported in soil and bedrock is encountered above the anticipated tip elevation, the contractor shall provide a 3 foot rock socket. In these cases the design axial capacities of the shafts can be conservatively assumed to be met. Lateral support conditions should still be verified and approved by the wall design consultant.

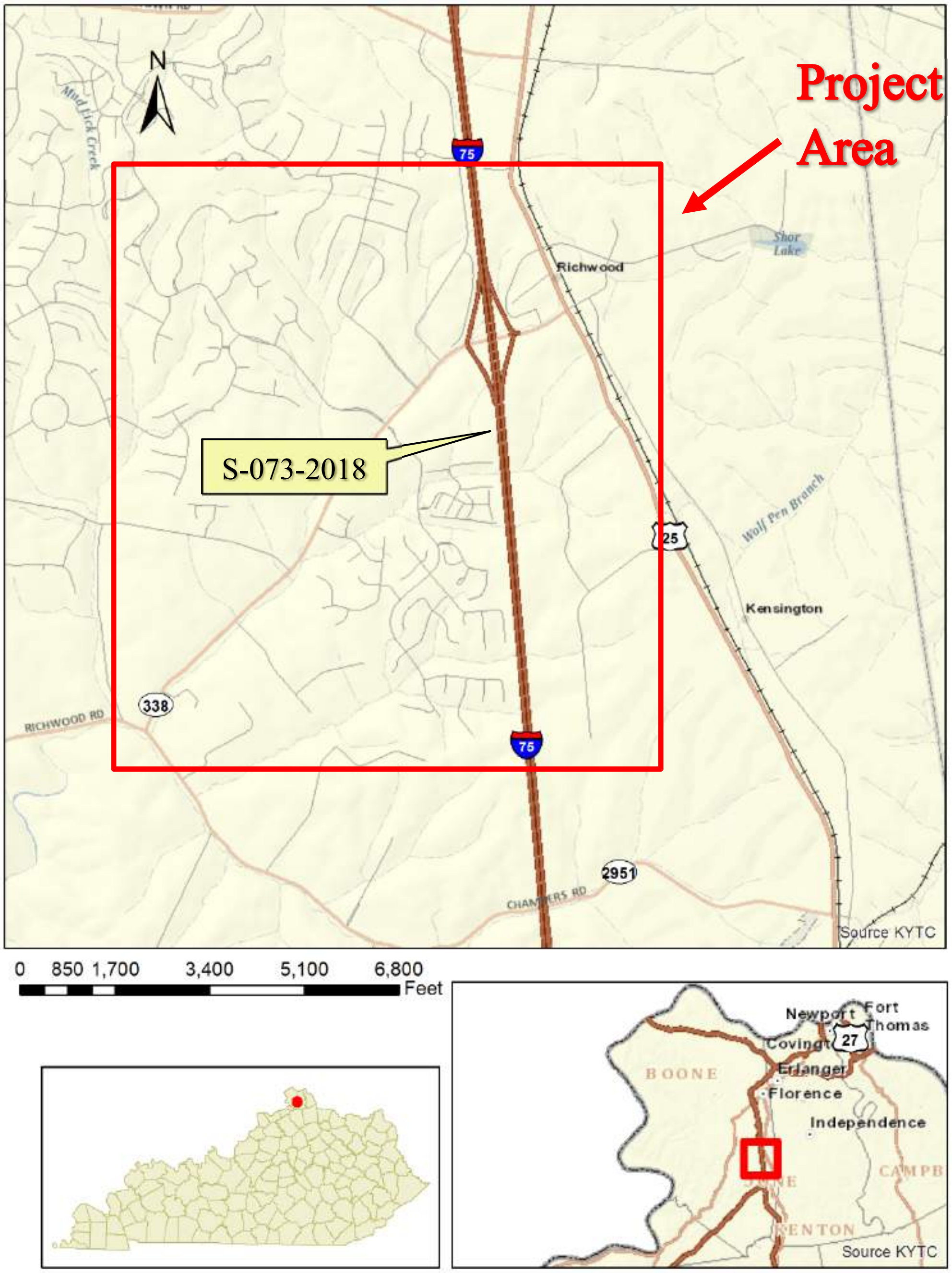
Bedrock Supported Shafts:
If the shaft is to be supported in bedrock and bedrock is encountered below the anticipated tip elevation the contractor must extend the shaft to bedrock in order to provide the required socket length unless the wall design consultant considers and approves the corresponding reduction in axial and lateral capacity

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Idealized Soil and Bedrock Profile**
- **Load and Resistance Factor Design Tables**
- **Rockline Estimate For S-073-2018**
- **Coordinate Data Sheet**
- **Sound Wall Profile Sheet**

Project Location Map



SHEET LOCATION:

SUBSURFACE DATA

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1057	1058	1059	1060	1061
Station	421+70.50	422+69.90	423+68.00	424+71.50	425+69.90
Offset	87.20 ft. Lt.	69.10 ft. Lt.	68.50 ft. Lt.	69.80 ft. Lt.	70.00 ft. Lt.
Elev. (NAVD 88 datum)	887.40	891.30	889.70	887.50	885.50

Cored Overburden: w/limestone fragments
Limestone:(70%) gray, medium & coarse grained, even & irregular bedding, fossiliferous, w/dark gray, silty, calcareous Shale (30%) as laminations & partings

Top of rock elev.= 872.00
Base of weathered rock elev.= 870.30

Shale:(73%) gray, silty & clayey, interbedded w/Limestone(27%) gray, coarse grained, even bedded, fossiliferous
Limestone:(70%) gray, medium & coarse grained, even & irregular bedding, fossiliferous, w/dark gray, silty Shale (30%) as laminations & partings

Top of rock elev.= 854.50
Base of weathered rock elev.= 853.00

DATE:	25-OCTOBER-2018	CHECKED BY
DESIGNED BY:		
DETAILED BY:	E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–75

CROSSING
Sound Wall

S–073–18

SUBSURFACE DATA

ITEM NUMBER
6–18.00

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

FILE NAME: $$$$design$file$$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

Addendum 2 -- 7-11-19

SUBSURFACE DATA

Plan Scale 1" = 20'

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1062	1063	1064	1065
Station	428+00.00	429+71.70	430+64.00	431+70.50
Offset	96.70 ft. Lt.	96.70 ft. Lt.	93.90 ft. Lt.	96.30 ft. Lt.
Elev. (NAVD 88 datum)	881.10	878.30	874.70	870.80

Cored Overburden: w/limestone fragments
Limestone:(60%) gray, medium & coarse grained, even & irregular bedding, fossiliferous, w/gray, silty, calcareous Shale (40%) as laminations & partings

Top of rock elev.= 873.50
Base of weathered rock elev.= 873.00

Overburden
Cored Overburden: w/limestone fragments
Limestone:(65%) gray, medium & coarse grained, even & irregular bedding, fossiliferous, w/gray, silty, calcareous Shale (35%) as laminations & partings

Top of rock elev.= 871.40
Base of weathered rock elev.= 870.30

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–75

CROSSING
Sound Wall

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

S–073–18

ITEM NUMBER
6–18.00

SHEET LOCATION:
FILE NAME: $$$$design$file$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

Addendum 2 -- 7-11-19

SHEET LOCATION:

FILE NAME: $$$$design$file$specification$$$$

USERNAME: $$$$USER$$$$

DATE: $$$$DATE$$$$

E-SHEET NAME:

SUBSURFACE DATA

Plan Scale 1" = 20'

Hole No.	1066	1067	1068
Station	433+71.30	434+67.40	436+68.80
Offset	70.60 ft. Lt.	68.40 ft. Lt.	69.30 ft. Lt.
Elev. (NAVD 88 datum)	866.10	864.70	862.60

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE
I–75

CROSSING
Sound Wall

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.

DRAWING NO.
00000

S–073–18

ITEM NUMBER
6–18.00

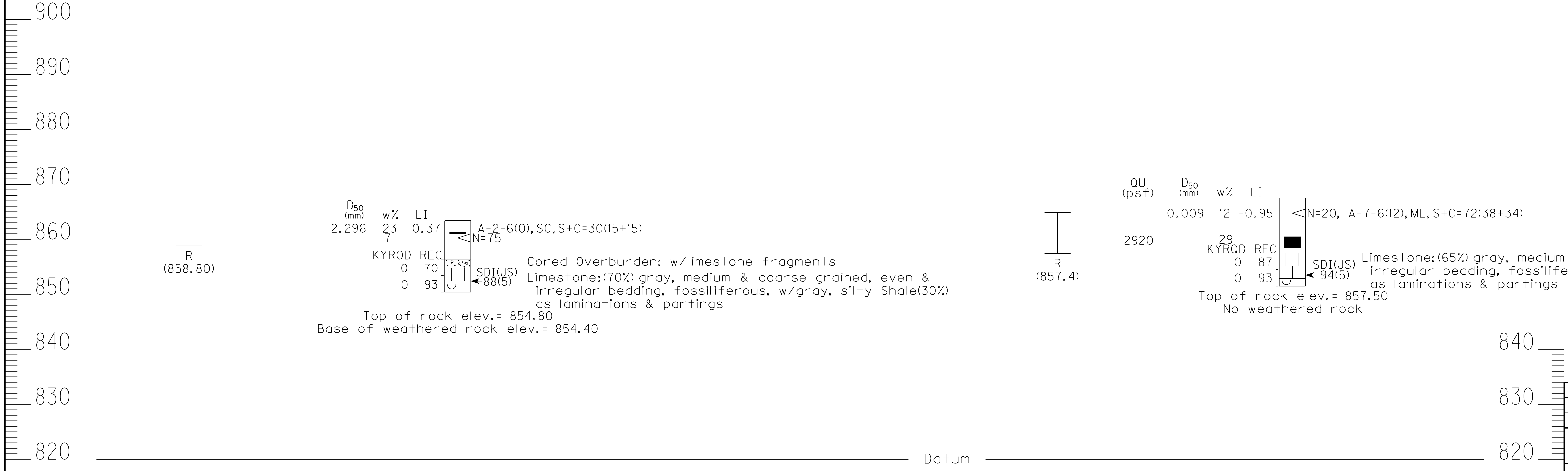
Addendum 2 -- 7-11-19

SUBSURFACE DATA

Plan Scale 1" = 20'

Profile Scale:
Vertical 1" = 10'
Horizontal not to scale

Hole No.	1069	1070	1071	1072
Station	438+70.50	439+70.50	440+70.50	441+55.10
Offset	99.40 ft. Lt.	103.60 ft. Lt.	107.50 ft. Lt.	111.90 ft. Lt.
Elev. (NAVD 88 datum)	859.70	863.40	864.90	867.50



Cored Overburden: w/limestone fragments

Limestone:(70%) gray, medium & coarse grained, even & irregular bedding, fossiliferous, w/gray, silty Shale(30%) as laminations & partings

Top of rock elev.= 854.80
Base of weathered rock elev.= 854.40

Limestone:(65%) gray, medium & coarse grained, even & irregular bedding, fossiliferous, w/gray, silty Shale(35%) as laminations & partings

Top of rock elev.= 857.50
No weathered rock

DATE: 25-OCTOBER-2018	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	C. COOK

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
BOONE

ROUTE **I-75**
CROSSING **Sound Wall**

SUBSURFACE DATA

PREPARED BY
Division of Structural Design
GEOTECHNICAL BRANCH

SHEET NO.
DRAWING NO. **00000**

S-073-18

ITEM NUMBER
6-18.00

Addendum 2 -- 7-11-19

SHEET LOCATION:
FILE NAME: $$$$design$files$specification$$$$
USERNAME: $$$$USER$$$$
DATE: $$$$DATE$$$$
E-SHEET NAME:

IDEALIZED SOIL AND BEDROCK PROFILE

Boone Co., Item No. 6-18.00, S-073-2018

Noise Wall Along I-75/-I-71, Left Station 421+70.50 to 441+55.10

CSC 1/4/2019

Elev. (ft.)	Strata	Parameters for Lateral Load Analyses	
			Top of Shaft
	Overburden - Neglect top 5 feet for lateral or axial support		
	Fill Materials / Overburden		
	Effective Unit Weight,	γ_e (lb/ft^3) =	120
	Cohesion	c (psf) =	1800
	Initial Modulus of Rock Mass,	k static (lb/in^3) =	500
	Strain Factor	k cyclic (lb/in^3) =	200
	e50	=	0.007
*			
	Shale/Limestone Mix	**Weak Rock**	
	Effective Unit Weight,	γ_e (lb/ft^3) =	130
	Uniaxial Compressive Strength,	q_u (psi) =	1000
	Initial Modulus of Rock Mass,	E_r (psi) =	44,000
	Strain Factor	(k rm) =	0.0005
	RQD	=	20
*			

* Elevations vary and estimates are given in attachments

ADDITIONAL DATA FOR GEOTECHNICAL CALCULATIONS ONLY:	
min. f'_c (psi) =	3500
p_a (psi) =	14.7

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Boone Co., Item No. 6-18.00, S-073-2018
Noise Wall Along I-75/-I-71, Left Station 421+70.50 to 441+55.10

Rock Socket Diameter = 1.5 feet
Rock Socket Diameter = 18 inches

CSC 1/4/2019

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	3.5	48	17	85	8	42	51	7
2.0	3.5	48	33	85	17	42	59	13
>>> 3.0	3.5	48	50	85	25	42	67	20
4.0	3.5	48	66	85	33	42	75	26
5.0	3.5	48	83	85	41	42	84	33
6.0	3.5	48	99	85	50	42	92	40
7.0	3.5	48	116	85	58	42	100	46
8.0	3.5	48	132	85	66	42	109	53
9.0	3.5	48	149	85	74	42	117	60
10.0	3.5	48	165	85	83	42	125	66
11.0	3.5	48	182	85	91	42	133	73
12.0	3.5	48	198	85	99	42	142	79
13.0	3.5	48	215	85	108	42	150	86
14.0	3.5	48	232	85	116	42	158	93
15.0	3.5	48	248	85	124	42	166	99
16.0	3.5	48	265	85	132	42	175	106
17.0	3.5	48	281	85	141	42	183	112
18.0	3.5	48	298	85	149	42	191	119
19.0	3.5	48	314	85	157	42	200	126
20.0	3.5	48	331	85	165	42	208	132
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	1.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Boone Co., Item No. 6-18.00, S-073-2018
Noise Wall Along I75-I-71, Left Station 421+70.50 to 441+55.10

Rock Socket Diameter = 2.0 feet
Rock Socket Diameter = 24 inches

CSC 1/4/2019

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	3.5	48	22	151	11	75	86	9
2.0	3.5	48	44	151	22	75	97	18
>>> 3.0	3.5	48	66	151	33	75	108	26
4.0	3.5	48	88	151	44	75	120	35
5.0	3.5	48	110	151	55	75	131	44
6.0	3.5	48	132	151	66	75	142	53
7.0	3.5	48	154	151	77	75	153	62
8.0	3.5	48	176	151	88	75	164	71
9.0	3.5	48	198	151	99	75	175	79
10.0	3.5	48	221	151	110	75	186	88
11.0	3.5	48	243	151	121	75	197	97
12.0	3.5	48	265	151	132	75	208	106
13.0	3.5	48	287	151	143	75	219	115
14.0	3.5	48	309	151	154	75	230	124
15.0	3.5	48	331	151	165	75	241	132
16.0	3.5	48	353	151	176	75	252	141
17.0	3.5	48	375	151	187	75	263	150
18.0	3.5	48	397	151	198	75	274	159
19.0	3.5	48	419	151	210	75	285	168
20.0	3.5	48	441	151	221	75	296	176
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	2.0

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Boone Co., Item No. 6-18.00, S-073-2018

Noise Wall Along I-75/I-71, Left Station 421+70.50 to 441+55.10

Rock Socket Diameter = 2.5 feet
Rock Socket Diameter = 30 inches

CSC 1/4/2019

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	3.5	48	28	236	14	118	132	11
2.0	3.5	48	55	236	28	118	145	22
>>> 3.0	3.5	48	83	236	41	118	159	33
4.0	3.5	48	110	236	55	118	173	44
5.0	3.5	48	138	236	69	118	187	55
6.0	3.5	48	165	236	83	118	201	66
7.0	3.5	48	193	236	96	118	214	77
8.0	3.5	48	221	236	110	118	228	88
9.0	3.5	48	248	236	124	118	242	99
10.0	3.5	48	276	236	138	118	256	110
11.0	3.5	48	303	236	152	118	269	121
12.0	3.5	48	331	236	165	118	283	132
13.0	3.5	48	358	236	179	118	297	143
14.0	3.5	48	386	236	193	118	311	154
15.0	3.5	48	414	236	207	118	325	165
16.0	3.5	48	441	236	221	118	338	176
17.0	3.5	48	469	236	234	118	352	187
18.0	3.5	48	496	236	248	118	366	198
19.0	3.5	48	524	236	262	118	380	210
20.0	3.5	48	551	236	276	118	393	221
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	2.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Boone Co., Item No. 6-18.00, S-073-2018

Noise Wall Along I-75/I-71, Left Station 421+70.50 to 441+55.10

Rock Socket Diameter = 3.0 feet
Rock Socket Diameter = 36 inches

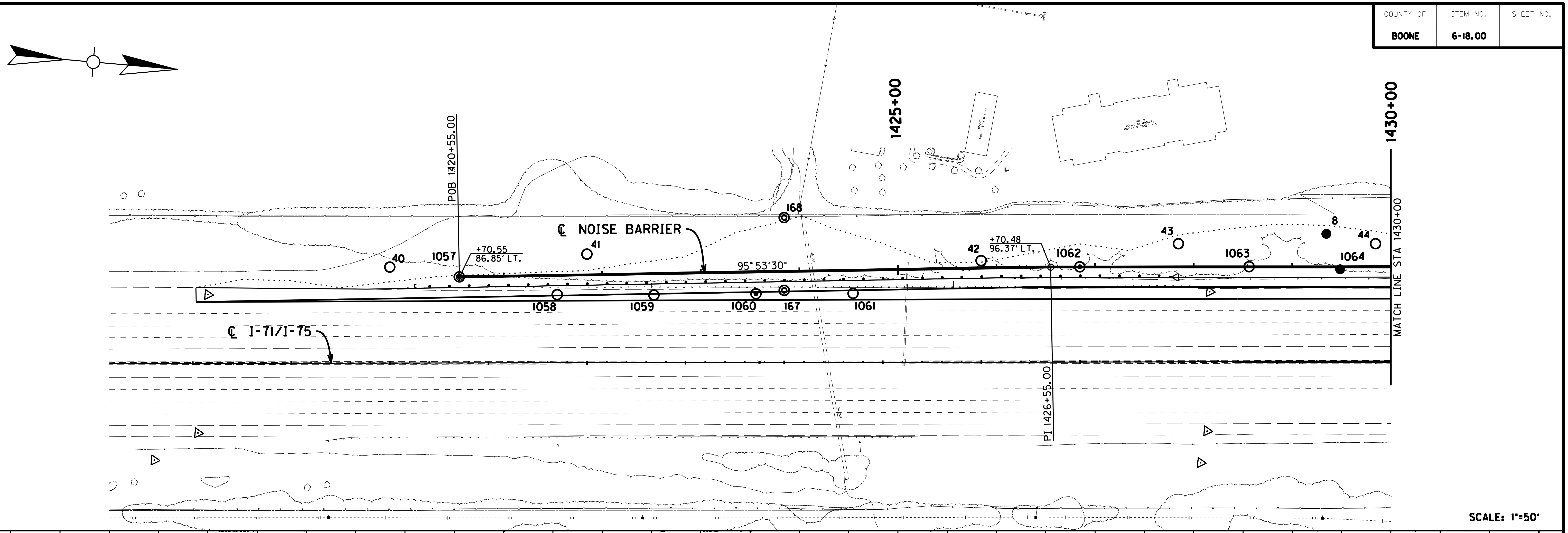
CSC 1/4/2019

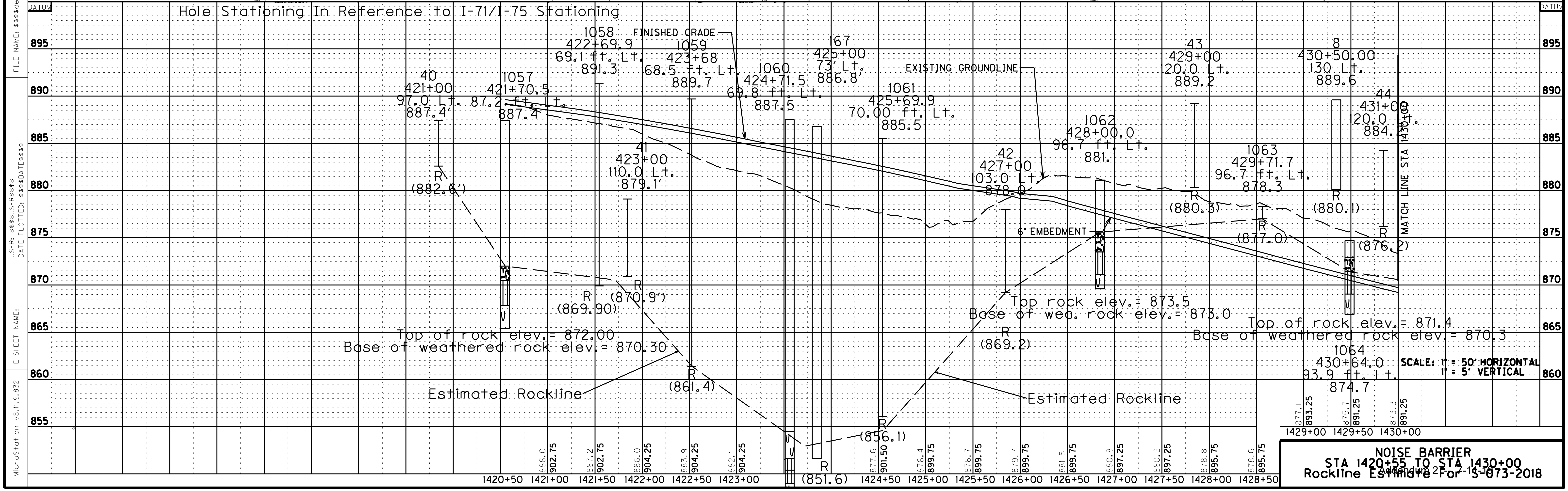
Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕ R_{sr} (kips)	Factored End Bearing Resistance ϕ R_{eb} (kips)	Total Factored Axial Resistance ϕ R_t (kips)	Total Factored Uplift Resistance ϕ R_{tu} (kips)
0.0								
1.0	3.5	48	33	339	17	170	186	13
2.0	3.5	48	66	339	33	170	203	26
>>> 3.0	3.5	48	99	339	50	170	219	40
4.0	3.5	48	132	339	66	170	236	53
5.0	3.5	48	165	339	83	170	252	66
6.0	3.5	48	198	339	99	170	269	79
7.0	3.5	48	232	339	116	170	285	93
8.0	3.5	48	265	339	132	170	302	106
9.0	3.5	48	298	339	149	170	319	119
10.0	3.5	48	331	339	165	170	335	132
11.0	3.5	48	364	339	182	170	352	146
12.0	3.5	48	397	339	198	170	368	159
13.0	3.5	48	430	339	215	170	385	172
14.0	3.5	48	463	339	232	170	401	185
15.0	3.5	48	496	339	248	170	418	198
16.0	3.5	48	529	339	265	170	434	212
17.0	3.5	48	562	339	281	170	451	225
18.0	3.5	48	595	339	298	170	467	238
19.0	3.5	48	629	339	314	170	484	251
20.0	3.5	48	662	339	331	170	500	265
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40

D (ft.) = 3.0

>>> = Min. Socket Length

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	

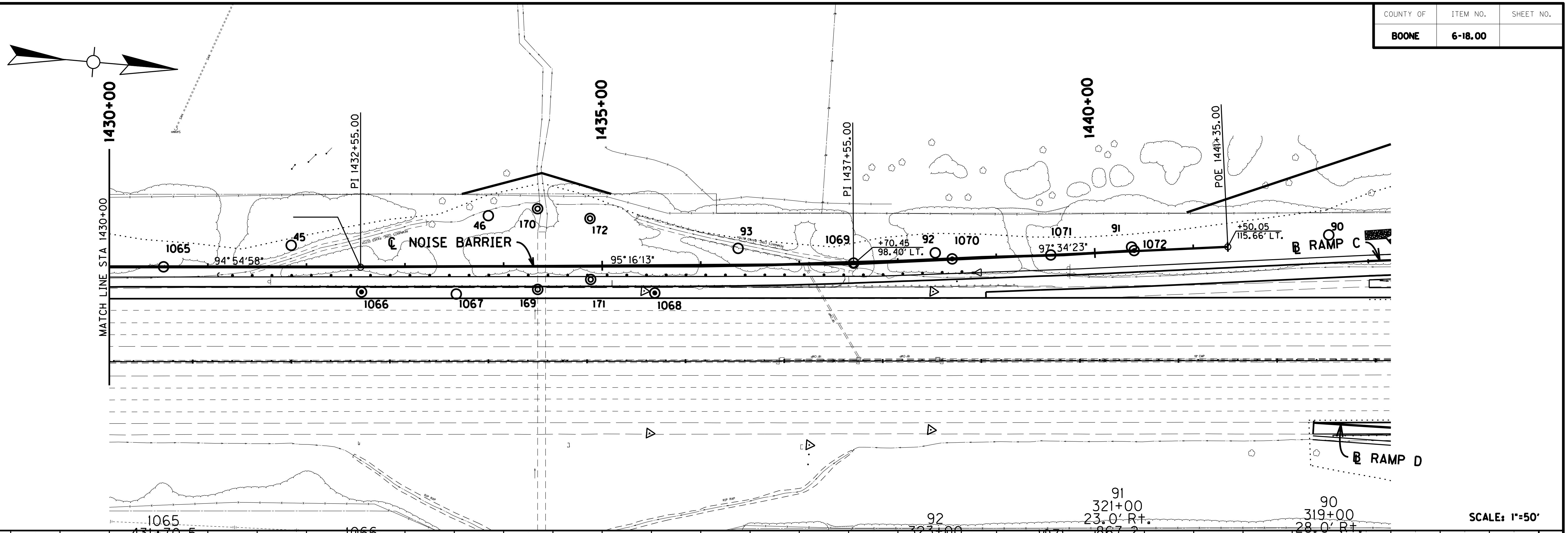


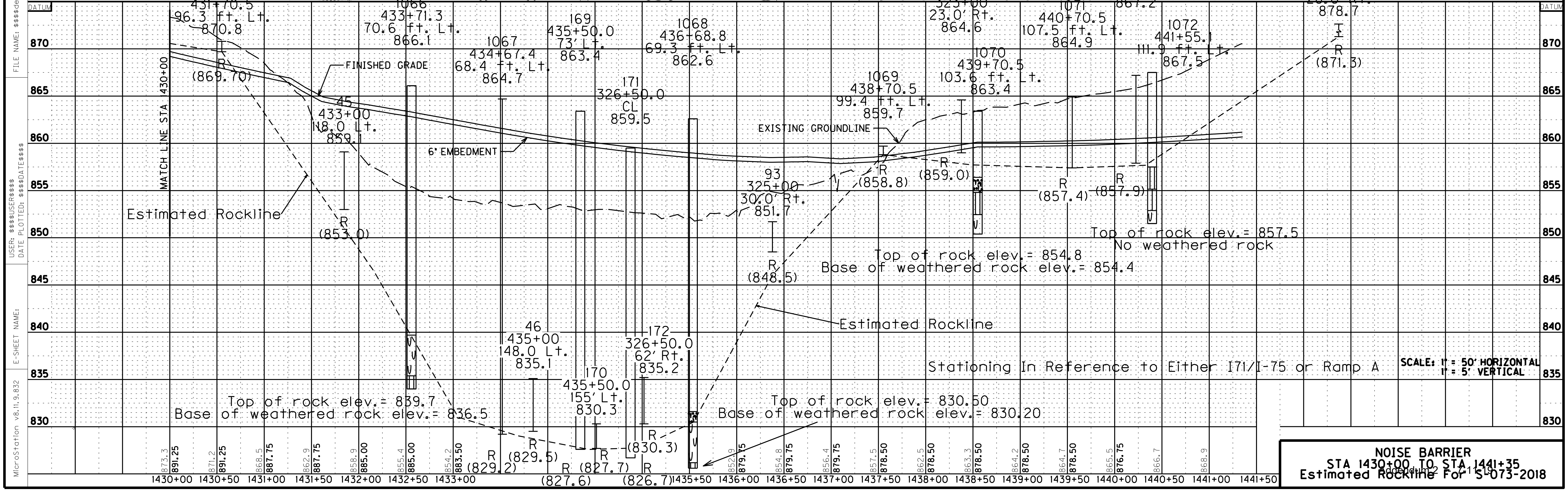


NOISE BARRIER
STA 1420+55 TO STA 1430+00
Rockline Estimate For S-073-2018

Addendum 2 -- 7-11-18

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	





NOISE BARRIER
STA 1430+00 TO STA 1441+35
Estimated Rockline For S-073-2018

Addendum 2 – 7-11-19

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DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.9.832

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Boone

Date

Road Number KY 338

Survey Crew / Consultant District- 6

Contact Person

Item # 6-18.00

Mars # 8433801D

Project # S-073-2018

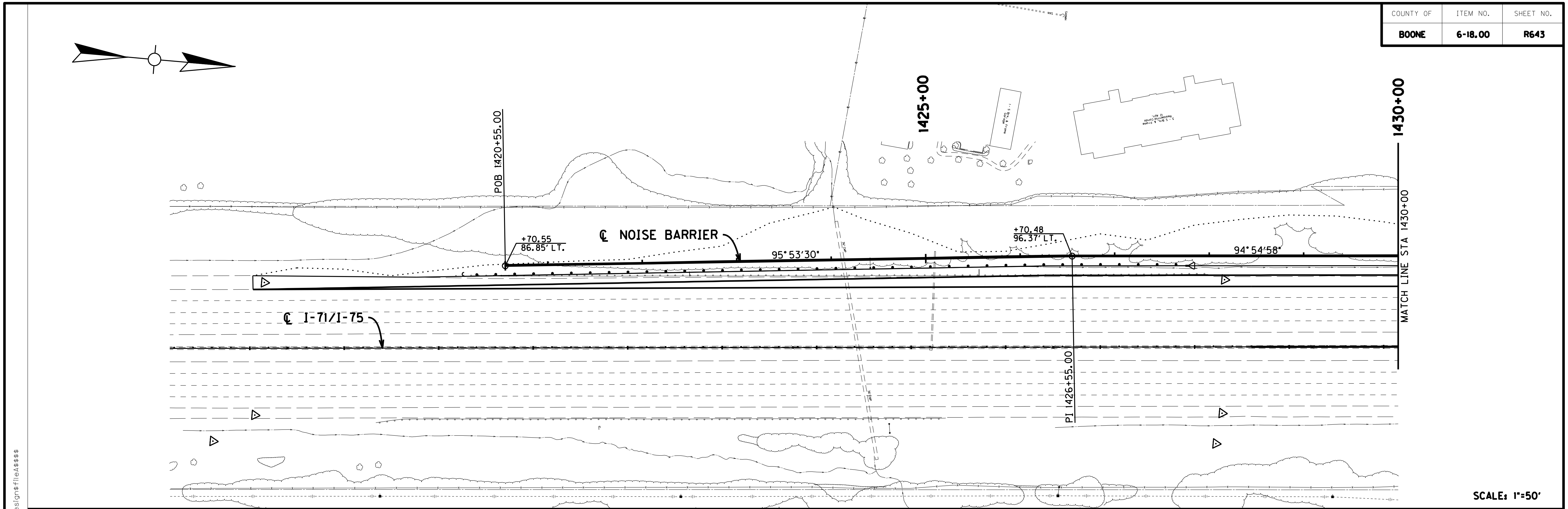
Notes:

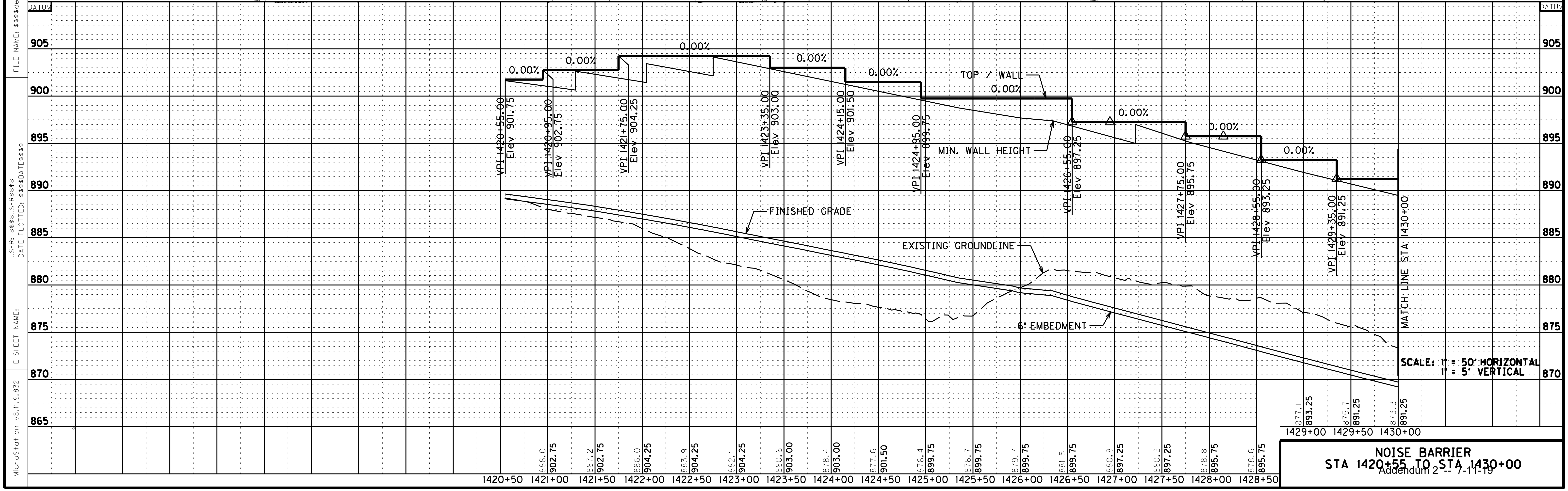
(circle one)

Elevation Datum (NAVD88) Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
S-073-2018						
1057	38.90720711	84.62830085	1057	I-75/I-71 Sta. 421+70.5	87.2' Lt.	888.36
1058	38.90748282	84.62826355	1058	I-75/I-71 Sta. 422+69.9	69.1' Lt.	891.28
1059	38.90775153	84.62828728	1059	I-75/I-71 Sta. 423+68	68.5' Lt.	889.65
1060	38.90803463	84.62831888	1060	I-75/I-71 Sta. 424+71.5	69.8' Lt.	887.46
1061	38.90830416	84.62834560	1061	I-75/I-71 Sta. 425+69.9	70' Lt.	885.45
1062	38.90892856	84.62849976	1062	I-75/I-71 Sta. 428+00	96.7' Lt.	881.14
1063	38.90939860	84.62854474	1063	I-75/I-71 Sta. 429+71.7	96.7' Lt.	878.30
1064	38.90965191	84.62855944	1064	I-75/I-71 Sta. 430+64	93.9' Lt.	874.72
1065	38.90994304	84.62859567	1065	I-75/I-71 Sta. 431+70.5	96.3' Lt.	870.18
1066	38.91049811	84.62855831	1066	I-75/I-71 Sta. 433+71.3	70.6' Lt.	866.08
1067	38.91076166	84.62857589	1067	I-75/I-71 Sta. 434+67.4	68.4' Lt.	864.69
1068	38.91131283	84.62863184	1068	I-75/I-71 Sta. 436+68.8	69.3' Lt.	862.57
1069	38.91185884	84.62879013	1069	I-75/I-71 Sta. 438+70.5	99.4' Lt.	858.24
1070	38.91213175	84.62883108	1070	I-75/I-71 Sta. 439+70.5	103.6' Lt.	863.38
1071	38.91240473	84.62887097	1071	I-75/I-71 Sta. 440+70.5	107.5' Lt.	864.92
1072	38.91263544	84.62890858	1072	I-75/I-71 Sta. 441+55.1	111.9' Lt.	867.54

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	R643

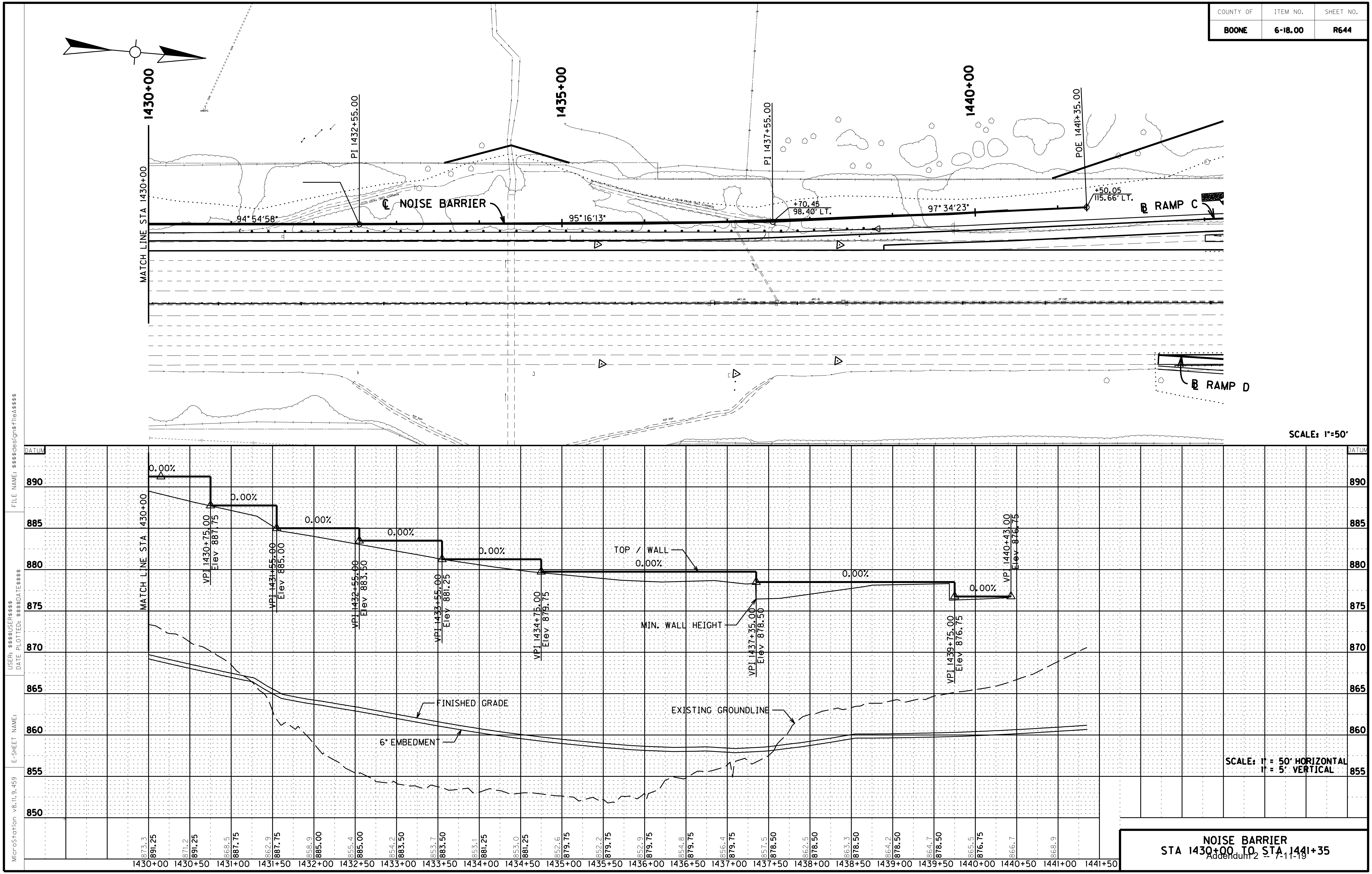




NOISE BARRIER
STA 1420+55 TO STA 1430+00

Addendum 2 -- 7-11-19

COUNTY OF	ITEM NO.	SHEET NO.
BOONE	6-18.00	R644



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DATE PLOTTED: $$$$DATE$$$$

E-SHEET NAME:

MicroStation v8.11.9.459

NOISE BARRIER
STA 1430+00 TO STA 1441+35

Addendum 2 -- 7-11-19

Appendix H5 -- KY 338 (Item No. 6-18) Geotechnical Reports (Railroad)

(Pending)

Appendix		SPECIAL NOTES	6-14 Mt. Zion Road	6-18 Richwood Road	6-20002 I-75 Rehab	Comments
I1	1-125	National Highway	x	x	x	
I1	1-126	Significant Project	x	x	x	
I1	1-132	Asphalt Mixtures	x	x	x	
I1	1-134	DGA Base	x	x	x	
I1	1-126	DGA Base for shoulders	x	x	x	
I1	1-160	Compaction Option A	x	x	x	
I5	1-175	Critical Path Method (CPM)	Use alt note	Use alt note	Use alt note	
I1	1-296	Waste and Borrow Sites	x	x	x	
F5	1-732	Standard Gas Bid item descriptions	see utilities	see utilities	see utilities	
F6	1-734	Standard Water Bid item descriptions	see utilities	see utilities	see utilities	
F7	1-736	Standard Sewer Bid item descriptions	see utilities	see utilities	see utilities	
I1	1-943	Special Note for Erosion Control	x	x	x	
I1	1-943a	BMP-KPDES Special Note-Draft NOI	x	x	x	
I1	1-3050	Pipeline Inspection	x	x	x	
I1	1-3060	Intelligent Compaction of Asphalt Mixtures	x	x	x	
I1	1-3061	Intelligent Compaction of Aggregate Bases & Soils	x	x	x	
I1	1-3062	Paver Mounted Temperature Profiles	x	x	x	
I1	1-98312	Guardrail Delivery Verification Sheet	x	x	x	
B2	4-100	Insurance (included in Appendix B2)	x	x	x	
I1	1I	Portable Changeable Message Signs	x	x	x	
I1	11C	Drilled Shafts	x	x	x	
I1	11F	Turf Reinforcing Mat	x	x	x	
I1	11N	Longitudinal Pavement Joint Adhesive	x	x	x	
I1		Barcodes on Permanent Signs	x	x	x	
I4		SN for Non-tracking Tack Cost	x	x	x	
I1		Special Provision 69 Embankment at Bridge End Structures	x	x	x	
I1		Before You Dig	x	x	x	
I4		Asphalt Milling & Texturing			x	

Appendix		SPECIAL NOTES	6-14 Mt. Zion Road	6-18 Richwood Road	6-20002 I-75 Rehab	Comments
I1		Inlaid Pavement Markers	x	x	x	
I4		Fine Milling			x	
I1		HMA Electronic Delivery Management System	x	x	x	
I4		Typical Sections Dimensions			x	
I3		Building Removal	in plans	x		
I3		Railroad Construction (aggregate note)		x		
I3		Repairs for I-71/I-75 Bridge		x		Updated
I3		Traffic Data Station Relocation			x	Included in Proposal Plans
I3		Sound Barrier Walls	x	x		
I3		Centrifugally Cast Concrete Pipe Liner		x		Includes specs
I3		Construction for Fire Station		x		Consent & Release
I3		Lighting and Temporary Lighting		x		
I1		No Blasting	x	x	x	
I3		Stormwater Basins		x		
F5		Gasline Relocations		see utilities		
F6		Waterline Relocations		see utilities		
F7		Sewer Relocations		see utilities		
I3		Accelerated Cement Subgrade Stabilization	x	x		
I3		Cellular Concrete Fill		x		
I3		Colored Concrete		x		Finalize locations
I3		EPS Foam Block Embankment		x		
I3		MSE Retaining Walls		x		
I3		Soil Nail Wall QC Inspection		x		
I3		Spot Subgrade Stabilization	x	x		
I4		Fiber Reinforcement of HMA			x	
I4		PVC Liner			x	
I4		Traffic Signal Loop Detectors			x	
I4		Replacing Expansion Dams and/or Installing Armored Edges for Concrete on Bridges			x	

SPECIAL NOTE FOR REPAIRS TO THE I-71/I-75 BRIDGE OVER KY338

KY338
Boone County
Item No. 6-18.00

I. DESCRIPTION

The following work will be performed as part of the KYTC contract. The work consists of concrete repair to the existing substructure of the I-71/I-75 Bridge over KY 338 in accordance with the Department's 2019 Standard Specifications, applicable Supplemental Specifications, and these Notes. Section references are to the Standard Specifications. The plans for the existing I-71/75 Bridge over KY 338 is Drawing Nos. 19484 and 21652, available from the KYTC Division of Structural Design.

The Contractor shall: (1) Furnish all labor, materials, tools, and equipment; (2) Locate and remove existing spalled/delaminated concrete; (3) Prepare the existing surface for concrete patching; (4) Place hook fasteners and welded wire fabric over surfaces to be repaired (where applicable); (5) Apply concrete patching as specified by this note (6) Finish and cure the new Concrete Patches; (7) Apply concrete sealer as specified by this note; and, (8) Maintain and control traffic.

The "**Appendix**" to this Special Note contains additional details and an estimate of the quantities.

II. MATERIALS

A. Concrete Approved Concrete Product for Vertical and Overhead Repair Patch.
B. Steel Reinforcement Use Grade 60. See Section 602.
C. Welded Steel Wire Fabric (WWF) Conform to Section 811.
D. Hook Fasteners Use commercial grade galvanized hook fasteners. Minimum 3/16" diameter.
E. Concrete Sealer Use a Product compatible with the Concrete Patching Material as approved by the Resident Engineer.

III. CONSTRUCTION

A. Concrete Removal and Preparation The Contractor, as directed by the Engineer shall locate and remove all loose, spalled, deteriorated and delaminated concrete. Sounding shall be used to locate delaminated areas. Care shall be exercised not to damage areas of sound concrete or reinforcing steel during concrete removal operations. Unless specifically directed by the Engineer, depth of removal shall not exceed 6 inches. Concrete removal shall be in accordance with a sequence approved by the Engineer.

Concrete removal shall be accomplished by chipping with hand picks, chisels or light duty pneumatic or electric chipping hammers (not to exceed 15 lbs.). If sound concrete is encountered before existing reinforcing steel is exposed, the surface shall be prepared and repaired without further removal of the concrete. When corroded reinforcing steel is exposed, concrete removal shall continue until there is a minimum ¾ inch clearance around the exposed, corroded reinforcing bar. Care shall be taken to not damage bond to adjacent non-exposed reinforcing steel during concrete removal processes.

The perimeter of all areas where concrete is removed shall be tapered at an approximately 45° angle, except that the outer edges of all chipped areas shall be saw cut to minimum depth of ¾ inch to prevent featheredging unless otherwise approved by the Engineer.

After all deteriorated concrete has been removed; the repair surface to receive concrete patching shall be prepared by abrasive blast cleaning. Abrasive blast cleaning shall remove all fractured surface concrete and all traces of any unsound material or contaminants such as oil, grease, dirt, slurry, or any materials which could interfere with the bond of freshly placed concrete.

The Contractor shall dispose all removed material off State Right Of Way in an approved site.

B. Steel Reinforcement All corroded reinforcing steel exposed during concrete removal shall have corrosion products removed by abrasive grit blasting or wire brush whichever is more appropriate. Furnish for replacement, as directed by the Engineer, additional linear feet of steel reinforcing bars ½” diameter by 20-foot lengths. Place these bars in areas deemed by the Engineer to require additional reinforcement. Field cutting and bending is permitted. Deliver unused bars to the nearest County Maintenance Barn. Payment will be made in accordance with Section 602.

Reinforcing steel displaying deep pitting or loss of more than 20 percent of cross-sectional area shall be removed and replaced. Such bars shall be placed in accordance with the recommendations of ACI 506R, Sections 5.4 and 5.5. In particular, bars shall not be bundled in lapped splices, but shall be placed such that the minimum spacing around each bar is three times the maximum aggregate size to allow for proper encapsulation with concrete patching.

Intersecting reinforcing bars shall be tightly secured to each other using tie wire and adequately supported to minimize movement during concrete placement.

Welded wire fabric (WWF) may be used at each repair area larger than 1 square foot if the depth of the repair exceeds 3 inches from the original dimension of the repaired member. Sheets of adjoining WWF shall be lapped by at least one and one-half spaces at all intersections, in both directions, and be securely fastened. WWF fabric shall be supported no closer than ½ inch to the prepared concrete surface and shall have a minimum concrete cover of 1.5 inches.

WWF shall be fastened to preset anchors on a grid not more than 12 inches square. Large knots of tie wire which could result in sand pockets and voids during patching shall be avoided.

C. Hook Fasteners Hook fasteners shall be positioned at the spacing as stated above or as directed by the Engineer. Any given area shall have a minimum of four anchors. The WWF shall not move or deform excessively during concrete patching. Maximum hook fastener spacing shall not exceed 2 feet on a grid pattern over the entire repair area.

Hook fasteners shall be of commercial grade galvanized steel with a minimum diameter of 3/16”. They may be mechanically set or grouted, as approved by the Engineer.

The Department will randomly select hook fasteners to be tested to verify pullout force is sufficient. If any anchors fail to meet the minimum acceptable pullout value, corrective measures shall be taken by the Contractor and further testing will be conducted.

D. Concrete Patching Place and finish the new concrete for the patching area in accordance with the manufacturer’s recommendations, where indicated by this note, or as directed by the Engineer. The Engineer shall approve the Contractor’s method of placing and consolidating the concrete prior to the beginning of this operation.

E. Curing On completion of finishing operation, patching concrete shall immediately be prevented from drying out and cracking by fogging, wetting, and/or any appropriate method approved by the Engineer. Curing shall continue for duration recommended by the product manufacturer.

F. Sealing After the patches have cured apply a concrete sealer in a manner and at rates specified in the Manufacturer’s literature and recommendations. Apply the sealer to limits extending 6 inches minimum beyond the extent of the concrete patches.

Each Contractor submitting a bid for this work shall make a thorough inspection of the site prior to submitting his bid and shall thoroughly familiarize himself with existing conditions so that the work can be expeditiously performed after a contract is awarded. Submission of a bid will be considered evidence of this inspection having been made. Any claims resulting from site conditions will not be honored by the Department. Quantities given are approximate. The quantity for “Concrete Patching Repair” shall be bid with the contingency that quantities may be increased, decreased, or eliminated by the Engineer. Dispose of all removed material entirely away from the job site as approved by the Engineer. This work is incidental to the contract unit price for “Concrete Patching Repair”.

The Contractor shall develop a maintenance of traffic plan for this work to be approved by the Engineer prior to conducting any work. The work may be conducted simultaneously with other work scoped in the KY 338 project so long as it does not interfere with those operations.

IV. MEASUREMENT

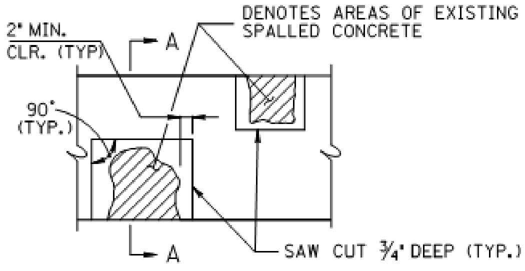
A. Concrete Patching The Department will measure the quantity per square feet of each area restored.
B. Steel Reinforcement See Section 602.
C. Welded Wire Fabric & Hook Fasteners Welded Wire Fabric and Hook Fasteners will not be measured for payment, but shall be considered incidental to “Concrete Patching Repair”.
D. Sealer Concrete sealer will not be measured for payment, but shall be considered incidental to “Concrete Patching Repair”.

V. PAYMENT

A. Concrete Patching Repair Payment at the contract unit price per square feet is full compensation for the following: (1) Furnish all labor, materials, tools, equipment; (2) preparation of specified bents including removing and disposing of specified existing materials; (3) place, finish and cure new concrete patches; and (4) all incidentals necessary to complete the work as specified by this note.
B. Steel Reinforcement See Section 602.

The Department will consider payment as full compensation for all work required by these notes.

APPENDIX



NOTE: SAW CUT EXISTING CONCRETE 3/4" DEEP SO AS TO OBTAIN A RECTANGULAR AREA. ALL EXISTING REINFORCEMENT SHALL BE CAREFULLY PRESERVED AND CLEANED. SEE SECTION A-A.

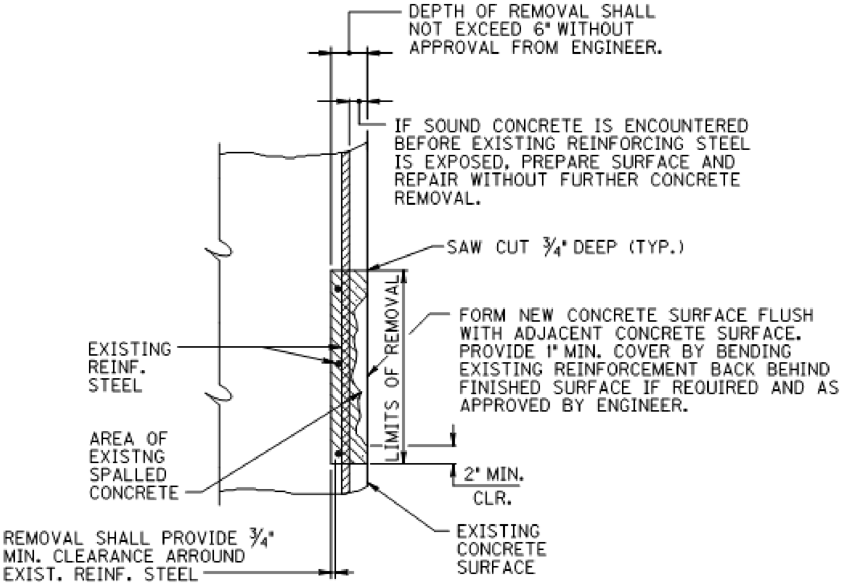
CONCRETE REMOVAL AREAS

NOTE: CARE SHALL BE TAKEN WHEN REMOVING THE EXISTING SPALLED CONCRETE SO AS NOT TO DAMAGE SOUND CONCRETE OR EXISTING REINFORCING STEEL. AFTER UNSOUND CONCRETE HAS BEEN REMOVED ABRASIVE BLAST CLEANING SHALL BE USED TO REMOVE ANY ADDITIONAL UNSOUND CONCRETE AND CONTAMINANTS. EXPOSED EXISTING REINFORCING STEEL SHALL RECEIVE A COMPLETE CLEANING TO REMOVE ALL RUST. PROVIDE ADDITIONAL REINFORCING STEEL WHERE DIRECTED. ALL WORK MUST BE APPROVED BY THE ENGINEER.

*** ESTIMATE OF QUANTITIES**

BID ITEM CODE	22146EN	08150
BID ITEM	Concrete Patching Repair	Steel Reinforcement
UNIT	S.F.	Lbs.
I-71/I-75 BRIDGE REPAIR	150	200
TOTALS	150	200

* QUANTITIES GIVEN ARE APPROXIMATE. THE QUANTITIES SHALL BE BID WITH THE CONTINGENCY THAT QUANTITIES MAY BE INCREASED, DECREASED, OR ELIMINATED BY THE ENGINEER.



SECTION A-A

SPALLED SURFACE REPAIR DETAILS

NOTE: LIMITS AND LOCATION OF REPAIRS TO BE DETERMINED BY CONTRACTOR WITH DIRECTION OF THE ENGINEER.

SPECIAL NOTE FOR FIBER REINFORCEMENT OF ASPHALT

PART 1 – GENERAL

1.1 DESCRIPTION

This Section includes specifications for furnishing all materials, equipment, labor, and incidentals for mixing aramid fiber reinforcements to hot mix asphalt.

1.2 DEFINITIONS

A. HMA - hot mix asphalt, without aramid fiber.
B. WMA- warm mix asphalt, without aramid fiber.
C. Reinforced HMA - hot mix asphalt including aramid fibers properly proportioned, uniformly mixed and coated with asphalt.
D. Aramid fiber - pure aramid fiber meeting the material properties of this specification, without additive materials.
E. Delivery material(s) - the material(s) combined with the pure aramid fiber to facilitate Aramid fiber and HMA/WMA proportioning, uniform mixing with the HMA/WMA, and asphalt coating of the aramid fibers.
F. Aramid product - the aramid supplier's mixture of pure aramid fiber and delivery material(s).
G. Manufacturer - the company that produces the aramid fiber from raw materials.
H. Supplier - the company that offers an aramid product.

PART 2 – PRODUCT

2.1 MATERIALS

Meet the following aramid fiber properties.

Property	Measure	Standard
Material	Aramid	ASTM D276
Form	Monofilament fibers	Manufacturer Certification
Length	0.75-1.50 inches (+/- 10%)	Manufacturer Cert.
Specific Gravity	1.44	ASTM D276
Minimum Tensile Strength	400,000 psi	ASTM D3379
Maximum Tensile Elongation	1.8 %	ASTM D3379
Degradation Temperature	800 degrees F	ASTM D276
Acid and Alkali Resistance	Inert	Manufacturer Cert.

2.2 SUBMITTALS

Submit the following.

A. Identify the mixing plant.
B. Provide a specification sheet from the aramid fiber manufacturer.
C. Provide the following from the aramid product supplier at least three weeks prior to HMA/WMA production.
    1. The supplier's specified mix rate for the aramid product.
    2. Certification that the amount of aramid fiber in the aramid product will be between 2.1 and 4.0

ounces of pure aramid fiber for each ton of hot mix asphalt.

3. Evidence showing how many times, if any, the supplier's fiber product has been successfully produced at the asphalt plant to be used for the project.
4. Proven method of introducing the aramid fibers into the hot mix asphalt which will not cause the aramid fibers to become airborne.

2.3 JOB MIX FORMULA

When aramid fiber is required as a mixture ingredient, modification to the job mix formula is not required.

PART 3 – EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

Store aramid product in a dry environment and do not allow them to be in contact with moisture.

Mix 3.0 ounces (+/1 1.0 ounces) of aramid fibers per ton of asphalt. The weight applied is for pure aramid fibers only, weight of any delivery materials is not considered.

Have a fiber supplier's representative on site during the first day of production mixing. This requirement can be waived if fiber supplier and HMA/WMA producer can supply evidence of supplier's brand of fiber product being successfully produced by the HMA/WMA producer. The fiber supplier's representative may be on site for additional days as requested by the Engineer.

Introduce the aramid product as follows:

1. Batch Plant

   When a batch type plant is used, add the aramid product dosage to the aggregate in the weigh hopper. This may be done with loose fibers and a fiber metering device, or may be done by using manual dosing equipment. If necessary, increase the batch dry mixing time to ensure the aramid fibers are uniformly distributed prior to the injection of asphalt cement into the mixer.

2. Drum Plant

   When a continuous or drier-drum type plant is used, add the aramid product to the RAP material to uniformly disperse with the aggregate and injected asphalt. Use a separate aramid product metering device feed system to proportion by weight of total mix, the required percentage of fiber reinforcement into the mixture. Control the aramid product metering system with a proportioning device to meet the dosing requirements.

   When a continuous or drier-drum type plant is used for limited production volumes, the addition of the aramid product may be done by using manual measuring tools or equipment and adding them directly onto the RAP belt or into the RAP opening on the plant. Because this is not an automated process, a written protocol must be supplied by the producer to demonstrate how they will attain the dosage requirement, and documentation must be supplied by the material manufacturer assuring this method will produce the desired uniform aramid fiber distribution.

Mix the aramid fiber with the aggregate longer, if needed, to allow thorough distribution of aramid fibers at the end of the mixing process and to promote asphalt coating of individual strands of aramid fiber. At the start of any fiber mixing, visually observe the reinforced HMA/WMA at the plant and in first three trucks at the point of discharge and prior to delivery to the job site. Observation shall include using a shovel or other device. Look for proper distribution of aramid fibers and make mixing adjustments if needed.

WMA: Use of a feeder system will be required for both Drum and Batch plants when producing Warm Mix Asphalt to ensure correct distribution and coating of the aramid fibers. This requirement maybe waved if the asphalt producer can demonstrate complete melting of the delivery material and proper incorporation of the aramid fibers into the WMA.

3.2 ACCEPTANCE

Acceptance of the reinforced HMA/WMA will include the following factors:

1. Aramid fiber is properly proportioned based on documentation comparing fiber feed to HMA/WMA mix production. A log of the total amount of aramid fibers applied certified by fiber manufacturer/supplier shall be required daily.
2. By visual inspection at the end of the mixing process, there is no clumping of aramid fiber or aramid delivery product and the aramid fibers are uniformly distributed.
3. All other mixture and density requirement of the asphalt as detailed in the Standard Specifications, current edition, shall apply.

PART 4 - MEASUREMENT AND PAYMENT

The Department will measure the quantity of Fiber Reinforcement for HMA/WMA as ton of asphalt placed with fibers. Each ton of asphalt placed with the aramid fibers according to this special note will be measured and paid for at the contract unit bid price per ton, and shall include full compensation for furnishing all labor, tools, equipment, and incidentals for doing all the work involved in adding the fibers to HMA/WMA.

Code	Pay Item	Pay Unit
24785EC	Fiber Reinforcement for HMA	Tons

SPECIAL NOTE FOR PVC FOLD-AND-FORM PIPE LINER

I. GENERAL

A. SUMMARY

1. Section Includes: Definition of the approved methods and materials to rehabilitate gravity pipelines by the insertion of a continuously extruded, folded, PVC Fold-and-Form Pipe Liner into a conduit (host pipe), and the "blow-molding" (thermoforming) of the pipe liner to conform to the shape of the existing pipe. The pipe liner shall:
    - a) Extend continuously from one access point to the next access point with no joints.
    - b) Provide a tightly conforming fit against the inner wall of the host pipe.
    - c) Definitions:
        - (1) PVC Fold-and-Form Pipe Liner: A continuously extruded (joint-less), polyvinyl chloride (PVC) Pipe Liner that is shaped into a reduced form to facilitate insertion into existing pipelines or conduits. The Pipe Liner shall return to its extruded, round memory upon application of heat and pressure and form tightly against the host pipe by "blow molding" (thermoforming) techniques.
        - (2) Host Pipe: An existing gravity pipeline or conduit to be internally rehabilitated by installation of the PVC Fold-and-Form Pipe Liner.

B. REFERENCES

1. Codes and standards referred to in this Special Note are:
    - a) ASTM D 256: Standard Test Methods for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
    - b) ASTM D 638: Standard Test Method for Tensile Properties of Plastics
    - c) ASTM D 790: Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics
    - d) ASTM D 1784: Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
    - e) ASTM D 2122: Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
    - f) ASTM D 2152: Standard Test Method for Extrusion Quality using Acetone Immersion
    - g) ASTM D 2444: Standard Test Method for Impact Strength
    - h) ASTM F 1057: Standard Test Method for Extrusion Quality using Heat Reversion
    - i) ASTM F 1504: Standard Specification for Folded/Formed Poly (Vinyl Chloride) Pipe for Existing Sewer and Conduit rehabilitation

C. PIPE DESIGN AND DIMENSION

1. Submittals: The Contractor shall furnish engineering data covering materials and installation procedures.

2. Unless otherwise specified, the Contractor shall determine the minimum and maximum length of liner to effectively span the distance from the inlet to the outlet of the respective pipelines.

3. The pipe liner shall have a nominal outside diameter and minimum wall thickness based upon project parameters and the condition of the host pipe.

D. SAFETY

1. The CONTRACTOR shall conform to all safety requirements of pertinent regulatory agencies, and shall secure the site for the working conditions in compliance with the same. The CONTRACTOR shall erect signs and devices as are necessary for the safety of the work site.

2. The CONTRACTOR shall also provide all of the WORK in accordance with applicable OSHA standards. Emphasis shall be placed upon the requirements for entering confined spaces and working with steam.

II. PRODUCTS

A. MATERIAL SPECIFICATIONS:

1. The PVC Fold-and-Form Pipe Liner will be manufactured from virgin PVC Fold-and-Form Pipe Liner compound, containing no fillers, and meet or exceed the following minimum physical properties:

a)	COMBUSTIBILITY:	Self-Extinguishing
b)	FLEXURAL MODULUS:	ASTM D 790 280,000 PSI @73F
c)	FLEXURAL STRENGTH:	ASTM D 790 5,000 PSI @73F
d)	IZOD IMPACT:	ASTM D 256 1.5 FT-LB/IN
e)	CHEMICAL RESISTANCE:	suitable under general sanitary sewer conditions

2. CHARACTERISTICS: The PVC Fold-and-Form Pipe Liner shall be designed to meet the following installation performance requirements:

a) The Pipe Liner shall be capable of expanding a full pipe size larger than the nominal diameter (ex: 8” to 10”) without splitting, or rupturing with the understanding that the pipe liner dimension ratio will increase when so expanded.

b) After being expanded by “blow-molding”, the installed Pipe Liner will match the configuration of the host pipe.

c) The Pipe Liner shall be capable of negotiating pipe line bends in the host pipe without splitting, rupturing, or wrinkling of the pipe liner material.

d) The pipe liner shall be dimensionally stable after cool-down.

e) Processing of the pipe liner shall cause no degradation of the pipe liner physical properties.

3. MARKINGS: The pipe liner shall be marked at maximum five (5) foot intervals indicating ASTM D 1784 cell classification, manufacturer, and size (diameter and SDR). Each production lot will be uniquely coded.

4. DIMENSIONS:

   a) The Pipe Liner outside diameter will be manufactured substantially smaller than the inside diameter of the host pipe. The pipe liner shall be manufactured with sufficient excess wall thickness to allow the pipe liner to meet or exceed the DR requirements after being expanded by “blow-molding” within the host pipe.

   b) Unless otherwise specified, the Standard Dimension Ration (SDR) of 4” to 15” diameter Pipe Liner will be SDR 35. 18” to 36” Pipe Liner will be specified by wall thickness. The Pipe Liner will be continuously extruded (no joints) at the factory to the minimum length required to effectively span the distance between access points, in accordance with actual distances which shall be field verified by the Contractor prior to manufacturing.

B. MATERIAL TESTING: Each production lot of Pipe Liner will be inspected and tested at the time of manufacture for defects is accordance with ASTM D 2444, and ASTM D 2152. All pipe liners shall conform to the specified dimensions. Material design properties shall be confirmed in accordance with ASTM D 790.

III. EXECUTION

A. HOST PIPE PREPARATION

1. The existing pipeline shall be cleaned of any obstructions and televised using CCTV immediately prior to installation of the pipe liner. The host pipe condition shall be acceptable to the ENGINEER as appropriate for lining prior to the insertion of the pipe Liner.

2. Prior to beginning the insertion of the pipe liner, the CONTRACTOR shall confirm that the host pipe is adequately cleaned.

B. INSTALLATION PROCEDURES:

1. The pipe liner manufacturer’s installation instructions and procedures shall be followed during installation.

2. Point Repairs

   a) Point repairs and obstruction removals shall be completed, as necessary, in order to enable lining.

3. Liner Insertion

   a) The entrance to the host pipe shall be covered so as to provide a smooth surface to prevent damage to the Pipe Liner.

   b) The Pipe Liner shall be positioned to enable it to naturally curve into the access point and the host pipe.

   c) The insertion end of the Pipe Liner shall be sealed to inhibit fluids and solids form entering the lumen of the Pipe Liner.

   d) Insert the Pipe Liner into the entry access point. Slowly feed the Pipe Liner from the supply reel, while simultaneously pulling the Pipe Liner at the exit access point, to minimize tension on the Pipe Liner. Maintain two-way communication between personnel at entry and exit access points to coordinate the rate of Pipe Liner supply and pulling operations.

   e) Use a power winch and a steel cable connected to the pulling head as recommended by the manufacturer to advance the Pipe Liner.

4. Pipe Liner Processing and "Blow-Molding":

   a) Process and "blow-mold" the PVC Fold and-Form Pipe Liner in accordance with the manufacturer's instructions for heating and expanding the Pipe Liner. Upon completion of processing and "blow-molding", the Pipe Liner shall fit tightly against the inside wall of the host pipe and be locked into the joints of the host pipe, if possible.

   b) Temperature and pressure gauges shall be used at the insertion and termination access points to monitor internal conditions during Pipe Liner processing and "blow-molding".

   c) Introduce pressurized steam to heat and relax the Pipe Liner in strict accordance with the recommendations of the Pipe Liner manufacturer.

   d) Continue the application of steam while introducing compressed air to increase internal pressure on the Pipe Liner as recommended by the manufacturer. DO NOT ALLOW PRESSURE TO EXCEED 12 PSI, AS DAMAGE MAY OCCUR TO HOST PIPE.

   e) Discontinue the use of steam while continuing the use of compressed air to maintain the internal pressure. Allow the Pipe Liner to cool below 100 F before releasing pressure.

5. Liner Termination:

   a) During the pulling in place and "blow-molding" process, the PVC liner shall form a bell shape at each end effectively locking the liner in place.

IV. PAYMENT

A. Payment for PVC Fold and Form Pipe Liners will be made per linear foot as

   1. PVC FOLD AND FORM PIPE LINER – 12 IN - ITEM 24860EC
   2. PVC FOLD AND FORM PIPE LINER – 15 IN - ITEM 24861EC
   3. PVC FOLD AND FORM PIPE LINER – 18 IN - ITEM 24862EC
   4. PVC FOLD AND FORM PIPE LINER – 24 IN - ITEM 24863EC
   5. PVC FOLD AND FORM PIPE LINER – 30 IN - ITEM 24864EC
   6. PVC FOLD AND FORM PIPE LINER – 36 IN - ITEM 24865EC

B. Payment will be considered full compensation for all work, equipment, and incidentals necessary to install the pipe liners in accordance with this note.

SPECIAL NOTE FOR TRAFFIC SIGNAL LOOP DETECTORS

1.0 DESCRIPTION. Be advised that there are existing traffic signal loop detectors within the construction limits of this project. Except as specified herein, perform traffic signal loop replacement in accordance with the Department's Standard/Supplemental Specifications, Special Provisions, Special Notes, and Standard/Sepia Drawings, current editions and as directed by the Engineer. Article references are to the Standard Specifications. Furnish all materials, labor, equipment, and incidentals for replacement of traffic signal loop installation(s) and all other work specified as part of this contract.

1.1 Pre-bid Requirements. Each Contractor submitting a bid for this work shall make a thorough inspection of the site prior to submitting his bid and shall thoroughly familiarize himself with existing conditions so that the work can be expeditiously performed after a Contract is awarded. Information provided in the Plans regarding types and quantities of work is not to be taken as an accurate or complete evaluation of the materials and conditions to be encountered during construction. The bidder must make his own determinations as to the conditions encountered.

2.0 MATERIALS. Except as specified herein, furnish materials in accordance with Subsection 732.02 and Section 835. Provide for materials to be sampled and tested in accordance with the Department's Sampling Manual. Make materials available for sampling a sufficient time in advance of the use of the materials to allow for the necessary time for testing, unless otherwise specified in this Special Note.

2.1 Maintain and Control Traffic. See Traffic Control Plan.

2.2 Sand. Furnish natural sand meeting the requirements of Subsection 804.04.01.

2.3 Seeding. Furnish Seed Mix Type I.

2.4 Loop Saw Slot and Fill. Furnish loop sealant, backer rod, and non-shrink grout according to the Saw Slot Detail.

2.5 Junction Boxes. Furnish junction box type B, #57 aggregate, and geotextile filter type IV according to junction box detail.

2.6 Cable No. 14/1 Pair (Lead-in). Furnish cable that is specified in Section 835. Cable shall be ran splice free. This shall include splice kits to connect to the loop wire.

2.7 Conduit. Furnish and install appropriate conduit from transitions to the roadway, junction boxes and poles. See details below.

3.0 CONSTRUCTION. Except as specified herein, install and test Traffic Signal Loop Detectors in accordance with Section 723 and the drawings.

3.1 Testing. The Contractor shall test all loops and cable no. 14/1 pair (lead-in) according to Subsection 723.03.17 before and after milling the roadway. The Contractor may have to separate the loop from the lead-in to perform this test. If the loop/lead-in meets the requirement in Section 723 at the controller cabinet, the loop/lead-in shall not be replaced. If existing loops do not meet the requirements in Subsection 723.03.17, the loops shall be replaced. Replacement loops may be installed either before or after the milling process.

The Contractor shall verify that loops (both existing and replacement loops) meet the requirements per Subsection 723.03.17 before the final surface is laid. If loops do not meet conditions of Subsection 723.03.17, the Contractor shall replace them before the resurfacing activities begin. If replacement loops have to be reinstalled, the costs of reinstallation shall be incidental to the milling bid item. The Contractor shall re-splice loops to the lead-in with the proper splice as noted in the spec book.

3.2 Coordination. Notify the Engineer in writing, two (2) weeks prior to beginning any work. The Engineer will contact the District Traffic Engineer to coordinate the Department's operations with the Contractor's work.

3.3 Connection. The Contractor shall schedule all signal loop installation to ensure the new loops are connected to the lead-in and operational within 5 calendar days of the old loops being damaged and/or disconnected. This requirement includes damage caused by any work activity associated with the project. If the new signal loops are not functioning as intended following 5 calendar days, the Department may assess Liquidated Damages at a rate of $500 per calendar day per signal location until the loops are operating at pre-construction conditions. All liquidated damages will be applied cumulatively.

3.4 Maintain and Control Traffic. See Traffic Control Plan.

3.5 Milling. On projects involving milling and texturing of the existing pavement, install loops in the existing pavement before or after performing the milling and texturing. After milling, the remnant contents of the existing saw slot (grout, loop wires, backer rod, and/or loop sealant) may not be flush with the top of the milled portion of the surface. In such cases, clear the saw slot of loose remnant contents and refill the saw slot with natural sand. Obtain the Engineer's approval of the stabilized saw slot prior to resurfacing. The Department will not measure for separate payment clearing and stabilizing the saw slot and shall consider this work incidental to milling.

3.6 Loop Saw Slot and Fill. The following is a typical step by step procedure for the installation of a loop.

1) Carefully mark the slot to be cut, perpendicular to the flow of traffic and centered in the lane.
2) Make each saw-cut 3/8-inch wide and at a depth such that the top of the backer rod is a minimum of 4 inches below the surface of asphalt pavement.
3) Drill a 1½ inch core hole at each corner and use a chisel to smooth corners to prevent sharp bends in the wire.
4) Clean all foreign and loose matter out of the slots and drilled cores and within 1 foot on all sides of the slots using a high pressure washer.
5) Completely dry the slots and drilled cores and within 1 foot on all sides of the slots.
6) Measure 9-12 inches from the edge of the paved surface (shoulder break or face of curb) and drill a 1½ inch hole on a 45° angle to the conduit adjacent to the roadway.
7) Closely inspect all cuts, cores, and slots for jagged edges or protrusions prior to the placement of the wire. All jagged edges and protrusions shall be ground or re-cut and cleaned again.

8) Place the loop wire splice-free from the termination point (cabinet or junction box) to the loop, continue around the loop for two turns (6’x30’ loop) or three turns (6’x6’ loop), and return to the termination point.
9) Push the wire into the saw slot with a blunt object such as a wooden stick. Make sure that the loop wire is pushed fully to the bottom of the saw slot. Screwdrivers shall not be used.
10) Install duct sealant to a minimum of 1 inch deep into the cored 1½ inch hole.
11) Apply loop sealant from the bottom up and fully encapsulate the loop wires in the saw slot. The wire should not be able to move when the sealant has set.
12) Cover the encapsulated loop wire with a continuous layer of backer rod along the entire loop and home run saw slots such that no voids are present between the loop sealant and backer rod.
13) Finish filling the saw cut with non-shrinkable grout per manufacturer’s instructions. Alleviate all air pockets and refill low spaces. There shall be no concave portion to the grout in the saw slot. Any excess grout shall be cleaned from the roadway to alleviate tracking.
14) Clean up the site and dispose of all waste off the project.
15) Ensure that the grout has completely cured prior to subjecting the loop to traffic. Curing time varies with temperature and humidity.

3.7 Final Dressing, Clean Up, and Seeding. After all work is completed, clean work sites and all disturbed areas. Dispose of all waste and debris off the right of way at sites obtained by the Contractor at no additional cost to the Department. Sow all disturbed earthen areas with Seed Mix Type I.

3.8 Removal. The Contractor shall remove all existing junction boxes, wire from spans/poles/junction boxes/conduits, and conduits. The removal will be incidental to the project.

3.9 Property/Roadway Damage. The Contractor shall be responsible for all damage to public and/or private property resulting from the work. Upon completion of the work, restore all disturbed highway features and private property in like kind design and materials at no additional cost to the Department.

3.10 Right-of-Way Limits. The Department has not established exact limits of Right-of-Way. Limit work activities to obvious Right-of-Way and work areas secured by the Department through Consent and Release of the adjacent property owners. Contractor is responsible for all encroachments onto private lands.

3.11 Utility Clearance. Work around and do not disturb existing utilities. The Department does not anticipate any utility impacts for loop installation. If utilities are impacted, work with associated utility companies to resolve issues.

3.12 Control. Obtain the Engineer’s approval of all designs required to be furnished by the Contractor prior to incorporation into the work. The Department reserves the right to permit other contractors, state forces, public utility companies, and others to do work during the construction within the limits of, or adjacent to, the project. Conduct operations and cooperate with such other parties so that interference with each other’s work will be reduced to a minimum. The Contractor agrees to make no claims against the Department for additional compensation due to delays or other conditions created by the operations of such other parties. Should a difference of opinion arise as to the rights of the Contractor and others working within the limits of, or adjacent to, the project, the Engineer will decide as to the respective rights of the various parties involved in order to ensure the completion of the work in general harmony and in a satisfactory manner, and the Engineer's decision shall be final and binding upon the Contractor.

3.13 Bore and Jack. Except for situations outlined in 3.15, bore and jack will be used if conduit is under pavement of any kind. The conduit shall be 2" rigid steel conduit under all pavement areas except for the area where the loop transitions from the saw slot. The installation of conduit should follow the below detail.

3.14 Open Cut Roadway. With permission of the Engineer, roadway may be open cut if the conduit is under pavement. The conduit shall be 2" rigid steel conduit under all pavement areas except for the area that the loop transition from the saw slot. The installation of conduit should follow requirements per Section 723.

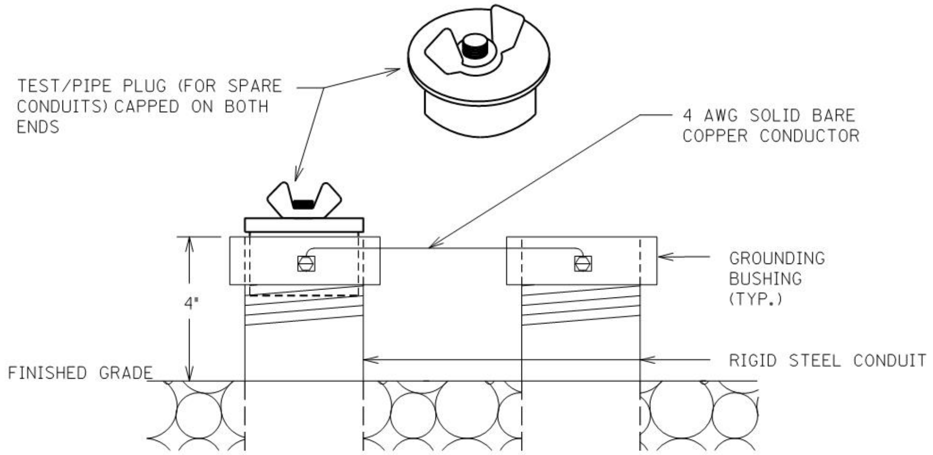
4.0 MEASUREMENT. See Subsection 723.04 for bid item notes. Additional bid items include the following:

4.1 Loop Test. The Department will measure the quantity as each individual unit loop tested. The Department will not measure disconnection, reconnection, traffic control, re-splicing per specifications, before and after testing per note above, and any associated hardware for payment and will consider them incidental to this item of work.

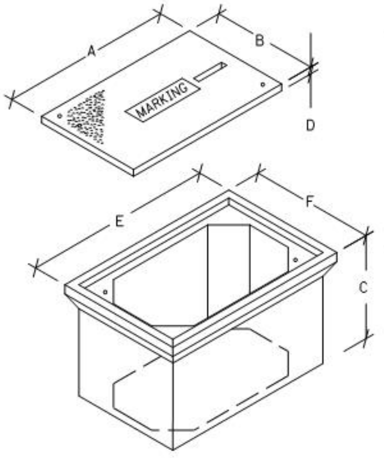
5.0 PAYMENT. The Department will make payment for the completed and accepted quantities of listed items according to Subsection 723.05 in addition to the following:

Code	Pay Item	Pay Unit
Conduit 1"	4792	Linear Foot
PVC Conduit – 1 ¼ inch – sch 80	24900EC	Linear Foot
PVC Conduit – 2 inch – sch 80	24901EC	Linear Foot
Conduit 2"	4795	Linear Foot
Electrical Junction Box type B	4811	Each
Loop Test	24963ED	Each
Trenching and Backfilling	4820	Linear Foot
Loop Wire	4830	Linear Foot
Cable-No. 14/1 Pair	4850	Linear Foot[1]
Loop Saw Slot and Fill	4895	Linear Foot[1]
Bore and Jack Conduit	21543EN	Linear Foot[3]
Open Cut Roadway	4821	Linear Foot[3]

The Department will consider payment as full compensation for all work required under these notes and the Standard Specifications.



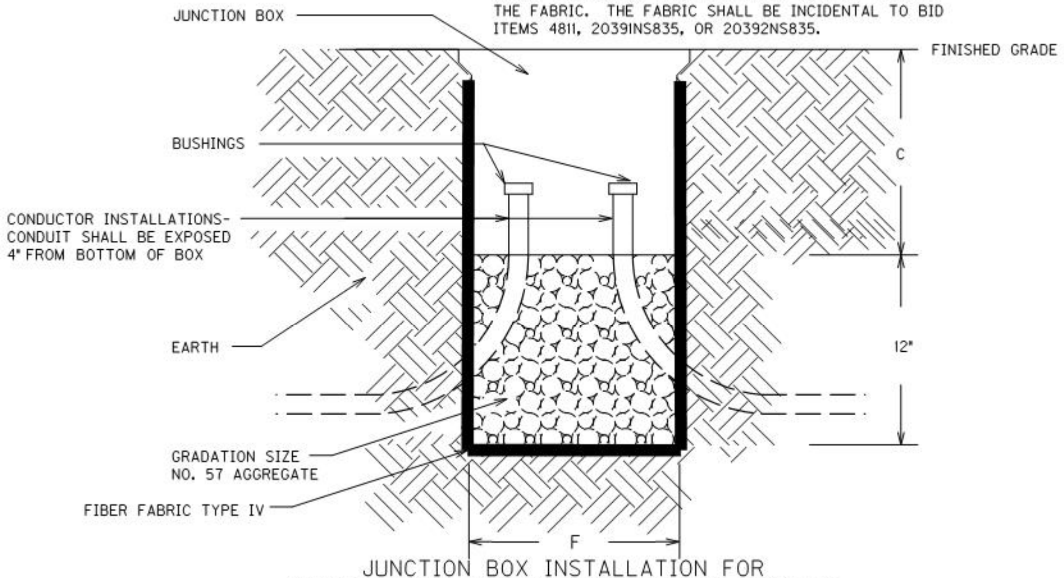
TEST/PIPE PLUG(FOR SPARE CONDUITS) AND GROUNDING DETAIL



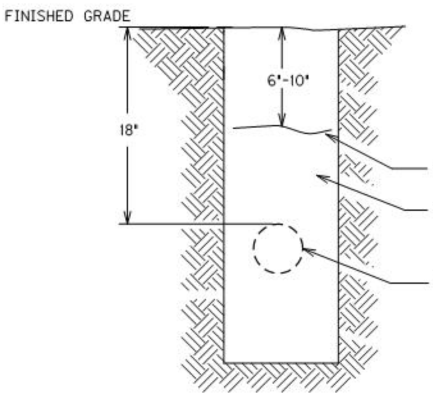
JUNCTION BOX DIMENSIONS (NOMINAL)						
	A	B	C	D	E	F
TYPE A	23"	14"	27"	2"	25"	15"
TYPE B	18"	11"	12"	1¾" *	20"	13"
TYPE C	36"	24"	30"	3"	38"	26"

* MINIMUM
NOTE: STACKABLE BOXES ARE PERMITTED

BEFORE THE INSTALLATION OF THE #57 AGGREGATE AND JUNCTION BOX, THE CONTRACTOR SHALL INSTALL GEOTEXTILE FILTER FABRIC TYPE IV IN THE HOLE. THE FABRIC SHALL EXTEND TO JUST BELOW THE LIP OF THE JUNCTION BOX AND SHALL BE CONTINUOUSLY ADHERED TO THE EXTERIOR OF THE BOX WITH ADHESIVE. ANY LOCATIONS WHERE CONDUITS ENTER THE BOX, THE FABRIC SHALL BE "X CUT" ONLY AS MUCH AS NECESSARY TO ALLOW PASSAGE OF EACH INDIVIDUAL CONDUIT THROUGH THE FABRIC. THE FABRIC SHALL BE INCIDENTAL TO BID ITEMS 4811, 20391NS835, OR 20392NS835.

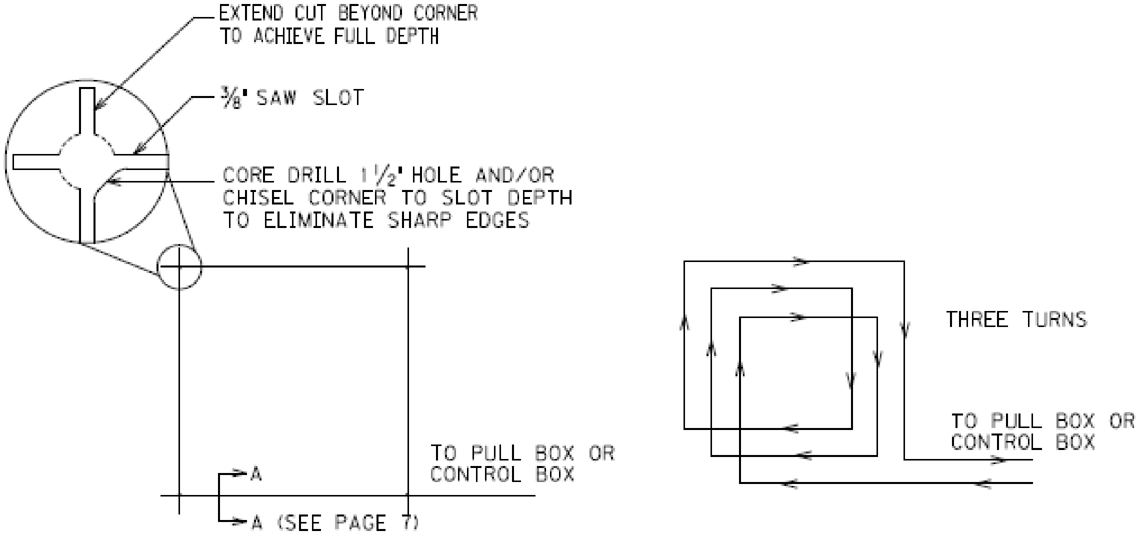


JUNCTION BOX INSTALLATION FOR
CONVENTIONAL LIGHTING OR TRAFFIC SIGNALS



DEPTHS SHOWN FOR CONDUIT AND DUCTED CABLE ARE MINIMUMS. CONTRACTOR SHALL PLACE AND COMPACT BACKFILL IN 9" MAXIMUM LIFTS AND RETORE DISTURBED AREA TO THE SATISFACTION OF THE ENGINEER.

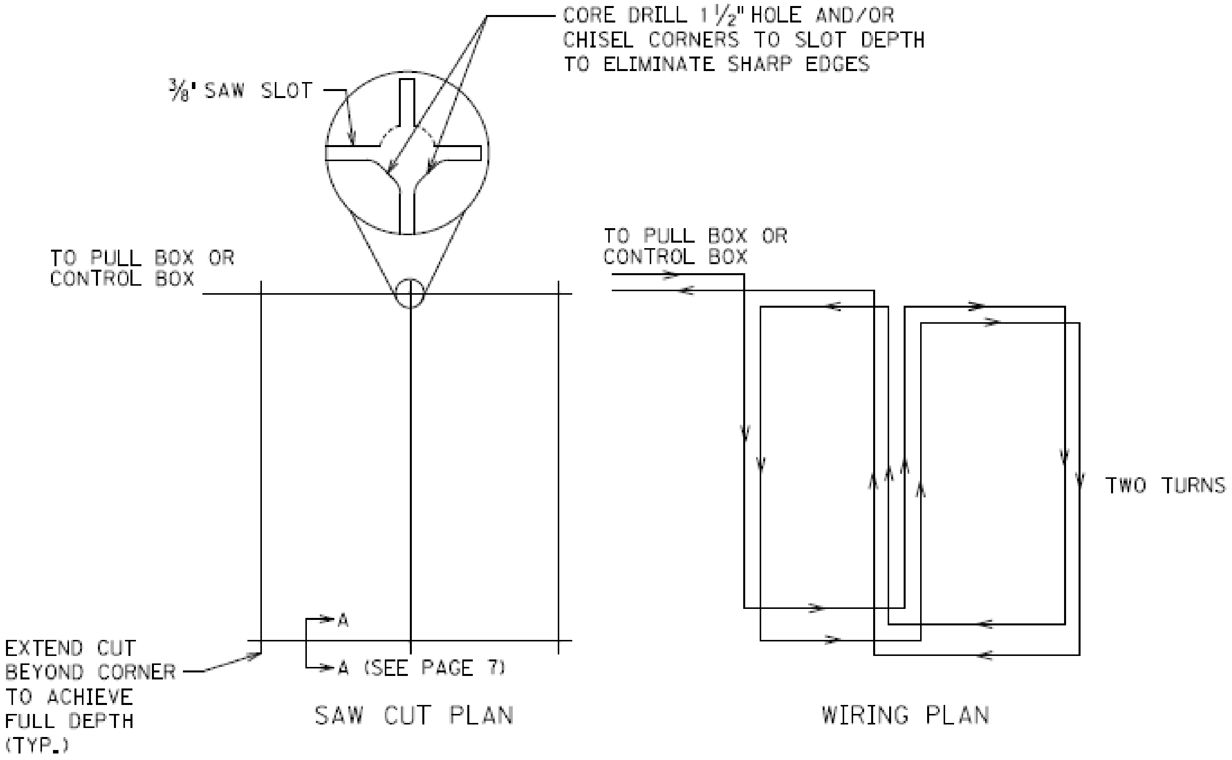
CONDUIT AND WARNING TAPE TRENCH



SAW CUT PLAN

WIRING PLAN

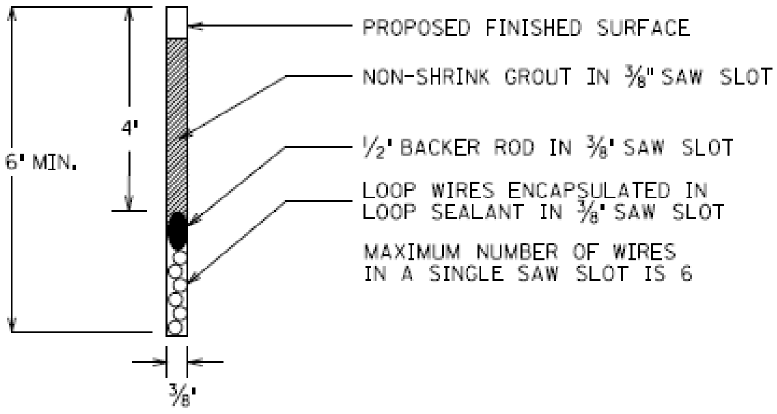
6'X6' LOOP



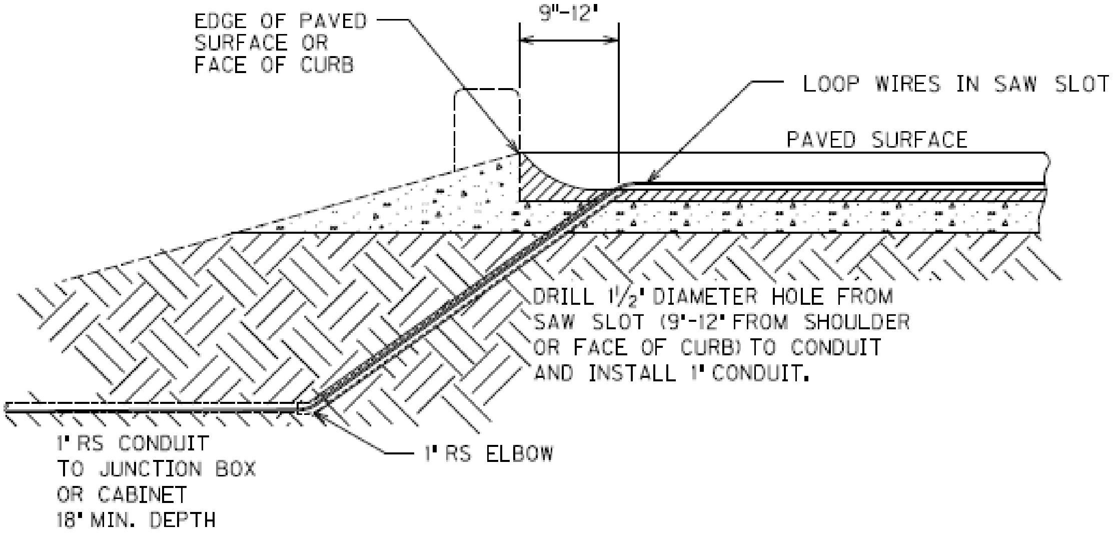
SAW CUT PLAN

WIRING PLAN

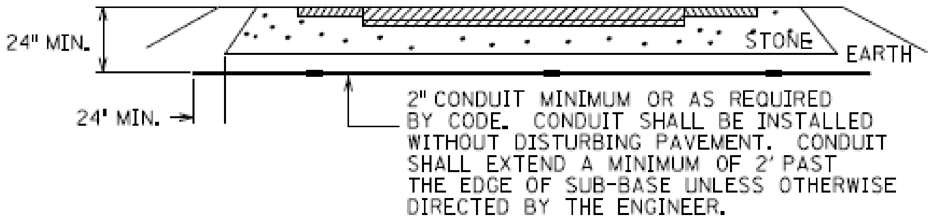
6'X30' QUADRAPOLE LOOP



SECTION A-A (SAW SLOT DETAIL)



SAW SLOT EDGE OF PAVEMENT TRANSITION



CONDUIT UNDER EXISTING PAVEMENT DETAIL

SPECIAL NOTE FOR REPLACING EXPANSION DAMS AND/OR INSTALLING ARMORED EDGES FOR CONCRETE ON BRIDGES

I. **DESCRIPTION.** Perform all work in accordance with the Kentucky Transportation Cabinet, Department of Highway's 2019 Standard Specifications for Road and Bridge Construction and applicable Supplemental Specifications, the Standard Drawings, this Note, and the attached detail drawings. Section references are to the Standard Specifications.

This work consists of the following: (1) Furnish all labor, materials, tools, and equipment; (2) Remove existing concrete and expansion device(s) and/or bridge ends; (3) Install armored edges and new concrete as specified and in accordance with the attached detail drawings; (4) Install new joint seals (where required); (5) Maintain and control traffic; and (6) Any other work specified as part of this contract.

II. MATERIALS.

A. **Class "M" Concrete.** Use either "M1" or "M2". See Section 601.

B. **Structural Steel.** Use new, commercial grade steel suitable for welding. The Engineer will base acceptance on visual inspection. See Standard Drawing BJE-001, current edition.

C. **Stud Anchors.** The armored edge stud anchors are %" x 6" embedded stud shear connectors conforming to ASTM A108, Grade 1015 (Nelson Studs or equal).

D. **Steel Reinforcement.** Use Grade 60. See Section 602.

E. **Epoxy Bond Coat.** See Section 511.

F. **Neoprene Joint Sealers (Compression Seals).** See Section 807.02.02.

G. **Neoprene Strip Seals.** See attached detail drawings.

III. CONSTRUCTION.

A. **Remove Existing Materials.** Remove the existing expansion dam/bridge end and specified areas of concrete as shown on the attached sketches. Remove debris and/or expansion joint filler as directed by the Engineer. Dispose of all removed material entirely away from the job site. This work is incidental to the contract unit price for "Expansion Joint Replacement" or "Armored Edge for Concrete".

Clean and leave all existing steel reinforcement encountered in place.

B. **Place New Concrete and Armored Edges.** After all specified existing materials have been removed; place new armored edges to match the grade of the proposed overlay or to match the original grade (See attached detail drawings). Place the new Class "M" concrete to the scarified grade and finish to receive the new overlay or place the new Class "M" concrete to the original grade and finish with broom strokes drawn transversely from curb to curb.

All new structural steel shall be cleaned and painted with two coats of commercial primer paint red orange in color, except that surfaces to come in contact with concrete are not to be painted.

Blast clean all areas of existing concrete and structural steel to come in contact with new concrete until free of all laitance and deleterious substances immediately prior to the placement of the Class "M" Concrete. The surface areas of existing concrete to come in contact with the new Class "M" Concrete are to be coated with an epoxy bond coat immediately prior to placing new concrete in accordance with Section 511. The interfaces of the new and old concrete shall be as nearly vertical and horizontal as possible.

C. **Additional Steel Reinforcement.** Furnish for replacement, as directed by the Engineer, 1200 linear feet of steel reinforcing bars 1/2" diameter by 20' lengths. Place these bars in areas deemed by the Engineer to require additional reinforcement. Field cutting and bending is permitted. Do not place any additional steel reinforcement above the height of the top row of Nelson Studs on the armored edges. Ensure that all exposed steel reinforcement is tied in accordance with Section 602.03.04 prior to pouring the new Class "M" concrete. Deliver unused bars to the Local County Maintenance Bam. Payment will be made in accordance with Section 602.

D. **Stage Construction.** Installation of concrete and armored edges in two (or more if specified) stages is necessary. Join the armored edges at or near the centerline of the roadway or lane line, field weld and grind smooth.

E. **Preformed Neoprene Joint Seal.** Place the preformed compression joint seal in one continuous, unbroken length. Place neoprene compression seals as recommended by the manufacturer and in accordance with Section 609.03.04 (D). Place neoprene strip seals as recommended by the manufacturer and in accordance with Section 609.03.04 (E), except that shop drawings will not be required.

F. **Shop Plans.** Shop plans will not be required. The Contractor is responsible for obtaining field measurements and supplying properly sized materials to complete the work.

IV. MEASUREMENT.

A. **Expansion Joint Replacement- X".** The Department will measure the quantity in linear feet from gutterline to gutterline along the centerline of the joint.

B. **Armored Edge for Concrete.** The Department will measure the quantity in linear feet from gutterline to gutterline along the face of the bridge end.

C. **Steel Reinforcement.** See Section 602.

V. PAYMENT.

A. **Expansion Joint Replacement- X".** Payment at the contract unit price per linear foot is full compensation for removing specified existing materials, furnishing and installing the new armored edges, concrete, neoprene joint seal, and all incidental items necessary to complete the work (except the overlay material) within the specified pay limits as specified by this note and as shown on the attached detail drawings.

B. **Armored Edge for Concrete.** Payment at the contract unit price per linear foot is full compensation for removing specified existing materials, furnishing and installing the new armored edges, concrete and all incidental items necessary to complete the work (except the overlay material) within the specified pay limits as specified by this note and as shown on the attached detail drawings.

C. **Steel Reinforcement.** See Section 602.

The Department will consider payment as full compensation for all work required by this note and the attached detail drawings.