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SECTION: 01 60 00 - MATERIALS AND EQUIPMENT

PART 1 - GENERAL

RELATED DOCUMENTS
Drawings and general provision of Contract, including General and Supplementary Conditions and other Division-1 Specifications Sections, apply to this Section.

SUMMARY
This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

Administrative procedures for handling request for substitutions made after award of the Contract are included under Section "Product Substitutions."

SUBMITTALS
Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

Coordinate the product list schedule with the contractor's Construction Schedule and the Schedule of Submittals.

Completed Schedule: Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements. An electronic version of the submittal is acceptable.

Architect's Action: The Architect will respond in writing to the Contractor within 3 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable product selections.

QUALITY ASSURANCE
Source Limitations: To the fullest extent possible, provide products of the same kind, from a sole source.

When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent possible.

Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, that product selected shall be compatible with products previously selected.

PRODUCT DELIVERY, STORAGE, AND HANDLING

Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.

Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within the range required by manufacturer's instructions.

PART 2 - PRODUCTS

General Product Requirements: Provide products that comply with the Contract Documents, which are undamaged and, unless otherwise indicated, unused at the time of installation.

Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulation. Procedures governing product selection include the following:

Proprietary Specification Requirements: Where only a sole product or manufacturer is named, provide the product indicated. No substitutions will be permitted.

Semi proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.

Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contractor Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

Descriptive Specification Requirements: Where Specification describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

Performance Specification Requirements: Where Specification require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standard, codes or regulations specified.

END OF SECTION

SECTION: 01 62 00 - PRODUCT SUBSTITUTION

PART 1 - GENERAL

RELATED DOCUMENTS
Drawings and general provision of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY
This section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."

DEFINITIONS
Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:

Substitutions are considered as included in the Contract Documents and are not subject to requirements specified in the Section for substitutions.

Specified options of products and construction methods included in Contract Documents.

SUBMITTALS
Substitution Request Submittal: Requests for substitution will be considered if received within 60 days after commencement of the Work. Requests received more than 60 days after the accepted Contract Price may be considered or rejected at the discretion of the Architect.

Submit an electronic copy of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

Product Data, including Drawings and descriptions of products, fabrication and installation procedures and samples, where applicable or requested.

A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance, and visual effect.

Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, which will become necessary to accommodate the proposed substitution.

A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

Cost information, including a proposal of the net change, if any to the Contract Sum.

Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, which may subsequently become necessary because of the failure of the substitution to perform adequately.

Architects Action: Within 10 days of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within 3 weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on the use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name.

PART 2 - PRODUCTS

SUBSTITUTIONS

Conditions: The Contractors substitution request will be received and considered by the Architect when extensive revisions to Contract Documents are not required, proposed changes are in keeping with the general intent of Contract Documents, the request is timely, fully documented and properly submitted, and when one or more of the following conditions are satisfied, as determined by the Architect, otherwise requests will be returned without action except to record noncompliance with these requirements.

The request is related to an "or equal" clause of similar language in the Contract Documents.

The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

A substantial advantage is offered to the Owner, in term of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional

compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar consideration.

The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

The specified product or method of construction cannot be coordinated with other materials, and the Contractor certifies that the proposed substitution can be coordinated.

The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION: 01 70 00 - PROJECT CLOSEOUT

PART 1 - GENERAL

RELATED DOCUMENTS
Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY
This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

Inspection procedures.
Project record document submittal.
Operating and maintenance manual submittal.
Submittal of warranties.
Final cleaning.
Owner Instruction.

SUBSTANTIAL COMPLETION
Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following:

In the Application for Payment at Substantial Completion, show 100 percent completion for the portion of the Work claimed as substantially complete.

If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

Advise Owner of pending insurance changeover requirements.

Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates, and similar releases.

Submit as built drawings, record drawings, maintenance manuals, final project photographs, damage or settlement survey, and similar final record information.

Deliver tools, spare parts, extra stock, and similar items.

Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
Complete start-up testing of systems, and instruction of the Owner's operating and

maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

The Architect will repeat inspection when requested and assured that the Work has been substantially completed.

Results of the completed inspection will form the basis of requirements for final acceptance.

FINAL ACCEPTANCE

Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following:

Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operation where required.

Submit an updated final statement, accounting for final additional changes to the Contract Sum.

Submit a certified copy of the Architect's final inspection punch list of items to be completed or corrected. The Contractor will annotate the list, stating that each item has been completed or otherwise resolved for acceptance. The list shall be endorsed and dated by the Architect.

Submit consent of surety to final payment (AIA Form G707)

Submit a final liquidated damages settlement statement.

Submit evidence of final, continuing insurance coverage complying with insurance requirements.

Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, have been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance. If necessary, reinspection will be repeated.

Payment for the cost of services from the Architect for reinspection beyond one (1) at each substantial completion phase and one (1) at Final Inspection will be the responsibility of the Contractor.

RECORD DOCUMENT SUBMITTALS

General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

Record Drawings: Maintain a clean, undamaged set of black line white prints of Contract Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing condition fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to the concealed elements that would be difficult to measure and record at a later date.

Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

Mark added information that is important to the Owner but was not shown on Contract Drawings of Shop Drawings.

Note related Change Order numbers where applicable.

Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, date, and other identification on the cover of each set.

As Built Drawing: The contractor shall engage a competent draftsperson to prepare as-built drawings using information from the record drawings. Draft modifications to the Project on correctable, reproducible prints of the original drawing. Provide the Owner with all corrected and unmodified sheets to comprise a complete set of reproducible, and one printed copy of these documents - bound. Reproducible copies of the original drawings may be obtained from the Architect at reproduction cost.

Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to

show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.

Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records, and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with picket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

Emergency instructions.
Spare parts list.
Copies of warranties.
Wiring diagrams.
Recommended "turn around" cycles.
Inspection procedures.
Shop Drawings and Product Data.
Fixture lamping schedule.

PART 2 - EXECUTION

CLOSEOUT PROCEDURES

Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

As Built Drawings.
Record documents.
Maintenance manuals.
Spare parts and materials.
Tools.
Lubricants.
Fuels,
Identification systems.
Control sequences.

Hazards.
Cleaning.
Warranties and bonds.
Maintenance agreements and similar continuing commitments.

As part of instructions for operating equipment, demonstrate the following procedures:
Start-up.
Shutdown.
Emergency operations.
Noise and vibration adjustments.
Safety procedures.
Economy and efficiency adjustments.
Effective energy utilization.

FINAL CLEANING

General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".

Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

Remove labels that are not permanent labels.

Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean, remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

Pest Control: Engage an experienced exterminator to make a final inspection, and rid the project of rodents, insect, and other pests.

Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of them in a lawful manner.

Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION: 01 71 23 - FIELD ENGINEERING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to the following:

Land survey Work.
Civil engineering services.
Structural engineering services.

SUBMITTALS

Certificates: Submit a certificate signed by the Land Surveyor or Professional Engineer certifying that the location and elevation of improvements comply with the Contract Documents.

Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals" and "Project Closeout".

QUALITY ASSURANCE

Surveyor: Engage a Registered Land Surveyor registered in the State where the project is located, to perform land-surveying services required.

Engineer: Engage a Professional Engineer of the discipline required; registered in the state in which the Project is located, to perform required engineering services.

PART 2 - EXECUTION

EXAMINATION

Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grade or locations. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.

Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verity the existence and location of underground utilities and other construction.

Prior to construction, verify the location and invert elevation at points of connection of

sanitary sewer, storm sewer and water service piping.

PERFORMANCE

Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimension.

Advise entities engaged in construction activities, of marked lines and levels provided for their use.

As construction proceeds, check every major element for line, level and plumb.

Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this lob available for reference.

Record deviation from required lines and levels and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.

Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, line, services, or other appurtenances located in, or affect by construction. Coordinate with local authorities having jurisdiction.

END OF SECTION

SECTION: 01 80 00 - WARRANTIES AND BONDS

PART 1 - GENERAL

RELATED DOCUMENTS
Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specifications Sections, apply to this Section.

SUMMARY
This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

General closeout requirements are included in Section "Project Closeout".

Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Section of Divisions 2 through 50.

Certifications and other commitments and agreements for continuing services to the Owner are specified elsewhere in the Contract Documents.

Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

WARRANTY REQUIREMENTS
Related Damages and Losses: When correcting warranted Work that has failed, remove, and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

Replacement Cost: Upon determination that Work covered by a warranty has failed, replace, or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and

shall not limit the duties, obligations, rights, and remedies otherwise available under the law, not shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with the requirements of the Contract Documents.

The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

SUBMITTALS

Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Final Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect. Warranties are to be for one year from the date of final completion unless specifically accepted in writing.

Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual and bind in a durable 3 ring loose leaf binder.

END OF SECTION

SECTION: 02 30 00 - SUBSURFACE INVESTIGATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

The General Provision of the Contract, including bidding conditions and contractual conditions, applies to the work specified in this section.

1.02 SCOPE:

The geo-technical exploration, boring log and recommendation of the Soil Engineer is made a part of this specification.

TIERRA

REPORT OF GEOTECHNICAL EXPLORATION

American Magic – Port of Pensacola
Phase I
Pensacola, Florida

Tierra Project No. 4511-23-051

Prepared for:

Muller & Muller, Ltd.
700 N. Sangamon Street
Chicago, Illinois 60642
Attn: Mr. Ed Frankowski, AIA

Prepared by:

Tierra, Inc.
175 South A Street
Pensacola, Florida 32502

August 29, 2024

175 South A Street • Pensacola, FL 32502
Phone (850) 462-8774 • Fax (850) 462-8784

TIERRA

August 29, 2024

Muller & Muller, Ltd.
700 N. Sangamon Street
Chicago, Illinois 60642
Attn: Mr. Ed Frankowski, AIA

Subject: American Magic – Port of Pensacola
Phase I
Pensacola, Florida
Tierra Project No. 4511-23-051

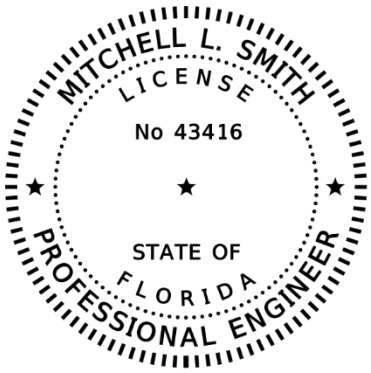
Mr. Frankowski:

Thank you for choosing Tierra, Inc. (Tierra) as your Geotechnical consultant. Per your authorization, we have completed the Geotechnical exploration for the subject project. The results of the study are discussed in this report.

Should you have any questions regarding the enclosed report or the project in general, please do not hesitate to contact us at (850) 462-8774.

Sincerely,
TIERRA, INC.

Matthew R. McCoy, EI
Engineer Intern



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

TIERRA, INC.
1300 WEST MAIN STREET
PENSACOLA, FLORIDA 32502

MITCHELL L. SMITH, P.E. NO. 43416

Mitchell L. Smith, PE
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1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed on this project was issued by Ms. Catherine Muller, President, Muller & Muller, Ltd. (Muller & Muller). A formal contract has been executed between Tierra, Inc. (Tierra) and Muller & Muller for these services.

1.2 Project Description

Phase I of the project consists of remodeling Building 10 which will serve as the headquarters for the American Magic team. The remodel consists of modifications to the east wall of the building and the construction of a mezzanine inside the building. The finished floor elevation of the building will remain at the current elevation of approximately +6.9 feet NAVD88.

The column loads along the east wall of the building include 30 kips of dead load, 15 kips of live load, and 50 kips (down) of wind load. The footings supporting the columns will measure 8 feet square and will bear 5 feet to 5 ½ feet below the finished floor elevation of +6.9 feet, or near elevation +1.5 feet. The column loads for the mezzanine include 40 kips of dead load and 40 kips of live load. The footings supporting these columns will measure 7 feet square and will bear 3 feet below the finished floor elevation of +6.9 feet, or near elevation +4 feet.

If any of the project information noted above is incorrect or has changed, please inform Tierra so that we may amend the recommendations presented in this report, if necessary.

1.3 Purpose and Scope of Services

The purpose of this exploration was to evaluate the subsurface conditions present in the subject areas and to render site preparation and foundation recommendations for the proposed project.

The exploration consisted of three (3) 81-foot deep Standard Penetration Test (SPT) borings; laboratory soil testing including water content tests, wash #200 sieve tests, and Atterberg Limit tests; and a site visit, visual classification of the soil samples, and analysis by our engineering staff.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous/toxic materials in the air, surface water(s), soil, or groundwater on or in the vicinity of the subject site. Any statements in this report or on the Soil Profiles regarding odors, stains, or unusual/suspicious conditions are strictly for the information of the client.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 Site Location and Description

Building 10 is located in the central portion of the Port of Pensacola, Florida. The general location is shown on the Boring Location Plan (Sheet 1, Appendix A).

At the time of this study, the skin of the steel framed building had been removed to expose the steel frame. The area east of the building, where the access path from the building to the dock, was and has been used for years as a storage area for rock aggregate.

The building had a finished floor elevation of +6.9 feet. Based on the topographic survey provided, site grades outside and east of the building ranged from +5 feet to +10 feet .

2.2 Subsurface Conditions

The Boring Location Plan and the Soil Profiles of the borings drilled for this study are attached in Appendix A. The borings were field located using a Garmin GPSMap 66ST Global Positioning System (GPS) unit with a reported accuracy of ±1 meter. Therefore, the boring locations should be considered approximate. The subsurface conditions encountered are discussed in general terms below.

The borings generally encountered very loose to loose sand and silty sand from the ground surface to a depth of approximately 25 feet to 30 feet below existing grade underlain by soft to stiff clay to roughly 60 feet where dense to very dense sands and silty sands were present to the bottom of the maximum 81 foot deep borings. Note that limerock aggregate was encountered in two of the borings (BB-1 and BB-3) to depths of approximately 6 inches to 4 feet below existing grade.

The above subsurface description is of a generalized nature provided to highlight the major soil strata encountered. The Soil Profiles should be reviewed for specific subsurface conditions at each boring location. The stratification shown on the Soil Profiles represents the subsurface conditions at the actual boring locations only, and variations in the subsurface conditions can and may occur between boring locations and should therefore be expected. The stratification represents the approximate boundary between subsurface materials, and the transitions between strata may be gradual.

2.3 Groundwater Conditions

Groundwater was encountered roughly 2 feet to 5 feet below grade (or at approximately elevation +3 to +4 feet NAVD 88) at the time of drilling, which was during a period of above-normal rainfall (approximately 6 inches above normal the trailing 3 months prior to drilling). Groundwater levels will fluctuate with rainfall and tides and could vary several feet during typical seasonal fluctuations. Larger fluctuations are possible under severe weather conditions. Estimated "normal" seasonal high groundwater elevations are shown on the Soil Profiles (Appendix A).

2.4 Laboratory Soil Testing

Laboratory soil testing consisted of water content tests, wash #200 sieve tests, and Atterberg Limit tests. The results of the water content, wash #200 sieve, and Atterberg Limit tests can be found on the Soil Profiles opposite the samples tested.

3.0 EVALUATION AND RECOMMENDATIONS

Based on the structural loading conditions provided and the subsurface conditions encountered in the borings, shallow foundations can be utilized to support the proposed mezzanine and end wall column footings. Settlement calculations using the column loads and the footing details yielded total settlements of approximately ½ inch to 1 inch, which is within commonly accepted tolerances.

The soils immediately beneath and to a mind depth of 12 inches below the footings should be compacted to a minimum soil density of 98% of the Modified Proctor test (ASTM D1557).

Note that groundwater was encountered at elevations ranging from +3 feet to +5 feet at the time of drilling. Therefore, dewatering will be required to construct the footings. The dewatering system should be designed to lower and maintain the groundwater table as need to compact the foundation soils and to maintain a dry and hydrostatic free condition until such time that it is safe to remove the system from operation without fear of water intrusion into the concrete and uplift instability of the footing.

4.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by Tierra, Inc. and design details furnished by Muller & Muller for the subject project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Tierra should be notified immediately to determine if changes in the foundation, or other, recommendations are required. If Tierra is not retained to perform these functions, we cannot be responsible for the impact of such conditions on the performance of the project.

The findings, recommendations, specifications, and professional advice contained herein have been made in accordance with generally accepted professional Geotechnical engineering practices in the local area.

After the plans and specifications are more complete, the Geotechnical engineer should be provided the opportunity to review the final design plans and specifications to assure our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Muller & Muller for the specific application to the subject project.

APPENDIX A

Boring Location Plan

Soil Profiles

NOTE: BASE MAP PROVIDED BY BASKERVILLE-DONOVAN, INC.

BORING LOCATION PLAN

0 100'

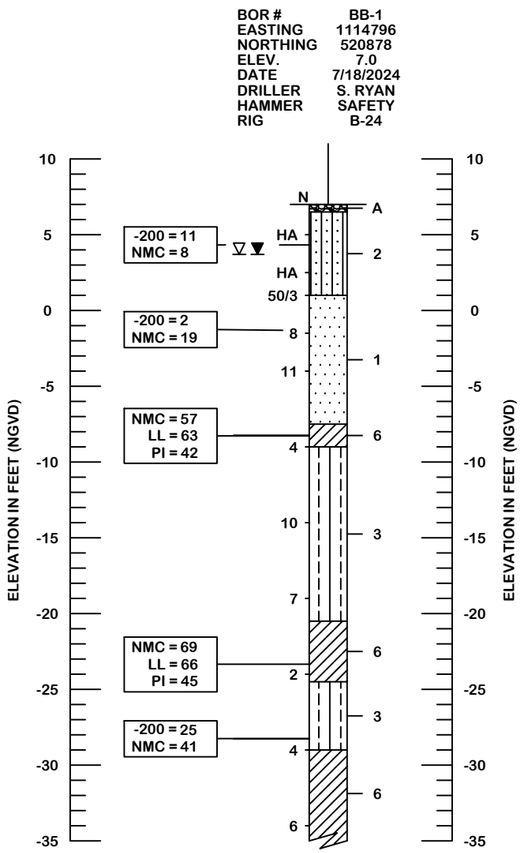
PLAN SCALE

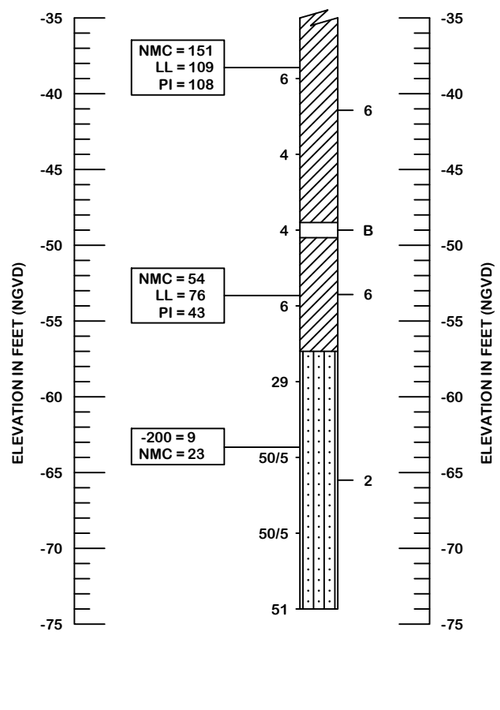
LEGEND

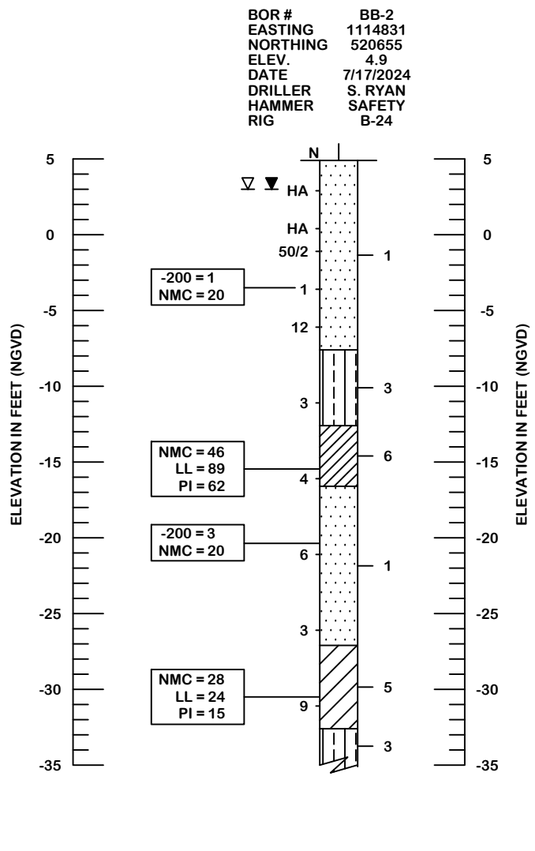
APPROXIMATE LOCATION OF SPT BORING

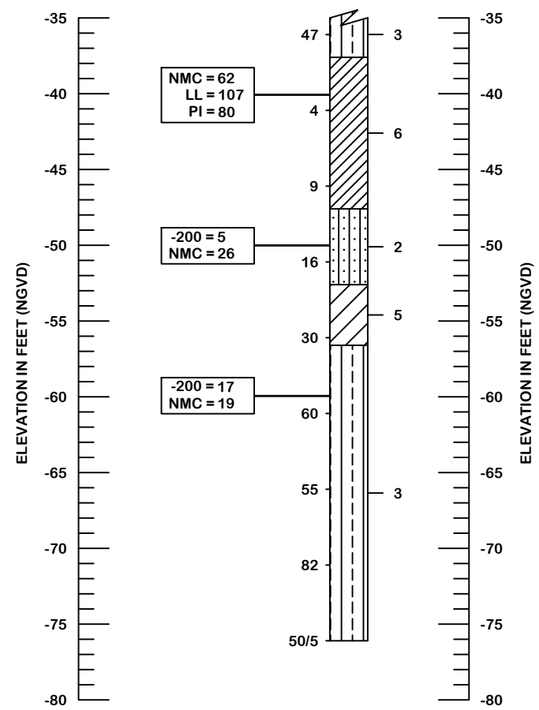
PHASE 1

DRAWN BY: SW CHECKED BY: MMC	APPROVED BY: MLS DATE: AUG 2024	ENGINEER OF RECORD: MITCHELL L. SMITH, P.E. FLORIDA LICENSE NO.: 43416	TIERRA 175 South A Street Pensacola, Florida 32502 Phone: 850-462-8774 Fax: 850-462-8784	SCALE: NOTED	PROJECT NUMBER: 4511-23-051	GEOTECHNICAL ENGINEERING SERVICES AMERICAN MAGIC PORT OF PENSACOLA ESCAMBIA COUNTY, FLORIDA	SHEET 1









LEGEND

1 GRAY, BROWN, WHITE SAND (SP)

2 GRAY, BROWN SLIGHTLY SILTY SAND (SP-SM)

3 GRAY, BROWN, ORANGE SILTY SAND (SM)

4 GRAY, BROWN, ORANGE CLAYEY SAND (SC)

5 GRAY CLAY (CL)

6 DARK GRAY, GREEN CLAY (CH)

A GRAVEL

B - WOOD

▼ GROUNDWATER LEVEL ENCOUNTERED DURING INVESTIGATION

▽ ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCES
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)

N	SPT N-VALUE IN BLOWS/FOOT FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED)
EASTING	EASTING COORDINATE REFERENCED TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, FLORIDA NORTH ZONE, N.A.D. 83 DETERMINED USING HAND-HELD GARMIN GPS MAP 64 ST GPS GLOBAL POSITIONING SYSTEM WITH A REPORTED ACCURACY OF +/- 1 METER.
NORTHING	NORTHING COORDINATE REFERENCED TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, FLORIDA NORTH ZONE, N.A.D. 83 DETERMINED USING HAND-HELD GARMIN EGARMIN GPS MAP 64 ST GPS GLOBAL POSITIONING SYSTEM WITH A REPORTED ACCURACY OF +/- 1 METER.

SAFETY HAMMER	
GRANULAR MATERIALS-RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4
LOOSE	4 TO 10
MEDIUM	10 TO 30
DENSE	30 TO 50
VERY DENSE	GREATER THAN 50
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2
SOFT	2 TO 4
FIRM	4 TO 8
STIFF	8 TO 15
VERY STIFF	15 TO 30
HARD	GREATER THAN 30

PHASE 1

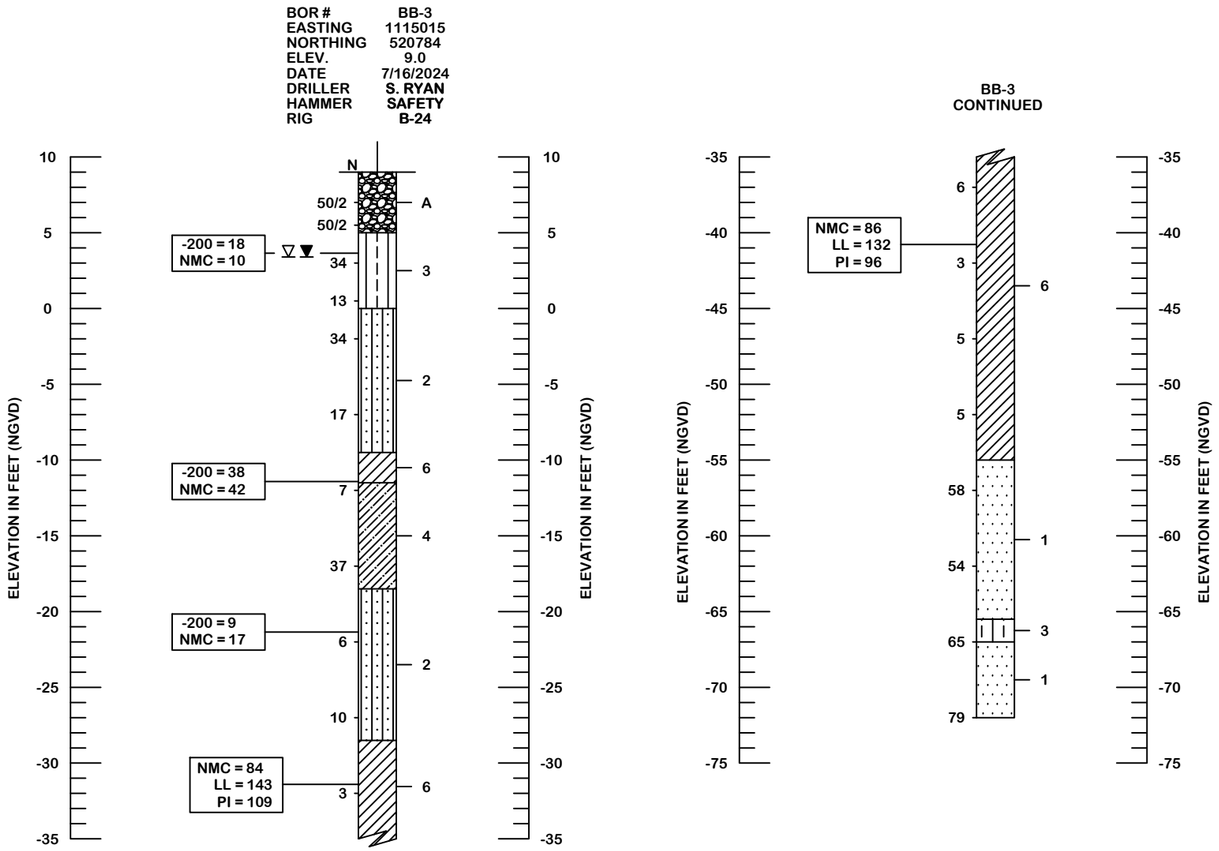
DRAWN BY: SW
CHECKED BY: MMC
APPROVED BY: MLS
DATE: AUG 2024
ENGINEER OF RECORD: MITCHELL L. SMITH, P.E.
FLORIDA LICENSE NO.: 43416

TIERRA
175 South A Street
Pensacola, Florida 32502
Phone: 850-462-8774 Fax: 850-462-8784

SCALE: NOTED
PROJECT NUMBER: 4511-23-051

GEOTECHNICAL ENGINEERING SERVICES
AMERICAN MAGIC PORT OF PENSACOLA
ESCAMBIA COUNTY, FLORIDA

SHEET 2



LEGEND

1	GRAY, BROWN, WHITE SAND (SP)	5	GRAY CLAY (CL)
2	GRAY, BROWN SLIGHTLY SILTY SAND (SP-SM)	6	DARK GRAY, GREEN CLAY (CH)
3	GRAY, BROWN, ORANGE SILTY SAND (SM)	A	GRAVEL
4	GRAY, BROWN, ORANGE CLAYEY SAND (SC)		B - WOOD
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PHASE 1

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DATE: AUG 2024
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FLORIDA LICENSE NO.: 43416

TIERRA
175 South A Street
Pensacola, Florida 32502
Phone: 850-462-8774 Fax: 850-462-8784

SCALE: NOTED
PROJECT NUMBER: 4511-23-051

GEOTECHNICAL ENGINEERING SERVICES
AMERICAN MAGIC PORT OF PENSACOLA
ESCAMBIA COUNTY, FLORIDA

SHEET 3

TIERRA

REPORT OF GEOTECHNICAL EXPLORATION

American Magic – Port of Pensacola
Phase II Design
Pensacola, Florida

Tierra Project No. 4511-23-051

Prepared for:

Muller & Muller, Ltd.
700 N. Sangamon Street
Chicago, Illinois 60642
Attn: Mr. Ed Frankowski, AIA

Prepared by:

Tierra, Inc.
175 South A Street
Pensacola, Florida 32502

January 10, 2025

175 South A Street • Pensacola, FL 32502
Phone (850) 462-8774 • Fax (850) 462-8784

TIERRA

January 10, 2025

Muller & Muller, Ltd.
700 N. Sangamon Street
Chicago, Illinois 60642
Attn: Mr. Ed Frankowski, AIA

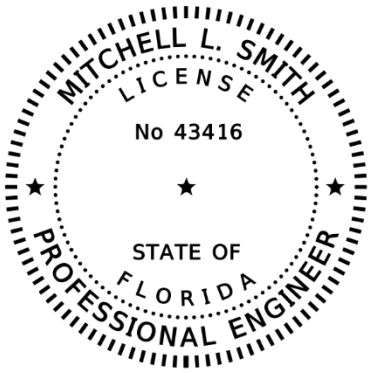
Subject: American Magic – Port of Pensacola
Phase II Design
Pensacola, Florida
Tierra Project No. 4511-23-051

Mr. Frankowski:

Thank you for choosing Tierra, Inc. (Tierra) as your Geotechnical consultant. Per your authorization, we have completed the Phase II Geotechnical exploration for the subject project. The results of the study are discussed in this report.

Should you have any questions regarding the enclosed report or the project in general, please do not hesitate to contact us at (850) 462-8774.

Sincerely,
TIERRA, INC.



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

TIERRA, INC.
1300 WEST MAIN STREET
PENSACOLA, FLORIDA 32502

MITCHELL L. SMITH, P.E. NO. 43416

Matthew R. McCoy, EI
Engineer Intern

Mitchell L. Smith, PE
Principal Geotechnical Engineer
Florida License No. 43416

175 South A Street • Pensacola, FL 32502
Phone (850) 462-8774 • Fax (850) 462-8784

TABLE OF CONTENTS

1.0 PROJECT INFORMATION

1.1 Project Authorization

Authorization to proceed on this project was issued by Ms. Catherine Muller, President, Muller & Muller, Ltd. (Muller & Muller). A formal contract has been executed between Tierra, Inc. (Tierra) and Muller & Muller for these services.

1.2 Project Description

Phase II of the project includes a berth with anchored steel sheetpile bulkheads, a steel sheetpile breakwater south and east of the berth, and a new channel on the east side of the Port of Pensacola leading from the berth to the Federal Channel located south of the Port.

The berth and the channel leading from the berth to the Federal Channel will be dredged to EL -20 feet. The berth will have anchored steel sheetpiles.

The steel sheetpile breakwater will be anchored laterally by steel H-Piles. Based on conversations with the structural engineer, 12x89 H-Piles are anticipated as they have been used on similar projects in the area. Rip rap will be placed on the seaward side of the sheetpiles for scour protection.

If any of the project information noted above is incorrect or has changed, please inform Tierra so that we may amend the recommendations presented in this report, if necessary.

1.3 Purpose and Scope of Services

The purpose of this exploration was to evaluate the subsurface conditions present in the subject areas and to provide Geotechnical design parameters to support design of the steel sheetpile bulkheads and breakwater structures, and mechanical characterization of the proposed dredge materials from the proposed channel. Note that the channel borings were sampled with decontaminated soil samplers so that split samples could be collected to allow the design team to perform chemical analyses on the proposed dredge spoils as required for permitting. The soil samples were collected, placed in sample jars provided by Baskerville-Donovan, Inc. (BDI), and then placed in coolers for daily collection by BDI.

The exploration consisted of nine (9) 15-foot to 75-foot deep Standard Penetration Test (SPT) borings; laboratory soil testing including water content tests, wash #200 sieve tests, grainsize

analysis tests, and Atterberg Limit tests; and a site visit, visual classification of the soil samples, and analysis by our engineering staff.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous/toxic materials in the air, surface water(s), soil, or groundwater on or in the vicinity of the subject site. Any statements in this report or on the Soil Profiles regarding odors, stains, or unusual/suspicious conditions are strictly for the information of the client.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 Site Location and Description

Phase II of the project is located east of Building 10 along the east portion of the Port of Pensacola, Florida. The general location is shown on the Boring Location Plan (Sheet 4, Appendix A).

At the time of this study, the area east of Building 10 has and is currently being as a stockpile area for coarse aggregate (e.g. limerock base material). The berth, breakwater, and the channel to be dredged are east of the Port in Pensacola Bay.

Based on the topographic and bathymetric surveys provided, site grades ranged from approximately EL +10 feet on land to as low as EL -13 feet in the proposed channel area.

2.2 Subsurface Conditions

The Boring Location Plan and the Soil Profiles of the borings drilled for this study are attached in Appendix A. The borings were field located using a Garmin GPSMap 66ST Global Positioning System (GPS) unit with a reported accuracy of ±1 meter. Therefore, the boring locations should be considered approximate. The subsurface conditions encountered are discussed in general terms below.

The land side borings near the berth (BB-4 and BB-5) generally encountered the following idealized profile:

Elevation (ft. NAVD 88)	Soil Description
+10’ to +8’	Stockpiled limerock base material (coarse aggregate)
+8’ to -15’	Very loose to loose SAND (SP) and slightly silty SAND (SP-SM)
-15’ to -52’	Soft to stiff CLAY (CL, CH)
-52’ to -66’	Dense to very dense slightly silty SAND (SP-SM)

The marine breakwater and dredge borings (B-6 through BB-12) generally encountered the following idealized profile:

Elevation (ft. NAVD 88)	Soil Description
-5’ to -15’	Very loose to loose SAND (SP)
-15’ to -64’	Very loose clayey SAND (SC) and soft to firm CLAY (CL, CH)
-64’ to -85’	Dense to very dense SAND (SP)

The above subsurface descriptions are of a generalized nature, provided to highlight the major soil strata encountered. The Soil Profiles should be reviewed for specific subsurface conditions at each boring location. The stratification shown on the Soil Profiles represents the subsurface conditions at the actual boring locations only, and variations in the subsurface conditions can and may occur between boring locations and should therefore be expected. The stratification represents the approximate boundary between subsurface materials, and the transitions between strata may be gradual.

2.3 Groundwater Conditions

Groundwater (on the land side borings, BB-4 and BB-5) was encountered near elevation +2 feet NAVD 88 at the time of drilling, which was during a period of above-normal rainfall (approximately 6 inches above normal the trailing 3 months prior to drilling). Groundwater levels will fluctuate with rainfall and tides and could vary several feet during typical seasonal fluctuations. Larger fluctuations are possible under severe weather conditions. Estimated “normal” seasonal high groundwater elevations for the landside borings are shown on the Soil Profiles (Appendix A).

2.4 Laboratory Soil Testing

Laboratory soil testing consisted of water content tests, wash #200 sieve tests, grainsize analysis tests, and Atterberg Limit tests. The results of the water content, wash #200 sieve, and Atterberg Limit tests can be found on the Soil Profiles opposite the samples tested. The grainsize analysis tests and laboratory tests mentioned above are also summarized in Table 1 (Appendix A).

3.0 EVALUATION AND RECOMMENDATIONS

3.1 Berth Sheetpile Wall Parameters

The planned steel sheetpile walls for the berth will be anchored with either piles or deadmen. Geotechnical design parameters for design of the steel sheetpile walls are presented in Table 2 (Appendix B).

Note that the borings drilled in this area (BB-4 and BB-5) encountered soft to firm clay from approximately EL -28 feet to EL -52 feet. With the berth being dredged to EL -20 feet and the adjacent upland area being at/near EL +10 feet, the anchored wall will retain approximately 30 feet of soil. Depending on the chosen sheetpile wall section and the lateral analyses performed by the Structural engineer, it is possible if not likely that the anchored sheetpiles will be tipped in the soft to firm clay. We recommend that once the lateral analyses have been performed and the sheetpile tip elevation(s) have been determined from a structural engineering perspective, that a global stability analyses be performed to confirm that slope stability is stable with the tip elevation calculated or if the sheetpiles piles need to be deepened to provide a minimum Factor of Safety of 1.3 against failure.

3.2 Marine Breakwater Design Parameters

The marine breakwater will consist of steel sheetpiles with steel H-piles to anchor the system to resist lateral loads. In addition, rip rap will be placed on the seaward side of the sheetpiles for scour protection.

Geotechnical parameters for lateral analysis of the steel H-Piles are presented in Appendix B. Geotechnical design parameters for the steel sheetpiles (if needed, given the use of H-piles to resist lateral loads) are presented in Table 2 (Appendix B).

4.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by Tierra, Inc. and design details furnished by Muller & Muller for the subject project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Tierra should be notified immediately to determine if changes in the foundation, or other, recommendations are required. If Tierra is not retained to perform these functions, we cannot be responsible for the impact of such conditions on the performance of the project.

The findings, recommendations, specifications, and professional advice contained herein have been made in accordance with generally accepted professional Geotechnical engineering practices in the local area.

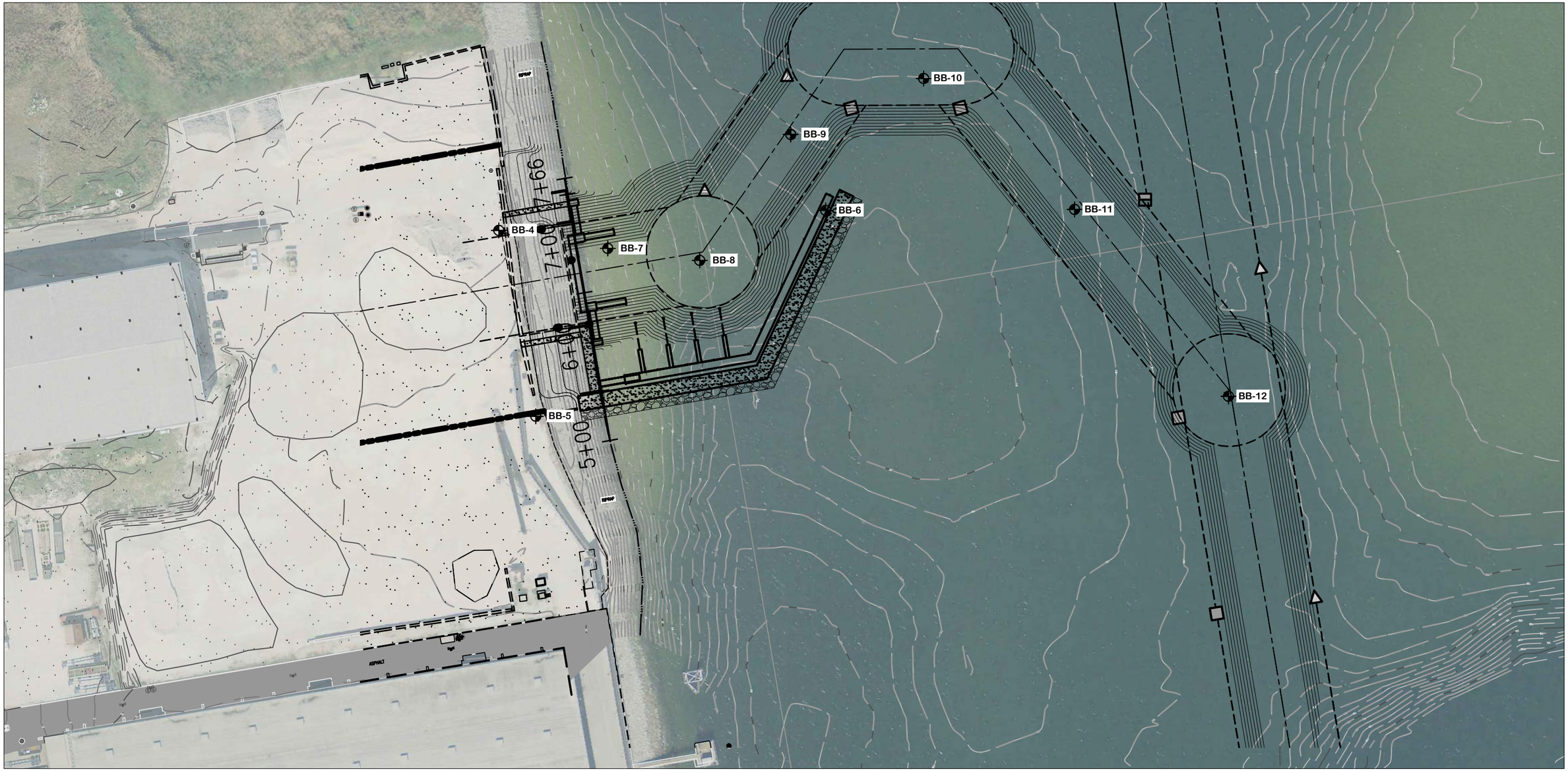
After the plans and specifications are more complete, the Geotechnical engineer should be provided the opportunity to review the final design plans and specifications to assure our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Muller & Muller for the specific application to the subject project.

APPENDIX A

Boring Location Plan

Soil Profiles

Table 1 – Summary of Laboratory Test Results



NOTE: BASE MAP PROVIDED BY BASKERVILLE-DONOVAN, INC.

BORING LOCATION PLAN

0 100'

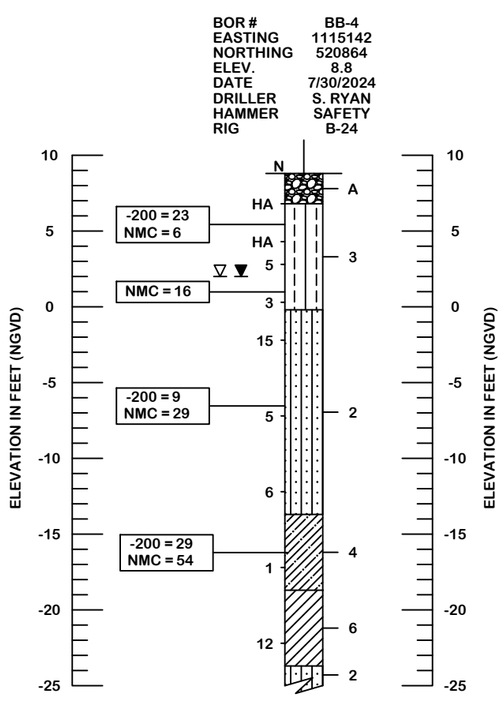
PLAN SCALE

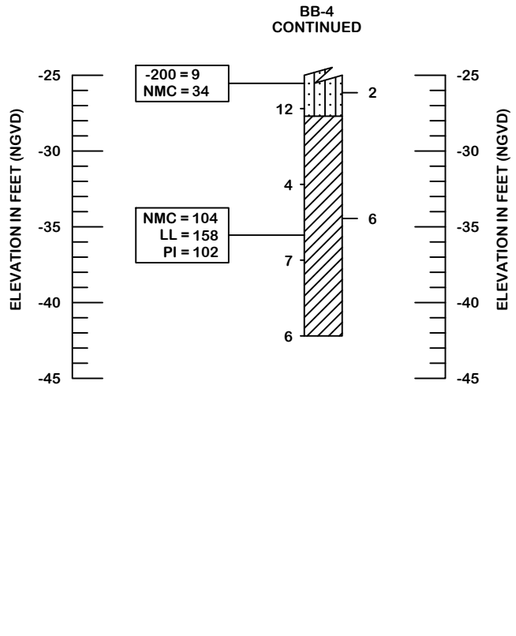
LEGEND

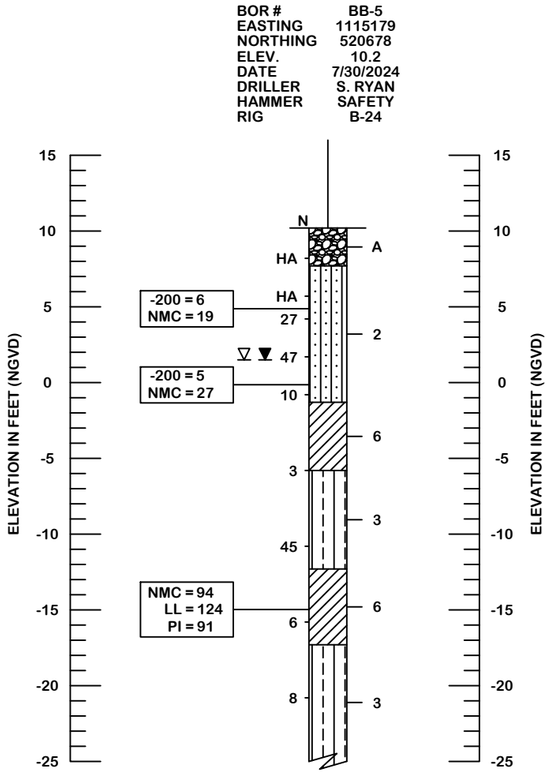
APPROXIMATE LOCATION OF SPT BORING

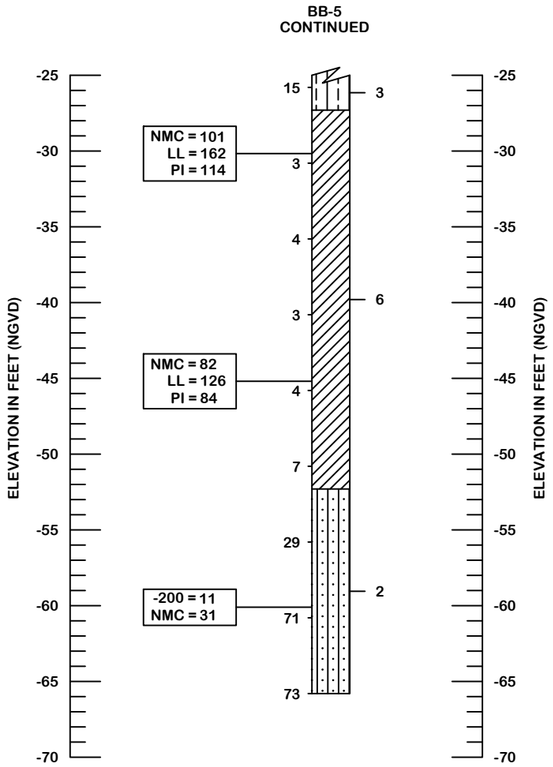
PHASE 2

DRAWN BY: SW CHECKED BY: MMC	APPROVED BY: MLS DATE: JAN 2025	ENGINEER OF RECORD: MITCHELL L. SMITH, P.E. FLORIDA LICENSE NO.: 43416	TIERRA 175 South A Street Pensacola, Florida 32502 Phone: 850-462-8774 Fax: 850-462-8784	SCALE: NOTED	PROJECT NUMBER: 4511-23-051	GEOTECHNICAL ENGINEERING SERVICES AMERICAN MAGIC PORT OF PENSACOLA ESCAMBIA COUNTY, FLORIDA	SHEET 4









LEGEND

1	GRAY, BROWN, WHITE SAND (SP)	5	GRAY CLAY (CL)
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PHASE 2

DRAWN BY: SW
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APPROVED BY: MLS
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ENGINEER OF RECORD: MITCHELL L. SMITH, P.E.
FLORIDA LICENSE NO.: 43416

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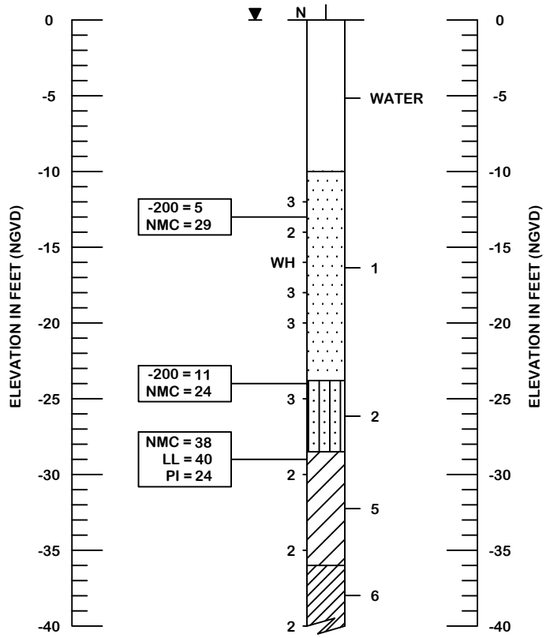
GEOTECHNICAL ENGINEERING SERVICES
AMERICAN MAGIC PORT OF PENSACOLA
ESCAMBIA COUNTY, FLORIDA

SHEET 5

BOR # BB-6
EASTING 1115469
NORTHING 520884
ELEV. -10
DATE 12/10/2024
DRILLER D. STAKELIN
HAMMER SAFETY
RIG BARGE



BB-6
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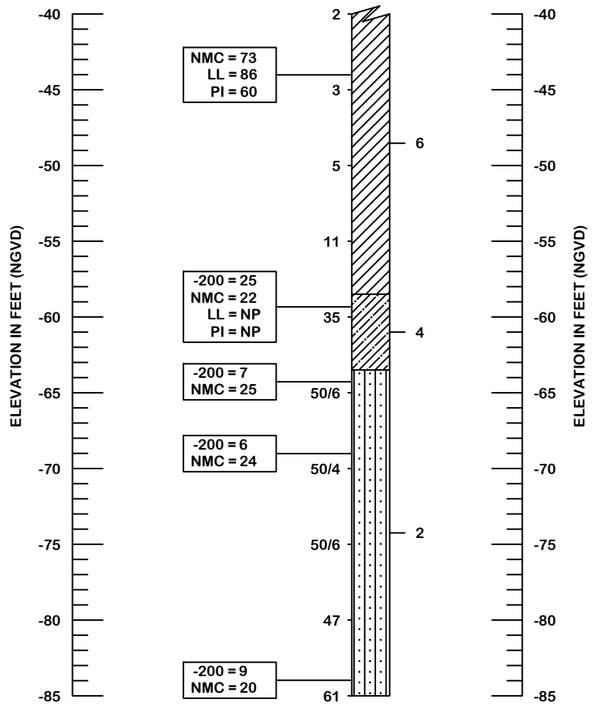

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		▼	GROUNDWATER LEVEL ENCOUNTERED DURING INVESTIGATION
		▽	ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCES
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON PLASTIC

N	SPT N-VALUE IN BLOWS/FOOT FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED)
EASTING	EASTING COORDINATE REFERENCED TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, FLORIDA NORTH ZONE, N.A.D. 83 DETERMINED USING HAND-HELD GARMIN GPS MAP 64 ST GPS GLOBAL POSITIONING SYSTEM WITH A REPORTED ACCURACY OF +/- 1 METER.
NORTHING	NORTHING COORDINATE REFERENCED TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, FLORIDA NORTH ZONE, N.A.D. 83 DETERMINED USING HAND-HELD GARMIN EGARMIN GPS MAP 64 ST GPS GLOBAL POSITIONING SYSTEM WITH A REPORTED ACCURACY OF +/- 1 METER.

SAFETY HAMMER	
GRANULAR MATERIALS-RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4
LOOSE	4 TO 10
MEDIUM	10 TO 30
DENSE	30 TO 50
VERY DENSE	GREATER THAN 50
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2
SOFT	2 TO 4
FIRM	4 TO 8
STIFF	8 TO 15
VERY STIFF	15 TO 30
HARD	GREATER THAN 30

PHASE 2

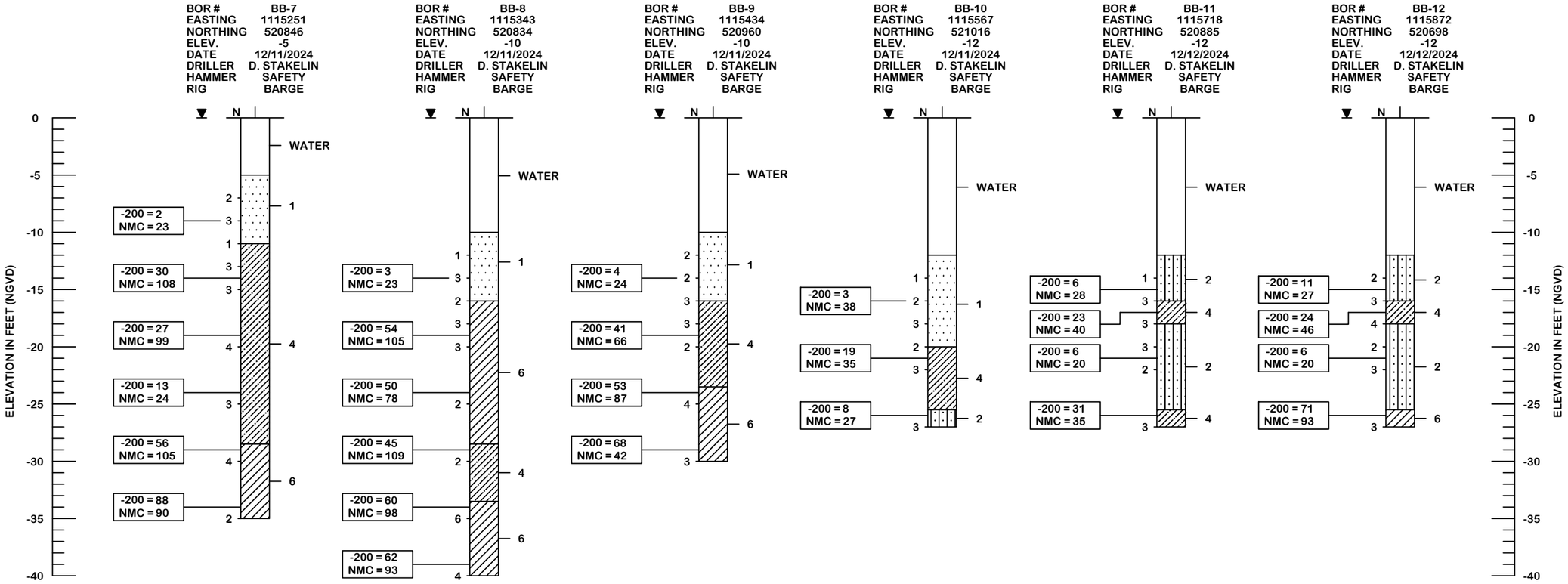
DRAWN BY: SW
CHECKED BY: MMC
APPROVED BY: MLS
DATE: JAN 2025
ENGINEER OF RECORD: MITCHELL L. SMITH, P.E.
FLORIDA LICENSE NO.: 43416

TIERRA
175 South A Street
Pensacola, Florida 32502
Phone: 850-462-8774 Fax: 850-462-8784

SCALE: NOTED
PROJECT NUMBER: 4511-23-051

GEOTECHNICAL ENGINEERING SERVICES
AMERICAN MAGIC PORT OF PENSACOLA
ESCAMBIA COUNTY, FLORIDA

SHEET 6



LEGEND

1 GRAY, BROWN, WHITE SAND (SP)

2 GRAY, BROWN SLIGHTLY SILTY SAND (SP-SM)

3 GRAY, BROWN, ORANGE SILTY SAND (SM)

4 GRAY, BROWN, ORANGE CLAYEY SAND (SC)

5 GRAY CLAY (CL)

6 DARK GRAY, GREEN CLAY (CH)

A GRAVEL

B - WOOD

▼ GROUNDWATER LEVEL ENCOUNTERED DURING INVESTIGATION

▽ ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

SP	UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW
50/4	NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION
HA	HAND AUGERED TO VERIFY UTILITY CLEARANCES
-200	PERCENT PASSING #200 SIEVE
NMC	NATURAL MOISTURE CONTENT (%)
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
NP	NON PLASTIC

N	SPT N-VALUE IN BLOWS/FOOT FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED)
EASTING	EASTING COORDINATE REFERENCED TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, FLORIDA NORTH ZONE, N.A.D. 83 DETERMINED USING HAND-HELD GARMIN GPS MAP 64 ST GPS GLOBAL POSITIONING SYSTEM WITH A REPORTED ACCURACY OF +/- 1 METER.
NORTHING	NORTHING COORDINATE REFERENCED TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, FLORIDA NORTH ZONE, N.A.D. 83 DETERMINED USING HAND-HELD GARMIN EGARMIN GPS MAP 64 ST GPS GLOBAL POSITIONING SYSTEM WITH A REPORTED ACCURACY OF +/- 1 METER.

SAFETY HAMMER	
GRANULAR MATERIALS-RELATIVE DENSITY	SPT N-VALUE (BLOWS/FT.)
VERY LOOSE	LESS THAN 4
LOOSE	4 TO 10
MEDIUM	10 TO 30
DENSE	30 TO 50
VERY DENSE	GREATER THAN 50
SILTS AND CLAYS CONSISTENCY	SPT N-VALUE (BLOWS/FT.)
VERY SOFT	LESS THAN 2
SOFT	2 TO 4
FIRM	4 TO 8
STIFF	8 TO 15
VERY STIFF	15 TO 30
HARD	GREATER THAN 30

PHASE 2

DRAWN BY: SW
CHECKED BY: MMC
APPROVED BY: MLS
DATE: JAN 2025
ENGINEER OF RECORD: MITCHELL L. SMITH, P.E.
FLORIDA LICENSE NO.: 43416

TIERRA
175 South A Street
Pensacola, Florida 32502
Phone: 850-462-8774 Fax: 850-462-8784

SCALE: NOTED
PROJECT NUMBER: 4511-23-051

GEOTECHNICAL ENGINEERING SERVICES
AMERICAN MAGIC PORT OF PENSACOLA
ESCAMBIA COUNTY, FLORIDA

SHEET 7

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS
AMERICAN MAGIC - PHASE II
ESCAMBIA COUNTY, FLORIDA
TIERRA PROJECT NO. 4511-23-051

STRATUM	BORING	SAMPLE DEPTH (ft)			MOISTURE CONTENT (%)	SIEVE ANALYSES (% PASSING)					ATTERBERG LIMITS (%)		USCS
						#10	#40	#60	#100	#200	LL	PI	
3	BB-4	2	-	4.5	6	---	---	---	---	23	---	---	SM
2	BB-4	7	-	8.5	16	---	---	---	---	---	---	---	SP-SM
2	BB-4	14.5	-	16	29	---	---	---	---	9	---	---	SP-SM
4	BB-4	24.5	-	26	54	---	---	---	---	29	---	---	SC
2	BB-4	34.5	-	36	34	---	---	---	---	9	---	---	SP-SM
6	BB-4	44.5	-	46	104	---	---	---	---	---	158	102	CH
2	BB-5	4.5	-	6	19	---	---	---	---	6	---	---	SP-SM
2	BB-5	9.5	-	11	27	---	---	---	---	5	---	---	SP-SM
6	BB-5	24.5	-	26	94	---	---	---	---	---	124	91	CH
6	BB-5	39.5	-	41	101	---	---	---	---	---	162	114	CH
6	BB-5	54.5	-	56	82	---	---	---	---	---	126	84	CH
2	BB-5	69.5	-	71	31					11	---	---	SP-SM
1	BB-6	2	-	4	29	---	---	---	---	5	---	---	SP
2	BB-6	13.5	-	15	24	---	---	---	---	11	---	---	SP-SM
5	BB-6	18.5	-	20	38	---	---	---	---	---	40	24	CL
6	BB-6	33.5	-	35	73	---	---	---	---	---	86	60	CH
4	BB-6	48.5	-	50	22	---	---	---	---	25	NP	NP	SC
2	BB-6	53.5	-	55	25	---	---	---	---	7	---	---	SP-SM
2	BB-6	58.5	-	60	24	---	---	---	---	6	---	---	SP-SM
2	BB-6	73.5	-	75	20	---	---	---	---	9	---	---	SP-SM
1	BB-7	2	-	6	23	99	81	36	7	2	---	---	SP
4	BB-7	8	-	10	108	94	64	52	41	30	---	---	SC
4	BB-7	13.5	-	15	99	79	61	47	35	27	---	---	SC
4	BB-7	18.5	-	20	24	99	82	43	25	13	---	---	SC
6	BB-7	23.5	-	25	105	99	86	79	68	56	---	---	CH
6	BB-7	28.5	-	30	90	100	99	96	94	88	---	---	CH
1	BB-8	2	-	6	23	98	80	33	7	3	---	---	SP
6	BB-8	8	-	10	105	84	68	64	60	54	---	---	CH
6	BB-8	13.5	-	15	78	97	82	75	66	50	---	---	CH
4	BB-8	18.5	-	20	109	92	67	57	52	45	---	---	SC
6	BB-8	23.5	-	25	98	92	78	73	68	60	---	---	CH
6	BB-8	28.5	-	30	93	94	80	75	70	62	---	---	CH
1	BB-9	2	-	6	24	100	79	36	11	4	---	---	SP
4	BB-9	8	-	10	66	99	89	78	60	41	---	---	SC
6	BB-9	13.5	-	15	87	97	89	82	70	53	---	---	CH
6	BB-9	18.5	-	20	42	98	92	87	79	68	---	---	CH

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS
AMERICAN MAGIC - PHASE II
ESCAMBIA COUNTY, FLORIDA
TIERRA PROJECT NO. 4511-23-051

STRATUM	BORING	SAMPLE DEPTH (ft)			MOISTURE CONTENT (%)	SIEVE ANALYSES (% PASSING)					ATTERBERG LIMITS (%)		USCS
						#10	#40	#60	#100	#200	LL	PI	
1	BB-10	2	-	6	38	98	79	39	11	3	---	---	SP
4	BB-10	8	-	10	35	99	85	52	30	19	---	---	SC
2	BB-10	13.5	-	15	27	99	80	38	16	8	---	---	SP-SM
2	BB-11	2	-	4	28	99	86	51	18	6	---	---	SP-SM
4	BB-11	4	-	6	40	99	91	66	39	23	---	---	SC
2	BB-11	8	-	10	20	97	55	24	12	6	---	---	SP-SM
4	BB-11	13.5	-	15	35	100	93	86	78	31	---	---	SC
2	BB-12	2	-	4	27	99	85	53	25	11	---	---	SP-SM
4	BB-12	4	-	6	46	98	89	65	41	24	---	---	SC
2	BB-12	8	-	10	20	99	67	29	11	6	---	---	SP-SM
6	BB-12	13.5	-	15	93	98	88	85	80	71	---	---	CH

APPENDIX B

Geotechnical Soil Parameters for Lateral Pile Analysis

Table 2 – Geotechnical Design Parameters for Steel Sheetpile Walls

Geotechnical Parameters for FB-MultiPier Input

American Magic - Phase II
Geotechnical Soil Parameters for Pile Analysis
Escambia County, Florida

Tierra Project No. 4511-23-051

	Reference Bent/Pier	TBD		Foundation Type	Steel H-Pile	
	Reference Boring	BB-4		Size (inch)	12x89	
	Ground Surface Elevation (ft)	8.8		Base Area (ft^2)	0.53	For HP Piles this is taken as 0.5*Width*Depth
	Ground Water Table Elevation (ft)	2.0		Nominal Area (ft^2)	0.53	

	Layer No,	1	2	3	4	5
	Soil Description	Sand	Sand	Clay	Sand	Clay
	Soil Type	Cohesionless	Cohesionless	Cohesive	Cohesionless	Cohesive
	Top Boundary Elevation (ft)	8.80	-14.00	-19.00	-24.00	-28.00
	Bottom boundary Elevation (ft)	-14.00	-19.00	-24.00	-28.00	-42.00
	Average SPT N-Value (Blows/ft)	5	1	12	12	6
LATERAL	Soil Model	Sand (Reese)	Sand (Reese)	Clay (Stiff, w/ Free Water)	Sand (Reese)	Clay (Soft,Matlock)
LATERAL	Internal Friction Angle, ϕ	29	28	-	31	-
LATERAL	Total Unit Weight (pcf), γ_t	105	100	115	112	110
LATERAL	Subgrade Modulus (pci), k	10	2	500	26	-
LATERAL	Undrained Shear Strength (psf), c_u	-	-	1500	-	750
LATERAL	Major Principal Strain @ ε_{50}	-	-	0.007	-	0.010
LATERAL	Major Principal Strain @ ε_{100}	-	-	-	-	-
LATERAL	Average Undrained Shear Strength (psf)	-	-	1500	-	-
LATERAL	Unconfined Compressive Strength (psf)	-	-	-	-	-
AXIAL	Soil Model	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile
AXIAL	Total Unit Weight (pcf), γ_t	105	100	115	112	110
AXIAL	Shear Modulus (ksi), G	0.42	0.08	1.81	0.96	0.95
AXIAL	Poisson's ratio, ν	0.25	0.25	0.50	0.30	0.45
AXIAL	Nominal Unit Skin Friction (psf)	112	22	882	269	468
AXIAL	Undrained Shear Strength (psf), c_u	-	-	1500	-	750
AXIAL	Ultimate Unit Skin Friction (psf) (Shaft)	-	-	-	-	-
AXIAL	Mass Modulus (ksi)	-	-	-	-	-
AXIAL	Modulus Ratio	-	-	-	-	-
AXIAL	Surface (Rough/Smooth)	-	-	-	-	-
AXIAL	Unconfined Compressive Strength (psf)	-	-	-	-	-
AXIAL	Split Tensile Strength (psf)	-	-	-	-	-
AXIAL	Concrete Unit Weight (pcf)	-	-	-	-	-
AXIAL	Slump (in)	-	-	-	-	-
TORSIONAL	Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
TORSIONAL	Total Unit Weight (pcf), γ_t	105	100	115	112	110
TORSIONAL	Internal Friction Angle, ϕ	-	-	-	-	-
TORSIONAL	Undrained Shear Strength (psf), c_u	-	-	1500	-	750
TORSIONAL	Shear Modulus (ksi), G	0.42	0.08	1.81	0.96	0.95
TORSIONAL	Torsional Shear Stress (psf)	112	22	882	269	468
TIP	Soil Model	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile
TIP	Shear Modulus (ksi), G	0.42	0.08	1.81	0.96	0.95
TIP	Poisson's ratio, ν	0.25	0.25	0.50	0.30	0.45
TIP	Unit Bearing , ksf	21	4	17	51	8
TIP	Axial Bearing Failure, kips	11	2	9	27	4
TIP	Uncorrected SPT-N Value (blows/ft)	-	-	-	-	-
TIP	Undrained Shear Strength (psf), c_u	-	-	1500	-	750
TIP	IGM Mass Modulus (ksi), E_m	-	-	-	-	-

Geotechnical Parameters for FB-MultiPier Input

American Magic - Phase II
Geotechnical Soil Parameters for Pile Analysis
Escambia County, Florida

Tierra Project No. 4511-23-051

Reference Bent/Pier	TBD
Reference Boring	BB-5
Ground Surface Elevation (ft)	10.2
Ground Water Table Elevation (ft)	1.5

Foundation Type	Steel H-Pile
Size (inch)	12x89
Base Area (ft^2)	0.53
Nominal Area (ft^2)	0.53

For HP Piles this is taken as 0.5*Width*Depth

	Layer No,	1	2	3	4	5	6	7	8
	Soil Description	Sand	Sand	Clay	Sand	Clay	Sand	Clay	Sand
	Soil Type	Cohesionless	Cohesionless	Cohesive	Cohesionless	Cohesive	Cohesionless	Cohesive	Cohesionless
	Top Boundary Elevation (ft)	10.20	5.00	-1.00	-6.00	-12.00	-17.00	-27.00	-52.00
	Bottom boundary Elevation (ft)	5.00	-1.00	-6.00	-12.00	-17.00	-27.00	-52.00	-66.00
	Average SPT N-Value (Blows/ft)	5	28	3	45	6	12	4	58
LATERAL	Soil Model	Sand (Reese)	Sand (Reese)	Clay (Soft,Matlock)	Sand (Reese)	Clay (Stiff, w/ Free Water)	Sand (Reese)	Clay (Soft,Matlock)	Sand (Reese)
LATERAL	Internal Friction Angle, ϕ	29	35	-	36	-	31	-	36
LATERAL	Total Unit Weight (pcf), γ_t	105	115	105	125	110	112	105	125
LATERAL	Subgrade Modulus (pci), k	10	74	-	125	250	26	-	125
LATERAL	Undrained Shear Strength (psf), c_u	-	-	375	-	750	-	500	-
LATERAL	Major Principal Strain @ ε_{50}	-	-	0.020	-	0.010	-	0.010	-
LATERAL	Major Principal Strain @ ε_{100}	-	-	-	-	-	-	-	-
LATERAL	Average Undrained Shear Strength (psf)	-	-	-	-	750	-	-	-
LATERAL	Unconfined Compressive Strength (psf)	-	-	-	-	-	-	-	-
AXIAL	Soil Model	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile
AXIAL	Total Unit Weight (pcf), γ_t	105	115	105	125	110	112	105	125
AXIAL	Shear Modulus (ksi), G	0.42	2.24	0.48	3.47	0.95	0.96	0.64	3.47
AXIAL	Poisson's ratio, ν	0.25	0.30	0.45	0.30	0.45	0.30	0.45	0.30
AXIAL	Nominal Unit Skin Friction (psf)	112	627	241	1008	468	269	318	1299
AXIAL	Undrained Shear Strength (psf), c_u	-	-	375	-	750	-	500	-
AXIAL	Ultimate Unit Skin Friction (psf) (Shaft)	-	-	-	-	-	-	-	-
AXIAL	Mass Modulus (ksi)	-	-	-	-	-	-	-	-
AXIAL	Modulus Ratio	-	-	-	-	-	-	-	-
AXIAL	Surface (Rough/Smooth)	-	-	-	-	-	-	-	-
AXIAL	Unconfined Compressive Strength (psf)	-	-	-	-	-	-	-	-
AXIAL	Split Tensile Strength (psf)	-	-	-	-	-	-	-	-
AXIAL	Concrete Unit Weight (pcf)	-	-	-	-	-	-	-	-
AXIAL	Slump (in)	-	-	-	-	-	-	-	-
TORSIONAL	Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
TORSIONAL	Total Unit Weight (pcf), γ_t	105	115	105	125	110	112	105	125
TORSIONAL	Internal Friction Angle, ϕ	-	-	-	-	-	-	-	-
TORSIONAL	Undrained Shear Strength (psf), c_u	-	-	375	-	750	-	500	-
TORSIONAL	Shear Modulus (ksi), G	0.42	2.24	0.48	3.47	0.95	0.96	0.64	3.47
TORSIONAL	Torsional Shear Stress (psf)	112	627	241	1008	468	269	318	1299
TIP	Soil Model	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile
TIP	Shear Modulus (ksi), G	0.42	2.24	0.48	3.47	0.95	0.96	0.64	3.47
TIP	Poisson's ratio, ν	0.25	0.30	0.45	0.30	0.45	0.30	0.45	0.30
TIP	Unit Bearing , ksf	21	119	4	192	8	51	6	247
TIP	Axial Bearing Failure, kips	11	63	2	102	4	27	3	131
TIP	Uncorrected SPT-N Value (blows/ft)	-	-	-	-	-	-	-	-
TIP	Undrained Shear Strength (psf), c_u	-	-	375	-	750	-	500	-
TIP	IGM Mass Modulus (ksi), E_m	-	-	-	-	-	-	-	-

Geotechnical Parameters for FB-MultiPier Input

American Magic - Phase II
Geotechnical Soil Parameters for Pile Analysis
Escambia County, Florida

Tierra Project No. 4511-23-051

	Reference Bent/Pier	TBD		Foundation Type	Steel H-Pile	
	Reference Boring	BB-6		Size (inch)	12x89	
	Ground Surface Elevation (ft)	-10.0		Base Area (ft^2)	0.53	For HP Piles this is taken as 0.5*Width*Depth
	Ground Water Table Elevation (ft)	0.0		Nominal Area (ft^2)	0.53	

	Layer No,	1	2	3	4	5
	Soil Description	Sand	Clay	Clay	Sand	Sand
	Soil Type	Cohesionless	Cohesive	Cohesive	Cohesionless	Cohesionless
	Top Boundary Elevation (ft)	-10.00	-28.00	-50.00	-58.00	-64.00
	Bottom boundary Elevation (ft)	-28.00	-50.00	-58.00	-64.00	-85.00
	Average SPT N-Value (Blows/ft)	2	2	7	35	82
LATERAL	Soil Model	Sand (Reese)	Clay (Soft,Matlock)	Clay (Stiff, w/ Free Water)	Sand (Reese)	Sand (Reese)
	Internal Friction Angle, ϕ	29	-	-	36	36
	Total Unit Weight (pcf), γ_t	102	100	110	120	125
	Subgrade Modulus (pci), k	4	-	292	95	125
	Undrained Shear Strength (psf), c_u	-	250	875	-	-
	Major Principal Strain @ ε_{50}	-	0.020	0.010	-	-
	Major Principal Strain @ ε_{100}	-	-	-	-	-
	Average Undrained Shear Strength (psf)	-	-	875	-	-
	Unconfined Compressive Strength (psf)	-	-	-	-	-
AXIAL	Soil Model	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile
	Total Unit Weight (pcf), γ_t	102	100	110	120	125
	Shear Modulus (ksi), G	0.17	0.32	1.10	2.80	3.47
	Poisson's ratio, ν	0.25	0.45	0.45	0.30	0.30
	Nominal Unit Skin Friction (psf)	45	162	540	784	1344
	Undrained Shear Strength (psf), c_u	-	250	875	-	-
	Ultimate Unit Skin Friction (psf) (Shaft)	-	-	-	-	-
	Mass Modulus (ksi)	-	-	-	-	-
	Modulus Ratio	-	-	-	-	-
	Surface (Rough/Smooth)	-	-	-	-	-
	Unconfined Compressive Strength (psf)	-	-	-	-	-
	Split Tensile Strength (psf)	-	-	-	-	-
	Concrete Unit Weight (pcf)	-	-	-	-	-
	Slump (in)	-	-	-	-	-
TORSIONAL	Soil Model	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic	Hyperbolic
	Total Unit Weight (pcf), γ_t	102	100	110	120	125
	Internal Friction Angle, ϕ	-	-	-	-	-
	Undrained Shear Strength (psf), c_u	-	250	875	-	-
	Shear Modulus (ksi), G	0.17	0.32	1.10	2.80	3.47
	Torsional Shear Stress (psf)	45	162	540	784	1344
TIP	Soil Model	Driven Pile	Driven Pile	Driven Pile	Driven Pile	Driven Pile
	Shear Modulus (ksi), G	0.17	0.32	1.10	2.80	3.47
	Poisson's ratio, ν	0.25	0.45	0.45	0.30	0.30
	Unit Bearing , ksf	9	3	10	149	256
	Axial Bearing Failure, kips	5	1	5	79	136
	Uncorrected SPT-N Value (blows/ft)	-	-	-	-	-
	Undrained Shear Strength (psf), c_u	-	250	875	-	-
	IGM Mass Modulus (ksi), E_m	-	-	-	-	-

TABLE 2
GEOTECHNICAL DESIGN PARAMETERS FOR STEEL SHEETPILE WALLS
AMERICAN MAGIC - PORT OF PENSACOLA
PHASE II
ESCAMBIA COUNTY, FLORIDA
TIERRA PROJECT NO. 4511-23-051

WALL	REFERENCE BORING	APPROXIMATE STRATUM ELEVATION (ft NAVD 88)			USCS [1]	SHWT [2] (ft NAVD 88)	UNIT WEIGHT (pcf)		SOIL FRICTION ANGLE (degrees)	COHESION (psf)	WALL / SOIL ADHESION [3] (psf)	WALL / SOIL FRICTION [3] (degrees)
							Total	Effective	Short Term (Undrained)	Short Term (Undrained)	Short Term (Undrained)	Short Term (Undrained)
Steel Sheetpile	B-4	> 9			Emb.Fill	9	115	53	30	---	---	14
		9	-	-14	SP-SM, SM		105	43	29	---	---	14
		-14	-	-19	SC		100	38	26	---	---	14
		-19	-	-24	CH		115	53	---	1500	750	---
		-24	-	-28	SP-SM		112	50	31	---	---	14
		-28	-	-42	CH		110	48	---	750	350	---
	B-5	> 10			Emb.Fill	10	115	53	30	---	---	14
		10	-	5	SP-SM		105	43	29	---	---	14
		5	-	-1	SP-SM		115	53	35	---	---	14
		-1	-	-6	CH		105	43	---	375	200	---
		-6	-	-12	SM		125	63	36	---	---	17
		-12	-	-17	CH		110	48	---	750	350	---
		-17	-	-27	SM		112	50	31	---	---	14
		-27	-	-52	CH		105	43	---	500	250	---
		-52	-	-66	SP-SM		125	63	36	---	---	17
	B-6	-10	-	-28	SP, SP-SM	N/A (Marine Boring)	105	43	29	---	---	14
		-28	-	-50	CL, CH		100	38	---	250	125	---
		-50	-	-58	CH		115	53	---	875	440	---
		-58	-	-63	SC		120	58	36	---	---	14
		-63	-	-85	SP-SM		125	63	36	---	---	17

Notes: (1) USCS - Unified Soil Classification System

(2) SHWT - Seaonal High Water Table

(3) Adhesion & Wall/Soil Friction values apply to uncoated steel sheets only. If coated sheets are used, these values should be zero and not used in computing Kp.

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Concrete toppings.
6. Building frame members.
7. Building walls.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Engineer.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.
e. Special concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, shoring and reshoring procedures, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.
b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
c. Structural 1, B-B or better; mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II

a. Meet FDOT Specification Section 346 for Class III Concrete in an extremely aggressive environment.

2. Blended Hydraulic Cement: ASTM C 595, Type IL
   a. Meet FDOT Specification Section 346 for Class III Concrete in an extremely aggressive environment.

3. Fly Ash: ASTM C618, Class F or C.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 CURING MATERIALS

A. Water: Potable.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.40.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.8 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Minimum Cementitious Materials Content: 600 lb/cu. yd.
3. Slump Limit: 3 inches plus or minus 1-1/2 inch.
4. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 REMOVING AND REUSING FORMS

A. See Cast-in-Place Concrete notes on the drawings.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 95 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.

Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

SECTION 31 41 16

METAL SHEET PILING
11/20

PART 1 GENERAL

1.1 DESCRIPTION

Design, furnish, and install metal sheet piles at the locations indicated on the drawings and specified herein.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.5M/D1.5	(2020; Errata 1 2022) Bridge Welding Code ASTM

INTERNATIONAL (ASTM)

ASTM A6/A6M	(2024b) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A328/A328M	(2024) Standard Specification for Steel Sheet Piling
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A690/A690M	(2024) Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
ASTM A857/A857M	(2007; R 2013) Standard Specification for Steel Sheet Piling, Cold-Formed, Light Gage
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM B308/B308M	(2010; R 2020) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM D4945	(2017) Standard Test Method for High-Strain Dynamic Testing of Deep Foundations
ASTM E329	(2023) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.3 BASIS OF BID

1.3.1 Contractor's Geotechnical Consultant

Hire the services of an independent, Registered Professional Geotechnical Engineer, experienced in soil mechanics and Pile Dynamic Analysis, to observe production pile installation as specified herein. The Contractor's Geotechnical Consultant must be independent of the Contractor and must have no employee of employer relationship which could constitute a conflict of interest.

1.3.2 Lump Sum Payment

Base bids upon providing the number, size, capacity, and length of piles as indicated on the drawings.

Include the cost of all necessary equipment, tools, material, labor, and supervision required to: deliver, handle, install, cut-off, dispose of any cut-offs, pullout, and meet the applicable contract requirements. Include mobilization, pre-drilling, and redriving heaved piles. If, in redriving, it is found that any pile is not of sufficient length to provide the requirements specified, notify the Engineer of Record, who reserves the right to increase or decrease the total length of piles to be provided and installed by changing the pile locations or elevations, requiring the installation of additional piles, or directing the omission of piles from the requirements shown and specified. If total number of piles or number of each length vary from that specified as the basis for bidding, an adjustment in the contract price or time for completion, or both, will be made in accordance with the contract documents. Payment for piles will be based on successfully installing piles to both the minimum tip elevation and satisfying the acceptance criteria identified herein. No additional payment will be made for: damaged, rejected, or misplaced piles; withdrawn piles; any portion of a pile remaining above the cut-off elevation; backdriving; cutting off piles; splicing; build-ups; any cut-off length of piles; or other excesses beyond the assumed pile length indicated for which the Contractor is responsible.

1.5 SUBMITTALS

SD-01 Preconstruction Submittals Installation

Procedures

Contractor's Geotechnical Consultant Documentation

SD-02 Shop Drawings

Metal Sheet Piling

Pile Splicing

Pile Placement

As-Driven Survey Pile

Shoe

SD-03 Product Data Driving

Pile Driving Equipment

Delivery, Storage, and Handling Pulling and

Redriving

SD-05 Design Data

Procedure for Insufficient Pile Length

SD-06 Test Reports

Materials Tests

SD-07 Certificates

Pile Shoe

Welding Certifications

Steel Plant Certificate

SD-11 Closeout Submittals Pile

Driving Record

1.6 DELIVERY, STORAGE, AND HANDLING

Conform all delivery, storage, and handling of materials to the requirements specified herein. Develop and submit plans for the delivery, storage, and handling of piles. Submit delivery, storage, and handling plans for piles at least 30 days prior to delivery of piles to the job site.

1.6.1 Delivery and Storage

Materials delivered to the site must be new and undamaged and must be accompanied by certified test reports. Provide the manufacturer's logo and mill identification mark on the sheet piling as required by the referenced specifications. Store and handle sheet piling in the manner recommended by the manufacturer to prevent permanent deflection, distortion or damage to the interlocks; as a minimum, support on level blocks or racks spaced not more than 10 feet apart and not more than 2 feet from the ends. Storage of sheet piling should also facilitate required inspection activities and prevent damage to coatings and corrosion protection prior to installation.

1.6.2 Handling

Lift piles to ensure that the maximum permissible curvature is not exceeded. Holes may be burned above the cutoff length for lifting piles into the leads. If there is evidence of pile damage during driving due to the holes, the Engineer of Record may forbid the burning of holes. Do not damage piles when dragging piles across the ground or barge deck.

Inspect piles for excessive curvature and for damage before transporting them from the storage area to the driving area and immediately prior to placement in the driving leads. Curvature in the pile must be measured with the pile laying on a flat surface and is the distance between the pile at the mid-length of the pile and the flat surface. Straightness of the sections of piles must conform to AWS D1.5M/D1.5, Section 3.5.1.1. Piles having excessive curvature will be rejected.

1.6.3 Damaged Piles

Inspect each pile for straightness and structural damage before transporting them to the project site and immediately prior to placement in the driving leads. Bring any damage to the attention of the Engineer of Record. Piles which are damaged during delivery, storage, or handling to the extent they are rendered unsuitable for the work, in the opinion of the Engineer of Record, will be rejected and removed from the project site, or may be repaired, if approved, at no additional cost.

Any pile damaged by reason of internal defects or by improper driving must be corrected by one of the following methods approved by the Engineer for the pile in question:

a. The pile is withdrawn, if practicable, and replaced by a new and, if necessary, longer pile.

b. One or more replacement piles are driven adjacent to the defective pile.

c. A Pile Dynamic Analysis and/or low integrity testing must be performed by the Contractor's Geotechnical Consultant to assess the structural integrity of the driven pile(s).

A pile driven below the specified butt elevation must be corrected by one of the following methods approved by the Engineer:

a. The pile is spliced (if approved).

b. A sufficient portion of the footing is extended down to properly embed the pile.

A pile driven out of its proper location or out of plumb as approved by the Engineer, must be corrected by one of the following methods approved by the engineer:

a. One or more replacement piles are driven next to the pile in question.

b. As directed by the structural engineer.

1.7 MATERIAL CERTIFICATES

For each shipment, submit certificates identified with specific lots prior to installing piling. Include in the identification data piling type, dimensions, chemical composition, mechanical properties, section properties, heat number, and mill identification mark.

PART 2 PRODUCTS

2.1 METAL SHEET PILING

Submit detail drawings for sheet piling, including fabricated sections, showing complete piling dimensions and details, driving sequence and location of installed piling.

a. Include in the drawings details of top protection, special reinforcing tips, tip protection, lagging, splices, fabricated additions to plain piles, cut-off method, corrosion protection, and dimensions of templates and other temporary guide structures for installing piling. Provide details of the method for handling piling to prevent permanent deflection, distortion or damage to piling interlocks.

b. Metal sheet piling must be hot-rolled steel sections conforming to ASTM A572/A572M, Grade 60.

c. For protection of sheet piling, coat it in accordance with the drawings.

2.1.1 Interlocks

The interlocks of sheet piling must be free-sliding, provide a swing angle suitable for the intended installation but not less than 5 degrees when interlocked, and maintain continuous interlocking when installed.

2.1.2 General Requirements

Provide sheet piles with minimum section modulus, moment of inertia, shape, and size as specified in the drawings. Sheet piling must be full-length

sections of the dimensions shown. Provide sheet piling with standard lifting holes.

2.2 APPURTENANT METAL MATERIALS

Provide metal plates, shapes, bolts, nuts, rivets and other appurtenant fabrication and installation materials conforming to manufacturer's standards and to the requirements specified in the respective sheet piling standards.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

Requirements for material tests, workmanship and other measures for quality assurance must be as specified. Provide manufacturer's steel plant certificate for review and approval.

2.3.1 Materials Tests

Submit certified materials tests reports showing that sheet piling and appurtenant metal materials meet the specified requirements, for each shipment and identified with specific lots prior to installing materials. Material test reports must meet the requirements of ASTM A6/A6M. Perform materials tests conforming to the following requirements. Sheet piling and appurtenant materials must be tested and certified by the manufacturer to meet the specified chemical, mechanical and section property requirements prior to delivery to the site. Testing of sheet piling for mechanical properties must be performed after the completion of all rolling and forming operations. Testing of sheet piling must meet the requirements of ASTM A6/A6M.

2.4 PILE DRIVING EQUIPMENT

Submit complete descriptions of sheet piling driving equipment including hammers, extractors, protection caps and other installation appurtenances, prior to commencement of work. Descriptive information includes manufacturer's name, model numbers, capacity, rated energy, hammer details, cushion material, helmet, and templates. Provide pile driving equipment conforming to the following requirements. Submit descriptions of pile driving equipment, including hammers, power packs, driving helmets, hammer cushions, pile cushions, leads, extractors, jetting equipment, and preboring equipment at least 30 days prior to commencement of work.

2.4.1 Driving Hammers

Hammers must be steam, air, or diesel drop, single-acting, double-acting, differential-acting type. The driving energy of the hammers must be as recommended by the manufacturer for the piling weights and subsurface materials to be encountered. Repair damage to piling caused by use of a pile hammer with excess delivered force or energy.

PART 3 EXECUTION

3.1 PRELIMINARY WORK

3.1.1 Pile Length Markings

Mark each pile prior to driving with horizontal lines at one foot intervals. Mark the interval number on pile every 5 feet from pile tip.

3.2 EARTHWORK

Pre-excavation will not be permitted. Backfill as indicated.

3.3 INSTALLATION

3.3.1 Placing and Driving

3.3.1.1 Placing

Submit a written description of the site specific pile installation procedures for review and approval. Pile placement installation drawings and details must also be provided.

Any excavation required within the area where sheet pilings are to be installed must be completed prior to placing sheet pilings. Pilings properly placed and driven must be interlocked throughout their length with adjacent pilings to form a continuous diaphragm throughout the length or run of piling wall.

a. Pilings must be carefully located as indicated. Pilings must be placed plumb with out-of-plumbness not exceeding 1/4 inch per foot of length and true to line. Place the pile so the face will not be more than 6 inches from vertical alignment at any point. Top of pile at elevation of cut-off must be within 1/2 inch horizontally and 2 inches vertically of the location indicated. Manipulation of piles to force them into position will not be permitted. Check all piles for heave. Re-drive all heaved piles to the required tip elevation.

b. Provide temporary wales, templates, or guide structures to ensure that the pilings are placed and driven to the correct alignment. Use a system of structural framing sufficiently rigid to resist lateral and driving forces and to adequately support the sheet piling until design tip elevation is

achieved. Use two templates, at least, when placing each piling not less than 20 feet apart. Templates must not move when supporting sheet piling. Fit templates with wood blocking to bear against the web of each alternate sheet pile and hold the sheet pile at the design location alignment. Provide outer template straps or other restraints as necessary to prevent the sheets from warping or wandering from the alignment. Mark template for the location of the leading edge of each alternate sheet pile. If in view, also mark the second level to assure that the piles are vertical and in position. If two guide marks cannot be seen, other means must be used to keep the sheet pile vertical along its leading edge.

3.3.1.2 Driving

Submit records of the completed sheet piling driving operations, including a system of identification which shows the disposition of approved piling in the work, driving equipment performance data, piling penetration rate data, piling dimensions and top and bottom elevations of installed piling. Drive pilings with the proper size hammer and by approved methods so as not to subject the pilings to damage and to ensure proper interlocking throughout their lengths.

a. Maintain driving hammers in proper alignment during driving operations by use of leads or guides attached to the hammer.

b. Employ a protecting cap in driving when using impact hammers to prevent damage to the tops of pilings. Remove and replace pilings damaged during driving or driven out of interlock at the Contractor's expense.

c. Drive pilings without the aid of a water jet.

d. Take adequate precautions to ensure that pilings are driven plumb. Where possible, drive Z-pile with the ball end leading. If an open socket is leading, a bolt or similar object placed in the bottom of the interlock will minimize packing material into it and ease driving for the next sheet. If at any time the forward or leading edge of the piling wall is found to be out-of-plumb in the plane of the wall the piling being driven must be driven to the required depth and tapered pilings must be provided and driven to interlock with the out-of-plumb leading edge or other approved corrective measures must be taken to insure the plumbness of succeeding pilings. The maximum permissible taper for any tapered piling must be 1/8 inch per foot of length.

e. Pilings in each run or continuous length of piling wall must be driven alternately in increments of depth to the required depth or elevation. No piling will be driven to a lower elevation than those behind it in the same run except when the pilings behind it cannot be driven deeper. Incrementally sequence driving of individual piles such that the tip of any sheet pile must not be more than 4 feet below that of any adjacent sheet pile. When the penetration resistance exceeds five blows per inch, the tip of any sheet pile must not be more than 2 feet below any adjacent sheet pile. If the piling next to the one being driven tends to follow below final elevation it may be pinned to the next adjacent piling.

f. If obstructions restrict driving a piling to the specified penetration, the obstructions must be removed or penetrated with a chisel beam. If the Contractor demonstrates that removal or penetration is impractical, make changes in the design alignment of the piling structure as directed to ensure the adequacy and stability of the structure.
Pilings must be driven to depths shown and must extend up to the elevation indicated for the top of pilings. A tolerance of 1/4 inches above the indicated top elevation will be permitted. Pilings must not be driven within 100 feet of concrete less than 7 days old.

g. Pre-augering or spudding of piles will not be permitted.

3.3.2 Cutting-Off and Splicing

Pilings driven to refusal or to the point where additional penetration cannot be attained and are extending above the required top elevation in excess of the specified tolerance must be cut off to the required elevation. Pilings driven below the required top elevation and pilings damaged by driving and cut off to permit further driving must be extended as required to reach the top elevation by splicing when directed at no additional cost. Submit procedure for insufficient pile length. Provide pile splicing information and details for review and approval prior to installation in the field.

a. Pilings adjoining spliced pilings must be full length unless otherwise approved. Splicing of pilings must be as indicated. Ends of pilings to be spliced must be squared before splicing to eliminate dips or camber. Pilings must be spliced together with concentric alignment of the interlocks so that there are no discontinuities, dips or camber at the abutting interlocks. Spliced pilings must be free sliding and able to obtain the maximum swing with contiguous pilings. Shop and field welding, qualification of welding procedures, welders, and welding operators must be in accordance with AWS D1.1/D1.1M. Submit welding certifications for all welders and welding operators for review and approval.

b. The tops of pilings excessively battered during driving must be trimmed when directed, at no additional cost. Piling cut-offs will become the property of the Contractor and must be removed from the site.

c. Cut holes in pilings for bolts, rods, drains or utilities in a neat and professional manner, as shown or as directed. Use a straight edge in cuts made by burning to avoid abrupt nicks. Bolt holes in steel piling must be drilled or may be burned and reamed by approved methods which will not damage the surrounding metal. Holes other than bolt holes must be reasonably smooth and the proper size for rods and other items to be inserted. Do not use explosives for cutting.

3.3.3 Inspection of Driven Piling

Perform continuous inspection during pile driving. Inspect all piles for compliance with tolerance requirements. Bring any unusual problems which may occur to the attention of the Engineer of Record. Inspect the interlocked joints of driven pilings extending above ground. Pilings found to be out of interlock must be removed and replaced at the Contractor's expense.

3.3.4 Pulling and Redriving

Submit the proposed method of pulling sheet piling, prior to pulling any piling. Pull, as directed, selected pilings after driving to determine the condition of the underground portions of pilings. Any piling so pulled and found to be damaged, to the extent that its usefulness in the structure is impaired, must be removed and replaced at the Contractor's expense.
Pilings pulled and found to be in satisfactory condition must be redriven when directed.

3.3.5 Survey Data

After the driving of each pile group is complete and before superimposed concrete is placed, provide the Engineer of Record with an as-driven survey showing actual location and top elevation of each pile. Submit an as-driven survey showing actual location and top elevation of each production pile within 7 calendar days of completing the pile installation. Do not proceed with placing concrete until the Engineer of Record has reviewed the survey and verified the safe load for the pile group driven. Present a survey in such form that it gives deviation from plan location in two perpendicular directions and elevations of each pile to nearest half inch. Survey must be prepared and certified by a land surveyor licensed in Florida.

3.4 REMOVAL

The removal of sheet pilings must consist of pulling, sorting, cleaning the interlocks, inventorying and storing previously installed sheet pilings as shown and directed.

3.4.1 Pulling

The method of pulling piling must be approved. Provide pulling holes in pilings, as required. Extractors must be of suitable type and size. Exercise care during pulling of pilings to avoid damaging piling interlocks and adjacent construction. If the Engineer of Record determines that adjacent permanent construction has been damaged during pulling, the Contractor will be required to repair this construction at no additional cost. Pull pilings one sheet at a time. Pilings fused together must be separated prior to pulling, unless the Contractor demonstrates, to the satisfaction of the Engineer of Record, that the pilings cannot be separated. The Contractor will not be paid for the removal of pilings damaged beyond structural use due to proper care not being exercised during pulling.

3.4.2 Sorting, Cleaning, Inventorying and Storing

Pulled pilings must be sorted, cleaned, inventoried and stored by type into groups as:

a. Piling usable without reconditioning.

b. Piling requiring reconditioning.

c. Piling damaged beyond structural use.

3.5 INSTALLATION RECORDS

Maintain a pile driving record for each sheet pile driven. Indicate on the installation record: installation dates and times, type and size of hammer, rate of operation, total driving time, dimensions of driving helmet and cap used, blows required per foot for each foot of penetration, final driving resistance in blows for final 6 inches, pile locations, tip elevations, ground elevations, cut-off elevations, and any reheading or cutting of piles. Record any unusual pile driving problems during driving. Submit complete records to the Engineer of Record.

-- End of Section 314116 --

SECTION 316213 - CONCRETE PILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes solid, precast concrete piles.

1.3 UNIT PRICES

A. Contract Sum: Base Contract Sum on number and dimensions of piles indicated from tip to cutoff, plus not less than 12 inches of overlength for cutting piles at cutoff elevations.

B. Work of this Section is affected as follows:

1. Additional payment for pile lengths in excess of that indicated, and credit for pile lengths less than that indicated, is calculated at unit prices stated in the Contract, based on net addition or deduction to total pile length as determined by Architect and measured to nearest 12 inches.

    a. Additional payment for splices required to extend pile lengths in excess of that indicated is calculated at unit prices stated in the Contract.

2. Additional payment for number of piles in excess of that indicated, and credit for number of piles less than that indicated, is calculated at unit prices stated in the Contract.
3. Unit prices include labor, materials, tools, equipment, and incidentals for furnishing, driving, cutting off, capping, and disposing of cutoffs.
4. Test piles that become part of permanent foundation system are considered as an integral part of the Work.
5. No payment is made for rejected piles, including piles driven out of tolerance, defective piles, or piles damaged during handling or driving.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For concrete piles. Prepared by or under the supervision of a qualified professional engineer detailing fabrication and lifting devices necessary for handling and driving piles.

1. Indicate pile dimensions, cross sections, locations, and sizes. Show details of pile splices and shoes.
2. Indicate types of reinforcement, including prestressing strand, and detail fabricating, bending, and placing.
3. Indicate layout and dimensions, and identify each pile. Indicate welded connections by AWS standard symbols. Detail cast-in hardware.
4. Indicate transportation, storage, and lifting points.
5. Include arrangement of static pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated-Design Submittal: For concrete piles.

1. Indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, professional engineer, and testing agency.

B. Welding certificates.

C. Design Mixes: For each concrete mix.

D. Material Certificates: For steel reinforcements and concrete admixtures.

E. Material Test Reports: For concrete materials.

F. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.

G. Static Pile Test Reports: Submit within three days of completing each test.

H. Pile-Driving Records: Submit within three days of driving each pile.

I. Certified Piles Survey: Submit within seven days of pile driving completion.

J. Field quality-control reports.

K. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Engineering Responsibility: Assumes engineering responsibility to comply with requirements in "Performance Requirements" Article by engaging a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data for piles.
2. PCI Plant Certification Program: Participates in PCI's Plant Certification Program and is designated a PCI-Certified Plant for C2 product group and category, or better.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. Installer's responsibility includes engaging a qualified professional engineer to prepare pile-driving records.

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Design Practices: Comply with ACI 318 and the recommendations in PCI Committee Report: "Recommended Practice for Design, Manufacture and Installation of Prestressed Concrete Piling."

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for piles, comply with applicable requirements in PCI MNL-116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

F. Comply with requirements in ACI 301, "Specifications for Structural Concrete."

G. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.8 PRECONSTRUCTION TESTING

A. General: Static pile tests are used to verify driving criteria and pile lengths and to confirm allowable load of piles.

1. Furnish test piles 60 inches longer than production piles.
2. Determination of actual length of piles is based on results of static pile tests.

B. Pile Tests: Arrange and perform the following pile tests:

1. Axial Compressive Static Load Test: ASTM D 1143/D 1143M. Procedure A, Quick Test.

C. Equip each test pile with two telltale rods, according to ASTM D 1143/D 1143M, for measuring deformation during load test.

D. Provide pile reaction frame, anchor piles, equipment, and instrumentation with enough reaction capacity to perform tests. Notify Architect at least 48 hours in advance of performing tests. On completion of testing, remove testing structure, anchor piles, equipment, and instrumentation.

1. Allow a minimum of seven days to elapse after driving test piles before starting pile testing.
2. Number of Test Piles: As indicated on the drawings.

E. Drive test piles at locations indicated to the minimum penetration or driving resistance indicated. Use test piles identical to those required for Project, and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.

1. Pile Design Load: As indicated.

F. Approval Criteria: Allowable load shall be the load acting on the test pile when the lesser of the following criteria are met, divided by a factor of safety of 2:

1. Net settlement, after deducting rebound, of not more than 0.01 inch/ton of test load.
2. Total settlement exceeds the pile elastic compression by 0.15 inch, plus 1.0 percent of the tip diagonal dimension.
3. A plunging failure or sharp break in the load settlement curve.

G. Test Pile-Driving Records: Prepare driving records for each test pile, compiled and attested to by a qualified professional engineer. Include same data as required for driving records of permanent piles.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent cracking, distorting, warping, or other physical damage, and so markings are visible.

B. Lift and support piles only at designated lifting or supporting points as shown on Shop Drawings.

1.10 FIELD CONDITIONS

A. Protect structures, underground utilities, and other construction from damage caused by pile driving.

B. Site Information: A geotechnical report has been prepared for this Project and is referenced elsewhere in the Project Manual for information only.

C. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Document conditions that might be misconstrued as damage caused by pile driving.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design piles, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Piles shall withstand transportation, erection, and driving stresses and design loads within limits indicated and under conditions existing at Project site.

2.3 MOLD MATERIALS

A. Molds: Provide molds of metal, plastic, wood, or another material that is nonreactive with concrete and that produces required finish surfaces.

2.4 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M, as follows:

1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60, deformed.

2.5 CONCRETE MATERIALS

A. General: Limit water-soluble chloride ions in concrete to the maximum percentage by mass of cementitious material permitted by ACI 318, but not more than 0.06 percent.

B. Portland Cement: ASTM C 150, Type II

1. Meet FDOT Specification Section 346 for Class III Concrete in an extremely aggressive environment.

2. Fly Ash: ASTM C 618, Class C or F.
3. Silica Fume: ASTM C 1240, amorphous silica.

C. Blended Hydraulic Cement: ASTM C 595 Type IL

1. Meet FDOT Specification Section 346 for Class III Concrete in an extremely aggressive environment.

D. Normal-Weight Aggregates: Except as modified by PCI MNL-116, ASTM C 33/C 33M. Provide aggregates from single source.

1. Nominal Maximum Size of Aggregate: 3/4 inch (19 mm)

E. Water: Potable, free of deleterious material that may affect color stability, setting, or strength of concrete, and complying with chemical limits of PCI MNL-116.

F. Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 PILE ACCESSORIES

A. Pile Shoes: 1-inch thick minimum, carbon-steel plate fabricated to match shape of pile tip.

B. Pile Splices: Manufactured from carbon-steel plates or castings and capable of developing strength of continuous pile at splice location.

2.7 CONCRETE MIXES

A. Prepare design mixes for each type of concrete required.

1. Limit use of fly ash and silica fume to not exceed, in total, 25 percent of portland cement by weight.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified personnel at precast manufacturing plant at precast manufacturer's option.

C. Proportion mixes by either laboratory trial batch or field-test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi
2. Maximum Water-Cementitious Material Ratio: 0.44

2.8 FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete placement and temperature changes and for pretensioning and detensioning operations. Maintain molds to provide completed piles of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL-116 and PCI MNL-135.

1. Chamfer edges and corners of square piles.

B. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

1. Accurately position, support, and secure reinforcement against displacement by molds, construction, or concrete placement. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
2. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

C. Pile Shoes: Accurately position and secure pile shoes at pile tips so as to not affect pile alignment during driving. Weld pile shoes to longitudinal reinforcements.

D. Pile Splices: Accurately position and secure pile-splice segments requiring embedding in tips of piles.

E. Mix concrete according to PCI MNL-116 and requirements in this Section. After initial concrete batching, no additional water may be added.

F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in piles. Comply with requirements in PCI MNL-116 for measuring, mixing, transporting, and placing concrete.

1. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL-116.
2. Comply with ACI 306.1 procedures for cold-weather concrete placement.
3. Comply with ACI 305R recommendations for hot-weather concrete placement.

G. Identify pickup points of piles with permanent markings that correspond with markings indicated on Shop Drawings. Imprint casting date on each pile.

H. Cure concrete, according to requirements in PCI MNL-116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

I. Finish: Fabricate concrete piles with normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.

1. Finish unformed surfaces by trowel unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.

J. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate pile manufacturer's quality-control and testing methods.

1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency, and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

B. Testing: Test and inspect piles according to PCI MNL-116.

1. Strength of piles will be considered deficient if units fail to comply with requirements.

C. If there is evidence that strength of piles may be deficient or may not comply with PCI MNL-116 requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.

1. A minimum of three representative cores shall be taken from piles of suspect strength, from locations directed by Architect.
2. Cores shall be tested, following immersion in water, in a wet condition per ACI 301 if piles are wet under service conditions.
3. Cores shall be tested in an air-dry condition per ACI 301 if piles are dry under service conditions.
4. Strength of concrete for each series of three cores shall be considered satisfactory if average compressive strength is at least 85 percent of the 28-day design compressive strength and no core compressive strength is less than 75 percent of the 28-day design compressive strength.
5. Test results shall be reported in writing on same day that tests are performed, with copies to Architect, Contractor, and pile manufacturer. Test reports shall include the following:

    a. Project identification name and number.
    b. Date when tests were performed.
    c. Name of precast concrete manufacturer.
    d. Name of concrete testing agency.
    e. Identification letter, name, and type of pile represented by core tests; design compressive strength; type of break; compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Patching: If core test results are satisfactory and piles comply with requirements, solidly fill core holes with patching mortar and finish to match adjacent pile surfaces.

E. Piles will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DRIVING EQUIPMENT

A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.

1. Use pile hammer capable of adjustment to deliver reduced impact to maintain tensile stress within 70 percent of yield strength of pile reinforcement.

B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.

C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that hold the full length of pile firmly in position and in axial alignment with hammer.

3.2 DRIVING PILES

A. General: Continuously drive piles to elevations or penetration resistance indicated. Establish and maintain axial alignment of leads and piles before and during driving.

B. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.

C. Pile Splices: Splice piles during installation, and align pile segments concentrically.

D. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:

1. Location: 4 inches from location indicated after initial driving, and 6 inches after pile driving is completed.
2. Plumb: Maintain 1 inch in 48 inches from vertical, or a maximum of 4 inches, measured when pile is aboveground in leads.

E. Withdraw damaged or defective piles and piles that exceed driving tolerances, and install new piles within driving tolerances.

1. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches.
2. Fill holes left by withdrawn piles as directed by Architect.

F. Abandon and cut off rejected piles as directed by Architect. Leave rejected piles in place, and install new piles in locations as directed by Architect.

G. Cut off tops of driven piles square with pile axis and at elevations indicated.

H. Buildups: Construct buildups to elevations indicated of cast-in-place reinforced concrete with compressive strength not less than 5000 psi at 28 days.

I. Pile-Driving Records: Maintain accurate driving records for each pile. Include the following data:

1. Project name and number.
2. Name of Contractor.
3. Type of pile and date of casting.
4. Pile location in pile group and designation of pile group.
5. Sequence of driving in pile group.
6. Pile dimensions.
7. Ground elevation.
8. Elevation of tips after driving.
9. Final tip and cutoff elevations of piles after driving pile group.
10. Records of redriving.
11. Elevation of splices.
12. Type, make, model, and rated energy of hammer.
13. Weight and stroke of hammer.
14. Type of pile-driving cap used.
15. Cushion material and thickness.
16. Actual stroke and blow rate of hammer.
17. Pile-driving start and finish times, and total driving time.
18. Time, pile-tip elevation, and reason for interruptions.
19. Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving.
20. Pile deviations from location and plumb.
21. Special procedures used.
22. Unusual occurrences during pile driving.

J. Certified Piles Survey: Engage a land surveyor to prepare a piles survey showing final location of piles in relation to the property survey and existing benchmarks.

1. Notify Architect when deviations from locations exceed allowable tolerances.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D 4945 during initial driving and during restriking on 3 percent of piles.
2. Low-strain integrity measurement shall be performed and reported for each pile.

C. Piles will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 DISPOSAL

A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 316213