

**ADDENDUM NO. 1**

**US 280 ELEVATED STORAGE WATER TANK**

**WATER WORKS BOARD OF THE CITY OF AUBURN  
AUBURN, ALABAMA**

**\*\*\*SPECIAL NOTICE\*\*\***

THE BID DATE FOR THIS PROJECT HAS BEEN CHANGED TO AUGUST 13, 2026  
THE TIME AND LOCATION OF THE BID DATE HAVE NOT CHANGED

**ADDITIONAL INFORMATION DOCUMENTS**

The following documents:

- Questions and Responses No. 1
- Report of Geotechnical Investigation

are being provided with this addendum for informational purposes only. The documents listed above are not, and will not, be considered as part of the Contract Documents.

**SPECIFICATIONS**

Delete Section 00 00 20 in its entirety and replace it with the attached Section 00 00 20.

Delete Section 00 01 00 in its entirety and replace it with the attached Section 00 01 00.

**Bidder Must Acknowledge Receipt of this Addendum on Bid Form**

July 17, 2026

Barge Design Solutions, Inc.  
1201 Front Avenue, Suite F  
Columbus, Georgia 31901  
(706) 321-4590

## QUESTIONS AND RESPONSES NO. 1

### US 280 ELEVATED STORAGE WATER TANK

#### WATER WORKS BOARD OF THE CITY OF AUBURN AUBURN, ALABAMA

|     |    |                                                                                                                                                                                                                                                                           |
|-----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Q: | Is a geotechnical report available?                                                                                                                                                                                                                                       |
|     | R: | See Addendum 1.                                                                                                                                                                                                                                                           |
| 2.  | Q: | Do you have a date the project must be completed by or have an anticipated NTP date? Depending on this, we may have to suggest more time than 365 days due to the backlog in the industry currently.                                                                      |
|     | R: | Please see Specification 00 01 00 - Item 9 regarding the Administration Period allotted to the contractor for scheduling availability of labor and materials. This period is provided prior to NTP to address this concern that we have heard from various manufacturers. |
| 3.  | Q: | Can you provide a current plan holder list?                                                                                                                                                                                                                               |
|     | R: | The plan holder list can be found at <a href="http://bidding.bargedesign.com">bidding.bargedesign.com</a>                                                                                                                                                                 |
| 4.  | Q: | Can the bid opening date be pushed by 1 week?                                                                                                                                                                                                                             |
|     | R: | See Addendum 1.                                                                                                                                                                                                                                                           |
| 5.  | Q: | Will weekend work be restricted on this project?                                                                                                                                                                                                                          |
|     | R: | The owner is open to allowing non-inspection work to occur on weekends. This can be discussed further during the Administration Period.                                                                                                                                   |
| 6.  | Q: | Is this project tax exempt?                                                                                                                                                                                                                                               |
|     | R: | Yes.                                                                                                                                                                                                                                                                      |
| 7.  | Q: | Is there an AIS requirement?                                                                                                                                                                                                                                              |
|     | R: | No.                                                                                                                                                                                                                                                                       |
| 8.  | Q: | Is there retainage for payments?                                                                                                                                                                                                                                          |
|     | R: | Yes.                                                                                                                                                                                                                                                                      |
| 9.  | Q: | What are the warranty requirements on this tank?                                                                                                                                                                                                                          |
|     | R: | Refer to Section 13.07 of the General Conditions and Specification 01 78 36.                                                                                                                                                                                              |
| 10. | Q: | Will this project require builder's risk?                                                                                                                                                                                                                                 |
|     | R: | Yes.                                                                                                                                                                                                                                                                      |

July 17, 2026

Barge Design Solutions, Inc.  
1201 Front Avenue, Suite F  
Columbus, Georgia 31901  
(706) 321-4590



July 9, 2026

INVITATION TO BID

The Water Works Board of the City of Auburn, (herein after referred to as Board) will receive sealed bids until 10:00 a.m., local time, on **August 13, 2026** in the Office of the City Manager, 144 Tichenor Avenue, Auburn, Alabama, and then publicly opened and read at the City Meeting Room, 122-B Tichenor Avenue, for furnishing all labor, materials and equipment necessary for the completion of the following project:

**US 280 ELEVATED WATER STORAGE TANK**

The following is a list of approximate quantities (see Base Bid for full schedule of quantities):

| ITEM NO. | ITEM DESCRIPTION                                                                                                                                                                                                           | UNIT      | QUANTITY |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------|
| 1        | Furnishing all products, materials, and equipment and performing all labor necessary to complete and put into operation the US 280 Elevated Storage Water Tank, including all work shown on the Drawings and/or specified. | LS        | 1        |
| 2        | Cash Allowances                                                                                                                                                                                                            |           |          |
| a.       | Soils and Concrete Testing                                                                                                                                                                                                 | ALLOWANCE |          |
| b.       | SCADA                                                                                                                                                                                                                      | ALLOWANCE |          |
| c.       | Property Protection during Coating Operations                                                                                                                                                                              | ALLOWANCE |          |

The instructions to Bidders, Bid, Contract Agreement, Specifications and forms of Proposal Bond, Performance Bond, Labor and Materials Bond and other Contract Documents may be examined at the following:

Bailey-Alexander Water and Sewer Complex  
1501 West Samford Avenue  
Auburn, Alabama 36832

Issuing Office  
Barge Design Solutions, Inc.  
1201 Front Avenue, Suite F  
Columbus, GA 31901  
706-321-4590

Copies of the Bidding Documents may be purchased from Memphis Reprographics as follows [bidding.bargedesign.com](http://bidding.bargedesign.com) or via phone at (901) 381-9811. Cost of Bidding Documents is \$75.00 per set. The deposit shall be refunded in full to each prime contractor bidder upon return of the documents in reusable condition within 10 days after bid opening. Additional sets for prime contractor bidders,

## **INSTRUCTIONS TO BIDDERS**

1. **Contract Documents.** The " Invitation to Bid", the "Instructions to Bidders", the "Proposal", the "Base Bid Summary of Quantities", the "General Conditions", the "Standard Specifications", the "Contract", the "Performance Bond", the "Labor and Material Payment Bond", the "Proposal Bond", "Special Conditions" make up the "Contract Documents". The Contractor must visit the location of the work and inform itself of all site conditions and make its own estimates of the facilities and difficulties attending the execution of the work.

2. **Proposal Documents.** Envelopes containing proposals must be sealed, addressed as follows, and sent First Class Mail or delivered to the City Purchasing Officer, Auburn City Hall, 144 Tichenor Avenue, Auburn, Alabama 36830. The City assumes no responsibility for the delivery of a proposal by mail or otherwise. The following note must be clearly shown on the face of the envelope:

|                           |                                           |
|---------------------------|-------------------------------------------|
| <b>BID:</b>               | <b>US 280 ELEVATED STORAGE WATER TANK</b> |
| <b>OPENING:</b>           | <b>10A.M., LOCAL TIME</b>                 |
| <b>DATE:</b>              | <b>8/13/2026</b>                          |
| <b>STATE LICENSE NO.:</b> | _____                                     |

3. **Omissions and Discrepancies.** Should a bidder find ambiguities or discrepancies in, or omissions from, Contract Documents, or should he be in doubt as to their meaning, he must at once notify the Engineer, who may send a written instruction to all bidders.

The Water Works Board of the City of Auburn ("Board") reserves the right to reject any and all Proposals and to waive any informality in the Proposals received.

4. **Acceptance or Rejection of Proposals.** The Board reserves the right to reject any or all Proposals. Without limiting the generality of the foregoing, any Proposal which contains incomplete, obscure or irregular material or information may be rejected; any Proposal which omits a Proposal on any one or more items in the price sheet may be rejected; any Proposal in which unit prices are omitted, or in which unit prices are obviously unbalanced, may be rejected; any Proposal accompanied by an insufficient or irregular Proposal bond, certified or cashiers check may be rejected.

5. **Proposal Bond.** All Proposals shall be accompanied by a Proposal bond, or a certified check or cashiers check upon a national or state bank, drawn and made payable to the order of the Water Works Board of the City of Auburn. The Proposal bond or check must be enclosed in the same envelope with the Proposal. The amount will be at least five percent (5%) of the amount of Proposal (**not to exceed \$10,000.00**). All such Proposal bonds or checks will be returned to the respective bidders within ten (**10**) days after Proposals are opened, except those which the Board elects to hold until the successful bidder has executed the Contract. Thereafter all remaining Proposal bonds and checks, including the Proposal bond or check of the successful bidder, will be returned within ten (**10**) days.

6. Acceptance of Proposals and Its Effect. All Proposals shall be irrevocable for a period of sixty **(60)** days after proposal opening. Within sixty **(60)** days after the opening of the Proposals, the Board will act upon them. The acceptance of a proposal will be a notice in writing signed by a duly authorized representative of the Board , and no other act of the Board shall constitute the acceptance of a Proposal. The acceptance of a Proposal shall bind the successful bidder to execute and perform the Contract and to be responsible for liquidated damages as provided in Paragraph 9. The rights and obligations provided for in the Contract shall become effective and binding upon the Board only upon its formal execution by the Board.

7. Contract Execution. Any bidder whose Proposal shall be accepted will be required to appear at the office of the *Chairman* of the Water Works Board of the City of Auburn, in person, or, if a firm or corporation, a duly authorized representative shall so appear, and to execute the contract within ten **(10)** days after notice that the Contract has been awarded to him. Failure or neglect to do so shall constitute a breach of the agreement effected by the acceptance of the Proposal.

The damages to the Board for such breach shall include loss from interference with its construction program and other items whose accurate amount will be difficult or impossible to compute. The amount of the Proposal bond or certified or cashiers check accompanying the Proposal of such bidder shall be retained by the Water Works Board of the City of Auburn as liquidated damages for such breach. In the event any bidder whose Proposal shall be accepted shall fail or refuse to execute the Contracts hereinbefore provided, the Chairman of the Board may, at their option, determine that such bidder has abandoned the Contract and thereupon the Board shall be entitled to liquidated damages as above provided.

The low bidder must supply the names and addresses of major material suppliers and subcontractors before the Notice of Award.

8. Determination of Low Bidder. Except where the Board exercises the right reserved herein to reject any or all proposals, the Contract will be awarded by the Board to the bidder who has submitted the lowest qualified Proposal determined by the sum of the following:

- For a Lump Sum Proposal
  - Base Proposal;
  - Algebraic sum of alternatives elected by Board after opening of Proposals;
  - Amount of unit price work based on quantities given in proposal form or estimated by Board or Engineer;
- For a Unit Price Proposal
  - Sums of unit price work based on quantities given in schedule;
  - Algebraic sum of alternatives elected by Board after opening of Proposals;

9. Time for Beginning and Completing the Work. The Contractor shall commence the work within ten (10) consecutive calendar days after the date specified in the Notice to Proceed given to him by the Director of the Board to commence work, and he shall complete the work within **365** consecutive calendar days after the date specified in the Notice to Proceed. An Administration Period preceding the Notice to

Proceed is available to the Contractor to coordinate availability of labor and materials. The Administration Period shall start with the Notice of Award and be no more than **120** consecutive calendar days.

The Board will allow **365** consecutive calendar days from the start date established by the written notice to proceed for completion of the project, and the Contractor will be subject to payment of Liquidated Damages in the amount of \$500.00 per calendar day for each day the contract remains incomplete (considering additional time which may be allowed the Contractor by the Engineer for completion of Extra Work) after the time allowed in the contract for final completion.

Within ten **(10)** days of delivery of the executed agreement by the Board to the Contractor, Contractor shall submit to Owner for approval a progress schedule indicating the starting and completion date of the various stages of the work and a preliminary schedule of shop drawings submissions (if applicable).

10. Prices. In case of discrepancy between the prices quoted in the Proposal in words and those quoted in figures, the words shall control. The prices are to include the furnishing of all materials, equipment, tools, and all other facilities, and the performance of all labor and services necessary or proper for the completion of the work, except such as may be otherwise expressly provided in the Contract Documents.

11. Interpretations and Addenda. No oral interpretations shall be made to any bidder as to the meaning of any of the Contract Documents, or be effective to modify any of the provisions of the Contract Documents. Every request for an interpretation shall be made in writing, addressed, and forwarded to Julia Smith at [julia.smith@bargedesign.com](mailto:julia.smith@bargedesign.com). Questions received less than seven days prior to the date for opening of Bids may not be answered. Oral and other interpretations or clarifications will be without legal effect.

12. Postponement of Date for Presenting and Opening Proposal. The Board reserves the right to postpone the date for presentation and openings of Proposals and will give notice by registered mail of any such postponement to each prospective bidder. Proposals shall be irrevocable for the period of any postponement of openings not to exceed sixty **(60)** days.

13. Bonds. A Performance Bond will be required for One hundred percent (100%) of the contract price. A Labor and Materials Bond will be required for One hundred percent (100%) of the contract price.

14. License Requirement. Successful bidder must have or must purchase all appropriate Auburn City Business Licenses and Permits before beginning work.

15. Federal Labor Standards Act. The contractor must abide by the requirements of the Federal Labor Standards Provisions Act.

subcontractors, vendors, or dealers may be obtained upon payment of the same deposit. The deposit shall be refunded less the cost of printing, reproduction, handling, and distribution, upon return of the documents in reusable condition within 10 days after bid opening.

Guarantee will be required with each bid as follows: At least five percent (not to exceed \$10,000) of the amount bid in the form of a certified or cashier's check or bid bond payable to the Water Works Board of the City of Auburn, Alabama.

All bidders are required to be compliant with the Beason-Hammon Alabama Taxpayer and Citizen Protection Act, Act No. 2011-535 (Code of Alabama (1975) § 31-13-9) as amended May 16, 2012 regarding employment practices. Documentation of enrollment in E-Verify should be included with the bid and will be required as a condition for the award of any contract. All bidders are advised that the award of the contract is conditioned on the bidder not knowingly employing, hiring for employment or continuing to employ an unauthorized alien within the State of Alabama. The awarded contract will contain a provision whereby the bidder pledges not to violate federal immigration law.

Legislative Act 2016-312 (the "Act") prohibits the Board from entering into contracts with any business entity that is actively engaged in or plans to engage in the boycott of a person or an entity based in or doing business with a jurisdiction with which the State can enjoy open trade; unless such business entity provides the goods or services for at least 20 percent (20%) less than the lowest business entity in compliance with the Act. All bidders understand and agree that in the awarded contract, the lowest responsive bidder must either certify that it is in compliance with the Act and agree that it will not violate the act during the term of the contract; or agree to offer the goods or services for at least 20 percent (20%) less than the lowest business entity certifying compliance with the Act.

Your attention in particular is invited to the section entitled "Instructions to Bidders", which is to be followed in all respects. The Board reserves the right to select the lowest responsible bidder as the best interest of the Board may require, to award the purchase contract from any of the bids, reject any and all bids, and waive any informalities in bids received. Bids will be good for sixty (60) days after being opened by the Board.

Bids must be submitted upon the standard forms furnished by the Board. No bids may be withdrawn for a period of sixty (60) days after the scheduled closing time for the receipt of bids. A sealed envelope containing the original bid and one (1) copy must be delivered to City Hall or mailed, addressed to:

Purchasing Officer, City of Auburn  
144 Tichenor Avenue  
Auburn, Alabama 36830

The envelope must be plainly marked on the outside as follows:

**BID:** US 280 ELEVATED WATER STORAGE TANK  
**OPENING:** 10 A.M. LOCAL TIME  
**DATE:** 8/13/2026  
**STATE LICENSE NO.:** \_\_\_\_\_

The contractor shall provide evidence that he has been issued a state license in accordance with Chapter 8, Title 34 of the Code of Alabama 1975 before his bid is considered. **Failure to clearly mark State License Number and Renewal Date on the outside of the bid envelope may result in the disqualification of bid proposal.** The successful low bidder is responsible for acquiring the appropriate business license and permits to conduct work within the City of Auburn. Business licenses may be obtained by contacting the City of Auburn's Revenue Office at 334-501-7239. Permits may be obtained by contacting Inspection Services at 334-501-3170. In addition to the business license and permit requirements, the bidder is required to remit all applicable sales and use tax, occupational license fees, and contractors/subcontractors license fees in accordance with City ordinances and codes. In accordance with Section 39-3-5 of State Code, any non-Alabama bidders must submit a written opinion from an attorney stating the amount and criteria, if any, of local preference granted by law to non-resident businesses in his state of residence.

The award of the contract, if to be awarded, will be made within sixty (60) calendar days after opening of bids and will be to the lowest responsible bidder whose proposal complies with the requirements of the Invitation to Bid. Should no award be made within the sixty (60) days, all proposals will be rejected unless the successful bidder agrees in writing to a stipulated extension in the time limit for award. The successful bidder will be notified by letter, mailed to the address shown on his proposal that his bid has been accepted and that he has been awarded the contract.

The Water Works Board of the City of Auburn believes fully in equal opportunity in the provision of supplies, equipment, construction and services. Positive steps should be taken to assure small businesses, minority businesses and women-owned businesses are given many opportunities to provide the above-mentioned services or materials when economically feasible. In the case of construction projects, the Board shall rely on individuals or firms seeking to do business with the Board to ensure that such above-mentioned businesses are given ample opportunity to participate on a sub-contractual basis.

The contractor agrees in all events to use materials, supplies and products manufactured, mined, processed or otherwise produced in the United States or its territories if the same are available at reasonable prices. If the contractor determines that said items are not available at a reasonable price, the contractor must first contact the Board and obtain approval for the use of other materials, supplies and products. In the event a contractor violates the provisions of this section, the Board may at its election, assess against the contractor liquidated damages in an amount of not less than five hundred dollars (\$500.00) nor more than 20% of the gross amount of the contract, as deemed appropriate by the Board.

The Contractor shall utilize Section 00 45 13 – Statement of Bidder's Qualifications in the bid package to indicate that he has performed a minimum of 10 tank construction projects of similar magnitude and scope in the last 5 years. The Contractor should provide the name of the project, location of the project, project details and a point of contact. The Contractor shall also submit documentation with the bid package indicating the following: (1) Contractor, or Contractor's Subcontractor, should have a minimum of ten years direct experience in performing construction of elevated storage water tanks (2) Contractor, or Contractor's Subcontractor, shall only assign a Crew Foreman who has a minimum of five years' experience in construction of elevated storage water storage tanks. Contractor shall complete and

submit all required items in the Statement of Bidder's Qualifications with his Proposal.

Please note that the Board has a mandatory Partial Payment Request form that must be completed and submitted by the contractor before payment is considered. Payments are mailed on each Friday of the month. Pay requests must be reviewed and approved by the appropriate Board representatives (architect, if applicable, inspector, project manager and department head) and received by accounts payable at least seven (7) days prior to the scheduled mailing date. The Board will process only one invoice per month for partial payment to the contractor. If you have any questions concerning billing, contact our accounts payable office at 334.501.7237 or 334.501.7238.

The Contractor will be required to provide certificates of insurance showing that it carries, or has in force, automobile liability insurance, general liability insurance, pollution liability insurance and workers' compensation insurance. Limits of liability for automobile liability insurance shall be, at a minimum, \$1,000,000.00 combined single limit. Limits of liability for general liability insurance shall be, at a minimum, \$5,000,000.00 per occurrence, \$5,000,000.00 personal and advertising injury, \$5,000,000.00 general aggregate and \$5,000,000.00 products/completed operations aggregate. General liability insurance will include coverage for contractually assumed liability and explosion, collapse, and underground (X, C & U) hazards. Limits of liability for pollution liability shall be, at a minimum, \$1,000,000.00 per occurrence or claim and \$1,000,000.00 aggregate. If the general liability insurance coverage and/or the pollution liability insurance coverage is on a claims-made basis, the Contractor will maintain coverage in force for a period of two (2) years following completion of the work specified in the agreement at the limits specified in this paragraph. Workers' compensation insurance shall provide statutory workers' compensation coverage and employers' liability coverage with limits of, at a minimum, \$1,000,000.00 each accident, \$1,000,000.00 disease- each employee and, \$1,000,000.00 disease – policy limit. The Contractor is responsible for the payment of any deductibles or self-insured retentions. The Contractor's insurance is primary. If the Contractor carries higher coverage limits than those mentioned above, the higher coverage limits will apply.

The certificate of insurance shall provide the Water Works Board of the City of Auburn (Board) with thirty (30) days written notice of cancellation of any of the coverages named in said certificate and waivers of subrogation in favor of the Board for the coverages listed on the certificate of insurance.

The Board and Barge Design Solutions will be named as additional insured under the Contractor's general liability insurance, pollution liability insurance, and automobile liability insurance policies.

The Contractor shall require certificates of insurance from subcontractors. Subcontractors will carry limits of insurance equal to or greater than those carried by the Contractor. These certificates shall evidence waivers of subrogation in favor of the Contractor and the Board and shall be made available to the Board upon request.

At the Board's discretion, the Contractor may be required to have in force builder's risk coverage and/or higher liability limits than that mentioned above and/or broader coverage than normally carried by the Contractor.

The Contractor agrees to indemnify, hold harmless, and defend the Board, its officials, representatives,

agents, servants, and employees from and against any and all claims, actions, lawsuits, damages, judgments, liability and expense, including attorney's fees and litigation expenses, in whole or in part arising out of, connected with, or in any way associated with the activities of the Contractor, its employees, or its sub-contractors in connection with the work to be performed under this contract. This obligation survives the payment of any losses by the Contractor's insurance company.

Legal action arising from the performance of this contract will be filed in the Circuit Court of Lee County, Alabama located in Opelika, Alabama or the Federal District Court for the Middle District of Alabama – Eastern Division located in Opelika, Alabama.

The contract may not be assigned by the contractor without written permission of the Board.

Questions concerning insurance coverage may be directed to the City Risk Manager, McCarthy Autry at 334.501.7247.

WATER WORKS BOARD OF THE CITY OF AUBURN  
Dawson Newman  
Purchasing Officer

FOR SPECIFIC INFORMATION CONCERNING THIS PROJECT, PLEASE CONTACT **JULIA SMITH, ENGINEERING ASSOCIATE**, BARGE DESIGN SOLUTIONS, INC. AT **615.252.4415** or **Julia.Smith@bargedesign.com**.

Report of Geotechnical Subsurface Investigation

**Highway 280 Elevated 300,000 Gallon Water Storage Tank**

Auburn, Lee County, Alabama

Our Job No. A24114.00604.000

Prepared For:

The Water Works Board of the City of Auburn  
c/o Mr. Tim Johnson, P.E.  
Water Resource Management, Principal Utility Engineer  
1501 West Samford Avenue  
Auburn, Alabama 36830

Prepared By:

UES Professional Solutions 18, LLC.  
P.O. Box 241702  
Montgomery, Alabama 36124-1702

334-213-5647  
[www.teamues.com](http://www.teamues.com)

August 29, 2024

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## **1.0 Introduction**

UES Professional Solutions 18, LLC., is pleased to provide this report of our subsurface investigation for the proposed 300,000 Gallon Elevated Water Storage Tank. The scope of this investigation included 4 soil test bores in the proposed tank area. The quantity and location of the test bores were taken in accordance with the authorized scope of work. This investigation was completed in general accordance with the American Water Works Association, AWWA Standard D107. The intent of this investigation was to evaluate the subsurface conditions with respect to the development of the site for support of the proposed elevated water storage tank.

This report has been prepared in accordance with generally accepted current standards of geotechnical engineering practices and no other warranties are expressed or implied. The recommendations of this report are based on our professional judgment considering the proposed construction as described by this report and the data available to us. The construction should include follow up geotechnical monitoring and construction materials testing by our firm. It is important that we confirm the expected subsurface conditions based on the soil boring data during the construction phase. This report is presented on the basis that all of our recommendations will be followed.



## **2.0 Summary**

Generally, the subsurface investigation indicated conditions which should be compatible with the planned tank construction provided the construction is completed in accordance with the recommendations which follow in this report. Please note that our recommendations are site specific and may not be suitable for other types of structures or other locations.

Four soil test bores were completed to evaluate the subsurface conditions. Beneath organic silty or sandy topsoil, the test bores penetrated in-situ earth described as cohesive silty clay, micaceous silty clay, clayey sand, micaceous silty clayey sand, silty clayey sand, and non-cohesive sandy silt, silty sand and micaceous silty sand. The test bores auger refused on hard rock at depths of 77 to 91' below ground surface on hard rock. The predominate sand earth is of marginal to good drainage classification. The predominate clay and silt earth is of a poor drainage classification. The test bores indicated low to moderate and stronger soil strengths. However, the estimated total settlements in the range of 5 to 7" using a shallow foundation system would be excessive. A ground modification system using aggregate piers and shallow foundations for tank support can be used to effectively reduce total settlements to an acceptable range.

The test bores indicated groundwater at depths of 47 to 48' below ground surface after 24 hours. The groundwater condition at this site is subject to seasonal variation and is expected to fluctuate. We do not anticipate that the groundwater condition will affect the long-term performance of this project.

The site is located in an area underlain by schist and quartzite rock exhibiting varying degrees of weathering. The rock has been folded and distorted during the geologic past and has been subjected to irregular weathering. Due to the irregular weathering, hard sections of rock may be encountered at various elevations beneath the ground surface. Large rock boulders, rock layers, and cobbles are common in the residual soil mass overlying the parent rock. Generally, those materials exhibiting "N" values of 50 or less may be excavated with conventional earth excavating equipment. Excavations in weathered rock material exhibiting "N" values greater than 50, especially in confined excavations, may require pneumatic hammers, rippers, blasting or other rock removal techniques to advance excavations. Based on the boring data we do not expect any hard rock within the expected excavation zones for the project. However, as a contingency, the construction documents should make provisions for rock removal.

A ground improvement system incorporating aggregate piers may be used to increase the allowable soil bearing capacity and reduce settlements for a shallow foundation system. The rammed aggregate piers should be designed and installed by a geotechnical specialty contractor. Generally, the rammed aggregate pier system is expected to improve allowable soil bearing capacities to the range of 6000 to 7000 psf and limit total settlements to 1.5 to 2.0" or less for a shallow foundation system.



### **3.0 Evaluation**

#### **3.1 Site Location**

The site subject to this report is located on the northside of US Highway 280 near the south bound intersection with Alabama Highway 147 in the City of Auburn, Lee County, Alabama. The tank will be located on the site of the City of Auburn Public Safety Training Facility. Our field personnel utilized the provided site plan and instructions to locate the tank site and test bores. A survey grade GPS was used to establish the test bore locations and ground elevations.

The tank center point is located at latitude 32.678117, longitude -85.485850. The tank has a estimated foundation with a 24' diameter and the four soil test bores were located equidistant along the perimeter of the 24' diameter foundation circle. The horizontal and vertical accuracy of the GPS can be variable due to atmospheric influences, tree canopies, and other obstructions. The locations should be considered approximate. The GPS data is provided for information only and has not been field verified.

The enclosed boring plan further describes the test bore locations.

#### **3.2 Site Conditions**

The site consisted of an irregular shaped parcel of property. The tank site was clear and open with grass vegetation. Scattered trees were present nearby.

The local terrain is described as gently sloping. The tank site was gently sloping with less than 2' of relief between the test bores. Surface drainage was described as good. Surface water is expected to flow over the site and discharge beyond the areas planned for development. There were no significant areas of ponded surface water located on the site during the field testing.

There was no difficulty mobilizing our rubber-tired ATV mounted drilling equipment at the test bore locations.



### 3.3 Site Geology and Subsurface Stratigraphy

Geologically, the site is located in the Inner Piedmont Province underlain by the Loachapoka Schist Formation, a member of the Opelika Complex, formed in the Precambrian to Paleozoic Period. This formation typically yields schist and quartzite, the upper sections of which have weathered into various combinations of clay, silt and sand.

The test bores penetrated 2 to 6" of organic silty and sandy topsoil. Beneath the topsoil, the test bores penetrated in-situ earth described as cohesive silty clay, micaceous silty clay, clayey sand, micaceous silty clayey sand, silty clayey sand, and non-cohesive sandy silt, silty sand and micaceous silty sand. Laboratory analyses confirmed "SM" Unified Soil Classifications of the predominate silty sand earth with plasticity indices of non-plastic, 7, 11, 12, and 14. The penetration resistance values, "N", ranged from 5 to 100+ blows per foot indicating relative densities of loose to very dense in the predominate sand earth and consistencies of stiff to hard. Moisture tests indicated water contents ranging from 3.3 to 24.4%. The test bores were terminated at depths of 77 to 91' below ground surface at practical auger refusal on hard rock.

The test bores indicated groundwater twenty-four hours following drilling at depths of 47 to 48' below ground surface. Twenty-four hours following drilling, the test bores caved at depths of 58 to 72' below ground surface.

The enclosed test boring records further describes the subsurface stratigraphy, Unified Soil Classifications, penetration resistance values, moisture contents, water levels, caved depths, and boring termination depths.

### 3.4 General Construction Information

The following data was extrapolated from the provided construction information and plans. The construction data described in this section was considered in the formulation of our recommendations; therefore, any significant changes, additions or modifications to the planned development may have a significant impact on our recommendations. We ask that we be advised of any significant errors, omissions, or revisions in the construction data to permit further comment as needed.

The planned 300,000 gallon water storage tank is expected to consist of a composite elevated tank with a steel tank and concrete base and pedestal. The tank is estimated to include a foundation with a 24' diameter circle. General loading information included a 250 kip dead load and live load at 2,503 kips.



## **4.0 Recommendations – Shallow Foundations with Aggregate Piers**

### **4.1 Shallow Foundation with Aggregate Pier Ground Improvement**

Rammed aggregate piers are an intermediate foundation system which is compatible with the soil conditions at this site for support of the tank structure. The aggregate pier system is a ground improvement system which can improve bearing and limit settlements for shallow foundations. The rammed aggregate piers should be designed and installed by an experienced geotechnical specialty contractor.

### **4.2 Maximum Allowable Soil Bearing Pressures**

The rammed aggregate piers should be designed to support the planned shallow foundation and to provide an allowable soil bearing pressure in the range of 6000 to 7000 psf. The aggregate pier design should limit total settlements to 1.5 to 2.0" or less and differential settlements of approximately 0.75 to 1.0" or less over the tank foundation diameter. A minimum of one load test should be completed to verify the design parameters.

Note: The aggregate piers are typically installed from the existing ground surface with a sacrificial length that is removed during excavation for the foundation. Caution should be exercised to minimize disturbance of the soil bearing level and the surface of the aggregate piers when the foundation is excavated. Do not backfill over-excavated foundation trenches. All soil disturbed in the excavation process should be removed to expose undisturbed soil prior to the placement of the foundation concrete. We recommend over excavating the foundation excavation by 6" and placing a 6" thick non-reinforced concrete mud sill to protect the soil bearing level, the tops of the aggregate piers, and to provide a working pad for the foundation construction. The exposed soil bearing level should be firm and the tops of the aggregate piers should be exposed and well defined.



### 4.3 Soil Design Parameters

**Table 1**

| Depth (ft) | Material           | Moist Unit Weight (pcf) | Angle of Friction (degrees) | Cohesion (ksf) | Coefficient of Friction | Base Cohesion (ksf) | Passive Earth Pressure Coefficient (Kp) | Lateral Earth Pressure (psf per foot of depth)* |
|------------|--------------------|-------------------------|-----------------------------|----------------|-------------------------|---------------------|-----------------------------------------|-------------------------------------------------|
| 0-5        | Native Silty Clay  | 120                     | 0                           | 2.5            | 0                       | 1.5                 | 1.0                                     | 120                                             |
| 0-5        | Native Clayey Sand | 130                     | 35                          | 0              | 0.5                     | 0                   | 3.69                                    | 479                                             |

Use an appropriate safety factor.

### 4.4 Minimum Foundation Dimensions

Depth - 5' below existing ground surface. Also provide for a minimum 6" thick mud mat or mud sill to serve as a working pad.

Note: All foundations should be sized for the total load but should not be less than the preceding described minimum depths. The recommended minimum bearing depth considers only the vertical bearing pressure; therefore, the depth or size of the foundation should be increased as required to resist uplift forces and lateral forces.

### 4.5 Settlement

The planned tank structure will be subjected to estimated total long-term settlements of 1.5 to 2.0" or less with differential settlements of 0.75 to 1.0" or less over the width of the tank foundation diameter. The tank foundation should be designed to tolerate these estimated settlements.



#### 4.6 Seismic Design

The design parameters for the ASCE 7-22 are as follows for the planned tank site in Auburn, Lee County, Alabama.

|               |                  |                  |
|---------------|------------------|------------------|
| $S_S = 0.190$ | $S_{MS} = 0.240$ | $S_{DS} = 0.160$ |
| $S_1 = 0.085$ | $S_{M1} = 0.180$ | $S_{D1} = 0.120$ |
| Site Class D  |                  |                  |

Seismic Design Category B for Use Group I, II or III and Seismic Design Category C for Use Group IV.

#### 4.7 Foundation Construction

Do not disturb the foundation bearing soil. Sections which become disturbed should be undercut and replaced with non-reinforced concrete. All foundations should be constructed as expediently as possible following completion of the foundation excavation. Caution should be exercised to prevent disturbance of the bearing soil and the tops of the aggregate piers during the excavation process. A minimum 6" thick mud sill (non-reinforced concrete) should be used to protect the bearing level of soil and the aggregate piers until the foundation reinforcement and concrete can be placed. The reinforced concrete foundation can bear directly on top of the mud sill.

#### 4.8 Acceptance of Foundation Bearing Levels

All foundation excavations should be examined by UES representatives prior to the installation of the foundation reinforcement and concrete. All unacceptable conditions should be corrected in accordance with our recommendations.



## **5.0 Recommendations - General**

### **5.1 Utility Trenches**

All utility trenches (new and existing) extending through the tank area should be backfilled in 8" loose layers and compacted to 95% of the materials ASTM D-698 standard density.

### **5.2 Grading and Drainage Improvements**

Incorporate finish grades, side drainage ditches, underdrains, etc., to reduce the possibility of ponding surface water within 5' of the tank foundation.

### **5.3 Vertical Cuts**

Vertical cuts greater than 4' or cuts required to remain open for extended periods of time should be sloped or braced as required for the protection of workmen entering deep excavations.

Heavy construction traffic and stockpiling of excavated earth or other materials should not be permitted near the top of open unsupported excavations. Current OSHA regulations should be adhered to with respect to excavations for this project.

### **5.4 Quality Control**

A qualified geotechnical and construction materials testing consultant should provide the following services;

- 5.4.1 Monitor the installation of the aggregate piers.
- 5.4.2 Complete soil particle size, atterberg limit and laboratory compaction tests on each different type of fill earth used for foundation backfill.
- 5.4.3 Complete a minimum of 3 field density tests or as required to adequately represent each foot of vertical thickness of fill. Also, a minimum of 1 field density test should be taken for each 100 linear feet per each 2' of vertical thickness of fill placed at utility trenches extending through tank area.
- 5.4.4 Test all structural concrete in accordance with the guidelines established by the American Concrete Institute.



## **6.0 General Comments**

The scope of this study did not include sampling or testing for an environmental analysis or assessment for this site. If an environmental assessment of this site is desired, we should be contacted for further comment.

The comments of this report do not consider local flood conditions. The local flood condition/elevation (if any) should be determined and considered in the design of this project.

The frost penetration depth in the area of this project is generally taken to be less than 10". Provided our recommendations for the development of the foundations are followed, we do not expect that the frost penetration will have any detrimental effects on the performance of the planned tank structure.

The comments of this report are based upon our interpretation of the construction information supplied by others, the data collected at the 4 soil test bores, and our visual examination of the site. The evaluation of subsurface conditions based on the 4 test bores taken with this study requires a certain amount of interpolation. Improper site preparation, extremes in climatic conditions, significant changes in locations, grades, time, etc., can each affect groundwater, surface, and subsurface conditions. If conditions are encountered as the construction advances which vary significantly from those described by this report, we should be contacted for supplemental comment.

The scope of this investigation is not intended to establish volumetric estimates of the various subsurface materials at the site. Volumetric estimates may require a large number of test bores placed on a close grid to establish reliable cross sections. If volume estimates are required of us for the design/development of this project to advance, please contact us for further comment.

We are available to provide a review of the final plans and project specifications with respect to their compatibility with the contents of this report. Furthermore, our firm would appreciate the opportunity to continue to serve as the geotechnical consultant and to provide the construction materials testing and monitoring for this project.



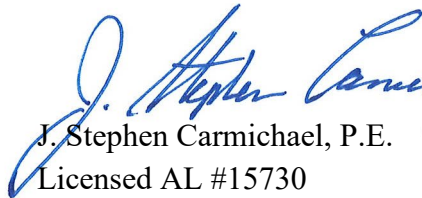
August 29, 2024

A24114.00604.000

## **7.0 Signature**

Thank you for selecting UES Professional Solutions 18, LLC., to provide the geotechnical services for this project. We are available to answer any questions concerning our findings and recommendations. If we can be of any further assistance, please contact our office.

Sincerely,

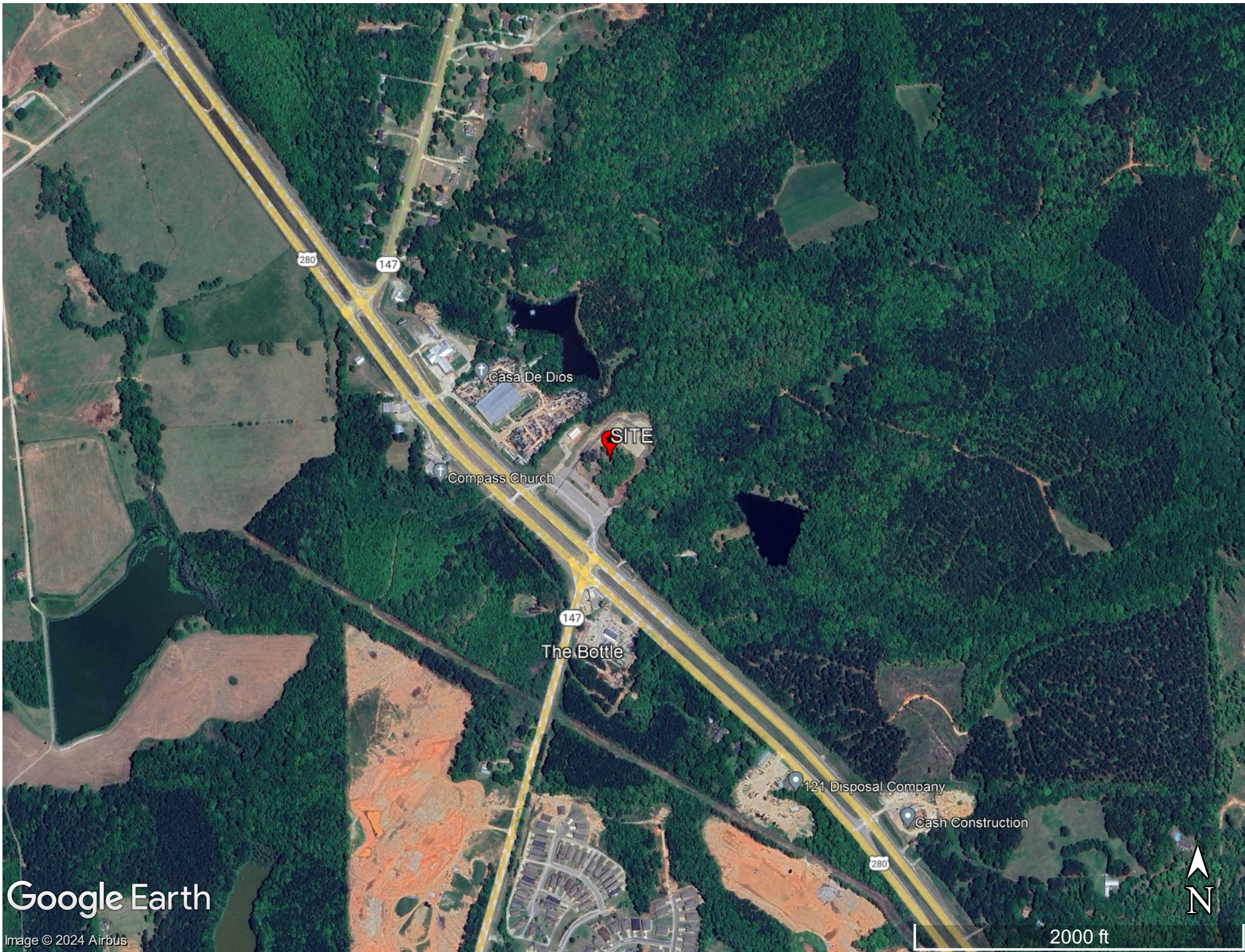
  
J. Stephen Carmichael, P.E.  
Licensed AL #15730



Report Distribution: 1 - Mr. Tim Johnson, P.E. (email)

JSC/cs





Google Earth

Image © 2024 Airbus

2000 ft

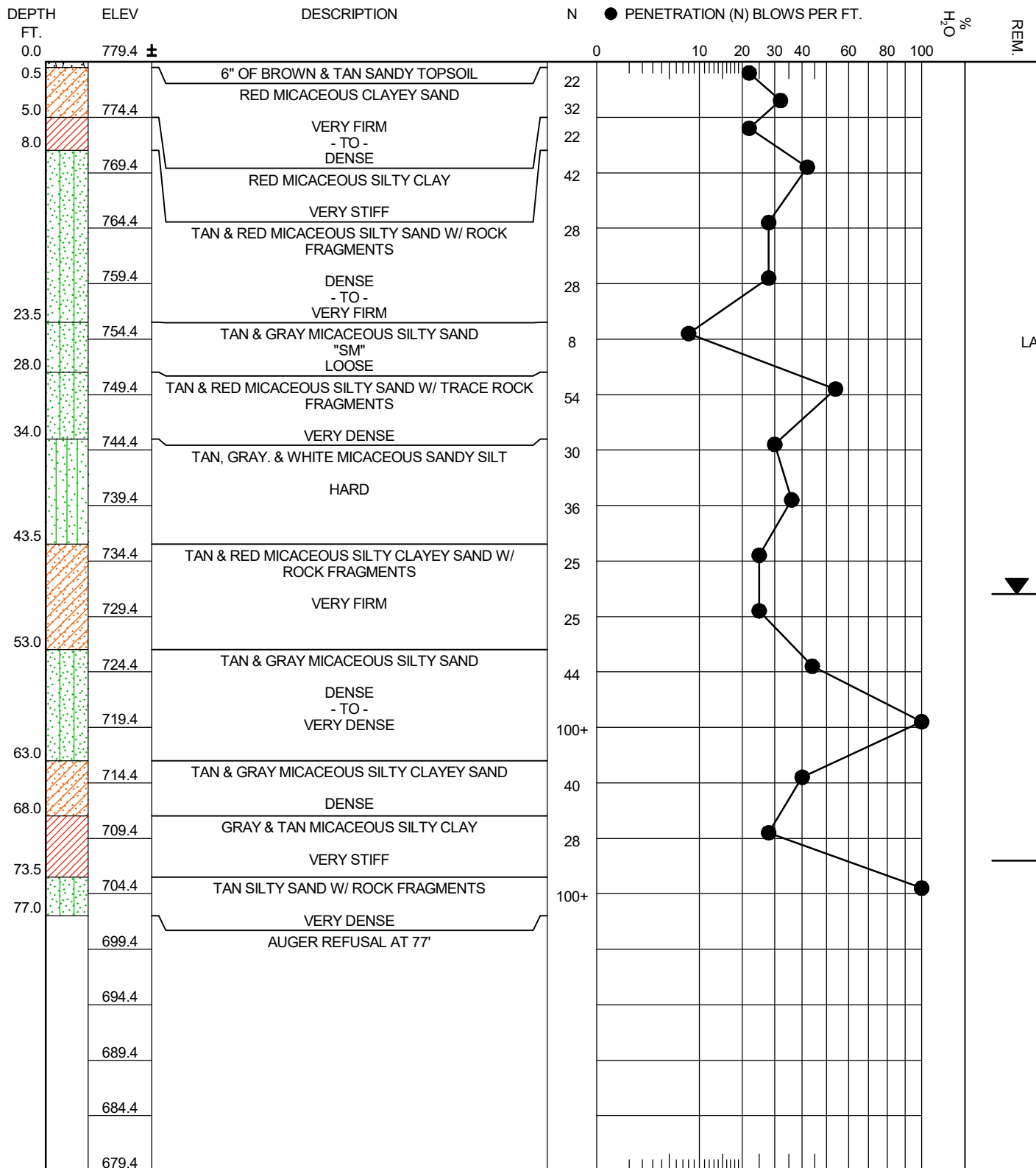




Google Earth

Image © 2024 Airbus

80 ft



Boring and Sampling Meets ASTM D-1586  
 Penetration (N) is the Number of Blows of 140 lb. Hammer  
 Falling 30 in. Required to Drive 1.4 in I.D. Sampler 1 Ft.

☒ Undisturbed Sample  
 LA Lab Analysis

▼ Water Level 48.0' AFTER 24 HOURS  
 ▽ Water Level  
 — Boring Caved 72.0' AFTER 24 HOURS

Note: (Pocket penetrometer value in tons/sf)  
 [Sample recovery in inches]

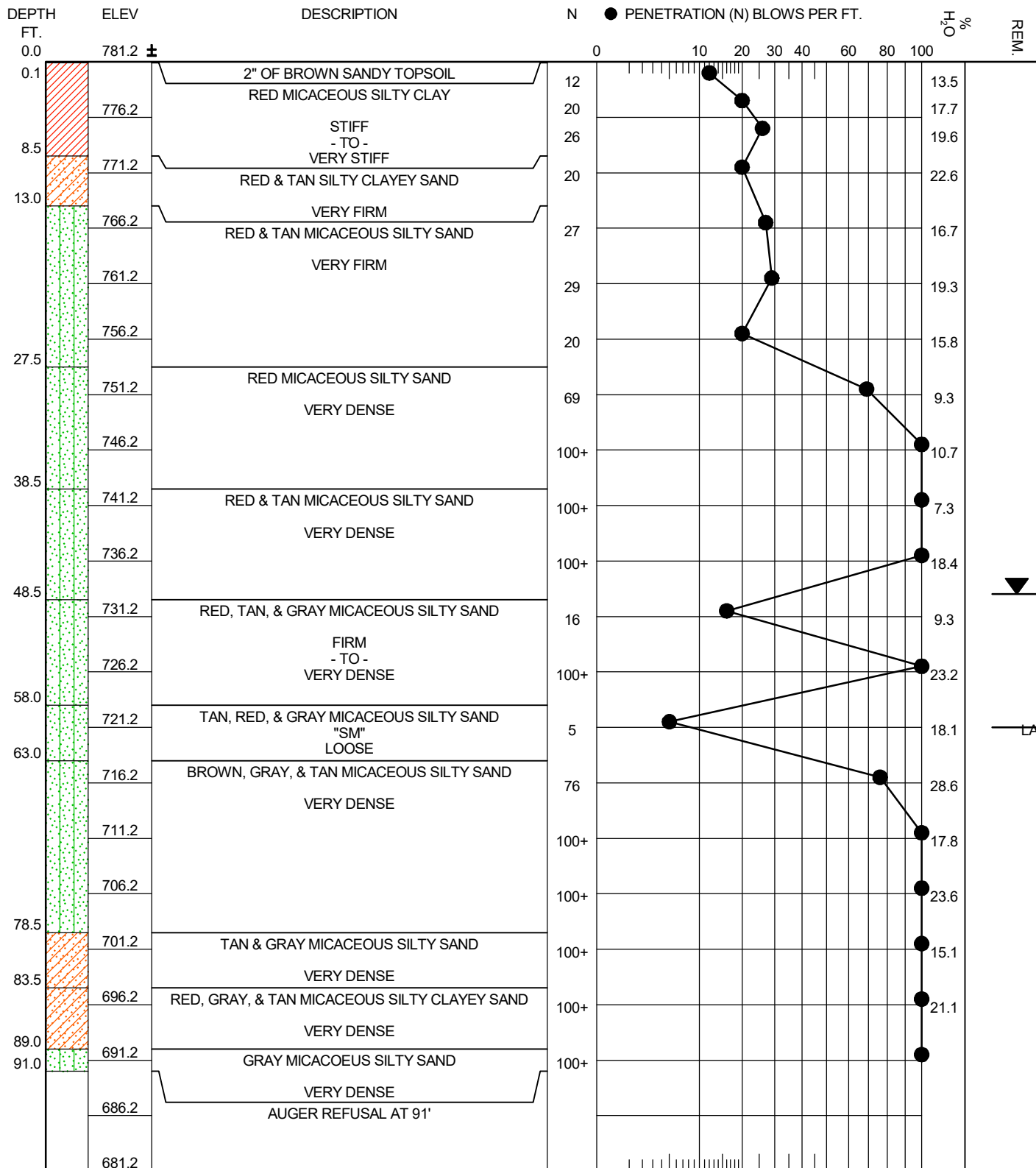
## TEST BORING LOG

JOB NO. A24114.00604.000

BORING NO. B-1

DATE DRILLED 8/16/24

TYPE BORING SB



Boring and Sampling Meets ASTM D-1586  
 Penetration (N) is the Number of Blows of 140 lb. Hammer  
 Falling 30 in. Required to Drive 1.4 in I.D. Sampler 1 Ft.

⊠ Undisturbed Sample  
 LA Lab Analysis

▼ Water Level 48.0' AFTER 24 HOURS  
 ▽ Water Level  
 — Boring Caved 60.0' AFTER 24 HOURS

Note: (Pocket penetrometer value in tons/sf)  
 [Sample recovery in inches]

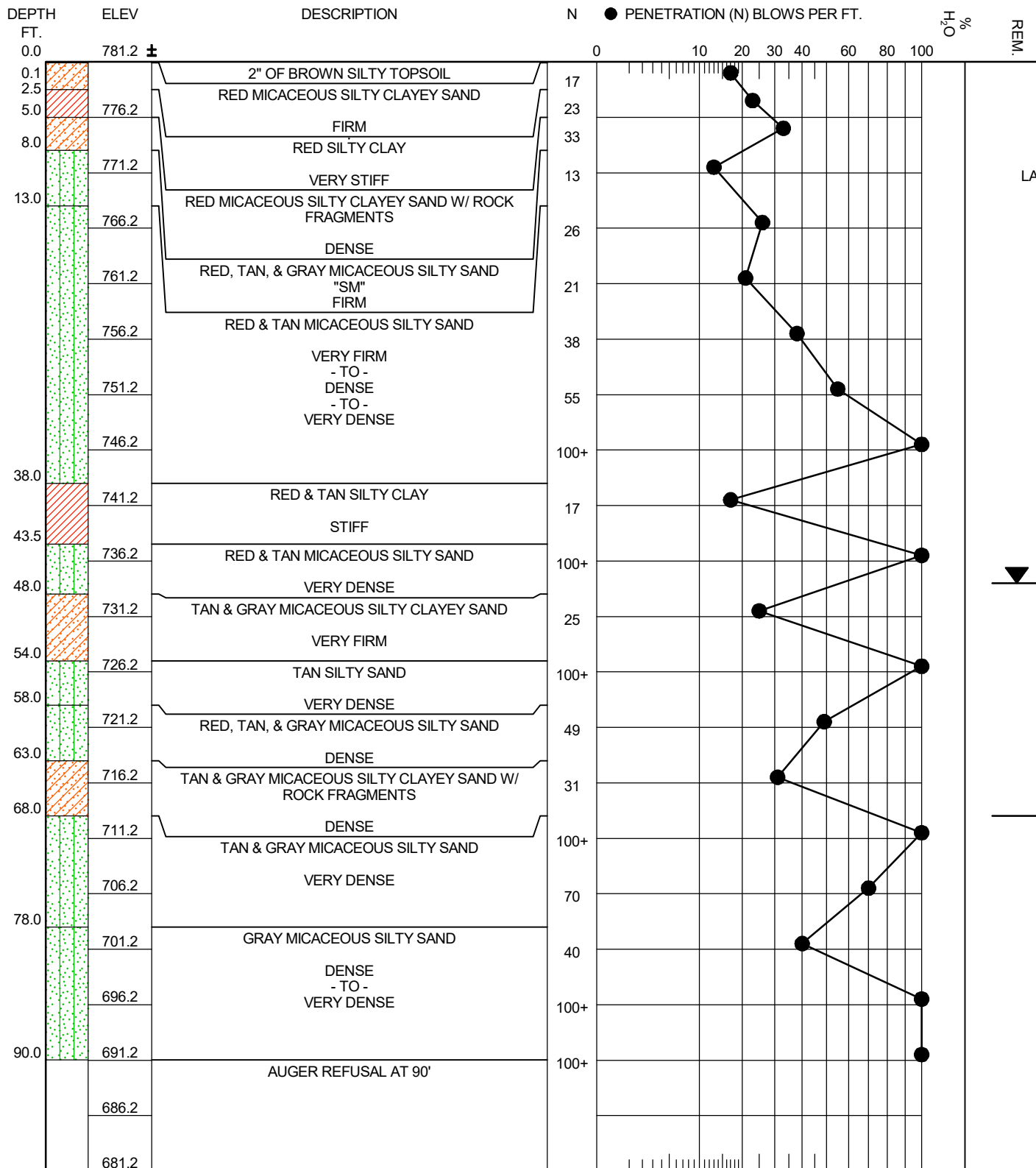
## TEST BORING LOG

JOB NO. A24114.00604.000

BORING NO. B-2

DATE DRILLED 8/14/24

TYPE BORING SB



Boring and Sampling Meets ASTM D-1586  
 Penetration (N) is the Number of Blows of 140 lb. Hammer  
 Falling 30 in. Required to Drive 1.4 in I.D. Sampler 1 Ft.

⊠ Undisturbed Sample  
 LA Lab Analysis

▼ Water Level 47.0' AFTER 24 HOURS  
 ▽ Water Level  
 — Boring Caved 68.0' AFTER 24 HOURS

Note: (Pocket penetrometer value in tons/sf)  
 [Sample recovery in inches]

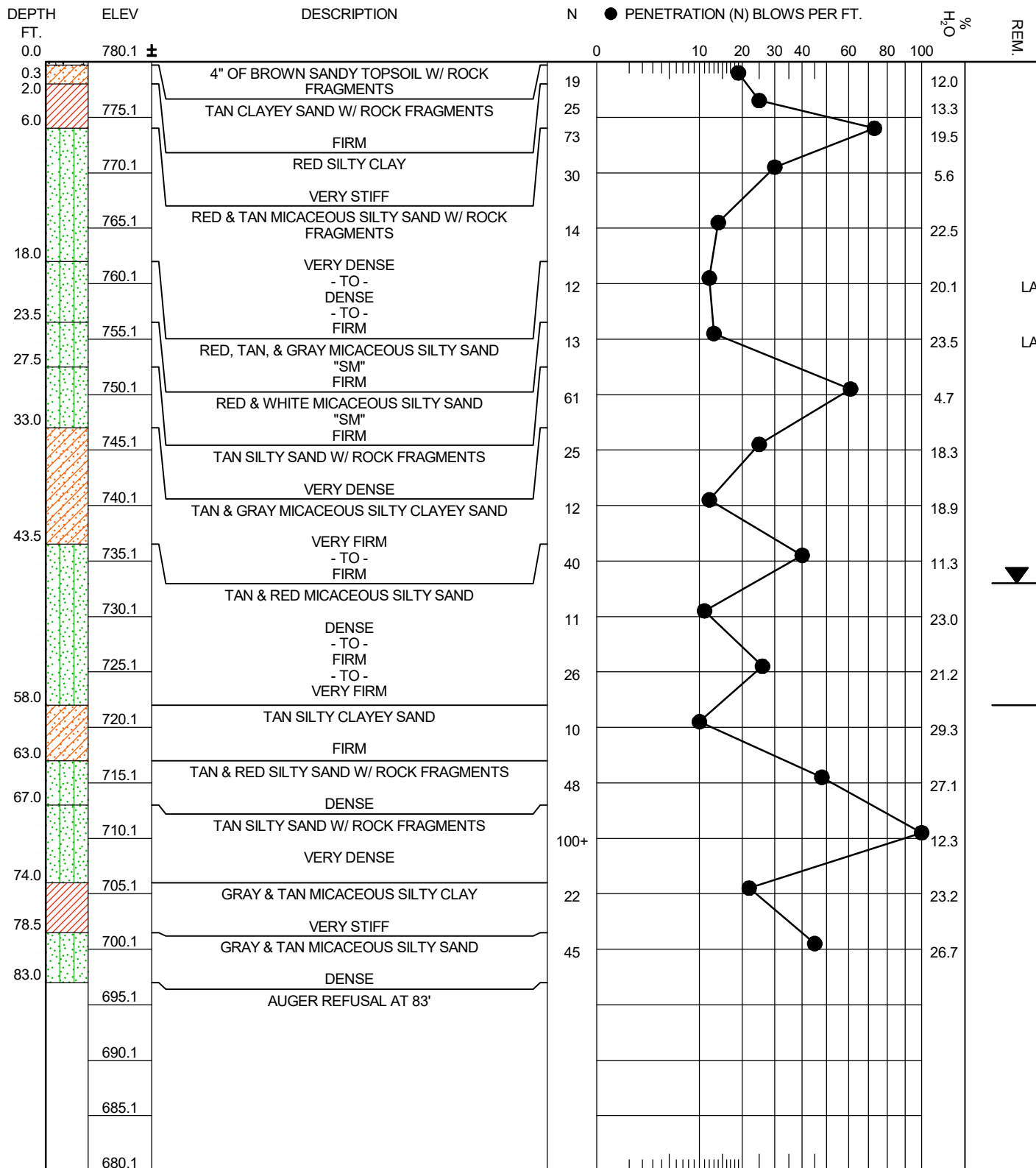
## TEST BORING LOG

JOB NO. A24114.00604.000

BORING NO. B-3

DATE DRILLED 8/15/24

TYPE BORING SB



Boring and Sampling Meets ASTM D-1586  
 Penetration (N) is the Number of Blows of 140 lb. Hammer  
 Falling 30 in. Required to Drive 1.4 in I.D. Sampler 1 Ft.

☒ Undisturbed Sample  
 LA Lab Analysis

▼ Water Level 47.0' AFTER 24 HOURS  
 ▽ Water Level  
 — Boring Caved 58.0' AFTER 24 HOURS

Note: (Pocket penetrometer value in tons/sf)  
 [Sample recovery in inches]

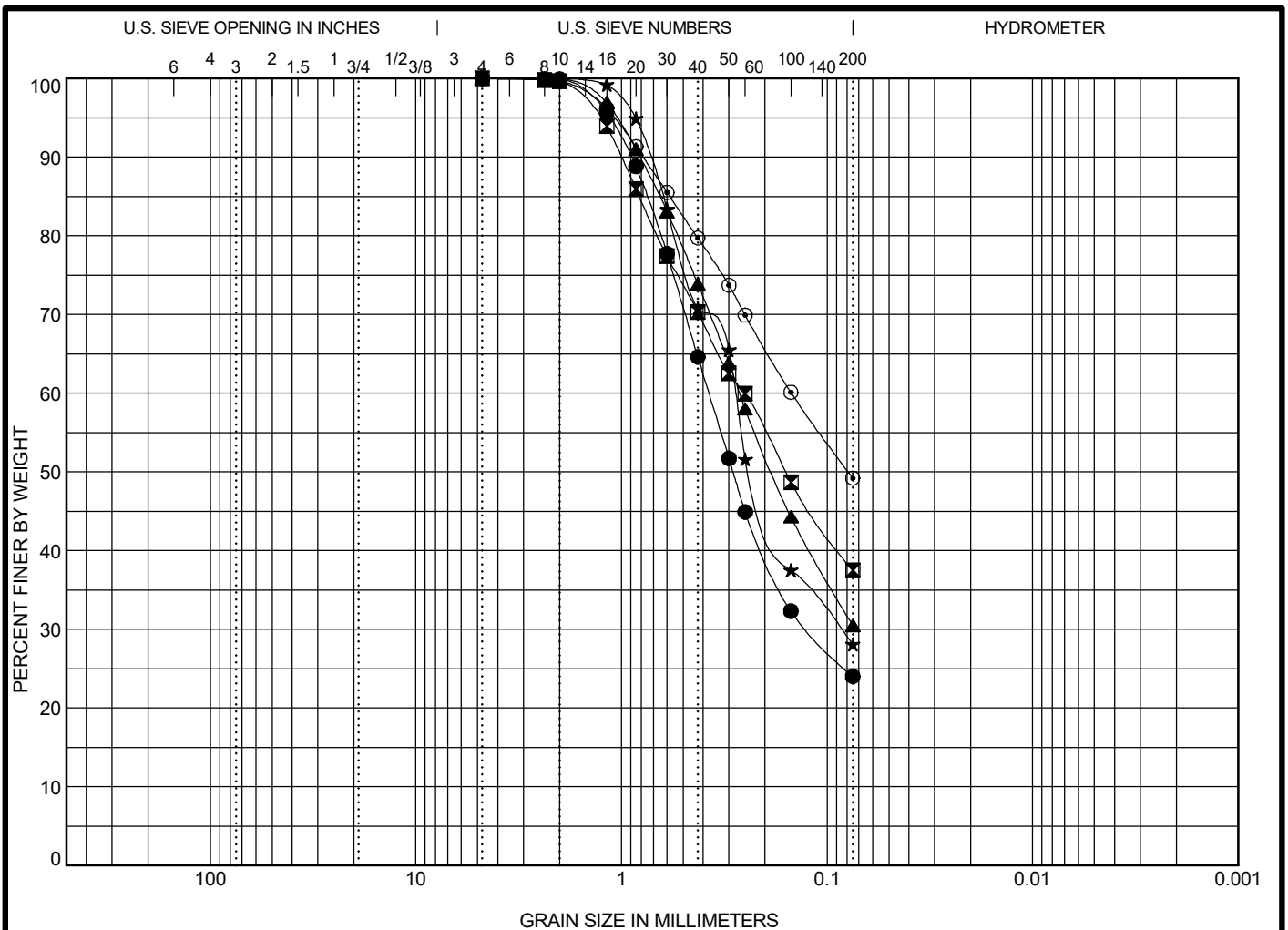
## TEST BORING LOG

JOB NO. A24114.00604.000

BORING NO. B-4

DATE DRILLED 8/15/24

TYPE BORING SB



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

| Specimen Identification |      |              | Classification |       |       | LL  | PL      | PI    | Cc    | Cu    |
|-------------------------|------|--------------|----------------|-------|-------|-----|---------|-------|-------|-------|
| ●                       | 7221 | B-1 23.5-25' | SILTY SAND SM  |       |       | 34  | 27      | 7     |       |       |
| ⊠                       | 7222 | B-2 58.5-60' | SILTY SAND SM  |       |       | 41  | 30      | 11    |       |       |
| ▲                       | 7223 | B-3 8.5-10'  | SILTY SAND SM  |       |       | NP  | NP      | NP    |       |       |
| ★                       | 7224 | B-4 18.5-20' | SILTY SAND SM  |       |       | 44  | 30      | 14    |       |       |
| ⊙                       | 7225 | B-4 23.5-25' | SILTY SAND SM  |       |       | 49  | 37      | 12    |       |       |
| Specimen Identification |      |              | D100           | D60   | D30   | D10 | %Gravel | %Sand | %Silt | %Clay |
| ●                       | 7221 | B-1 23.5-25' | 4.75           | 0.375 | 0.124 |     | 0.0     | 76.0  | 24.0  |       |
| ⊠                       | 7222 | B-2 58.5-60' | 4.75           | 0.252 |       |     | 0.0     | 62.5  | 37.5  |       |
| ▲                       | 7223 | B-3 8.5-10'  | 4.75           | 0.266 |       |     | 0.0     | 69.5  | 30.5  |       |
| ★                       | 7224 | B-4 18.5-20' | 2              | 0.279 | 0.086 |     | 0.0     | 71.9  | 28.1  |       |
| ⊙                       | 7225 | B-4 23.5-25' | 4.75           | 0.149 |       |     | 0.0     | 50.8  | 49.2  |       |

Client: The Water Works Board of the City of Auburn  
144 Tichenor Ave, Suite 7  
Auburn, AL 36830

Test Methods: ASTM D422, ASTM D4318  
Sample Received Date: 8/15/2024  
Test Date(s): Grain Size - 8/26/2024, Atterberg Limits - 8/26/2024



## GRAIN SIZE DISTRIBUTION

Project: Hwy 280 Elevated 300,000 Gallon Water Tank

Location: Auburn, AL

Job No.: A24114.00604.000

Report Date: 8/27/2024

Reviewed By: Steve Carmichael, P.E.

## INVESTIGATIVE FIELD PROCEDURES

Penetration Testing & Split Barrel Sampling: A standard 2.0" O.D. (1.4" I.D.) split barrel sampler is first seated 6" to penetrate any loose cuttings and then driven an additional 12" with blows of a 140-pound hammer falling 30". The number of blows required to drive the sampler the final foot is recorded and designated the "penetration resistance" (N). (ASTM D- 1586)

Soil Boring (SB): The test bore is advanced by a drilling rig utilizing 5-5/8" O.D. (2-1/4" I.D.) hollow stem augers. Soil samples are obtained with a standard split-tube sampler by driving the sampler thru the hollow auger. Collected soil specimens are sealed in air tight containers and delivered to the laboratory to confirm the drillers classifications. (ASTM D- 1452 & 1586)

Auger Boring (AB): Steel flight augers are utilized to advance the test bore. The soils are visually classified and sampled from the cuttings which are brought to the surface. (ASTM D-1452)

Undisturbed Sampling (UD): Relatively undisturbed soil samples are obtained by forcing a section of 3" O.D. 16-gauge steel tubing into the soil at the desired sample location. The tube is then sealed from moisture loss and delivered to the laboratory for possible laboratory testing.

Rotary-Wash Boring (RB): The drilling operation is performed by first setting a length of casing and then advancing the test bore by "jetting" a bentonite solution thru drill rods and bit.

Core Drilling (CD): The test bore is advanced thru rock by coring which utilizes a diamond bit and a double tube, swivel type core barrel. (ASTM D-2113)

Monitoring Wells (MW): Temporary or permanent wells may be installed to provide the accurate water table determination and periodic monitoring. The well is constructed with 1.5" to 4" diameter PVC pipe meeting current standards for monitoring well construction.



## NOTES AND REFERENCES

Soil descriptions are based on the predominate constituent of the material and are further described by appropriate modifiers in reverse order of their importance. For example, a predominate sand soil containing clay would be described as “clayey sand”. Additional modifiers may be used, beginning with the least important constituent such as “silty clayey sand”, etc.

Water levels shown on the test boring logs reflect those levels measured at the specified time and date indicated on the logs. These water levels are subject to seasonal fluctuation and can be effected by local surface drainage and/or rainfall during the monitoring period.

The following table describes soil relative densities and consistencies based on penetration resistance values (N) determined by the Standard Penetration Test. The “N” values are estimated for hand tool bores using a portable dynamic cone penetrometer.

|               | N       | Relative Density |
|---------------|---------|------------------|
| Sand          | 0 – 3   | Very Loose       |
|               | 4 – 9   | Loose            |
|               | 10 – 19 | Firm             |
|               | 20 - 29 | Very Firm        |
|               | 30 - 49 | Dense            |
|               | 50+     | Very Dense       |
|               | N       | Consistency      |
| Clay and Silt | 0 - 2   | Very Soft        |
|               | 3 - 5   | Soft             |
|               | 6 - 11  | Firm             |
|               | 12 - 17 | Stiff            |
|               | 18 - 29 | Very Stiff       |
|               | 30 - 49 | Hard             |
|               | 50+     | Very Hard        |

### Laboratory Test References

| Test                               | Reference           |
|------------------------------------|---------------------|
| Moisture Content.....              | ASTM D-854          |
| Particle Size Analysis.....        | ASTM D-421,422,1140 |
| Atterberg Limit.....               | ASTM D-423, 424     |
| Specific Gravity.....              | ASTM D-2216         |
| Compaction Test.....               | ASTM D-698, 1557    |
| California Bearing Ratio Test..... | AASHTO T-193        |
| Triaxial Shear Test.....           | ASTM D-2850         |
| Unconfined Compression Test.....   | ASTM D-2166         |
| Consolidation Test.....            | ASTM D-2435         |
| Soil Permeability Test.....        | ASTM D-2434         |



# The Unified Soil Classification System

| Major divisions                                                             |                                                                             |                                    | Group symbol | Typical names                                                                                                       | Classification criteria for coarse-grained soils                                                                                                                                                                                                                                                                       |                                                                              |                                                                                                             |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Coarse-grained soils<br>(more than half of material is larger than No. 200) | Gravels (more than half of coarse fraction is larger than No. 4 sieve size) | Clean gravels (little or no fines) | GW           |                                                                                                                     | Well-graded gravels, gravel-sand mixtures, little or no fines                                                                                                                                                                                                                                                          | $C_u \geq 4$<br>$1 \leq C_c \leq 3$                                          |                                                                                                             |
|                                                                             |                                                                             |                                    | GP           |                                                                                                                     | Poorly graded gravels, gravel-sand mixtures, little or no fines                                                                                                                                                                                                                                                        | Not meeting all gradation requirements for GW ( $C_u < 4$ or $1 > C_c > 3$ ) |                                                                                                             |
|                                                                             |                                                                             |                                    | GM           | d/u                                                                                                                 | Silty gravels, gravel-sand-silt mixtures                                                                                                                                                                                                                                                                               | Atterberg limits below A line or $I_p < 4$                                   | Above A line with $4 < I_p < 7$ are borderline cases requiring use of dual symbols                          |
|                                                                             |                                                                             |                                    | GC           |                                                                                                                     | Clayey gravels, gravel-sand-clay mixtures                                                                                                                                                                                                                                                                              | Atterberg limits below A line with $I_p > 7$                                 |                                                                                                             |
|                                                                             | Sands (more than half of coarse fraction is smaller than No. 4 sieve size)  | Clean sands (little or no fines)   | SW           |                                                                                                                     | Well-graded sands, gravelly sands, little or no fines                                                                                                                                                                                                                                                                  | $C_u \geq 6$<br>$1 \leq C_c \leq 3$                                          |                                                                                                             |
|                                                                             |                                                                             |                                    | SP           |                                                                                                                     | Poorly graded sands, gravelly sands, little or no fines                                                                                                                                                                                                                                                                | Not meeting all gradation requirements for SW ( $C_u < 6$ or $1 > C_c > 3$ ) |                                                                                                             |
|                                                                             |                                                                             |                                    | SM           | d/u                                                                                                                 | Silty sands, sand-silt mixtures                                                                                                                                                                                                                                                                                        | Atterberg limits below A line or $I_p < 4$                                   | Limits plotting in hatched zone with $4 \leq I_p \leq 7$ are borderline cases requiring use of dual symbols |
|                                                                             |                                                                             |                                    | SC           |                                                                                                                     | Clayey sands, sand-clay mixtures                                                                                                                                                                                                                                                                                       | Atterberg limits above A line with $I_p > 7$                                 |                                                                                                             |
| Fine-grained soils<br>(more than half of material is smaller than No. 200)  | Silts and clays (liquid limit < 50)                                         | ML                                 |              | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity | 1. Determine percentages of sand and gravel from grain-size curve.<br>2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows:<br>Less than 5%-GW, GP, SW, SP<br>More than 12%-GM, GC, SM, SC<br>5 to 12%-Borderline cases requiring dual symbols. |                                                                              |                                                                                                             |
|                                                                             |                                                                             | CL                                 |              | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays                   |                                                                                                                                                                                                                                                                                                                        |                                                                              |                                                                                                             |
|                                                                             |                                                                             | OL                                 |              | Organic silts and organic silty clays of low plasticity                                                             |                                                                                                                                                                                                                                                                                                                        |                                                                              |                                                                                                             |
|                                                                             | Silts and clays (liquid limit > 50)                                         | MH                                 |              | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts                                 | $C_u = D_{60}/D_{10}$<br>$C_c = D_{30}^2/D_{10}D_{60}$                                                                                                                                                                                                                                                                 |                                                                              |                                                                                                             |
|                                                                             |                                                                             | CH                                 |              | Inorganic clays or high plasticity, fat clays                                                                       |                                                                                                                                                                                                                                                                                                                        |                                                                              |                                                                                                             |
|                                                                             |                                                                             | OH                                 |              | Organic clays of medium to high plasticity, organic silts                                                           |                                                                                                                                                                                                                                                                                                                        |                                                                              |                                                                                                             |
|                                                                             | Highly organic soils                                                        | Pt                                 |              | Peat and other highly organic soils                                                                                 |                                                                                                                                                                                                                                                                                                                        |                                                                              |                                                                                                             |



