PART 2 – TECHNICAL SPECIFICATIONS

SEALS PAGE: STRUCTURAL

This seal covers the following sections of the project manual:

Division 3 Concrete

Section 031000	Concrete Forming and Accessories
Section 032100	Reinforcing Steel
Section 033000	Cast In Place Concrete
Section 039100	Concrete Curing

Division 5 Metals

Section 050523B	Welding

Division 35 Waterway and Marine Construction

Section 355113	Concrete Floating Dock System
Section 355114	Steel Frame Floating Dock System

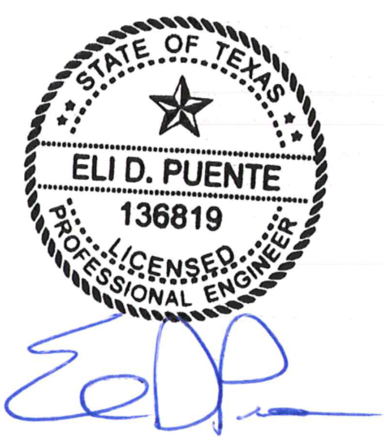
STATE OF TEXAS
JON CASEY LONG
94119
LICENSED
PROFESSIONAL ENGINEER

11/01/2022

SEALS PAGE: ONSITE SANITARY SEWER FACILTIES

This seal covers the following sections of the project manual:

Division 22 Plumbing
Section 221313 Facility Sanitary Sewers



11/01/2022

TBPE Firm No. 928

Kimley-Horn and Associates, Inc.

SEALS PAGE: CIVIL

This seal covers the following sections of the project manual:

Division 2 Sitework

Section 024119	Selective Demolition

Division 31 Earthwork

Section 311000	Site Clearing
Section 312000	Earth Moving
Section 313213	Soil Mixing Stabilization
Section 315000	Excavation Support and Protection

Division 33 Utilities

Section 330500	Common Work Results for Utilities
Section 331110	PVC Water Pipe
Section 331215	Valves, Hydrants, and Appurtenances
Section 334100	Storm Utility Drainage Piping

11/02/2022

SEALS PAGE: LANDSCAPE ARCHITECTURE

This seal covers the following sections of the project manual:

Division 1 General Requirements

Section 011010	Summary of Work
Section 01020	Contract Considerations
Section 01039	Coordination and Meetings
Section 01300	Submittals
Section 01340	Shop Drawings, Product Data, and Samples
Section 01410	Testing Laboratory Services
Section 01500	Construction Facilities and Temporary Controls
Section 015639	Temporary Tree and Plant Protection
Section 01600	Materials and Equipment
Section 01630	Substitutions and Product Options
Section 01700	Project Closeout

Division 2 Sitework

Section 02100	Site Preparation/Tree Protection Fencing
Section 02200	Earthwork
Section 02210	Fine Grading
Section 02220	Excavation, Trenching, and Backfilling
Section 02380	Drilled Piers
Section 02441	Irrigation
Section 02900	Tree Shrub and Groundcover Planting
Section 02930	Turfgrass Planting

Division 4 Masonry

Section 04100	Mortar and Grout
Section 04400	Stone Masonry

Division 32 Exterior Improvements

Section 321314	Concrete Sidewalk
Section 321373	Concrete Paving and Joint Sealants
Section 321723	Pavement Marking

Manufacturer's Specifications
CXT Taos Building Style Restroom
Structural Wood Components

11.01.2022

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART I – GENERAL

1.1 Work covered by Contract Documents for Sam Collins Park – Phase 1A Site Improvements

A. This project shall consist of all work, complete and in place including but not limited to: Site Preparation and Tree Protection, Demolition, Grading, Temporary Erosion Control, Vehicular Concrete Paving, Parking Lot Striping, Marine Construction of Floating Docks and Concrete Boat Ramp, Pedestrian (Trail/Sidewalk) Concrete Paving and Aggregate Trail Building, Site Furnishings, Masonry, Utilities, Concrete Retaining Walls, Pre-fabricated Restrooms, Wood Pavilions and Shade Structures, Landscape Planting, Automatic Irrigation System, and all items necessary to construct the Phase 1A Site Improvements, complete and in place as shown in the plans and specifications.

B. All work shall comply with the Texas Accessibility Standards (TAS) of the Architectural Barriers Act Article 9102, Texas Civil Statutes, effective April 1, 1994 and subsequent adopted updates. This standard is prepared and administered by the Texas Department of Licensing and Regulations, Policies and Standards Division, Architectural Barriers Section, PO Box 12157, Austin, Texas 78711, 920 Colorado, Fourth Floor, Austin, Texas 78701, (512) 463-3211.

C. Contractor's Duties

1. Except as specifically noted otherwise, provide and pay for:
   a. Labor, materials, and equipment.
   b. Tools, construction, equipment, and machinery.
   c. Other facilities and services necessary for proper execution and completion of work.
2. Owner is exempt from sales tax on products permanently incorporated into the work. Follow instructions issued by State Comptroller's Office for purchase of such products free of tax.
3. Secure as necessary for proper execution and conditions of work:
   a. License/Business Registration; paid by Contractor.
   b. Permits/Approvals required by governing entities; paid by Contractor.
4. Comply with codes, ordinances, rules, regulations, orders, and other legal requirements of public authorities which bear on performance of work.
5. Promptly submit written notice to the Owner of observed variances of Contract Documents from legal requirements.
6. Enforce strict discipline and good order among employees. Do not employ on work:
   a. Unfit persons.
   b. Persons not skilled in assigned task.
7. Checking Dimensions at Site:
   a. Verify measurements as necessary before ordering any materials or doing any work.
   b. Report any discrepancies to the Owner for instructions before proceeding.
8. Approval of Working Conditions:
   a. Notify the Owner of any unsatisfactory condition before beginning to perform work.
   b. Beginning of work by Contractor shall constitute his acceptance of substrate and surface conditions.
9. Under no condition shall a portion of work proceed prior to preparatory work having been completed, cured, dried, or otherwise made satisfactory to receive such related work.
10. The Contractor shall establish and maintain their own grades, lines, levels, and benchmarks. Verify all grades, lines, levels, and dimensions shown on drawings and report in writing any observed errors or inconsistencies to the Owner before beginning

work. Establish their own basic lines and grades in conformity with Owner's permanent benchmarks and coordinate systems for the construction area.

11. It is the intent of this project that all items of work include the materials, standards, trades, procedures, etc., customarily associated with the items of work, <u>whether or not such materials, standards, trades, procedures, etc., are expressly stated</u>. In case of ambiguity, unclearness, or conflict in these Construction Documents, the Contractor shall submit the matter promptly in writing for determination by the Owner. The Owner will render in writing a clarification reasonably inferable from these Documents and consistent with the intent of this proposed work.
12. Contractor shall employ only experienced and qualified workers and subcontractors.

1.2 Contracts

A. Perform work under Lump Sum Contract

1.3 Conditions of the Contract

A. The following Special Conditions also shall govern the work under each Section in the Technical Requirements.
   1. Uninterrupted Operations. Work on this Project shall not interrupt or compromise the routine operations of the Owner unless specifically authorized by the Architect/Engineer.
   2. Experienced Supervision. Employ a competent Supervisor for work on this Project, approved by the Owner, skilled in coordination of the trades involved and the type of scheduling required by a project of this nature. Replace approved Supervisor only with the permission of the Owner.
   3. Interrelation of Documents. The interrelation of the Specifications, the Drawings, and the Schedules are generally as follows:
      a. The Specifications determine the nature and setting of the several materials.
      b. The Drawings establish the quantities, dimensions, and details.
      c. The Schedules give locations.

      Anything mentioned in the Specifications and not shown on the Drawings and/or the Schedules, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both. Should there be a conflict within or among the Drawings or the Specifications or any other Contract Document, perform or furnish <u>the better quality or greater quantity</u> of work or materials. Figures given on details govern small scale drawings. The "Section Includes" statement, placed in the front of each Section of the Specifications, is intended to designate the scope and location of the work included therein, either generally or specifically. It is not intended to limit the Scope of Work should plans, schedules, or notes indicate an increased scope. Inadvertent omission of an item from its proper Section in the Specifications and its inclusion in another Section of the Specifications shall not relieve the Contractor of responsibilities for the item specified.
   4. Contract Administration. The Architect/Engineer has the authority to act on behalf of the Owner to the extent provided for in the Contract Documents, unless otherwise modified by written instrument which will be shown to the Contractor at his request.

      All instructions affecting Contract Sum, Contract Time, or Contract interpretations shall be confirmed expeditiously in writing, with copies furnished to the Owner's designated representative and the Contractor by the party issuing the instructions.
   5. Conduct of the Contractor
      a. Type of Dress:
         1.) Workmen must wear shirts at all times.
         2.) Wearing apparel that portrays obscene or vulgar language and/or art work is prohibited.
      b. Alcoholic Beverages and other Drugs:
         1.) Alcoholic beverages and other drugs will not be permitted on the property of the Owner.

2.) Persons under the influence of alcoholic beverages and/or any other drug are prohibited from the Project.

c. Obscenity:

1.) The Owner reserves the right to require dismissal from the Project of any person using obscene gestures.

d. Portable Radios and Other Sound-Producing Devices:

1.) Hold the volume of portable radios or other sound-producing devices to such a level so that individuals not related to the construction are not disturbed.

2.) Do not broadcast obscenity.

1.4 Contractor Use of Premises

A. Confine operations at site to areas permitted by:

1. Law.
2. Ordinance.
3. Permits.
4. Contract Documents.

B. Limit use of site and premises to allow:

1. Uninterrupted Owner activity where required for Owner’s business purposes.
2. Work by Others and Work by Owner.
3. Use of site and premises by public where required for Owner’s business purposes.

C. Construction Operations:

1. Yard Operations and/or New Construction: Limited to areas noted on Drawings unless specifically approved otherwise by the Owner.
2. Protection:
   a. Take over and assume responsibility for the premises necessary for each portion of the Work. Provide and maintain all protections required by governing laws, regulations, and ordinances. Be responsible for any loss or damage caused by workmen to the property of the Owner or to the work or materials installed. Make good any loss, damage, or injury without cost to the Owner.
   b. The protection of adjacent property shall include, but will not necessarily be limited to, the erection and maintenance of shoring, underpinning, and fences as necessary to protect and to support existing work to be left in place.
   c. Protect against damage to all trees and all shrubs on the site which do not have to be removed for the Work. Remove or trim any tree or shrub only with the specific approval of the Owner.
   d. Send proper notices, make necessary arrangements, and perform other services required for the care, protection, and maintenance of utilities, including fire hydrants, piping, wires, and all other such items on and around the building site.
   e. At no additional cost to the Owner, hold the Owner harmless from, and make good, any damage occurring as a result of the Contractor’s failure to provide required protection.

3. Other:
   a. No fires on the site.
   b. No dumping on the Owner’s property.
   c. Do not unreasonably encumber site with materials or equipment.
   d. Assume full responsibility for protection and safekeeping of products stored on premises.
   e. Obtain and pay for use of additional storage or work areas needed for operations.

1.5 Concealed Piping and Conduit

A. Should active piping or conduit be encountered below grade or concealed by existing construction and be found at variance with the conditions indicated by the Drawings and Specifications, relocate such piping and/or conduit as directed by the Owner.

B. Contract Sum shall be adjusted on the following basis:

1. If the concealed condition would not reasonably be anticipated by a competent workman, the Contractor shall be fairly compensated as determined by the Owner.
2. If, in the judgement of the Owner, the concealed condition could reasonably be anticipated by a competent workman, it shall be understood that the conditions were provided for in the bid and no additional compensation shall be due the Contractor. The Contractor shall be responsible for properly remedying the condition in a manner acceptable to the Owner.
3. Any additional compensation shall be net cost of labor and materials only.

1.6 Substantial Completion

A. Reference Section 01700 – Project Closeout for Substantial Completion Requirements.

PART II – PRODUCTS

Not used.

PART III - EXECUTION

3.1 Means and Methods

A. Unless otherwise expressly provided in the Contract Documents, the means and methods of construction shall be such as the Contractor may choose, subject, however, to the Owner's right to reject means and methods proposed by the Contractor which:

1. will constitute or create a hazard to the work or to persons or property; or
2. will not produce finished work in accordance with the terms of the Contract.

B. The Owner's acceptance of the Contractor's means and methods of construction or the Owner's failure to exercise his right to reject such means or methods shall not relieve the Contractor of his obligation to accomplish the result intended by the Contract; nor shall the exercise of such right to reject create a cause of action for damages.

3.2 Cleaning Up

A. Contractor shall clean and secure the work area at the end of each work day.

END OF SECTION 01010

SECTION 01020

CONTRACT CONSIDERATIONS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Articles and portions of articles of the General Conditions and Supplementary Conditions not amended, supplemented or superseded by these General Requirements (Division 1) shall remain in effect.

1.2 SECTION INCLUDES

A. Allowances

B. Schedule of Values

C. Application for Payment

D. Proposal Request (Changes)

E. Architect/Engineer’s Supplemental Instructions

F. Request for Interpretation

1.3 ALLOWANCES

A. Purchase product under each allowance as directed and approved by the Owner and Landscape Architect/Engineer.
B. Contractor shall submit any use of allowance items with monthly pay requests.
C. Any remaining allowance upon final completion shall be returned to The Sabine River Authority through a final Change Order.
D. The following allowances shall be included in this project:
1. Testing Allowance

1.4 SCHEDULE OF VALUES

A. Schedule of Values shall be submitted on AIA Document G703 - Continuation Sheet of Application and Certification for Payment, or electronic media printout.

B. Submit a Schedule of Values to the Architect/Engineer within ten calendar days after the date of the Owner-Contractor Agreement. Upon request of the Owner or Architect/Engineer the Contractor shall furnish additional line item breakdown of the Schedule of Values.

C. Use Table of Contents of Project Manual as basis of format for listing cost of work.

D. Include separate line items for the following:
1. Site Mobilization
2. Bonds / Insurance
3. Permits / Fees
4. Supervision / PM
3. Contractor’s Overhead and Profit
4. Record Drawings
5. Change Orders

1.5 APPLICATION FOR PAYMENT

A. At least twenty days before each progress payment falls due, the Contractor shall submit to the Landscape Architect/Engineer a notarized, itemized Application For Payment based on the previously approved Schedule Of Values, of 90 percent of the value of labor and materials incorporated in the Work including the last day of the preceding month, less the aggregate total of all previous payments, provided the aggregate total of all monthly payments shall not exceed 90 percent of the contract price. Applications for payment shall be supported by data substantiating the Contractor's right to payment as the Owner or the Landscape Architect/Engineer may require.

B. Payment will be made for the storing of materials on site, only if stored in a secured and bonded storage container, located on-site or at a designated off-site location.

1.6 CHANGE PROCEDURE

A. Change Proposal Request (CPR): The Architect/Engineer may issue a Change Proposal Request during the course of the Work. A Proposal Request is a description of a change in the Work under Contract such as additional work or revisions to work already completed, work not yet started or work in progress. The Change Proposal Request is issued to obtain a mutually accepted lump sum for the Work described, add, deduct or no change.

B. The Contractor shall promptly submit to the Landscape Architect/Engineer his completed Proposal, properly itemized and supported by sufficient substantiating data to permit evaluation.

C. The Contractor shall not proceed with the Work described in a Proposal Request until the Proposal has been evaluated, found to be fair and equitable by the Architect/Engineer, presented to the Owner for approval and authorized in writing or issued in a Change Order. The Contractor upon issuance of a Proposal Request shall make every attempt to not install items of work that are affected by the Proposal and will notify the Architect/Engineer of any and all items that cannot be postponed.

D. Unless agreed otherwise, two weeks shall be allowed for evaluation by the Architect/Engineer. If in the opinion of the Architect/Engineer a Proposal is not found to be fair and equitable, the Contractor will reevaluate the cost and no additional cost or time extension will be considered for the time required for the reevaluation.

E. Two weeks will be required to issue authorization to proceed after the Proposal Request is found to be fair and equitable. The Contractor's Proposal must be valid for the four weeks stated above unless agreed otherwise.

1.7 ARCHITECT/ENGINEER'S SUPPLEMENTAL INSTRUCTIONS

A. Landscape Architect/Engineer's Supplemental Instructions are issued for work that is not described in sufficient detail or is generally stated but not specifically described to the extent required for the exact construction of such items. This information shall be issued to the Contractor(s) in the form of Architect/Engineer's Supplemental Instructions (A.S.I.), AIA Document G710 and shall be considered a minor change in the Work.

B. Should the Contractor consider Architect/Engineer's Supplemental Instructions an item to be a change in the Contract Documents, he may notify the Architect/Engineer in writing of the items in dispute and include the actual cost increase or decrease associated with each item.

C. Claims by the Contractor for additional cost, in response to an Architect/Engineer's Supplemental Instruction, must be received by the Architect/Engineer within 20 days after the posted date on the

A.S.I. or claims will not be considered. Proceeding with work described in an A.S.I. shall constitute waiver of rights to claims.

1.8 REQUEST FOR INTERPRETATION

A. Request for Interpretation (R.F.I.) shall be submitted to the Architect/Engineer in written form through the Owner's selected electronic Project Management Information System, conforming to the following:

1. Each R.F.I. shall be numbered, as for referencing and entered into a log which shall be kept by the Contractor and the Architect/Engineer.
2. R.F.I.'s shall have a designated space titled Category. The Contractor shall enter the proper Category No. in this space, which will identify the urgency of the R.F.I., as shown below:
    a. Category 1 - an emergency and requires an answer in 24-48 hours or work will stop.
    b. Category 2 - a normal request and requires a five (5) working day response.
    c. Category 3 - is low priority and requires an answer within 2-4 weeks.
3. The R.F.I. log shall be reviewed during each progress meeting and any problems discussed.

END OF SECTION 01020

SECTION 01039

COORDINATION AND MEETINGS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Articles and portions of articles of the General Conditions and Supplementary Conditions not amended, supplemented or superseded by these General Requirements (Division 1) shall remain in effect.

1.2 SECTION INCLUDES

A. Coordination

B. Cutting, Patching and Touch-up

C. Pre-Construction Conference

D. Progress Meetings

1.3 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify utility requirement characteristics of operating equipment are compatible with building utilities.

C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable.

D. In finished areas, conceal pipes, ducts, and wiring within the construction.

1.4 CUTTING, PATCHING AND TOUCH-UP

A. Employ skilled and experienced installers to perform cutting and patching of new and existing Work; restore Work with new Products.

B. Establish elevations, lines, and levels and certify that elevations and locations of the Work conform with Contract Documents.

C. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes. Fit Work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

D. Execute cutting and demolition by methods that will prevent damage to other work and will provide proper surfaces to receive installation of repairs and new work.

E. Restore work that has been cut or removed; install new products to provide completed work in accordance with requirements of Contract Documents.

F. Refinish entire surfaces to match adjacent finishes to the nearest intersections. Refinish assemblies entirely.

G. Execute excavating and backfilling by methods that will prevent damage to other work and will prevent settlement.

1.5 PRE-CONSTRUCTION CONFERENCE

A. Prior to the start of the Work of this Contract, the Contractor, the Architect/Engineer and the Owner’s Representative will meet for the purpose of reviewing schedules and conditions of the buildings and site.

B. The location and date of the Pre-Construction Meeting will be scheduled after the Award of Contract to all affected parties.

C. Pre-Construction Conference Agenda:
   1. Introduction of Key Personnel.
   2. Dates will be selected for meetings.
   3. All required contract forms, bonds and insurance will be reviewed.
   4. Schedules and Submittal Process will be reviewed.
   5. Use of Site.
   6. Contractor questions.

1.6 PROGRESS MEETINGS

A. Weekly Job Site Progress Meeting Agenda (Contractor/Sub Contractors):
   1. Monitor the progress of construction.
   2. Discuss any coordination issues.
   3. Discuss any shop drawing issues.
   4. Discuss questions from subcontractors.
   5. Confirm next week meeting date and time.
   6. Consultant may be included in Weekly Progress Meetings via virtual meeting and/or on site.

B. Monthly Job Site Progress Meeting Agenda (Owner/Contractor/Consultant):
   1. Review Project Schedule: An up-to-date project schedule shall be submitted at each monthly meeting. Review list of construction items to be observed before being covered or completed.
   2. Review Record Set of Drawings: Record set of drawings must be kept current with any changes to utilities, partitions, etc.
   3. Review Pay Request: Provide rough-draft copies of the pay request for review. Corrections must be made on the rough-draft copies and a corrected, notarized, and signed copy shall submitted through the Owner’s selected Project Management Information System.
   4. Discuss any coordination issues.
   5. Discuss any shop drawing issues.
   6. Discuss any weather days or anticipated delay days.
   7. Discuss questions from subcontractors.
   8. Confirm next month meeting date and time.
   9. Submit Daily Activity Reports.

END OF SECTION 01039

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Articles and portions of articles of the Contract Documents not amended, supplemented or superseded by these General Requirements (Division 1) shall remain in effect.

B. All Submittals, Shop Drawings, Data, Schedules, Certificates, Reports, and all other documents and formal correspondence will be required to be submitted in digital format through the Owner’s selected Project Management Information System.

1.2 SECTION INCLUDES

A. Submittal Procedures

B. Schedules

C. Reports, Warranties, Certificates and Manuals

D. Schedule of Submittals

E. Construction Schedule

1.3 SUBMITTAL PROCEDURES

A. Identify long lead or specialty submittals (Pre-Fabricated Restroom Building, Pavilion, Floating Docks and site features, etc.) and submit within first 30 days of contract.

B. Submit shop drawings and product data in the quantity as required by the various sections of the Specifications or if not specified, submit three copies for the use of the Landscape Architect/Engineer, plus the number of copies the contractor’s needs may dictate. Documents shall be submitted through the Owner’s selected Project Management Information System. All submittals, regardless of the source of origin, shall be submitted via the General Contractor.

C. For each product specified or noted on the Drawings, submit digital copies of product data with installation directions as applicable to the construction requirements of this project, together with any required samples for approval. Shop drawings and product data shall be submitted within 30 days of Notice to Proceed. Documents shall be submitted through the Owner’s selected Project Management Information System.

D. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

E. Apply Contractor’s stamp, signed or initialed certifying that review for verification of product required, field dimensions, adjacent construction Work and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

F. Provide space for Contractor and Architect/Engineer review stamps.

G. Revise and resubmit submittals as required; identify all changes made since previous submittal.

H. Submittals shall be executed in sufficient time to allow at least three weeks for each review by the Architect/Engineer.

I. Each product submitted shall be submitted with it's own transmittal form, stating the product name, manufacturer and related specification section. Number each submittal consequently in order of submission (1, 2, 3, etc.), also reference the Project Manual specification number for the submittal identity. (example: 07270- 1 for the first submittal for Firestopping and 07270-2 for the second item submitted under the same section). Revised submittals should have original number and a sequential alphabetic suffix. (example: 1A for a revised submittal).

1.4 SCHEDULES

A. The following schedules must be prepared and submitted to the Architect/Engineer for approval within twenty (20) calendar days (unless noted otherwise) after date of Owner-Contractor Agreement. Failure to submit any of the following items to the Architect/Engineer within the time allotted shall be grounds for withholding Contractor’s Certificate for Payment.

1. List of Subcontractors and Suppliers, including category of work, contact name, address, and telephone number.
2. Construction Schedule. Refer to Paragraph 1.7 below.
3. Schedule of Values. Refer to Section 01020, Paragraph 1.4.
4. Cash flow schedule of anticipated amount of monthly estimates.
5. Schedule of Submittals.
6. Requests for Substitutions: Submit within 30 days, in accordance with Section 01600, Paragraph 1.5.
7. Schedule of Operation and Maintenance Data for Manuals. Refer to Section 01700, Paragraph 1.7.

1.5 REPORTS, WARRANTIES, CERTIFICATES AND MANUALS

A. Warranties:

1. On all materials for a period of one year or as per the maintenance bond and as required by various specification sections.
2. Warranty on all pre-fabricated products and structures.

B. Special warranties in conjunction with mechanical equipment.

C. Test reports and certificates in conjunction with electrical equipment.

D. Operation and Maintenance Manuals. Refer to Section 01700, Paragraph 1.7.

E. Concrete Design and Test Reports:

1. In conjunction with concrete paving.
2. In conjunction with structural concrete.

1.6 SCHEDULE OF SUBMITTALS

A. Provide list of all items requiring shop drawings, product data or samples.

B. Organize list by specification sections, and provide exact break down of phased portions of work.

C. Provide proposed date for each initial submittal. Allow sufficient time as may be required for resubmittals.

1.7 CONSTRUCTION SCHEDULE

A. The Construction Schedule shall be prepared in the form of a bar graph, identifying the first work day of each week and provide dates for completion of phases in the various categories of the work.

B. Revise and resubmit as required. Submit revised schedule with each Application for Payment.

C. The purpose of the Construction Schedule shall be to allow the Owner and Architect/Engineer to evaluate the Contractor's performance and adherence to the schedule on a monthly basis along with the Contractor's Application for Payment.

D. Liquidated Damages will be paid by the Contractor to the Owner at a rate specified in the Agreement Between the Owner and Contractor Form for each and every calendar day that actual Substantial Completion exceeds the time for Substantial Completion authorized under the terms of this Contract.

END OF SECTION 01300

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Submit to the Architect/Engineer shop drawings, product data, and samples required by specification sections.

1.2 SHOP DRAWINGS

A. Prepared by a qualified detailer.

B. Identify details by reference to sheet and detail numbers shown on Contract Documents.

C. Shop Drawings shall be submitted <u>only</u> to clarify, amplify, or revise information shown or called for in the contract documents.

1.3 PRODUCT DATA

A. Manufacturer’s standard schematic drawings and diagrams:

1. Modify drawings to delete information which is not applicable to the work.
2. Supplement standard information to provide additional information specifically applicable to the work.

B. Manufacturer’s catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data:

1. Clearly mark each copy to identify pertinent materials, products or models.
2. Show dimensions and clearances required.
3. Show performance characteristics and capacities.
4. Show wiring or piping diagrams and controls.

1.4 SAMPLES

A. Office samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of product or material, with integrally related parts and attachment devices.
2. Full range of color samples.

B. Field Samples and Mock-ups:

1. Erect at project site at location acceptable to Architect/Engineer.
2. Construct each sample or mock-up complete, including work of all trades required in finish work.

1.5 SUBMISSION REQUIREMENTS

A. Submit shop drawing and product data as soon as practicable after award of contract but not later than 30 days before dates reviewed submittals will be needed.

B. Submit all office samples as soon as practicable but not later than 30 days after award of contract in order to facilitate color selections and coordination of the various materials. Final color selections and release of shop drawings contingent upon color selection will not be made until all office samples have been submitted, coordinated, and approved.

C. Number of submittals required:

1. Shop Drawings: Submit digital copies through the Owner's selected Project Management Information System.
2. Product Data: Submit digital copies through the Owner's selected Project Management Information System.
3. Samples: Submit the number stated in each specification section, minimum of three samples for each item.

D. Each submittal print shall include a cover sheet with sequential submittal number and:

1. Date and revision dates.
2. Project title and number.
3. Names of Contractor, subcontractor, supplier, and manufacturer.
4. Identification of product or material and specification section number.
5. Relation to adjacent structure, materials or other critical features.
6. Field dimensions clearly identified as such.
7. Applicable reference standards.
8. A blank space 4" x 8" for Architect/Engineer's stamp (on cover sheet).
9. Other pertinent data required by specifications.
10. Identification of variation from contract documents.
11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements, compliance with contract documents, and coordination with requirements of the work.

    Note: Absence of the Contractor's stamp shall constitute grounds for rejection of the submittal until such time as the submittal has been processed in accordance with this requirement. DO NOT FOLD SUBMITTALS TO EXPOSE STAMPS ON BACK OF PAGES. STAMPS TO BE ON COVER PAGE(S).

1.6 RESUBMISSION REQUIREMENTS

A. Resubmission: Make corrections and changes in submittals required by Architect/Engineer and resubmit until approved.

B. Shop Drawings:

1. Revise initial drawings and resubmit as specified for initial submittal.
2. Indicate on drawings any changes which have been made, other than those requested by Architect/Engineer.

C. Product Data and Samples: Submit new data and samples as specified for initial submittal.

1.7 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

A. Distribute reviewed copies of shop drawings and product data which carry Architect/Engineer's stamp as follows:

1. Job Site File.
2. Record Documents File.
3. Other affected contractors.
4. Subcontractors.
5. Supplier or Fabricator.

END OF SECTION 01340

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Articles and portions of articles of the Contract Documents not amended, supplemented or superseded by these General Requirements (Division 1) shall remain in effect.

1.2 SECTION INCLUDES

A. Cooperate with the Owner’s selected testing agency and any others responsible for testing and inspecting work.

B. Provide such other testing and inspecting as are specified to be furnished by the Contractor in this Section and/or elsewhere in the Contract Documents.

C. Where no testing requirements are described, but the Owner decides, that testing is required, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made using funds from the Testing Allowance as described in the Bid Form and Pay Item Descriptions.

1.3 PAYMENT FOR TESTING

A. Initial Testing: The Contractor shall contract with a pre-approved testing agency for all initial services of the testing laboratory as required by the Contract Documents and testing as the Owner deems necessary. Payment for initial testing will be paid through the Testing Allowance.

B. Retesting: When initial testing indicates non-compliance with the Contract Documents, subsequent retesting required by the non-compliance shall be performed by the same testing agency, and costs thereof will be paid directly by the Contractor, at no additional cost to the Owner.

1.4 LABORATORY DUTIES

A. Cooperate with Architect/Engineer and Contractor; provide qualified personnel after due notice.

B. Perform specified inspections, sampling and testing:

1. Comply with specified standards.
2. Ascertain compliance of materials and work procedures with requirements of Contract Documents.

C. Promptly notify Architect/Engineer and Contractor of observed irregularities or deficiencies of work or products.

D. Promptly submit written report of each test and inspection; digital copies shall be submitted through the Owner’s selected Project Management Information System. Each report shall include:

1. Date issued.
2. Project title and number
3. Testing laboratory name, address and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.

7. Date of test.
8. Identification of product and specification section.
9. Location of sample or test in the Project.
10. Type of inspection or test.
11. Interpretation of test results, when requested by Architect/Engineer.

E. Perform additional tests as required by Architect/Engineer of the Owner.

1.5 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.
4. Stop the Work.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to Work.

B. Furnish copies of Products tests reports as required.

C. Furnish incidental labor and facilities:
1. To provide access to Work to be tested.
2. To obtain and handle samples at the Project site.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

D. Notify Architect/Engineer and Laboratory 48 hours prior to expected time for operations requiring inspection and testing services.

E. Payment for all retesting required because of non-conforming work of materials.

1.7 SCHEDULE OF INSPECTIONS AND TESTS

A. Section 02200 – Earthwork (refer to Specifications)

1. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698.
2. Frequency of Tests: Field density tests should be taken as each lift of fill material is placed. As a guide, one field density test per lift for each 5,000 square feet of compacted area is recommended. For small areas or critical areas the frequency of testing may need to be increased to one test per 2,500 square feet. A minimum of two tests per lift should be required.

B. Section 032100 – Concrete Reinforcement

1. Prior to each concrete pour, inspect reinforcing sizes, bending of bars, quantities, spacing, placement, clearance of reinforcing from forms and tying in accordance with the Contract Documents and ACI 315.
2. Inspect support and securing of reinforcement.
3. Inspect condition of reinforcing.
4. Prior to each concrete pour, inspect positioning of steel inserts and assemblies, sizes and spacing of reinforcement and inspect fusion-welded anchors and sheer connectors.

C. Section 033000 - Cast-In-Place Concrete

1. Sample Cylinders: During the progress of the work, test cylinders shall be made from each different mix. Four compression test cylinders will be taken during the pour for every pour of 100 cubic yards or part thereof. One tested at 7 days, two tested at 28 days, and one retained in reserve for further testing.
2. Make a slump test in accordance with ASTM C-143 slump shall be a minimum of 4 inches to a maximum of 6 inches for each 60 cubic yards, or portion thereof, of concrete placed.
3. If tests of concrete do not meet the specified strength, coring shall be required. All coring shall be at the Contractor’s expense.
4. Testing and coring shall be in compliance with ACI, Section 301.
5. Mix design: The Contractor shall submit a concrete mix design for approval.

END OF SECTION 01410

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Articles and portions of articles of the General Conditions and Supplementary Conditions not amended, supplemented or superseded by these General Requirements (Division 1) shall remain in effect.

1.2 SECTION INCLUDES

A. Security

B. Protection of Completed Work

C. Water Control

D. Use of Site

E. Temporary Controls

F. Project Identification and Signs

G. Field Offices and Sheds

H. Removal of Utilities

I. Fire Protection

J. Protection of Trees and Vegetation

K. Traffic Control

L. Temporary Fencing

1.3 SECURITY

A. A night watchman is not a requirement. However, protection of the property at all times is the responsibility of the Contractor, as well as replacement of any loss due to thieves or damage by vandals.

1.4 PROTECTION OF COMPLETED WORK -DAMAGED ITEMS

A. The Contractor shall be fully responsible for the protection of all items, finishes, etc., from the time they are delivered to or installed in the Work, until finished work is turned over to the Owner. Whenever such items, finishes, etc., are damaged, they shall be completely replaced, including all required removal work, patching, repairing, refinishing, and reinstallation as required to turn item over to Owner in new condition.

1.5 WATER CONTROL

A. Provide pumps, piping, fittings, hose, trenching, sumps, etc., as required to control and remove surface and subsurface water from excavation and the site. Dispose of water in accordance with E.P.A. storm water management for construction activities #482N.

1.6 USE OF SITE

A. The Contractor will be responsible for protection of the Owner's property, including all adjacent structures, trees and shrubs.

B. Temporary toilets may be located in the construction area.

C. Prior to construction, inspect all areas of the site to be used including adjacent landscaping and irrigation, etc and prepare a photographic record of the conditions. As a part of the Work of this contract the site will be restored to its previous condition. All damages in the proximity of the construction area, not represented by the photographic survey shall be repaired to “like new condition.”

1.7 TEMPORARY CONTROLS

A. Temporary Services and Utilities:

1. Contractor shall pay for electrical utilities and water for the project during the construction period. Contractor to arrange and pay for all other services and utilities required and all deposits therefore, including but not limited to telephone, service, during the construction period.
2. Provide and maintain in a neat and sanitary condition such toilet accommodations for use of employees as may be necessary to comply with requirements and regulations of the The Sabine River Authority and State Department of Health, or other “authorities” having jurisdiction. Permanent toilets within adjacent buildings shall not be used by employees. Maintain temporary toilet facilities on the site until final acceptance of Work, unless permission is given by the Architect/Engineer for earlier removal.

B. Temporary Hoists: The General Contractor shall furnish, install and operate all temporary hoists as his needs may require; shall erect temporary stairs as may be required for his operations and shall erect and maintain suitable handrails and toeboards around all openings in floors and roofs and wherever else required for proper safety precautions. All of the foregoing requirements of the “Manual of Accident Prevention in Construction” published by the Associated General Contractors of America.

1.8 PROJECT IDENTIFICATION AND SIGNS

A. No signs or advertising of any kind will be permitted without the approval of the Owner.

B. Project signs or other signs or advertising of any kind will not be permitted.

1.9 FIELD OFFICES AND SHEDS

A. Provide a suitable office with telephone, data/internet and fax throughout construction. Keep an approved set of Drawings and Project Manual, including revisions, approved shop drawings, and samples on job at all times.

1.10 REMOVAL OF UTILITIES

A. Should active piping or conduit be encountered below grade within the construction site and be found at variance with the known conditions indicated by the Drawings and Specifications, relocate piping or conduit as directed by the Architect/Engineer. Provide temporary support of active piping and conduit encountered in the excavations until permanent support or removed is accomplished. Cut off, and cap or plug abandoned lines at least 3 feet outside the building lines. In all cases, conform to the applicable requirements of the locality or governing agency.

1.11 FIRE PROTECTION

A. All contractors and subcontractors shall observe, and the General Contractor shall enforce throughout the work, during the whole period of construction all requirements of the SRA, State and Insurance Authorities, to minimize the fire hazards during the progress of the work. In addition, the General Contractor shall post signs and warnings and ensure the following requirements are met:

1. Combustible refuse shall be removed from the building daily.
2. Storage of materials inside the building shall be restricted to fireproof areas with no-smoking signs posted.
3. No oils, gasoline or other volatile liquids shall be stored inside the building.
4. No bitumen kettles shall be operated inside the building.
5. Space heaters and other types of heaters shall be set on incombustible flooring only. Building refuse shall not be burned in salamanders. Heaters shall not be placed closer than 15 feet to any combustible hanging or eight feet to a combustible partition or ceiling.
6. Tarpaulins shall be flame proofed and when in use, securely braced and tied.
7. Provide metal canisters with covers for storage of paint contaminated and oil waste materials.
8. During all welding operations, a safety man with a fire extinguisher shall be on hand at all times to control any fire that may result from welding operations.
9. The General Contractor shall provide fire extinguishers within 75 feet of any point of the area under construction. In addition, the General Contractor shall also provide one fire extinguisher outside each paint storage room and every other storage room where combustible materials are stored and in each field office.
10. Burning of trash and excess materials on the premises is prohibited. No fires, including roofer's kettles, will be permitted within 40 feet of the buildings, sheds, shrubs or other material subject to fire, heat or smoke damage. The Contractor shall be solely responsible for any loss resulting from any fires.

1.12 PROTECTION OF TREES AND VEGETATION

A. The Contractor shall be fully responsible for the protection of all trees and vegetation to remain and/or not in the footprint of the designed facility. The Contractor’s failure to comply with the following will cause for the Owner to shut the project down at the Contractor’s expense:

1. Contractor will be required to install (and maintain throughout construction) protective fencing at least 10’ outside the drip line of all trees to remain.
2. Parking vehicles under trees will not be permitted. The Contractor will be fined $100.00 for each violation, which will be deducted from the contract amount by Change Order.
3. All branches that interfere with construction activity shall be temporarily tied back to prevent damage. Branch removal is permitted only as approved by the Architect/Engineer.
4. Tree damage will be assessed from the International Shade Tree Conference formula, D (diameter of tree measured 12” above ground) x 0.7854 x $36.00. Total damages will be deducted from the contract amount by Change Order.
5. Trenching for utilities in wooded areas must be staked and approved by Owner prior to construction. The Owner reserves the right to adjust line locations to avoid damage to existing trees.
6. Where plans call for disturbance of the root system of existing trees, roots must be pruned (by machine manufactured for that purpose) prior to any other construction activity.

Immediately after excavation, exposed roots must be immediately covered with a finely shredded mulch and kept moist until backfilling is complete.

1.13 TEMPORARY FENCING

A. The Contractor shall be fully responsible for providing and maintaining temporary fencing and gates at the project site, with minimum 6’ high chain link fencing. Fencing shall be ‘breakaway’ fencing when placed within floodplain areas, as required by The Sabine River Authority. Fencing shall be secured with gravel bags and base plates and/or temporary staking. Reference Temporary Fence Details.

END OF SECTION 01500

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Tree preservation work includes, but is not limited to:

1. Protection of existing trees and all other indicated to remain in place.
2. Maintenance of protected areas.
3. Clearing and grubbing activity within protected areas.
4. Damage compensation.

1.02 APPLICABLE REGULATIONS

A. Comply with all applicable local laws and regulations concerning tree preservation as well as the specific requirements stated elsewhere in the Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PROTECTION OF EXISTING TREES TO REMAIN

A. Tagging and Fencing

1. Trees to remain shall be tagged and protective fencing installed prior to any construction, demolition, or other disturbance.
2. Protective fencing shall be installed at the dripline of the tree to be protected unless otherwise noted on the Plans.
3. The area inside the protective fencing will heretofore be referred to as the protected area.
4. The Contractor shall verify tagged trees and fence locations in field with the Landscape Architect prior to any construction or demolition activity.

3.02 MAINTENANCE OF PROTECTED AREA

A. No construction activity shall occur inside protected areas other than that landscape construction which is required for completion of the project.

1. Construction activity includes, but is not limited to, building material storage, waste stockpiling, topsoil stockpiling, equipment storage or parking, disposal of waste materials of any kind, draining or flushing of tanks, canisters, drums, or other containers, trailer parking or storage, and demolition activity.

B. No traffic, vehicular or pedestrian, shall encroach upon protected areas.

1. This includes, but is not limited to, personal passenger vehicles, construction vehicles, grading machinery, and loading/lifting machinery.

C. No material, machine, vehicle, or part thereof shall encroach above or below the vertical plane of the protective fencing into the protected area.

D. The Contractor shall notify the Landscape Architect of any activity which might infringe or encroach upon the protected area prior to start of said activity.

3.03 ENCROACHMENT UPON PROTECTED AREA

A. If encroachment into the protected area does occur, notify the Landscape Architect immediately.

3.04 ACTIVITY INSIDE PROTECTED AREAS END OF SECTION

A. Clearing and Grubbing:

1. Clearing of small trees, shrubs, and herbaceous plants in the protected area shall be performed by hand only.

2. Bulldozers and/or drag chain operations are not permissible inside protected areas.

3. Grubbing of stumps shall be performed in two (2) ways:

a. Under 6" diameter shall be pulled by chain.

1. The vehicle used for pulling shall remain outside the protected area (dripline of the tree to remain) whenever possible.

2. Under no circumstance shall the pulling vehicle encroach into the protected area by more than 1/3 of the distance from the trunk of tree to remain to the nearest edge of the protected area (dripline).

3. Any depressions shall be filled with topsoil and leveled to grade by hand.

b. Stumps over 6” diameter shall be ground out to a depth of 4” below grade.

1. Stump grinder shall be trailer mounted and maneuvered by light truck or bobcat.

2. Wood chips generated by grinding shall be removed and any depressions shall be filled with topsoil and leveled to grade.

3. These operations shall be performed by hand.

B. Grading:

1. Any grading which may be required inside the protected area shall be performed by hand only.

2. No grading or earthmoving machinery shall be allowed inside the protected area.

3. Provide grade stakes and verify grade elevations with the Landscape Architect prior to commencement of any grading activity.

C. Preparation of soil for seeding and/or sodding within the protected areas shall be done by hand or with a power rake and shall not disturb soil more than 2" deep to prevent damage to feeder root systems.

1. Chemical herbicides shall be used within protected areas unless the Contractor can obtain written manufacturer's guarantee that herbicide will not harm tree health or growth and obtain written approval from the Landscape Architect.

2. Contact the Landscape Architect prior to seed or sod preparation within protected areas to determine exact seed and/or sod limits.

D. Stake locations of all utilities which encroach protected areas.

1. Contact the Landscape Architect prior to clearing or trenching for utilities to verify that staked location is the least obtrusive to protected area.

3.05 REMOVAL OF PROTECTIVE FENCING

A. Protective fencing may be removed to facilitate landscape work in the protected area.

1. All Work in the protected area shall be initiated within 24 hours of fence removal.

2. If landscape work in the protected area is delayed or interrupted for more than 24 hours, then protective fencing shall be reinstalled until such time as work in the protected area is resumed.

3. Protective fencing shall be reinstalled after substantial completion of work inside protected area and shall remain until substantial completion of the project or approval of the Landscape Architect, whichever is later.

3.06 DAMAGE COMPENSATION

A. Any damage occurring to trees to remain or protected areas or removal of trees to remain in the protected areas caused by neglect, unauthorized encroachment and/or inadequate protection enforcement as

1. Financial Compensation for said damage or removal shall be determined by the Landscape Architect and Owner as per the following guidelines on a per occurrence basis.

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Articles and portions of articles of the General Conditions and Supplementary Conditions not amended, supplemented or superseded by these General Requirements (Division 1) shall remain in effect.

1.2 SECTION INCLUDES

A. Products

B. Transportation and Handling, Storage and Protection

C. Substitutions

D. Manufacturer’s Directions

E. Color Schedule

1.3 PRODUCTS

A. Products include new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components specifically identified for reuse.

1.4 TRANSPORTATION AND HANDLING

A. Transport, handle, store and protect Products in accordance with manufacturer's instructions.

B. Materials shall be new, delivered and stored in authorized locations in unopened containers and in ample quantity to prevent delay. Ordering of materials shall be made well in advance so as not to hinder the progress of work. Grade marks, labels, etc. shall be kept readable.

1.5 SUBSTITUTIONS

A. The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

B. The details on the Drawings and the requirements of the Specifications shall be based on the first listed materials, products or equipment in the Contract Documents. All other products will be considered substitutions. If the Contractor desires to use any of the other listed materials, products or equipment other than that listed first or if the Contractor substitutes a material, product or equipment, the Contractor alone shall be responsible for the correct function, operation and accommodation of the other materials, products or equipment into the spaces allotted on the Drawings.

C. The “listing” of a manufacturer does not imply “acceptance” or “approval” of any standard product of that manufacturer.

D. Limitations of Substitutions:

1. Substitutions will not be considered when indicated or implied on shop drawings or product data submittals by subcontractor or supplier, or when acceptance will require substantial revision of Contract Documents.
2. Substitute product shall not be ordered or installed without written acceptance.
3. Only one request for substitution for each product will be considered. If substitution is not accepted, Contractor shall provide specified product.
4. Architect/Engineer will determine acceptability of substitutions and the Architect/Engineer's decision of approval or disapproval of a requested substitution shall be final.

E. Whenever, in any of the Contract Documents, any material, product or equipment is defined through the use of any federal association or other standard specification, the Contractor shall present satisfactory evidence of compliance with the particular specification for the material, product or equipment he proposes to furnish.

F. Request for Substitution Submittal Procedures:

1. No substitution will be considered unless three copies are submitted on General Contractor's Request for Substitution Form (see Section 01630-3 and 01630-4).
2. Request for Substitution during the bidding period:
   a. Substitutions shall be submitted to the Architect/Engineer at least seven days prior to the date for receipt of bids by the General Contractor.
   b. If the Architect/Engineer approves a proposed substitution prior to receipt of bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.
3. Request for Substitution after award of contract:
   a. Substitutions shall be submitted to the Architect/Engineer within at least 30 (thirty) calendar days after the award of contract. No substitutions will be considered after that time and the Contractor must provide the specified product.

1.6 MANUFACTURER'S DIRECTIONS

A. All manufactured articles, material, appliance and equipment shall be delivered, stored, applied, installed, connected, erected, used, cleaned, conditioned and placed in operation, as directed by the respective manufacturers, insofar as these directions are applicable to this particular project and are not in conflict with superior requirements in the Specifications or requirements of applicable Building Codes.

END OF SECTION 01600

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Articles and portions of articles of the General Conditions and Supplementary Conditions not amended, supplemented or superseded by these General Requirements (Division 1) shall remain in effect.

B. All closeout documents (Record Drawings, Operation and Maintenance Manuals and Warranties) shall be provided to the Owner in digital format, and submitted through the Owner’s selected Project Management Information System.

1.2 SECTION INCLUDES

A. Substantial Completion

B. Cleaning

C. Record Drawings

D. Operation and Maintenance Manuals

E. Warranties

F. Spare Parts and Maintenance Materials

G. Letters of Compliance

1.3 SUBSTANTIAL COMPLETION

A. After the Work has been cleaned and finished to a state of Substantial Completion, the Contractor shall prepare a list of items to be completed or corrected. The Contractor shall give the Architect/Engineer 10 days written notice of the date the Work, or a portion of the Work, will be ready for each inspection.

B. First Inspection: Upon receipt of the list of items to be completed or corrected, if the Architect/Engineer agrees that the level of completeness meets the standards established, the Architect/Engineer will inspect the project for compliance with the Contract Documents. The Architect/Engineer shall verify and amend the Contractor’s list. The Architect/Engineer will designate specific items on the list which must be completed or corrected before the Certificate of Substantial Completion will be issued.

C. If, in the Architect/Engineer’s opinion, the Contractor is not making the proper effort to complete or correct listed items, the Architect/Engineer may report same to the Owner who will have the option of engaging other contractors to complete the work of the project. Such contractors shall be employed as stipulated in the General Conditions.

D. Second Inspection: When items have been corrected to meet Substantial Completion, the Contractor shall notify the Architect/Engineer to perform a second Substantial Completion inspection. If, in the opinion of the Owner and Architect/Engineer, the work has been performed in compliance with the Contract Documents, and if documents defined in this Section, and in Paragraph 9.10.1 of the General Requirements have been prepared and received by the Owner, the

Architect/Engineer will issue the Certificate of Substantial Completion with the remaining items to be completed or corrected for final acceptance on an attached list.

E. Items to be Completed or Corrected: The list of items attached to the Certificate of Substantial Completion is a guideline of items to be corrected for final acceptance. Items may be added to the list after the date of Substantial Completion as a guide of items to review at final inspection and as a record of the warranty date for those items.

1.4 CLEANING

A. Execute cleaning prior substantial completion reviews and final inspections.

B. Clean interior and exterior surfaces exposed to view.

C. Clean debris from entire site, roofs, gutters, downspouts, and drainage systems.

D. Clean or replace filters of operating equipment.

E. Remove waste and surplus materials, rubbish, and construction facilities from the site.

F. The Contractor shall turn the work over in clean condition inside and outside (including the premises). Clean up shall include removal of smudges, marks, stains, fingerprints, soil, dirt, paint, dust, lint, unnecessary labels, discoloration's and other foreign materials. Clean all finished surfaces, such as (but not limited to) walks, drives, curbs, paving, fences, grounds, etc. Slick surfaces shall be left with a clear shine. Remove all temporary facilities and job sign, including surface materials and temporary roads and walkways.

1.5 RECORD DOCUMENTS

A. The contractor shall provide to the Landscape Architect/Engineer complete record documents at the completion of the project which includes the drawings and project manual. The record documents shall be submitted in electronic format.

B. The contractor shall acquire and pay for a set of prints of the drawings on heavy weight paper and one Project Manual with a laminated cover at the beginning of the project to be kept in a safe, neat environment at the site. The prints and project manual will be labeled with neat bold letters "Record Drawings Prints" and "Record Project Manual". The edges of the prints shall be protected with clear tape.

C. During the course of performing the work, the contractor shall neatly record all changes to the Contract Documents on the "Record Drawing Prints" and "Record Manual", including but not limited to:
   1. All Addendum's issued by the Architect/Engineer.
   2. All Change Orders approved by the Owner.
   3. All Architect/Engineer's Supplemental Instructions issued by the Architect/Engineer.
   4. All answers issued by the Architect/Engineer in response to "Requests for Interpretation" issued by contractor that change any drawing or specification.
   5. All changes by the contractor of piping routings, duct layouts, electrical equipment placement, circuiting, etc. that deviate from locations shown on the Contract Documents, shall be carefully recorded. The contractor shall show and label all valves with the corresponding tag number.
   6. All underground utility locations shall be reviewed with the Architect/Engineer and consequently recorded on the "Record Drawing Prints".

D. Prior to application for payment each month, the Architect/Engineer will review the "Record Drawing Prints" and "Project Manual" to verify that any changes during that pay period have been properly recorded. The contractor shall keep a log on the cover sheet of the drawings and a log in the front of the Project Manual indicating which Addendum's, Change Orders, Supplemental Instructions, R.F.I.'s, etc. have been posted, the date they were posted, and by whom they were posted. Failure to record the changes that have occurred in that pay period will be grounds to withhold payment until they are recorded.

E. As part of Project Close-out, the Record Documents, shall be scanned to PDF format, and submitted through the Owner's selected Project Management Information System for review and approval after substantial completion and prior to final payment.

F. As part of Project Closeout, the "Record Documents shall be submitted for review after substantial completion and prior to final payment. The Landscape Architect/Engineer will compare the "Record Documents" to his own record set. The Landscape Architect/Engineer will return the "Record Documents" to the contractor who will promptly correct any deficiencies or discrepancies to the satisfaction of the Landscape Architect/Engineer. The contractor will then submit the final record drawings and record project manual in digital format through the Owner's selected Project Information System.

G. Preparation of "Record Documents" is subsidiary to the project pay items. No separate pay will be provided for preparation of record document.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Furnish the Owner, through the Architect/Engineer, copies of operating instructions and maintenance recommendations for all work installed in the building, including that installed by General Contractor's own forces and all work done by subcontractors.

B. Operating instructions and maintenance recommendations shall be furnished in a form approved by the Architect/Engineer and shall be neatly typewritten and complete, bound into Operations and Maintenance Manuals.

C. These manuals shall be prepared and transmitted to the Architect/Engineer for approval so they can be given to the Owner no less than 10 days prior to Substantial Completion.

D. The work covered by these manuals will not be inspected for Substantial Completion until Owner has received the manuals described above.

1.7 WARRANTIES

A. Warranties and Certificates: Prior to the final payment, Contractor and subcontractors shall forward to the Architect/Engineer, copies of warranties and certificates as required by the Contract Documents.

B. The Contractor and each subcontractor shall furnish written warranties, covering their respective work or equipment for a minimum period of two years from the date of acceptance, against defects of material or workmanship at no cost to the Owner. Some work may be specified to be covered under a longer period of warranty. All warranties shall be signed by the responsible Contractor and subcontractor.

C. Wherever defects occur within the time limit of the warranty, if such unsatisfactory condition is due to the use of materials, or workmanship which are inferior, defective or not in accordance with the Contract, the Contractor, whenever notified, shall immediately:

1. Place any such warranted work and/or materials in satisfactory condition.

2. Make good any work or materials, or the equipment or contents of said structures or grounds, which are damaged in fulfilling any such warranty at no cost to the Owner, and to the satisfaction of the Architect/Engineer.

D. Should the Contractor fail to proceed promptly with the terms of this warranty the Owner may have such work performed as he may deem necessary to fulfill the warranty, charging the cost thereof against the Contractor.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

END OF SECTION 01700

DIVISION 2 – SITEWORK

SECTION 02100

SITE PREPARATION/TREE PROTECTION FENCING

PART 1 - GENERAL

1.1 SCOPE: Work in this section includes furnishing all labor, materials, equipment, and services required for clearing and grubbing, minor demolition, removal, and disposal of items as specified herein and on the plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 02200 - Earthwork.

B. Existing Conditions, Removal and Demolition Items, and Grading Plan: Refer to plan sheets.

PART 2 - PRODUCTS

2.1 No products are required to execute this work, except as the Contractor may deem necessary.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING:

A. Clearing and grubbing shall consist of removing all natural and artificial objectionable materials from the project site or from limited areas of construction specified within the site.

B. In general, clearing and grubbing shall be performed in advance of grading and earthwork operations and shall be performed over the entire area of earthwork operations.

C. Unless otherwise specified on the plans, all trees and shrubs of three (3”) inches caliper and less (caliper is the diameter as measured twelve (12”) inches above the ground) and all scrub growth, such as cactus, yucca, vines, and shrub thickets, shall be cleared within the site’s construction areas. All dead trees, logs, stumps, rubbish of any nature, and other surface debris shall also be cleared.

D. Buried material such as logs, stumps, roots of downed trees that are greater than one and one-half (1-1/2”) inches in diameters, matted roots, rubbish, and foreign debris shall be grubbed and removed to a minimum depth of twenty-four (24”) inches below proposed finished grades.

E. Ground covers of weeds, grass, and other herbaceous vegetation shall be removed prior to stripping and stockpiling topsoil from areas of earthwork operations. Such removal shall be accomplished by “blading” off the uppermost layers of sod or root-matted soil for removal.

3.2 TREES AND SHRUBS TO BE PRESERVED AND PROTECTED:

A. Unless otherwise specified on the plans, trees and shrubs with calipers greater than three (3”) inches shall not be cleared (removed) provided that both of the following conditions are met:

1. The vegetation exists in an area that is not proposed for pavement, a structure, or the playing bounds of an athletic field.

2. The vegetation is in an area where the cut or fill does not exceed six (6”) inches.

B. The Owner will assist the Contractor in identifying trees that are to be saved from clearing. The Contractor will protect such trees from construction damage such as trunk impacts and scrapes, limb breakage, compaction of soil within the drip line, and other injurious construction activities.

1. If necessary, the Owner may direct the Contractor, at the Contractor’s expense, to erect protective stockades along the drip lines of trees that the Owner considers vulnerable to damage. Such stockades shall be of eight (8’) foot long x six (6”) inch diameter posts vertically buried three (3’) feet deep at six (6’) foot intervals along the drip line.

C. Where grading or clearing and grubbing operations are to occur between trees that are to be preserved and protected, the Contractor will prune the lower branches of these trees as necessary to prevent their breakage and to permit access by construction machinery. Branches will be cut off to the trunk or major limb in a workmanlike manner. The Architect/Engineer may direct that the Contractor remove additional branches in such a manner that the tree presents a balanced appearance. Scars will be treated with a heavy coat of an approved tree sealant.

3.3 PAVEMENT REMOVAL:

A. Bituminous and concrete pavements shall be removed to neatly sawed edges. Saw cuts shall be made to a minimum depth of one and one-half (1-1/2”) inches. If a saw cut in concrete pavement falls within three (3’) feet of an existing score joint, construction joint, saw joint, cold joint, expansion joint, or edge, the concrete shall be removed to that joint or edge. All saw cuts shall be parallel and/or perpendicular to the line of existing pavement. If an edge of a cut is damaged subsequent to saw cutting, the concrete shall again be sawed to a neat, straight line for the purpose of removing the damaged area.

B. Concrete curb and gutter shall be removed as specified above. No section to be replaced shall be smaller than thirty (30”) inches in length or width.

3.4 UTILITIES REMOVAL: In general, those utilities on the site that are to be removed or abandoned and that belong to the Owner shall be removed or abandoned by the Contractor. The Owner is responsible for arranging the relocation or removal of other utilities owned by utility companies or other parties.

3.5 MISCELLANEOUS DEMOLITION: There may be certain items on the site such as old building foundations, fences and other undetermined structures and improvements that must be removed before construction can commence. Unless otherwise specified, such items become the property of the Contractor for subsequent disposal.

3.6 USE OF EXPLOSIVES: The use of explosives will not be permitted in site preparation operations unless specifically permitted by the Owner in writing.

3.7 BACKFILLING: All holes, cavities, and depressions in the ground caused by site preparation operations will be backfilled and tamped to normal compaction and will be graded to prevent ponding of water and to promote drainage. In areas that are to be immediately excavated, the Architect/Engineer may permit holes, etc., to remain open.

3.8 DISPOSAL OF WASTE MATERIALS:

A. Unless otherwise stated, materials generated by clearing, grubbing, removal, and demolition shall be known as “waste” or “spoils” and shall be removed from the site and disposed of by the Contractor. Similar materials may be unearthed or generated by earthwork operations or by the drilling of piers. Unless otherwise specified any merchantable items become the property of the Contractor.

B. In certain cases, the Owner or Architect/Engineer may grant special permission for the Contractor to dispose of certain “wastes” or “spoils” by deep burial on the site. Such material would be buried in an approved area; would not be organic, biodegradable, or crushable; and would be buried in lifts or layers with soil thoroughly compacted around and over the material. A minimum of thirty (30”) inches of cover would be required over the burial site.

END OF SECTION 02100

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 SCOPE: Work in this section includes furnishing all labor, materials, equipment, and services required to construct, shape, and finish earthwork to the required lines, grades, and cross sections as specified herein and on the plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 02100 - Site Preparation.

B. Grading Plan: Refer to plan sheets.

1.3 TEST REPORTS: The Owner will bear the cost of all testing requirements (unless re-testing is required) and the Testing Laboratory will submit test reports from a commercial testing laboratory as specified herein and in the Conditions of the Contract.

1.4 METHOD OF PAYMENT: Earthwork is a necessary and incidental part of the work. The total cost will be included in the Bid Proposal. Payment will not be made on a unit price basis.

PART 2 - PRODUCTS

2.1 UNCLASSIFIED EXCAVATION: Unclassified excavation shall consist of all excavation, unless separately designated, within the limits of the work. Unclassified excavation includes all material encountered regardless of its nature or the manner in which it is to be excavated.

2.2 UNCLASSIFIED FILL:

A. Unclassified fill shall consist of all fill within the limits of the work. All suitable native materials removed in unclassified excavation, or similar imported materials, shall be used insofar as practicable as unclassified fill. Properly deposited, conditioned, and compacted fill is hereinafter referred to as “earth embankment.”

B. Rock: Minor quantities of rock not greater than four (4”) inches in greatest dimension are permissible in fill materials used to construct earth embankment. Minor quantities of rock of greater dimensions may be placed in the deeper fills in accordance with the Texas Department of Transportation requirements for construction of rock embankments, provided such placement of rock is not immediately adjacent to structures or piers. Also, rock may be placed in the portions of embankments outside the limits of the completed graded width where the size of the rock prohibits their incorporation in the normal embankment layers.

2.3 TOPSOIL: Shall be as follows:

A. On-Site Topsoil: Topsoil shall consist of an average depth of six (6”) inches of native surface soil left in place after the ground cover of herbaceous vegetation and other objectionable matter has been cleared by “blading,” as specified in Section 02100, “Site Preparation.” Topsoil may be greater or less than the upper six (6”) inches in depth. However, it must be removable without contamination by the subsoil or substratum or other objectionable matter that would render it as “unsuitable material” as described herein.

B. Imported Topsoil: In the event there is not sufficient onsite topsoil, imported clean sandy loam topsoil will be imported so that the result is a full 6” deep of top soil in all planting areas. Submit a one (1) gallon sample and a pit analysis for approval.

2.4 IMPORTED FILL:

A. Imported fill materials shall be used for the construction of earth embankment in the event that (1) the volume of unclassified excavation is less than the volume of fill required for earth embankment and/or (2) the condition of materials removed in unclassified excavation makes them unsuitable for use in the construction of earth embankment.

B. The Contractor shall haul, and place imported fill obtained from off-site sources as necessary to construct the embankment and various other details of the construction plans. All costs related to such imported fill will be included in the contract price, and no additional or separate payment for imported fill will be due the Contractor.

C. A sample of the proposed imported fill must be provided by the Contractor and be approved by the Architect/Engineer. In general, imported material must be equal to or better than native material in quality and engineering characteristics. The Architect/Engineer may also require the Contractor to provide a material analysis test of the proposed fill.

2.5 SELECT MATERIALS:

A. Select materials shall be imported form off-site sources, unless they are available from specifically designated areas on the site as marked on the plans.

B. Select Fill: The recommendations as called for in the “Geotechnical Investigation” shall be used for select fill. If none are provided in the “Geotechnical Investigation”, the select fill shall be as follows: select fill shall be used for the construction of subgrades under building foundations, slabs on grade, and other concrete construction as shown and detailed on the plans. All select fill shall be sandy material or other suitable granular material (more than fifty (50%) percent by weight retained on a No. 200 sieve) and shall have a plasticity index not less than four (4) nor more than fifteen (15). Properly deposited, conditioned, and compacted select fill is hereinafter referred to as “select embankment.”

C. Testing Requirements:

1. The Contractor shall have the testing lab to provide a material analysis test of a pit sample of select fill prior to hauling it to the site. This test will include the percentage by weight retained on a No. 200 sieve, the plasticity index, a physical description of the material, and the Standard AASHTO Density and optimum moisture content as required in the execution of “DENSITY CONTROL” in this specification. Tests performed on samples of fill material used for other projects are unacceptable.
2. The Contractor shall have the testing lab to provide a maximum of four additional material analysis tests as described above for specimens chosen until after an entire lift of select fill material is hauled and deposited on the prepared subgrade, and all steps have been executed except for conditioning and compaction as required in the execution of “EARTH EMBANKMENT” and “SELECT EMBANKMENT” of this specification. The Owner or Architect/Engineer may call for a series of tests from the same lift or from any given lift of deposited material.

2.6 UNSUITABLE MATERIALS:

A. Topsoil, select material, imported fill, or unclassified fill will be declared as “unsuitable” by the Owner if, in his opinion, any of the following conditions or matter and particles are present to a degree that is judged detrimental to the proposed use of the material.

1. Moisture.
2. Decayed or undecayed vegetation.
3. Hardpan clay, heavy clay, or clay balls.
4. Rubbish.

5. Construction rubble.
6. Sand or gravel.
7. Rocks, cobbles, or boulders.
8. Cementous matter.
9. Foreign matter of any kind.

B. Unsuitable materials will be disposed of as “waste” as specified in Section 02100.

C. Wet Material: If fill material is unsatisfactory for use as embankment solely because of high moisture content, the Architect/Engineer may grant the Contractor permission to process the material to reduce the moisture content to a usable optimum condition.

PART 3 - EXECUTION

3.1 SITE PREPARATION: In general, “site preparation,” as specified in Section 02100, shall be performed in advance of grading and earthwork operations and shall be completed over the entire area of earthwork operations.

3.2 TOPSOIL:

A. The removal and storage of topsoil shall occur after site preparation is complete and before excavation and embankment construction begin. Likewise, topsoil will be replaced after excavation and embankment construction are complete.

B. Removal: Topsoil shall be stripped to an average depth of six (6”) inches from areas where excavation and embankment construction are planned. Topsoil may be obtained from greater depths if it is uncontaminated by the substratum and it is of good quality in the opinion of the Architect/Engineer.

C. Storage: Topsoil shall be stored in stockpiles conveniently located to areas that will later receive the topsoil. Stockpiles shall be out of the way of earthwork operations in locations approved by the Owner or Architect/Engineer. Stored topsoil shall be kept separate from other excavated materials and shall be protected from contamination by objectionable materials that would render it unsuitable.

D. Timing: Topsoil will not be replaced (deposited) until construction activities are complete that would create undesirable conditions in the topsoil, such as overcompaction or contamination. Trenching for items such as electrical conduit and irrigation pressure lines must be complete before topsoil replacement may begin.

E. Replacement: Topsoil will be deposited in a single layer or lift. It will be placed, processed, compacted, and graded to leave a finished layer of topsoil not less than five (5”) inches in depth. Unless otherwise indicated, topsoil will be replaced over all areas of earthwork (including slopes), except where pavement is planned.

F. Grading: Topsoil will be final graded to the elevations shown on the plans. Unless otherwise indicated, the final plane of compacted topsoil will be between 0.10 foot and one (1”) inch below adjacent paved surfaces. Fine grading will be accomplished with a weighted spike harrow, weighted drag, tractor box blade, light maintainer, or other acceptable machinery. Grading operations and equipment will be such that topsoil does not become overcompacted. Bulldozer blades and front-end loader buckets are not acceptable devices for topsoil grading operations.

G. Plant Bed Areas: Excavate to a depth of 12” to receive proposed soil mix.

H. Acceptability: Finished areas of topsoil are satisfactory if they are true to grade, true in plane, even in gradient (slope), uniform in surface texture, and of normal compaction. Areas of loose granular pockets or of overcompacted soils are not acceptable and will be reworked. Finished areas will promote surface drainage and will be ready for turfgrass planting.

3.3 UNCLASSIFIED EXCAVATION:

A. All excavated areas shall be maintained in a condition to assure proper drainage at all times, and ditches and sumps shall be constructed and maintained to avoid damage to the areas under construction.

B. Surplus Material:

1. Surplus excavation is that quantity of material that may be left over after the grading plan is executed, and all earthwork operations, including excavation, embankment construction, topsoil replacement, and final grading, are completed. Unless otherwise specified, the Contractor shall dispose of surplus material as "waste" as specified in Section 02100.
2. In certain cases, if the on-site excavation and embankment quantities are not balanced and there is a surplus of excavated material, the Architect/Engineer may permit the Contractor to "waste" the surplus by constructing additional embankment in an approved location. No additional payment for such work would be due that Contractor.

C. Excavation in Rock: The use of explosives will not be permitted unless specifically permitted in writing by the Owner. Unless otherwise indicated on the plans, excavation in solid rock shall extend six (6") inches below required subgrade elevation for the entire width of the area under construction and shall be backfilled with suitable materials as indicated on the plans.

3.4 EARTH EMBANKMENT:

A. Earth embankment is defined as embankment composed of suitable materials removed in unclassified excavation and/or imported fill. The construction of embankment includes preparing the area on which fill is to be placed and the depositing, conditioning, and compaction of fill material.

B. General: Except as otherwise required by the plans, all embankment shall be constructed in layers approximately parallel to the finished grade of the graded area, and each layer shall be so constructed as to provide a uniform slope as shown on the grading plan. Embankments shall be constructed to correspond to the general shape of the typical sections shown on the plans, and each section of the embankment shall correspond to the detailed section or slopes established by the drawings. After completion of the graded area, embankment shall be continuously maintained to its finished section and grade until the project is accepted.

C. Preparation: Prior to placing any embankment, all preparatory operations will have been completed on the excavation sources and areas over which the embankment is to be placed. Stump holes or other small excavations in the limits of the embankments shall be backfilled with suitable material and thoroughly tamped by approved methods before commencing embankment construction. The surface of the ground, including plowed, loosened ground, or surfaces roughened by small washes or otherwise, shall be restored to approximately its original slope by blading or other methods, and, where indicated on the plans or required by the Architect/Engineer, the ground surface, thus prepared, shall be compacted by sprinkling and rolling.

D. Scarification: The surface of all areas and slopes over which fill is to be placed, other than rock, shall be scarified to a depth of four (4") to six (6") inches to provide a bond between the existing surface and the proposed embankment. Scarification shall be accomplished by plowing, discing, or other approved means. The material that has been loosened shall be recompacted with the new embankment.

E. Benching: Scarification is normally adequate for sloping surfaces. However, in certain cases where fill is to be placed against hillsides or existing embankment with slopes greater than four to one (4:1), the Architect/Engineer may direct the Contractor to key the fill material to the existing slopes by benching. A minimum of two (2') feet normal to the slope shall be removed and recompacted to insure that the new work is constructed on a firm foundation free of loose or disturbed material.

F. Depositing: Fill material shall be placed in horizontal layers or lifts, evenly spread, not to exceed eight (8") inches in loose depth before conditioning and compaction. Unless otherwise permitted, each layer of fill material shall cover the length and width of the area to be filled and shall be conditioned and compacted before the next higher layer of fill is placed. Adequate drainage shall be maintained at all times.

G. Watering: At the time of compaction, the moisture content of fill material shall be such that the specified compaction will be obtained and the fill will be firm, hard, and unyielding. Fill material, which contains excessive moisture shall not be compacted until it is dry enough to obtain the specified compaction.

H. Compacting: Each layer of earth fill shall be compacted by approved tamping or sheepsfoot rollers, pneumatic tire rollers, or other mechanical means acceptable to the Architect/Engineer. Hand-directed compaction equipment shall be used in areas inaccessible to vehicular compactors.

I. Grading: Embankments shall be constructed in proper sequence and at proper densities for their respective functions. All embankment serves in one capacity or another as subgrade (e.g., under topsoil, under concrete and asphalt pavement, under structures, etc.). Accordingly, the upper layer of embankment shall be graded to within plus or minus 0.10 foot of proper subgrade elevation prior to depositing topsoil, and prior to the construction of pavements, slabs, etc.

3.5 SELECT EMBANKMENT: Select embankment is defined as embankment constructed of select fill material. In general, it is constructed the same as earth embankment, except as described below.

A. Subgrade: In cases where select fill is to be placed on a subgrade surface that is proposed to be within 0.50 foot in elevation of the existing surface grade, the top six (6") inches of soil shall be stripped and removed as unsuitable waste. A minimum of six (6") inches of fill comprising the subgrade for the select embankment shall be prepared and compacted as "earth embankment under select embankment" (see Density Control paragraph).

B. Mixing: If the select fill is non-uniform in material composition, the Contractor may elect to mix with discing or pulverizing machinery to ensure that it meets the specified density and material analysis testing requirements. During mixing, care shall be taken not to disturb the subgrade nor to incorporate the subgrade material into the select material. Mixing would occur between the depositing and watering steps described in the embankment construction process. Also, see "Testing Requirements" under "SELECT MATERIALS" of the PRODUCTS section of this specification.

C. It is the sole responsibility of the Contractor to provide a select material of such quality that it can be "set-up" and "finished" to provide a stable support for the hot mix asphaltic concrete pavement. In addition to the density requirements, the subgrade must have sufficient strength at time of paving to support the proposed hot mix paving operation including paving machine, haul trucks, and rollers. If significant deterioration of the finished subgrade occurs during paving operations, paving shall be suspended until the required remedial action is taken by the Contractor. Approval of submitted samples of select material by the Architect/Engineer does not relieve the Contractor of this responsibility. All irregularities, depressions, or weak spots which develop in the subgrade shall be corrected prior to paving by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling. Should the select material subgrade, due to any reason or cause, lose the required stability, density, or finish before surfacing is complete, it shall be recompacted and refinished at the sole expense of the Contractor.

3.6 DENSITY CONTROL:

A. Backfill Placement and Compaction: The backfill material should be placed in maximum of eight (8)-inch lifts and compacted to a density ranging between 92 and 98 percent of maximum Standard Proctor (ASTM D 698) dry density at a moisture content ranging from one (1) percentage point below optimum to four (4) percentage points above optimum (-1 to +4).

B. Non-Expansive, Select Fill: The select fill should be placed in loose lifts not exceeding eight (8) inches in uncompacted thickness, and be uniformly compacted to a minimum of ninety-five (95) percent of the maximum dry density determined by Standard Proctor (ASTM D 698). The moisture content of the fill at the time of compaction should be from minus two (2) to plus five (5) percentage points of optimum (-2 to +5).

C. Pavement Subgrade: The subgrade should be compacted to a minimum of 95 percent of Standard Proctor (ASTM D 698) at a moisture content ranging from optimum to four (4) percentage points above optimum (0 to +4).

For additional information, refer to the Subsurface Investigation, located in Part I of the Project Manual.

3.7 MOISTURE MAINTENANCE: The specified moisture content shall be maintained in all embankments that are to function as subgrade for structures, areas of pavement, or for select embankment. After completion of the embankment, the Contractor shall prevent excessive loss of moisture in the embankment by sprinkling as required. Loss of moisture in excess of two (2%) percent below optimum in the top twelve (12") inches of the fill will require that the top twelve (12") inches of the embankment be scarified, wetted, and recompacted prior to placement of the structure, select fill or pavement. If desired, the Contractor may place an asphalt membrane of emulsified or cutback asphalt over the completed embankment and thus eliminate the sprinkling requirement.

3.8 TESTING: Spot field tests of embankment densities shall be required of the Contractor by the Owner at the place and time of their choosing. Any area not meeting density control requirements shall be immediately excavated, reconstructed, and retested, at the expense of the Contractor, until satisfactory results are obtained. See Section 01410.

END OF SECTION 02200

SECTION 02210

FINE GRADING

PART 1 - GENERAL

1.1 SCOPE: Work in this section includes furnishing all labor, materials, equipment, and services required to construct, shape and finish earthwork to the required lines, fine grades and cross sections as specified herein and on the plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. 1998 North Central Texas Council of Governments (NCTCOG) Public Works Construction Standards

B. Grading Plan: Refer to plan sheets.

C. Geotechnical Report – Riner Engineering Inc No. 21-0782

1.3 METHOD OF PAYMENT: Fine grading of earthwork is a necessary and incidental part of the work. The total cost will be included in the Bid Proposal as a subsidiary item. Payment will not be made on a unit price basis nor by any other separate measured payment method.

1.4 GENERAL IMPORTANCE: Properly placed and finished earthwork accomplished by fine grading is essential to the success of this project. Much of the area to be re-vegetated with sod or seed, as specified on the plans, has a minimal surface gradient, which must be properly finished to ensure positive surface drainage. The Contractor will be required to prove the competence and experience of his workers and subcontractors with respect to their abilities to execute the fine grading required on this project.

PART 2 - PRODUCTS

2.1 TOPSOIL: Topsoil is used in the construction of fine graded areas to be planted with sod, seed, or other planted materials. Topsoil material must be approved by the Owner's Representative, prior to delivery to site.

A. Topsoil shall be Screened Loam. Screened Loam shall be a sandy loam, free from subsoil, of uniform quality as manufactured and blended by Living Earth, 871 Hwy 96, Pineland Texas 75968, www.livingearth.net, Phone 409-584-2155 or approved equal.

B. Topsoil shall be free from hard clods, roots, sods, stiff clay hard pan, stones larger than 1", lime, cement, ashes, slag, concrete, tar residues, tarred paper, boards, chips, sticks or any other undesirable material. No topsoil is permitted that has been harvested from a previous agricultural or industrial site.

C. Topsoil shall be blended with 25% Organic Compost by volume in order to achieve at least 3% organic matter determined by the wet combustion method (chromic acid reduction) as described in Circular #757 by the U.S. Department of Agriculture. The acidity range shall be between pH 6.5 and 8.0 inclusive. The mechanical analysis of the soil shall be as follows:

PASSING RETAINED ON PERCENTAGE	
SIEVE SIZE	PERCENT PASSING
1” Screen	100%
1/4” Screen	Gravel not more than 30%
#100 Sieve Coarse	Medium and Fine Sand 40-60%
#100 Sieve Very Fine	Sand, Silt 40-60% and Clay

D. Compost shall be an organic, aerobically composted product containing grass clippings, leaves, manure, straw, stable bedding and other valuable organic components consisting of 80% vegetative material and 20% manure. Compost shall be stable, free of weeds, weed seeds, insects and pests with pH ranges from 6.5 to 8.0. Manufactured by Living Earth, 1901 California Crossing Rd., Dallas, Texas, 75220, www.livingearth.net, Phone 972-869-4332 or approved equal. Compost provider shall also be a current participant in the US Composting Council Seal of Testing Approval Program (STA).

E. Submittal:
  a. Contractor shall submit a (5) gallon container with each type of material used.
  b. Topsoil analysis to include: source location, content percentage, ph, organic content.
  c. Compost analysis to include: source location, content percentage, ph, organic content.
  d. Compost provider certification.

2.2 “BLUE TOP” STAKES: Wooden stakes shall be used to mark final fine grades. Stakes shall be capable of being driven fully into the ground without splitting and without pulverization of their tops. Nominal dimensions of stakes shall not be less than 2”x2”x8” long with all four sides beveled into a sharpened bottom point at one end and with a flat top at the other end. After being driven to the proper elevation, each stake top shall be securely fitted with a brightly colored attachment of fibrous plastic strands suitable for promoting visual identification of the driven stake.

PART 3 - EXECUTION

3.1 GENERAL: All fine grading and corresponding construction shall be performed as specified herein, and the completed work shall conform to the required lines, grades, and detailed illustrated on the plans.

3.2 ALLOWABLE DEVIATION:

A. The maximum allowable deviation from the required finished grades of a line or plane shall be a slope (gradient) of plus or minus 0.5% in a horizontal dimension of eight (8’) feet maximum. This shall be field tested without using and eight (8’) foot long straight edge. If the surface has a deviation of more than one-half inch (1 ½”) above or below the midpoint of the straight edge when its ends rest on high or low points, the finished grade will be unsatisfactory and shall be immediately corrected.

B. Surface gradients and flowlines may be similarly checked by the use of string lines and survey instruments. The Sabine River Authority will be the judge of whether deviations from the designed gradients are acceptable or not.

3.3 LIMITS OF WORK: The limits of areas to be fine graded shall generally correspond to the areas to be revegetated and/or as illustrated on the plans to be planted with sod, seed, or plant material.

3.4 SEQUENCE OF WORK:

A. Fine grading will not begin until all structures and concrete are complete, in place, tested/inspected, and properly backfilled. Fine grading will not be attempted until construction which involves heavy vehicles is complete.

B. After fine grading is accomplished, it shall be the Contractor's responsibility to protect all fine graded areas from vehicular traffic or other disruptive activities. Damages to the fine graded surfaces will be restored to a satisfactory condition as prescribed herein until final acceptance.

3.5 FINE GRADING OPERATIONS: As a minimum, the following measures will be executed in the accomplishment of fine grading on areas to be re-vegetated and/or as illustrated on the plans to be planted with sod, seed or planting materials.

A. Topsoil shall first be placed at a depth of four (4") inches and shall be rough graded to within 0.05 foot of finished grade. Topsoil placement shall be performed as follows:

1. Clear the subgrade of stones larger than four (4) inches in any dimension, and of concrete, wood, construction debris, and other deleterious matter. Excavate to a depth of twelve (12) inches all areas that may have been saturated with oil, gasoline or bituminous products and backfill with clean earth.

2. Import topsoil mix directly to site of deposition or stockpile new topsoil mix on site in quantity needed to produce the required depth after spreading. Protect topsoil mix piles from erosion with tarpaulins and limit boards.

3. Spread two (2) inches topsoil mix in median and two (2) inches topsoil on side swales to existing soil and water to settle the mixture to one (1) inches below top of curb. Feather smoothly finished grade to reduce undulation.

4. Contractor shall take necessary measures to keep the topsoil mix friable and porous. Do not handle or work topsoil mix when it is excessively wet or during a rainfall. Topsoil mix shall not be placed on any subgrade that is heavily compacted to prevent uneven mixture until it is loosened or tilled. Till the mixed soil at three (3) inches depth and re-till any areas that become unduly compacted by vehicular movement.

5. Use of heavy machinery in placement of topsoil material should be minimal. No heavy equipment will be allowed to be used without the written permission of the Parks Project Manager.

B. Fine grading shall be executed by the placement and use of final grade stakes or "blue tops". Final grade stakes shall be placed at intervals not to exceed seventy-five (75') feet along the exact contour lines as dimensioned on the grading plan. The stakes will be driven to the exact foot elevation of the contour and will then be marked with a brightly colored plastic attachment.

C. Final grade stakes will also be placed wherever a contour line makes a significant change of direction and on critical spot grades as directed by The Sabine River Authority and the project Landscape Architect/Engineer.

D. It is anticipated that some areas of topsoil may become overcompacted and resistant to proper grading. Such areas will be loosened and pulverized with discing machinery and aeration, and will then be recompacted to normal density before fine grading. The use of a watering truck to moisten dried and hardened areas may be necessary.

E. The Contractor shall be responsible for minor adjustments to the finished grade if such treatment is required in the opinion of the Parks Project Manager.

F. In an effort to prevent excessive weed growth, the Contractor should be prepared to immediately install the sod upon the completed and acceptable finished grade.

G. Upon completion of fine grading and top-soiling operations, no trucks or other heavy equipment shall be driven over finished areas.

3.6 ACCEPTABILITY:

A. Provide 72-hour notification to Landscape Architect and/or Owner's Representative for final grade inspection prior to sod or seed installation.

B. Fine graded areas shall be true in plane, even in gradient (slope), uniform in surface texture, and of normal compaction. Areas of loose granular soil pockets interspersed with overcompacted soils are not acceptable. Fine graded areas for sod, seed and planting beds will promote complete surface drainage, and will be ready for planting, and will ensure pliability.

B. The Landscape Architect/Engineer will perform instrumental checks of final grade stakes and surface gradients as he deems proper and necessary. Unsatisfactory areas will be regarded and corrected until accepted by the Owner.

3.7 SITE MAINTENANCE: The Contractor is responsible for the maintenance of all finished surface gradients in the project until final acceptance. The Contractor will maintain erosion control measures up until final acceptance of fine grading and re-vegetation by the Owner.

END OF SECTION 02210

SECTION 02220

EXCAVATION, TRENCHING, AND BACKFILLNG

PART 1 - GENERAL

1.1 SCOPE: The work to be performed under this section of the specifications shall consist of furnishing all labor, equipment and materials, and performing all operations in connection with the excavation, trenching, and backfilling for the installation of water, sanitary sewer, drain lines, and perforated pipe underdrains as shown on the plans and as specified herein. Contractor will be required to coordinate with the selected Skate Park Contractor for verification of the rough grades located within and adjacent to the proposed skate park site.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

1.3 SUBMITTALS: Submit to the Engineer in conformance with the requirements of the Conditions of the Contract.

PART 2 - PRODUCTS

2.1 MATERIALS: No materials are required in this section.

PART 3 - EXECUTION

3.1 EXCAVATION:

A. General: Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles that may obstruct the line of work, and the excavation and removal of all earth, rock, or other materials to the extent necessary to install the pipe, appurtenances, and structures in conformance with the line and grades shown in the plans or as specified.

B. Maximum and Minimum Width of Trenches: The sides of all trenches shall be cut as nearly vertical as possible from the bottom of the trench to a point twelve (12") inches above the top of the pipe when it is laid to grade. The minimum width of trench in which the pipe may be installed shall be as shown in the plans, measured at an elevation in the trench which is twelve (12") inches above the top of the pipe when it is laid to grade.

1. Whenever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher class of embedment or encasement than specified, based upon the load factors shown on the plans, and the additional cost incurred will be borne by the Contractor.

2. Nothing herein shall be construed as prohibiting the Contractor from moving the upper portion of earth to a depth twelve (12") inches above the top of the pipe, in sections of the line where the cut is deep, by means of scrapers, bulldozers, or other dirt moving equipment, as a preliminary to trenching for the pipe if he elects to do so and has permission therefor from the property owner whose land will be affected. Such permission must be obtained from the property owner prior to the start of any such earth moving operations.

C. Sheeting and Shoring: In caving ground, or in wet, saturated, or flowing materials, the sides of all trenches and excavation shall be adequately sheeted and braced so as to maintain the excavation free from slides or cave-ins and safe for workmen. It shall be the sole responsibility of the Contractor to conform to the requirements of Occupational Safety and Health Act of 1970.

1. Sheeting and shoring shall not be left in place unless its removal is impractical, as determined by the Architect/Engineer.

D. Dewatering Excavation: The Contractor shall, commencing sufficiently in advance of excavation, during the excavation period, and as long thereafter as the condition of the work may require, provide and maintain in good operating condition such equipment as may be required to prevent all water from entering any trench excavation. This shall include, but is not limited to: surface water which would drain into the excavation; seepage water which would enter the trench as a result of the excavation and a high ground water level; and the water which could penetrate the trench bottom due to the anticipated piezometric head coupled with the removal of overburden should the Contractor not lower the water table in advance of the excavation. Backfilling operations shall be completed before dewatering operations are suspended. Water removed from the excavation shall be disposed of in such a manner as to prevent damage to adjacent property or to other work under construction. Damage of whatever nature caused by dewatering the work or failure to dewater the work satisfactorily shall be promptly repaired and/or remedied by the Contractor at his own expense.

1. Provision shall be made for the satisfactory disposal of water pumped from excavations so as to prevent damage to public or private property. In all cases, accumulated water in the trench shall be removed before placing embedment, laying pipe, placing any concrete or backfilling.

E. Subgrade in Earth: Where a firm and stable foundation for the pipe can be obtained in the natural soil and where special embedment is not shown on the plans or specified herein, the bottom of the trench shall be carefully and accurately trimmed to fit the lower portion of the pipe barrel. Bell holes shall be excavated for each joint. The bell holes shall be accurately located and shall be of sufficient width and depth to allow ample room for making the joint and to relieve the pipe bell of all load.

1. Should the excavation be carried below grade, except as herein specifically provided, the Contractor shall, at his own expense, refill it to the proper elevation with gravel or crushed stone, which shall be compacted by tamping until it is firm and unyielding.

F. Soft Subgrade: If soft or spongy material is encountered in the excavation at subgrade level, after proper dewatering has been performed, it shall be removed, to such a depth that, by replacing the unsuitable material with tamped crushed stone or gravel, a firm and stable foundation can be secured.

G. Disposal of Excavated Materials: Excavated material shall be piled adjacent to the work to be used for backfilling as required. Where required, desirable topsoil shall be piled separately in a careful manner and replaced in its original position.

1. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of in a manner approved by the Owner.

H. Subgrade in Rock: If the bottom of the excavation for the pipeline is found to be in rock or other hard material that cannot be excavated to a true subgrade and shaped to provide uniform bearing for the pipe barrel, the rock or other material shall be removed to a depth not less than three (3”) inches below subgrade and the bottom of the trench brought to true subgrade elevation by filling with gravel or suitable rock cuttings and shavings from the excavation and compacting by means of tamping until a firm and uniformly unyielding foundation is obtained.

I. Damage to Existing Utilities: Where existing utilities are damaged, they shall be replaced immediately with material equal to or better than the existing material. Such work shall be at the entire expense of the Contractor. The Contractor shall immediately notify the Owner of the damaged utility facility.

3.2 BACKFILLING:

A. Backfilling shall include the refilling and consolidating of the fill in trenches and excavations up to the surrounding ground surface or road grade at crossings. Backfilling shall be done with good earth, sand, or gravel and shall be free from large rocks or hard lumpy material. No material of a perishable, spongy or otherwise unsuitable nature shall be used in backfilling.

B. After the pipe and embedment have been placed, the method of backfilling pipe trenches shall be as follows: Select material shall first be carefully placed on both sides of the pipe simultaneously in layers of not more than four (4") inches in loose thickness, and these layers shall be firmly compacted by hand or mechanical tamping. The layers of backfill shall be sprinkled lightly with water if additional moisture is required for proper compaction. This process of filling and tamping in layers shall be continued until the backfill is brought up to the level of the pipe spring line. A sufficient amount of selected material shall then be carefully placed over the top of the pipe so that, when consolidated, the level of the select material will be not less than twelve (12") inches above the top of the pipe. Before backfilling the remainder of the trench, the select material shall be consolidated by jetting and flooding or mechanical tamping, at the option of the Contractor, to such an extent as to secure uniform consolidation.

C. Excavated material which is unsuitable for backfilling and excess material shall be disposed of in a manner approved by the Architect/Engineer.

END OF SECTION 02220

SECTION 02380

DRILLED PIERS

PART 1 - GENERAL

1.1 SCOPE: The extent of drilled piers is shown on the drawings. In general, the work includes the excavation for piers, the furnishing and installation of reinforcing steel for piers, the furnishing and installation of concrete for the piers, and the clean up and removal of all waste materials and spoils created by work under this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 02200 - Earthwork.

B. Section 032100 - Concrete Reinforcement.

C. Section 033000 - Cast-In-Place Concrete

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with codes, standards, and specifications indicated in Section 032100 and 033000 of this specification.

B. Concrete Testing Service: Shall be provided as required for in Section 033000.

C. Standard Specification for end Bearing Drilled Piers", ACI336.1, as published by the American Concrete Institute.

D. Standards and Specifications for the Foundation Drilling Industry, as published by the Association of Drilled Shaft Contractors.

1.4 SUBMITTALS:

A. Submit to the Engineer in conformance with the requirements of the Conditions of the Contract.

B. Laboratory Test Reports, Concrete: Submit in accordance with Section 03300.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Section 032100 - Concrete Reinforcement.

B. Section 033000 - Cast-in-Place Concrete.

C. Steel Casings: Inside diameter one (1") inch greater than size concrete pier shown on drawings.

2.2 CONCRETE PROPORTIONING AND PRODUCTION: Refer to Section 03300.

2.3 REINFORCEMENT FABRICATION: Refer to Section 032100.

PART 3 - EXECUTION

3.1 DRILLING PROCEDURE:

A. After the layout for pier locations has been completed and certified correct by the Contractor, the drilling may be started.

B. Drill placement shall be such as to insure accuracy of location and plumbness, to a maximum lateral deviation not to exceed one and one-half (1-1/2") inch, and out of plumb deviation not to exceed one-eighth (1/8") inch per foot for any portion of the pier or one-sixteenth (1/16") inch per foot for its entire length.

C. The spoils from the pier excavation shall not be allowed to build up around that shaft opening. Excavated materials shall be removed from the area during the drilling operation. At the completion of drilling, the area adjacent to the excavation shall be cleared of spoils at working grade level for a distance of not less than four (4") feet in each direction and the top of the shaft wall shall be chamfered one (1") inch at its periphery.

D. Provide a pump on the site and use it to keep holes dry.

E. If free ground water is uncontrollable by pumping and/or if the nature of the overburden is such that caving or any probability of caving of the excavated shaft is evident, the Contractor shall, with approval of the Architect/Engineer, install temporary steel casings.

F. If the nature of overburden is such that very large voids are created by caving of shaft walls during the drilling process, the casing shall be installed.

G. Concrete shall be placed in excavated shafts as soon as is practical after drilling and cleaning has been completed and, in no case, shall the time lapse between the completion of the shaft excavation and placement of concrete therein exceed eight (8) hours.

3.2 REINFORCEMENT FOR DRILLED PIERS:

A. The reinforcing shall be carefully fabricated with all the verticals parallel. The entire assembly shall be straight, true, and without twist or warp. Provide extra X-tie bracing around perimeter of cage as required to hold cage straight and true. The Owner's Representative shall approve each cage before placement.

B. All anchor bolt assemblies for light pole footings shall be welded in place in the reinforcing cage prior to concrete placement.

3.3 CONCRETE PLACEMENT:

A. Reinforcing cage shall be accurately centered. Concrete shall be placed with an approved type tremie to direct the flow of concrete through the center of the pier. Stop the pour at regular intervals and check the proper positioning of the reinforcing. Pour concrete to top of pier elevation as shown on the drawings.

B. When concrete is placed in temporary casings the casing shall be removed and shall be kept exactly vertical during the pulling operation. Care shall be exercised during casing withdrawal to insure that steel remains within established limits, and to insure that no separation of freshly placed concrete occurs. It is imperative that no rotation or vibration of the casing be permitted during withdrawal and that the head of plastic concrete within the casing be sufficient at all times to prevent squeezing and/or encroachment of ground water, slush, or caving materials into the freshly placed concrete below the pier top elevation.

3.4 FIELD INSPECTION AND TESTING:

A. To facilitate the inspection of open shafts and reinforcing, the Contractor shall make available, for the Architect/Engineer and Owner, electric drop cords with spot type bulbs, reflectors, and guards.

B. All concrete testing shall be as required in Section 01410.

3.5 EXISTING UTILITIES:

A. Prior to any drilling operations, the Contractor shall have verified all existing utility locations. If there is a conflict between the proposed pier location and an existing utility the Contractor shall contact the Architect/Engineer and/or Owner for directions.

B. Any existing utility damaged shall be repaired at the Contractor's expense.

3.6 FINISHES OF EXPOSED CONCRETE PIERS:

A. Exposed portions of piers must be perfectly formed as a true circular shape.

B. Skim coating will not be permitted. Form marks from sonatubes will be rubbed and ground smooth.

END OF SECTION 02380

SECTION 02441

IRRIGATION SYSTEM

PART I - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and all applicable specification sections, apply to this section.

1.2 DESCRIPTION

A. This Section specifies the requirements for providing the irrigation system as indicated on the Drawings.

B. Contractor shall provide irrigation system as a complete system including but not limited to: heads, valves, valve boxes, control wire splice boxes, control wiring, electric controller, piping circuits, vacuum breaker, water meters and all accessories, including electric power source coordination and installation.

1.3 QUALITY ASSURANCE

A. Available Manufacturers: Subject to compliance with specified requirements, manufactures offering products which may be incorporated in the Work are included in the specifications or denoted on the Drawings.

B. Installer: Installation of Irrigation System shall be performed under the direction of a State of Texas licensed irrigator with not less than 5 years experience in this type of work.

C. Reference Standards Applicable to this Section:

1. ANSI: American National Standards Institute
   a. Z55.1: Gray Finishes for Industrial Apparatus and Equipment
2. ASTM: American Society for Testing and Materials
   a. B88: Specifications or Seamless Copper water tube.
   b. D 1785: Specifications for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
   c. D 2241: Specification for Poly Vinyl Chloride (PVC) Pressure Rated Pipe (SDR Series)
   d. D 2466: Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
   e. D 2564: Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
   f. F 690: Practice for Underground Installation of Thermoplastic Pressure Piping Irrigation Systems.
3. AWWA: American Water Works Association
   a. C 500: Gate Valves, 3 inches through 48 inches NPS, for Water
   b. C 506: Backflow Prevention Devices, Reduced Pressure Principle and Double Check Valve Types.
4. IAMPO: International Association of Plumbing Mechanical Officials
   a. UBC: Uniform Building Code
5. NEMA: National Electrical Manufacturer's Association
   a. 250: Enclosures for Electrical Equipment (1000 Volts Maximum)
6. NFPA: National Fire Protection Association
   a. NFPA 70 (NEC): National Electrical Code
7. Uniform Plumbing Code
8. NSF: National Sanitation Foundation

a. No. 14 Plastic Piping System Components and Related Materials

1.4 SUBMITTALS

A. Product Data

1. Submit manufacturer's technical data, specifications, shop drawings, and installation instructions for sprinkler heads, automatic valves, controllers, backflow preventers, connections, details, and related items.
2. Submit manufacturer's operating instructions and a schedule indicating length of time each valve is to be open to produce a given amount of precipitation.
3. Submit maintenance instructions on all items requiring manufacturer's standard detail submittal.

B. Spares and Special Tools: Provide Owner with four (4) spare sprinkler heads of each size and type, two (2) wrenches for each type of head cover and two (2) wrenches for removal and installation of each type of head. In addition, see Section 2.17E

C. Water: potable water to be supplied by Owner. Contractor shall make provisions for all connections required.

1.5 PRODUCT DELIVERY AND HANDLING

A. Materials shall be delivered in manufacturer's unopened packaging labeled to indicate manufacturer's name and product identification. Insure that packaging and labeling remain intact until installation. Materials shall be stored protected form the elements, including direct sunlight.

B. Pipes shall be handled so as to prevent being damaged and to maintain their straightness. Pipe ends shall be wrapped. Pipes shall be stored on beds the full length of the pipes. Damaged or dented pipes or fittings shall not be used.

1.6 DEFINITIONS

A. Irrigation Main: Irrigation main is the piping from the water source to control valves. Irrigation main is that pipe which is on the pressure side of irrigation control valves.

B. Irrigation Lateral Lines: Irrigation lateral line is the piping from the control valves to the irrigation heads. Lateral line is that pipe which is on the non-pressure side of irrigation control valves.

PART 2 - PRODUCTS

2.1 PIPES

A. Markings: Thermoplastic pipes should be marked in accordance with ASTM D 1785 and ASTM D 2241 as applicable and shall bear the NSF mark in accordance with NSF 14.

B. Irrigation Main Pipe: ASTM D 2231, PVC, 1120 or 1220, Schedule 40.

C. Irrigation Lateral Line Pipe

1.Pipes ¾ inch diameter and larger: ASTM D 2231, PVC, 1120 or 1220 SDR 21.0, 200 PSI.
2. Pipes ½ inch diameter: ASTM D 2241, PVC, 1120 or 1220, SDR 13.5, 3.5 PSI.

2.2 SETTINGS FOR THREADED JOINTS

A. ASTM D 2466, PVC, Schedule 80.

2.3 SEALANT FOR THREADED JOINTS

A. Rector Seal Liquid Teflon by Rector Seal Corp., 2830 Produce Row, Houston, Texas 77023, (713) 928-6423, or approved equal.

2.4 SLEEVES UNDER PAVING FOR CONTROL WIRE AND IRRIGATION LINES

A. ASTM D 2466, PVC, Schedule 40, sized as shown on drawings.

2.5 IRRIGATION SPRINKLERS

A. Pop-Up Spray Sprinklers as specified on drawings.

1. Shall be heavy-duty plastic pop-up to specified height with appropriate nozzle as indicated on Drawings.
2. Irrigation head body, stem, nozzle, and screen shall be constructed of heavy duty plastic.
3. Head shall have wiper seal for cleaning debris as it retracts into case.
4. Plastic nozzles shall have matched precipitation rate with an adjusting screw capable of regulating the radius and flow.
5. Head shall have stainless steel retroactive spring.
6. Head shall have filter screen under nozzle.
7. Head shall have side and bottom inlet on racketing system for easy alignment of pattern on 6 inch and 12 inch pop-ups.
8. The nozzles on pop-up spray head body shall be as shown on Drawings and shall be capable of covering the radius as designated on Drawings. Nozzles in same series shall have matched precipitation rates.
9. Heads shall be connected to irrigation lateral lines by swing joints as indicated. Flexible PVC shall not be accepted as a swing joint.

B. Gear Driven Sprinklers as specified on drawings.

1. The pop-up sprinklers shall be a gear driven sprinkler. The part circle sprinklers shall have an infinitely adjustable arc of coverage from 40° to 360°.
2. The sprinkler case and internal assembly, except for the arm spring, bearing spring, wiper seal and bearing washers, shall be constructed of durable plastic.
3. The sprinkler shall have an adjustable nozzle-retainer/range adjustment screw for distance and distribution control and shall be capable of full or part circle operation as noted on Drawings.
4. The sprinkler shall have a 4" pop-up stroke, turbine bypass valve, fine mesh filter screen, and the gear drive shall be sealed in oil.
5. Plastic nozzles shall be as per irrigation legend.

2.6 ELECTRIC REMOTE CONTROL VALVES

A. Electric remote control valves shall be as specified on Drawings.

1. Remote control valves shall be normally closed, 24 volt AC 60 Cycle, solenoid actuated glove pattern diaphragm. Valve pressure rating shall be 200 psi minimum.
2. Valve body and bonnet shall be constructed o heavy-duty glass-filled nylon. Diaphragm shall be nylon reinforced rubber. Solenoid coil shall be encapsulated in molded epoxy.
3. Valve shall be actuated by a low power, 2.0 watt 24 volt AC Solenoid.
4. Valve shall have a flow control stem with wheel handle for regulating or shutting off flow of water and a bleed plug for manual operation.
5. All valve integral parts shall be removable from top of valve without disturbing the valve installation.

2.7 REMOTE CONTROL VALVE TIES

A. Remote control valve ties shall be plastic tags with wire to attach numbered tag to valve.

2.8 VALVE BOXES

A. Valve boxes shall be heavy duty plastic 17 inch by 11-¾ inch by 12-inch depth, black with green cover. Valve box shall be Series 1419, non-hinged, non-bolt cover, by Carson Industries, Inc., 1925 Street, La Verne, CA 91750. (213) 732-6265, or approved equal.

2.9 CONTROL WIRE SPLICE BOXES

A. Control wire splice boxes shall be heavy duty plastic 10 inch diameter by 10 ¼ inch deep, black with black cover, No. 910-12B, by Carson Industries, Inc. or approved equal.

2.10 GRAVEL BACKFILL

A. Gravel backfill for valve boxes and control wire splice boxes shall be 3/8-inch diameter pea gravel.

2.11 IRRIGATION CONTROL WIRE

A. Wire: Solid copper wire, NEC type UF, UL listed for direct burial in ground. Minimum size: No. 14 AWG.

B. Splicing Material: Scotchlok connector with No. 3570/Scochlok Connector Sealing Packs by Electro-Products Division/3M, Minneapolis, Minnesota, Rain Bird Snap-Tites by Rain Bird Sprinkler Manufacturing Corporation, or approved equal. Use separate packs for each splice.

2.12 GATE VALVES

A. Gate Valves shall be PVC Ball Valves, size as noted on drawings.

2.13 QUICK COUPLING VALVES

A. Quick coupling valves shall have heavy-duty brass construction, durable thermoplastic rubber cover, stainless steel internal valve springs, one-piece body design, as indicated on drawings.

B. Provide four valve keys with ¾ inch swivel hose ells.

2.14 BACKFLOW PREVENTER

A. Backflow Preventers shall be bronze and copper, pressure vacuum breaker assembly Febco No. 765 by Febco Sales, Inc. (CMB Industries), P.O. Box 8070, Fresno, CA 93747 (209) 252-0791, or approved equal. Size as per drawings.

2.15 CONTROLLER

A. Controller shall be as indicated on drawings.

2.16 CONTROLLER ENCLOSURE

A. Controller enclosure shall be painted, galvanized NEMA enclosure as provided by Lemuer or approved equal. Enclosure to be vented, lockable with accessible bottom, panel.

PART 3 – EXECUTION

3.1 SYSTEM DESIGN

A. Design Pressures: Pressure shall be as indicated on Drawings, and as measured at last head in circuit.

B. Location of Heads: Design location is represented as accurately as possible. Make minor adjustments on site with approval of Landscape Architect as necessary to ensure consistent and even spacing where applicable. Set all heads minimum 6” from back of curb and 4” from edge of concrete walls.

3.2 TRENCHING AND BACKFILLING

A. General: Contractor shall comply with Section 02221 Trenching & Trench Backfill and Section 02200 Earthwork of these Specifications. Excavate straight and true with bottom uniformly sloped to low points. Protect existing lawns and plantings. Remove and replant as necessary to complete installation. Replace damaged lawn areas and plants with new products to restore to existing installation’s original condition

B. Minimum Cover: Provide 18-inch minimum cover over top of installed irrigation main piping. Provide 12-inch minimum cover over top of installed irrigation later piping. Provide 2 inches of earth between parallels and wire. Parallels shall be laid side-by-side, not stacked.

C. Backfill: Backfill with clean material from excavation after obtaining Landscape Architect’s approval. Remove organic material, as well as rocks and debris larger than 1 inch in diameter. Place acceptable backfill in 6 inch lifts, compacting each lift.

D. Existing Lawns: Where trenching is required across existing lawns, (or in event of changes or repairs after new lawn has been established), uniformly cut strips o sod 6 inches wider than trench. Remove sod in rolls of suitable size for handling and keep moistened until replanted.

1. Backfill trench to with 6 inches of finished grade and compact. Continue fill with acceptable topsoil; and compact to bring sod even with existing lawn.
2. Replant sod within 2 days after removal, roll and water generously.
3. Resod and restore to original condition all sod areas not in healthy condition equal to adjoining lawns 30 days after replanting.

3.3 INSTALLATION

A. General: Unless otherwise indicated, Contractor shall comply with requirements of the Uniform Plumbing Code, latest edition, City of Houston Plumbing Code, and ASTM F 690.

B. Pipes

1. Piping Mains and Laterals: Lay out sprinkler mainlines and perform line adjustments and site modifications to laterals prior to excavation. Lay pipe on solid sub-base, uniformly sloped without humps or depressions.

2. PVC Pipe Assembly

a. Cut PVC pipe square and de-burr. Clean pipe and fittings using primer and cleaner as recommended by the PVC pipe manufacturer. Use tinted primer to aid in visual inspection.

b. Apply a thin even flow coat of PVC solvent cement to inside of the fitting and pipe mating surface. Cure joints as recommended by the manufacturer and keep pipe and fitting out of service during curing period. Construct watertight joints equal or greater in strength than the pipe. Do not tap pipe at fittings.

3. Install plastic pipe in dry weather, when temperature is above 40 degrees F. and in accordance with manufacturer's written instructions. Allow joint to cure at least 24 hours at temperature above 40 degrees F. before testing.

4. Plastic pipe shall be snaked in the trenches in a manner to provide for expansion and contraction as recommended by pipe manufacturer.

C. Sleeves Under Paving: The majority of sleeves under paving are existing as shown on drawings. Where boring is required for new sleeves (refer to drawings), it shall be a "wet bore." Install sleeves 12" beyond edge of pavement. Perform trench and backfill in accordance with these specifications.

D. Irrigation Heads

1. Flush irrigation lines with full head of water and install heads after hydrostatic test is completed.
2. Install heads at manufacturer's recommended heights.
3. Locate part-circle heads to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries, unless otherwise indicated.
4. Check for uniformity of coverage and pattern correctness. Adjust for 100% coverage where required.

E. Electric Remote Control Valves

1. Adjust automatic control valves to provide flow rate at rated operating pressure required for each irrigation section.
2. Install valves in valve boxes, arranged for easy adjustment and removal. Locate valves to ensure ease of access for maintenance such that no physical interference with other elements of the project exists.

F. Remote Control Valve Tags: One Remote Control Valve Tag shall be attached to stem of each electric remote control valve. Tags shall be numbered sequentially. Numbers shall correspond to station numbers in electric controller. Provide tags and corresponding numbers for wires pulled for future valves.

G. Valve Boxes: Install valve boxes to cover electric remote control valves. Install two valves maximum in valve box where possible. Top of Valve box shall be flush with finished grade. Bury minimum 2 bricks under base of each box as support.

H. Control Wire Splice Boxes: Install control wire splice box to cover any splice in control wire. Top of valve box shall be flush with finished grade. Bury minimum 2 bricks under base of each box as support. Install control wire splice box to cover wires pulled for future valves.

I. Gravel Backfill: Backfill valve boxes and control wire splice boxes with gravel, minimum 6-inch depth.

J. Irrigation Control Wires

1. Provide 24-volt system for control of automatic circuit-section valves of underground irrigation system. Provide unit capacity to suit number of circuits indicated.
2. Install control wires with irrigation mains and laterals in common trench where possible. Lay control wire to side of pipe. Provide looped slack at valves and snake wire in trench to allow for contraction. Tie wires in bundles at 10-foot intervals. Line Splices will be allowed on runs of 500 Ft. or more. Splices shall be made and placed in control wire splice boxes.
3. Common ground wire shall be white. No other wires shall be white.

4. Supply one extra wire, for each direction of run, to valve, which is located the greatest distance from the controller. Extra wire shall be green. Leave two loops of wire at each valve location.
5. Color of wire from controller to control valve shall be consistent to each valve.
6. Solder splices and protect with splicing material specified. Provide 12 inch long expansion loop within 3 feet of each wire connection and splice on runs of wire 100 feet or longer.

K. Quick Coupling Valves

1. Connect quick coupling valves to irrigation mains by installing a Schedule 40 galvanized joint as per drawing.
2. Swing joints at quick couplers shall have threaded fittings with liquid Teflon sealant.

L. Backflow Preventers

1. Make required connection to water supply according to local codes and manufacturer's written instructions.
2. Install pressure type backflow devices at required grade in accordance with the Houston Plumbing Code. Exposed mainline and mainline risers above PVC pipe main elevation shall be copper. Install one brass union in riser downstream of device.

M. Irrigation Controller

1. Install controllers within lockable NEMA enclosure, Re: drawings. Wire complete and operable.

3.4 TESTING

A. General: Notify Landscape Architect 48 hours in advance when testing will be conducted. Conduct tests in presence of Landscape Architect.

B. Hydrostatic Test: Test irrigation main line, before backfilling trenches, to a hydrostatic pressure of not less than 100 psi for 1 hour. Piping may be tested in sections to expedite work, remove and repair or replace piping and connections which do not pass hydrostatic testing. System shall not lose more than 1 ½ gallons of water in 1 hour.

C. Operational Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place and Irrigation heads are adjusted to final position.

1. Demonstrate to Landscape Architect that system meets coverage requirements, is a specified and indicated, and that automatic controls function properly.
2. Coverage requirements are based on operation of one circuit at a time. After completion of grading, sodding and rolling of grass areas, carefully adjust lawn sprinkler heads so they will be flush with or not more than ½ inch above finished grade. Set shrub sprinkler heads no more than ½ inch above top of mulch.

3.5 MAINTENANCE

A. Contractor shall correctly maintain the irrigation system during the installation process and throughout the landscaping maintenance service period. Specified in Section 02493, Exterior Landscape Maintenance.

B. Contractor shall provide "As Built" Drawings showing dimensioned location of valves, meters, vacuum breakers, controllers, and mainline.

END OF SECTION 02441

SECTION 02580

PAVEMENT MARKING

PART 1 - GENERAL

1.1 Drawings, Standard General Conditions of Contract, Supplementary Conditions and Division - 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION:

The work under this section consists of furnishing all labor, materials and equipment to paint stripping of new concrete paving as indicated and detailed on the drawings.

1.3 QUALITY ASSURANCE:

A. Include on label of containers:

1. Manufacturer's name.
2. Type of paint.
3. Manufacturer's stock number.
4. Color.
5. Instructions for reducing, where applicable.

1.4 SUBMITTALS:

A. Submit complete manufacturer's project data sheets for all paints.

B. Prepare color/texture sample in each type of surface to be painted.

C. Make samples not less than 12 inches square.

D. All samples to remain at project site for reference.

PART 2 - PRODUCTS

2.1 MATERIALS

Paint for pavement marking shall be thermoplastic paint and conform to local standards, color as selected.

PART 3 - EXECUTION

3.1 METHODS OF APPLICATION

A. Equipment: All machines, tools and equipment used in the performance of the work shall be approved by the Owner's representative and shall be maintained in satisfactory operating condition.

1. Paint Application: The equipment for applying paint to pavements shall be self-propelled or mobile drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall be capable of applying the stripe widths indicated, shall have a speed during application not less than 5 miles per hour and shall be capable of applying the paint at the coverage rate specified in paragraph APPLICATION, at an even uniform thickness with clear-cut edges. Equipment used for marking pavements shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of three different colors of paint as specified.

The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with the requirements specified. The tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gages in full view and reach of the operator. Paint strainers shall be installed in the paint supply lines to insure freedom from residue and foreign matter that may cause malfunction of the spray guns. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

2. Sandblasting equipment shall include an air compressor, hoses and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cubic feet of air per minute at a pressure not less than 90 pounds per square inch at the nozzle for each nozzle used.

B. Surface Preparation: New concrete pavement surfaces shall be allowed to cure for a period of not less than ten days, and asphalt surfaces for thirty days before application of marking materials. All surfaces to be marked shall be thoroughly cleaned before application of the paint. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, and other coatings adhering to the pavement shall be completely removed with abrasion as directed. Where oil or grease is present on pavements to be marked, the affected areas shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinsed thoroughly after application. After cleaning, the oil soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint.

C. Application:

1. Rate of Application: Paint shall be applied evenly to the pavement surface to be coated at a rate of 105 plus or minus 5 square feet per gallon.

2. Paint shall be applied to clean, dry surfaces, and only when the air and pavement temperatures are above 40º and less than 95º F. The paint temperature shall be maintained within these limits. Paint shall be applied pneumatically with approved equipment and at the rate of coverage specified herein. The Contractor shall provide guidelines and templates as necessary to control paint application.

   The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and so there will be no pickup, displacements, or discoloration by tires or traffic. If there is a deficiency in drying of the markings, painting operations shall be discontinued until the cause of the slow drying is determined and corrected. If discoloration of the paint occurs due to bleeding of bituminous materials, the paint should be applied in two coats. A light coat of paint should first be applied at coverage of about 35 to 40 percent of the specified coverage. After drying, a second coat should be applied to complete the specified coverage.

D. CLEANING

1. Touch up and restore all finish surfaces where damaged.

2. Remove spilled, splashed or splattered paint from all surfaces.

3. Do not mar surface finishes being cleaned.

4. Dispose of all paint and containers as per environmental requirements.

END OF SECTION 02580

SECTION 02900

TREE, SHRUB, AND GROUNDCOVER PLANTING

PART 1 - GENERAL

1.1 SCOPE: This work includes all final fine grading and minor leveling of planting areas, soil preparation, and planting. Furnish all labor, materials, equipment, and services required as herein specified and indicated on the drawings. Refer to planting details on plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 02200 - Earthwork.

PART 2 - PRODUCTS

2.1 TOPSOIL:

A. All planting bed topsoil shall be soil/compost mix as produced by Living Earth Resources, Pineland, Texas, or approved equal.

B. Submittal: Submit picture/measurements to Landscape Architect for Approval.

2.2 COMMERCIAL FERTILIZER:

A. Shall be organic base fertilizer containing the following minimum percentages of available plant nourishment, by weight 5-10-5 (N-P-K), mixed nitrogen, not less than fifty (50%) percent from an organic source and trace elements, Wacco brand or approved equal. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

B. Commercial fertilizer shall be a complete organic fertilizer, part of the element of which is derived from organic sources. It shall be the type percentages and applied at the rate specified in the soil analysis. Fertilizer shall be delivered mixed as specified in standard size bags, showing weight, analysis, and name of manufacturer, and shall be stored in a weatherproof storage place, and in such a manner that it will be kept dry and its effectiveness will not be impaired.

C. Submittal: Submit labels to Landscape Architect for Approval.

2.3 SOIL AMENDMENTS: (None required.)

2.4 MULCH:

A. Shall be shredded cypress bark mulch.

B. Submittal: Submit a one (1) quart sample of proposed mulch for approval by Landscape Architect.

2.5 ROOT ACTIVATOR: (Not required.)

2.6 WATER: Water shall be available at the site via irrigation system. Water required in connection with planting will be furnished and paid for by the Owner provided it is not used in a wasteful manner. Any hose or other watering equipment shall be provided by the Landscape Contractor to water planting areas until the job is accepted by the Owner.

2.7 PLANT MATERIALS:

A. Plant Name and Location: The names and locations of all plants are noted on the drawings. The nomenclature of all plant materials is per Standardized Plant Names, 1942 edition and Manual of Cultivated Plants by L. H. Bailey. Plant materials not conforming to these two references will be rejected by the Architect/Engineer.

B. Quality and Size: All plant materials shall be first class representatives of their normal species or variety unless otherwise specified. They shall have a habit of growth that is normal for the species and shall be healthy, shapely, well-rooted, and vigorous. All plant materials shall be free from insect pests, plant diseases, and injuries. The containers and balls of all plants delivered to the site shall be free from any weeds or grasses which could be considered noxious or objectionable; i.e., nutgrass or Johnsongrass. ALL PLANT MATERIALS SHALL BE EQUAL TO OR EXCEED THE MEASUREMENTS SPECIFIED ON THE PLANTING PLAN WHICH ARE THE MINIMUM ACCEPTABLE SIZES. They shall be measured after pruning with the branches in normal position. The requirements for measurement, branching, grading, quality, balling and burlapping of plants specified generally follow the code of the standards currently recommended by the American Association of Nurserymen, Inc., in the American Standards for Nursery Stock.

C. Packaging:

1. Container Grown Plants: Plants designated as “gal. can” on the plans shall be full or heavy grade and shall have been growing in the specified size container for one full season prior to delivery to the site.

2. Balled and Burlapped Plants (B&B): Plants designated “B&B” on the plans shall be balled and burlapped. They shall be dug with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Balls shall be firmly wrapped with burlap or similar materials and bound with twine, cord, or wire mesh. Where necessary, to prevent breaking or cracking of the ball during the process of planting, the ball may be secured to a platform.

3. Alternate to B&B: Plants grown in containers may be accepted as B&B provided that the plant has been growing in the container for one full growing season prior to delivery. Alternate must be approved by Owner.

D. Substitutions: Substitutions will be permitted only upon submission of proof that any plant is not obtainable and authorization by the Owner or his representative by a Change Order providing for the use of the nearest equivalent obtainable size or variety of plant having the same essential characteristics with an equitable adjustment of contract price.

2.8 SOIL STERILANT: (Not required.)

2.9 WEED CONTROLLER: Shall be “Round-Up” as manufactured by Monsanto, Inc.

PART 3 – EXECUTION

3.1 LAYOUT: Location and spacing for plants and outline of areas to be planted shall be as denoted by stem location or by notations on the plan. All tree and shrub planting locations shall be staked by the Landscape Contractor and shall be approved by the Owner prior to digging the planting pits.

3.2 SCARIFICATION

A. All bed areas to receive planting shall be scarified to a depth of twelve (12”) inches and all debris, stone, rubbish, and weeds shall be removed from the site.

B. Weed Control: Prior to scarification the Contractor shall apply "Round-Up" herbicide to all bed areas. Follow manufacturer's directions as to timing requirements for effective weed control.

3.3 BED PREPARATION:

A. Planting areas shall be dug and soil fully prepared, graded, and made ready to receive the plants before delivery of plant materials. After planting, all beds shall be one (1") inch above finished grade to allow for settling.

B. Groundcover and Vine Planting Areas:

1. Commercial Soil Mix: All planting beds shall be excavated to twelve (12") inches below finished grade by Landscape/General Contractor, and all debris, stone, rubbish, weeds, and topsoil shall be removed from the site. The subgrade shall then be tilled to a depth of six (6") inches and the planting bed shall be backfilled with soil compost mix as available from Living Earth Resources, Inc., Houston, Texas, or approved equal. Upon replacement of topsoil with mix and after watering in, the bed should be at the specified level.

C. Tree and Shrub Planting Pits:

1. Planting Pits: After scarifying, the planting pits shall be excavated. All shrub pits shall be a minimum of six (6") inches larger in diameter and three (3") inches deeper than the shrub ball or root spread. All tree pits shall be a minimum of twelve (12") inches larger in diameter and six (6") inches deeper than the tree ball or root spread.

2. Soil Mix: Soil mix for backfilling the tree and shrub planting pits shall be soil/compost mix as specified for Groundcover and Vine Planting Areas.

D. Raised Planters:

1. Backfilling: Planters shall be backfilled with specified commercial soil mix.

3.4 DELIVERY OF PLANT MATERIALS: Plants shall be packed and protected during delivery and after arrival at the site, against climatic, seasonal, wind damage, or other injuries, and at no time shall be allowed to dry out.

3.5 PROTECTION OF PLANT MATERIALS: All plants shall be handled so that roots are adequately protected at all times from drying out and from other injury. The balls of balled plants which cannot be planted immediately on delivery shall be "heeled in" for protection with soil mulch, straw, or other acceptable material.

3.6 SETTING THE PLANTS: All plants shall be planted in pits, centered, and set to touch such depth that the finished grade level at the plant after settlement will be the same as that at which the plant was grown. Each plant shall be planted upright and faced to give the best appearance or relationship to adjacent plants or structures. No burlap shall be pulled out from under balls or balls broken when taken from containers. All broken or frayed roots shall be cut off cleanly. Prepared soil shall be placed and compacted carefully to avoid injury to roots and to fill all voids. When the hole is nearly filled, add water and root activator, mixed per manufacturer's recommendations, and allow it to soak away. Fill the hole to finished grade and form a shallow saucer around each tree or shrub by placing a ridge of topsoil around the edge of each pit after planting.

3.7 MULCHING: All plants will be mulched after planting with a two (2") inch deep layer of mulch material entirely covering the area around each plant. In the groundcover and massed shrub areas, the entire area between the plants is to be so treated, regardless of plant spacing.

3.8 GRADING: The surface of all planting areas shall slope as shown on the plans. Unless otherwise shown, slope one-quarter (1/4") inch per foot (two (2%) percent gradient) away from foundations and walk.

3.9 CLEANUP: All excess soil, soil preparation materials, fertilizer, or plant containers shall be removed form the site upon completion of the work.

3.10 PRUNING AND SPRAYING: Each tree will be pruned to preserve the natural shape and character of the plant. All pruning will be done after delivery to the site, under supervision of the Architect/Engineer. All soft wood or sucker growth and all broken or badly bruised branches shall be removed. All pruning diameter will be painted with tree surgery paint, applied on all cambium and other living tissues immediately after cuts are made. Immediately after planting and staking, all plant material except coniferous evergreens must be sprayed with an antidesiccant, if required, using an approved power sprayer for applying an adequate film over trunks, branches, and foliage. Antidesiccants and surgery paint shall be delivered in manufacturer's sealed containers and used in accordance with their recommendations.

3.11 MAINTENANCE: The Landscape Contractor is responsible for watering, cultivating, and other necessary maintenance until the completion and acceptance of all the work.

3.12 INSPECTION FOR ACCEPTANCE:

A. Inspections: Inspection of work and planting to determine completion of the work, exclusive of possible warranty plant replacement, will be made by the Owner upon notice by the Landscape Contractor. The Owner needs not less than two (2) days notice prior to the anticipated date, enabling him to schedule the inspection.

B. Acceptance: Acceptance of all work and planting, exclusive of possible plant replacements subject to guarantee, will be granted to the Landscape Contractor, provided there are no deficiencies at inspection time. After inspection, the Landscape Contractor will be notified by a letter of acceptance of work by the Owner. All plants must be healthy (not dry or wilted) to be accepted.

3.13 GUARANTEE:

A. Terms: All shrubs and groundcover shall be guaranteed for one (1) year and all trees for one (1) year. Guarantee begins upon completion of the Landscape Contractor's work and acceptance of work by the Owner.

B. Plant Replacement: At the end of each guarantee period, inspection will be made by the Owner and the Landscape Contractor. Any plant material required under this contract that is dead or not in satisfactory growth condition shall be removed and replaced with the same size and kind of plant specified, at no cost to the Owner.

3.14 MAINTENANCE GUIDE: The Landscape Contractor, upon delivery of the plant materials, shall deliver to the Owner a brief, written maintenance guide. This guide should describe recommended planting maintenance procedures, methods, products, quantities, timing, etc.

END OF SECTION 02900

SECTION 02930

TURFGRASS PLANTING

PART 1 - GENERAL

1.1 SCOPE: This work includes all labor, materials, and equipment for soil preparation, fertilization, planting, and other requirements regarding turfgrass planting areas shown on the plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 02200 - Earthwork

1.3 CODES AND STANDARDS: None in this section.

1.4 SUBMITTALS:

A. Delivery Receipts and Invoices: All delivery receipts and copies of invoices for materials used for this work shall be subject to checking by the Owner or his representative and shall be subsequently delivered to the office of the Owner.

B. Samples and Producers' Specifications: Various samples, certificates, and specifications of seed, fertilizer, sand, compost, other soil amendments, and other materials shall be submitted for approval as required by subsequent sections of this specification.

PART 2 - PRODUCTS

2.1 TURFGRASS:

A. Bermudagrass Seed: Turfgrass seed shall be "Cynodon dactylon" (Common Bermudagrass). The seed shall be harvested within one (1) year prior to planting, free of Johnsongrass, field bind weed, dodder seed, and free of other weed seed to the limits allowable under the Federal Seed Act and applicable seed laws. The seed shall not be a mixture. The seed shall be hulled, extra fancy grade, treated with fungicide, and have a germination and purity that will produce, after allowance for Federal Seed Act tolerances, a pure live seed content of not less than 85% using the formula: <u>purity % times (germination % times plus hard or sound seed %)</u>. Seed shall be labeled in accordance with U.S. Department of Agriculture rules and regulations.

1. Certificate Submittal: Prior to planting, provide the Owner or his representative with the State Certificate stating analysis of purity and germination of seed.

B. Sod: Turfgrass sod shall be "Cynodon dactylon" (Common Bermudagrass). Sod shall consist of stolons, leaf blades, rhizomes, and roots with a healthy, virile system of dense, thickly matted roots throughout the soil of the sod for a thickness not less than three-quarters (3/4") inch. Sod shall be alive, healthy, vigorous, free of insects, disease, stones, and undesirable foreign materials and grasses. The grass shall have been mowed prior to sod cutting so that the height of the grass shall not exceed two (2") inches. Sod shall have been produced on growing beds of clay or clay-loam topsoil. Sod shall not be harvested or planted when its moisture condition is so excessively wet or dry that its survival will be affected. All sod is to be harvested, delivered, and planted within a thirty-six (36) hour period of time. Sod shall be protected from exposure to wind, sun, and freezing. If sod is stacked, it shall be kept moist and shall be stacked roots-to-roots and grass-to-grass.

1. Dimensions: All sod shall have been machine cut to uniform soil thickness of one (1") inch plus or minus one-quarter (1/4") inch. All sod shall be of the same thickness. Rectangular sections of sod may vary in length, but all shall be of equal width and of a size that permits the sod to be lifted, handled, and rolled without breaking. Broken pads and torn, uneven ends will be unacceptable.

C. Ballfield Sod: Turfgrass sod for the baseball field shall be TifTuf Certified Bermuda Sod "Cynodon dactylon x Transvaalenis 'DT-1'™" (TifTuff Bermuda). Sod shall consist of stolons, leaf blades, rhizomes, and roots with a healthy, virile system of dense, thickly matted roots throughout the soil of the sod for a thickness not less than three-quarters (3/4") inch. Sod shall be alive, healthy, vigorous, free of insects, disease, stones, and undesirable foreign materials and grasses. The grass shall have been mowed prior to sod cutting so that the height of the grass shall not exceed two (2") inches. Sod shall have been produced on growing beds of clay or clay-loam topsoil. Sod shall not be harvested or planted when its moisture condition is so excessively wet or dry that its survival will be affected. All sod is to be harvested, delivered, and planted within a thirty-six (36) hour period of time. Sod shall be protected from exposure to wind, sun, and freezing. If sod is stacked, it shall be kept moist and shall be stacked roots-to-roots and grass-to-grass.

2.2 FERTILIZER:

A. General: Fertilizer shall be a commercial product, uniform in composition, free flowing, and suitable for application with approved equipment, Fertilizer shall be delivered to the site in fully labeled original containers. Fertilizer which has been exposed to high humidity and moisture has become caked or otherwise damaged making it unsuitable for use will not be acceptable.

B. Initial Planting Application: Fertilizer for the initial planting application shall be of an organic base containing by weight the following (or other approved) percentages of nutrients: 15-15-15 (N-P-K), also containing 10-15% sulphate and traces of iron and zinc as required and approved by the Owner.

1. Specification Submittal: Submit a sample label or specification of the fertilizer proposed to be used for the Owner's approval.

C. Post Planting Application: Fertilizer for the post planting application will be a chemical base fertilizer containing by weight the following percentages of nutrients: 21-0-0 (N-P-K) ammonium sulphate or the nitrogen equivalent of 33-0-0 ammonium nitrate.

1. Specification Submittal: Submit a sample label or specification of the fertilizer proposed to be used for the Owner's approval.

2.4 SOIL AMENDMENTS: (Per Plans.)

PART 3 - EXECUTION

3.1 GENERAL: All turfing operations are to be executed across the slope, parallel to finished grade contours.

3.2 SOIL PREPARATION:

A. Contractor shall kill all vegetation prior to soil preparation.

B. Tillage: Tillage shall be accomplished to loosen the soil, destroy existing vegetation, and prepare an acceptable seed/sprig/sod bed. All areas shall be tilled with a heavy duty disc or a chisel-type breaking plow, chisels set not more than ten (10") inches apart. Initial tillage shall be done in a crossing pattern for double coverage, then followed by a disc harrow. Depth of tillage shall be five (5") inches. A heavy duty rototiller may be used for areas to be planted with sod.

C. Cleaning: Soil shall be further prepared by the removal of debris, building materials, rubbish, weeds, and stones larger than two (2") inches in diameter.

D. Fine Grading: After tillage and cleaning, all areas to be planted shall be leveled, fine graded, and drug with a weighted spike harrow or float drag. The required result shall be the elimination of ruts, depressions, humps, and objectionable soil clods. This shall be the final soil preparation step to be completed before the commencement of fertilizing and planting.

E. Rock Removal: During the soil preparation process, a “Rock Pick” or other approved piece of machinery shall be used to gather surface stones as small as three-quarter (3/4”) inch in diameter. The Contractor shall be responsible for the disposal of collected materials as waste per “Clean Up” Paragraph 3.9.

3.3 FERTILIZING:

A. Initial Planting Application: The specified fertilizer shall applied at the rate of (18) pounds per one thousand (1,000) square feet (800 pounds per acre).

1. Timing: The initial planting application of fertilizer for seeded/sprigged areas shall be applied after the soil preparation, but not more than two (2) days prior to turfgrass planting. (Fertilizer shall be applied over sodded areas after planting, but not more than two (2) days later.)

B. Post Planting Application: Thirty (30) days after planting, turfgrass areas shall receive an application of 21-0-0 or 33-0-0 fertilizer at the rate of nine (9) pounds per one thousand (1,000) square feet (400 pounds per acre).

1. Timing: The Owner or his representative will determine if it is too late in the growing season for the post planting application. In the event that it is, the application shall be made in the spring of the next year, or the cost of the application may become a credit due to the Owner.

2. Post Planting Maintenance: See Paragraph 3.6. Areas without a uniform stand (complete coverage) that must be maintained later than thirty (30) days after the initial planting shall receive subsequent applications of fertilizer, as described above, every thirty (30) days until a uniform stand is achieved.

3.4 PLANTING:

A. Seeding: Following soil preparation and initial fertilizing, apply Bermudagrass seed at the rate of two (2)/three (3) pounds per one thousand (1,000) square feet (90/130 pounds per acre)/ryegrass seed at the rate of eight (8) pounds per one thousand (1,000) square feet (350 pounds per acre). Seed shall be uniformly placed with a Brillion seeder-cultipacker, or the seed shall be broadcast uniformly, followed by rolling with a weighted lawn roller.

1. Timing: Bermudagrass shall not be seeded in planting periods other than the following unless special permission is granted by the Owner: April 15 to June 15, and August 15 to September 15.

B. Solid Sodding: Prior to laying the sod, the planting bed shall be raked smooth to true grade and moistened to a depth of four (4”) inches, but not to the extent causing puddling. The sod shall be laid smoothly, tightly butted edge to edge, and with staggered joints. The sod shall be pressed firmly into contact with the sod bed by rolling or by hand tamping with an approved tamper so as to eliminate all air pockets, provide a true and even surface, and insure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Following compaction, fine screened soil of good quality shall be used to fill all cracks between sods. Excess soil shall be worked into the grass with suitable equipment and shall be well watered. The quantity of fill soil shall be such that it will cause no smothering of the grass.

3.5 PROTECTION: No heavy equipment shall be moved over the planted lawn area unless the soil is again prepared, graded, leveled, and replanted. It will be the responsibility of this Contractor to protect all paving surfaces, curbs, utilities, plant materials, and any other existing improvements from damage. Any damages shall be repaired or replaced at no cost to the Owner. This Contractor will also locate and stake all irrigation heads, valve risers, etc., prior to beginning any soil preparation work.

3.6 ESTABLISHMENT AND ACCEPTANCE: Regardless of unseasonable climatic conditions or other adverse conditions affecting planting operations and the growth of the turfgrass, it shall be the sole responsibility of the Contractor to establish a uniform stand of turfgrass as herein specified. When adverse conditions such as drought, cold weather, high winds, excessive precipitation, or other factors prevail to such an extent that satisfactory results are unlikely, the Owner may, at his own discretion, stop any phase of the work until conditions change to favor the establishment of turfgrass.

3.7 POST-PLANTING MAINTENANCE: Maintenance shall begin immediately after each portion of grass area is planted. All planted areas will be protected and maintained by watering, weed control, and replanting as necessary for at least thirty (30) days after, initial planting and for as much longer as necessary to establish a UNIFORM STAND WITH COMPLETE COVERAGE OF THE SPECIFIED GRASS. It is anticipated that a minimum of one (1) mowing will occur before the grass areas are accepted by the Owner. Only those areas which are not completely covered with the specified grass at the end of thirty (30) days will continue to be replanted and maintained by the Contractor until complete coverage and acceptance are achieved. The automatic irrigation system will be available for the Contractor's use. Any other water equipment deemed necessary by the Contractor will be provided by the Contractor.

A. Watering: Use the automatic irrigation system to apply at least one-half (1/2") inch of water over the entire planted area every three days. Contractor shall water thoroughly and infrequently once grass is established to encourage deep root growth.

B. Mowing: Once grass is established the planted area shall be mowed at least once a week during the growing season. Grass shall be mowed to a height of one (1") inch. Mowing during dormant season will be done as necessary.

C. Weed Control: No sooner than 45 days after grass has germinated any weed growth shall be arrested by applying MSMA broadcasted over the entire planted area. Additional applications of MSMA will be required to eliminate weed growth that continues to grow after the initial application. MSMA will only be used during the growing season. All weed growth during the dormant season will be controlled with spot applications of "Round-Up." "Round- Up" will not be used until the grass is totally dormant.

3.8 GRADING: All grading and placing of topsoil on any given area will be done by others prior to the beginning of this Contractor's work in that area. It will be this Contractor's responsibility to maintain the existing grades and leave them in a true and even condition after planting turfgrass. Finish condition of turf grass will be such that sod sits flush with paving (topsoil 1" below paving) and such that drainage grades and swales function and to not trap draining on the paving.

3.9 EROSION CONTROL: Throughout the project and the maintenance period for turfgrass, it is the Contractor's responsibility to maintain the topsoil in place at specified grades. Topsoil and turfgrass losses due to erosion will be replaced by the Contractor until establishment and acceptance is achieved.

3.10 CLEAN UP: This Contractor shall remove any excess material or debris brought onto the site or unearthed as a result of his turfgrass operations.

3.11 GUARANTEE: This Contractor shall guarantee all materials used for this work to be the type, quality, and quantity specified.

END OF SECTION 02930

SECTION 024119

SELECTIVE DEMOLITION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.

2. Demolition and removal of selected site elements.

3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.

2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

5. Review areas where existing construction is to remain and requires protection.

6. If needed, insert list of conference participants not mentioned in Section 013100 "Project Management and Coordination."

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.

2. Interruption of utility services. Indicate how long utility services will be interrupted.

3. Coordination for shutoff, capping, and continuation of utility services.

4. Use of elevator and stairs.

5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Pre-demolition Photographs or Video: Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.07 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.08 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.09 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.

2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

3. Retain subparagraph below if hazardous materials are known to be present. Delete if Owner does not have, or will not provide, material safety data sheets for these materials.

4. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

F. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

G. Storage or sale of removed items or materials on-site is not permitted.

H. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.01 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.

2. Arrange to shut off indicated utilities with utility companies.

3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

c. Equipment to Be Removed: Disconnect and cap services and remove equipment.

d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.

5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting

flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.

6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly comply with requirements in Section 017419 "Construction Waste Management and Disposal.

B. Work in Historic Areas: Selective demolition may be performed only in areas of the Project that are not designated as historic. In historic spaces, areas, and rooms or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 013591 "Historic Treatment Procedures."

C. Removed and Salvaged Items:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area designated by Owner.

5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.

2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings. Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

1. Remove existing roof membrane, flashings, copings, and roof accessories.

2. Remove existing roofing system down to substrate.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Coordinate first subparagraph below with use of elevators, stairs, or building entries permitted by building manager.

4. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

5. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Burning: Burning of demolished materials will be permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.08 SELECTIVE DEMOLITION SCHEDULE

A. Existing Items to Be Removed: See construction drawings.

B. Existing Items to Be Removed and Salvaged: See construction drawings.

C. Existing Items to Be Removed and Reinstalled: See construction drawings.

D. "Existing Items to Remain" Paragraph below may be used to inform Contractor of items that are to remain, such as those that occur in, or are adjacent to, construction being demolished, but are not being removed and reinstalled. Retain paragraph if required.

E. Existing Items to Remain: See construction drawings.

END OF SECTION

DIVISION 3 – CONCRETE

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART I – GENERAL

1.1 References

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 117/117R, Standard Tolerances for Concrete Construction and Materials.
   b. 318/318R, Building Code Requirements for Structural Concrete and Commentary.
   c. 347, Guide to Formwork for Concrete.

1.2 Design Requirements

A. Design formwork in accordance with ACI 347 and ACI 318/318R to provide concrete finishes specified in Section 03 30 00, Cast-in-Place Concrete.

B. High range water reducer (superplasticizer) may be used in concrete mixes. Forms shall be designed for full hydrostatic pressure per ACI 347.

C. Make joints in forms watertight.

D. Limit panel deflection to 1/360th of each component span to achieve tolerances specified.

1.3 Submittals

A. Action Submittals:

1. Shop Drawings:
   a. Layout of panel joints and tie hole pattern.
   b. Form Ties-Tapered Through-Bolts: Proposed method of sealing form tie hole; coordinate with details shown.
   c. Manufacturer’s data for form release agent.
2. Samples: One each as follows:
   a. Form ties.

B. Informational Submittals:

1. Statement of qualification for formwork designer.
2. Manufacturer’s Certificate of Proper Installation.

1.4 Qualifications

A. Formwork Designer: Formwork, falsework, and shoring design shall be by a structural engineer licensed by the State of Florida.

PART II – PROJECTS

2.1 Form Materials

A. Wall, Footings and Encasements:

1. Materials: Plywood, hard plastic finished plywood, or steel in "new and undamaged" condition, of sufficient strength and surface smoothness to produce specified finish.

B. Form Release Agent:

1. Material: Release agent shall not bond with, stain, or adversely affect concrete surfaces, and shall not impair subsequent treatments of concrete surfaces when applied to forms. A ready-to-use water based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Environmentally safe, meeting local, state, and federal regulations and can be used in potable water facilities.
2. Manufacturers and Products:
   a. BASF, Shakopee, MN; MBT, Rheofinish 211.
   b. Cresset Chemical Company; Crete-Lease 20-VOC.
   c. Unitex Chemicals; Farm Fresh.
   d. Atlas Construction Supply, Inc.; Bio-Guard.

C. Form Ties:

1. Material: Steel.
2. Spreader Inserts:
   a. Conical or spherical type.
   b. Design to maintain positive contact with forming material.
   c. Furnish units that will leave no metal closer than 1.5 inches to concrete surface when forms, inserts, and tie ends are removed.
3. Wire ties not permitted.
4. Flat bar ties for panel forms; furnish plastic or rubber inserts with minimum 1.5-inch depth and sufficient dimensions to permit patching of tie hole.
5. Water Stop Ties:
   a. Neoprene water stop 3/16 inch thick and 15/16 inch diameter whose center hole is one half diameter of tie, or molded plastic water stop of comparable size.
   b. Orient water stop perpendicular to tie and symmetrical about center of tie.
   c. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

PART 3 - EXECUTION

3.1 Form Surface Preparation

A. Thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants prior to coating surface.

B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by the manufacturer.

C. Steel Forms: Apply form release agent to steel forms as soon as they are cleaned to prevent discoloration of concrete from rust.

3.2 Erection

A. General: Unless specified otherwise, follow applicable recommendations of ACI 347.

B. Beveled Edges (Chamfer):

1. Form 1-inch bevels at concrete edges, unless otherwise shown.
2. Where beveled edges on existing adjacent structures are other than 1-inch, obtain Engineer's approval of size prior to placement of beveled edge.

C. Forms:

1. Do not reuse forms with damaged surfaces.
2. Locate form ties and joints in an uninterrupted uniform pattern.
3. Inspect form surfaces prior to installation to assure conformance with specified tolerances.

D. Form Tolerances: Provide forms in accordance with ACI 117/117R, ACI 347, and ACI 318/318R and the following tolerances for finishes specified:

1. Walls, Footings and Encasement Tolerances:
   a. Exposed Straight Horizontal and Vertical Surfaces: Flat planes within tolerances specified.
   b. Lateral Alignment:
      1) Centerlines must be within plus or minus 1/2 inch from dimensions shown.
      2) At intersections, centerlines shall intersect within plus or minus 1/2 inch of dimensions shown.
   c. Tolerances:
      1) Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
      2) Elevations: Within plus or minus 1/2 inch.

3.3 Form Removal

A. Nonsupporting forms may be removed after cumulatively curing at not less than 50 degF for 48 hours from time of concrete placement if:

1. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
2. Curing and protection operations are maintained.

B. Supporting forms may be removed in accordance with ACI 318/318R, Chapter 6, and at such time as concrete has reached compressive strength equal to 80 percent of specified 28-day compressive strength as determined by test cylinders.

END OF SECTION 03 10 00

SECTION 03 21 00

REINFORCING STEEL

PART II – GENERAL

1.1 References

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 318/318R, Building Code Requirements for Structural Concrete and Commentary.
   b. SP-66, Detailing Manual.
2. American Welding Society (AWS): D1.4, Structural Welding Code - Reinforcing Steel.
3. ASTM International (ASTM):
   a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   b. A185, Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   c. A497, Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   d. A615/A615M, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   e. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
4. Concrete Reinforcing Steel Institute (CRSI):
   a. Placing Reinforcing Bars.
   b. Manual of Standard Practice.
5. International Conference of Building Officials (ICBO): ICBO Research Report.
6. Wire Reinforcement Institute (WRI): Manual of Standard Practice, Welded Wire Fabric.

1.2 Submittals

A. Action Submittals:

1. Shop Drawings prepared in accordance with CRSI Manual of Standard Practice and ACI SP-66 Detailing Manual:

   a. Bending lists.
   b. Placing drawings.

2. Welded, metallic sleeve splice, and mechanical threaded connection details and product data.
3. Welding Qualification: Prior to welding, submit welder qualifications, AWS certifications, and nondestructive testing procedures in accordance with Section 05 05 23, Welding.

B. Informational Submittals:

1. Lab test reports for reinforcing steel showing stress-strain curves and ultimate strengths.
2. Mechanical Threaded Connections:
   a. Current International Conference of Building Officials (ICBO) Research Report or equivalent code agency report listing findings to include acceptance, special inspection requirements, and restrictions.
   b. Manufacturer’s instructions.

c. Verification that device threads have been tested and meet requirements for thread quality, in accordance with manufacturer's published methods.

3. Test results of field testing.

1.3 Quality Assurance

A. Welder Qualifications: Certified in accordance with AWS D1.4, within the last 6 months.

1.4 Delivery, Storage and Handling

A. Unload, store, and handlebars in accordance with CRSI publication "Placing Reinforcing Bars."

PART II – PRODUCTS

2.1 Materials

A. Deformed Billet-Steel Reinforcing Bars:

1. Includes primary reinforcing bars, stirrups, ties, and spirals.
2. ASTM A615/A615M, Grade 60, where welding is not required.
3. ASTM A706/A706M, Grade 60, for reinforcing to be welded and for reinforcement where tight radius bends are required, such as closed ties and stirrups.

B. Mechanical Splices and Connections:

1. Metal Sleeve Splice: Furnish with cast filler metal, capable of developing, in tension or compression, 125 percent of minimum tensile strength of bar.
   a. Manufacturer and Product: Erico Products, Inc., Cleveland, OH; Cadweld T-Series.
2. Mechanical Threaded Connections: Furnish metal coupling sleeve with internal threads engaging threaded ends of bars developing in tension or compression 125 percent of yield strength of bar.
   a. Manufacturers and Products:
      1) Erico Products, Inc., Cleveland, OH; Lenton Reinforcing Steel Couplers.
      2) Richmond Screw Anchor Co., Inc., Fort Worth, TX; Richmond DB-SAE Dowel Bar Splicers.

C. Welded Wire Fabric:

1. ASTM A185 or ASTM A497 and ACI 318/318R, using ASTM A82 wire of 75 ksi minimum tensile strength.
2. Furnish flat sheets only, rolled sheets not permitted.

2.2 Accessories

A. Tie Wire:

1. Black, soft-annealed 16-gauge wire.
2. Nylon-, epoxy-, or plastic-coated wire.

B. Bar Supports and Spacers:

1. Use precast concrete bar supports or all-plastic bar supports and side form spacers meeting the requirements of CRSI "Manual of Standard Practice". Do not use other types of supports or spacers.

2. Bar supports shall have sufficient strength and stiffness to carry loads without failure, displacement, or significant deformation. Space bar supports so minimum concrete cover is maintained for reinforcing between supports.
3. Use only precast concrete bar supports where concrete surfaces are exposed to weather, earth, water, chloride intrusion, or corrosive chemicals. Bar supports shall be nonconductive and have geometry and bond characteristics that deter movement of moisture from the surface to the reinforcement.
4. Precast concrete supports shall have the same color and minimum compressive strength and shall be made from same materials as that of the concrete in which they are to be embedded. Precast concrete supports shall be cast and properly cured for at least 7 days before use and shall have a wire or other device cast into each block for the purpose of attaching them securely to the reinforcing steel.
5. In Concrete Exposed to View After Form Removal: Use small precast concrete blocks made of same color and minimum compression strength as concrete in which they are embedded. All-plastic bar supports and side form spacers may be used, except where surface is exposed as described above.
6. Plastic Bar Supports: Manufactured by Aztec Concrete Accessories, Bloomington, CA.
7. Precast Concrete Supports: Total bond precast high performance concrete bar supports as supplied by Con Sys Inc., Pinawa, MB, Canada.

2.3 FABRICATION

A. Follow CRSI Manual of Standard Practice.

B. Bend bars cold.

PART III - EXECUTION

3.1 Preparation

A. Notify Engineer when reinforcing is ready for inspection and allow sufficient time for inspection prior to placing concrete.

B. Clean reinforcing bars of loose mill scale, oil, earth, and other contaminants.

C. Coat wire projecting from precast concrete bar supports with dielectric material, epoxy, or plastic.

3.2 Reinforcing Bar Installation

A. Bundle or space bars, instead of field bending where construction access through reinforcing is necessary.

B. Spacing and Positioning: Conform to ACI 318/318R.

C. Location Tolerances: In accordance with CRSI publication, “Placing Reinforcing Bars”.

D. Splicing:

1. Follow ACI 318/318R.
2. Use Class B tension lap splices, unless otherwise shown or permitted in writing by Engineer.
3. Stagger splices in adjacent bars such that no more than 50 percent of the bars are spliced at one location. Space lap splices such that there is at least the equivalent of one Class B tension splice length of unspliced bar between splices.

4. Welded Splices: Obtain Engineer's approval. Accomplish by full penetration groove welds and develop a minimum of 125 percent of yield strength of bar.

E. Mechanical Splices and Connections:

1. Use only in areas specifically approved in writing by Engineer.
2. Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICBO Research Report.
3. For metal sleeve splice, follow manufacturer's installation recommendations.
4. Maintain minimum edge distance and concrete cover.

F. Tying Reinforcing Bars:

1. Tie every other intersection on mats made up of Nos. 3, 4, 5, and 6 bars to hold them firmly at required spacing.
2. Bend tie wire away from concrete surface to provide clearance of 2 inches from surface of concrete to tie wire.

G. Reinforcement Around Openings: On each side and above and below pipe or opening, place an equivalent area of steel bars to replace steel bars cut for opening. Extend steel reinforcing a standard Class B tension lap splice length beyond opening at each end.

H. Welding Reinforcement:

1. Do not perform welding until Engineer's written approval is granted for welding reinforcement.
2. Only ASTM A706/A706M bars shall be welded.
3. Do not perform welding until welder qualifications and current (within 12 months) AWS Welder Certificates are approved.

I. Straightening and Rebending: Field bending of reinforcing steel bars is not permitted.

J. Unless permitted by Engineer, do not cut reinforcing bars in field.

3.3 Welded Wire Fabric Installation

A. Use only where specifically shown.

B. Extend fabric to within 3 inches of edges of slab, and lap splices at least 1-1/2 courses of fabric or minimum 8 inches.

C. Tie laps and splices securely at ends and at least every 24 inches with tie wire.

D. Place welded wire fabric on concrete blocks and rigidly support equal to that provided for reinforced bars. Do not use broken concrete, brick, or stone.

E. Follow ACI 318/318R and current Manual of Standard Practice, Welded Wire Fabric.

F. Do not use fabric that has been rolled. Install flat sheets only.

3.4 Tests and Inspection

A. An independent testing agency shall be retained by Contractor and approved by the Engineer to visually inspect, 100 percent of all welds shall be visually inspected by an AWS CWI, and test reinforcing steel welds in accordance with AWS D1.4 as specified in Section 05 05 23, Welding.

B. An independent testing agency shall be retained by Contractor and approved by the Engineer to inspect each mechanical splice and verify each component is installed in accordance with manufacturer's instructions and ICBO Research Report.

END OF SECTION 03 21 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART I - GENERAL

1.1 References

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   b. 223R, Guide for the Use of Shrinkage – Compensating Concrete.
   c. 301, Specifications for Structural Concrete.
   d. 302.1R, Guide for Concrete Floor and Slab Construction.
   e. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
   f. 305R, Hot Weather Concreting.
   g. 306.1, Standard Specification for Cold Weather Concreting.
   h. 309R, Guide for Consolidation of Concrete.
   i. 318, Building Code Requirements for Structural Concrete and Commentary.
2. ASTM International (ASTM):
   a. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   b. C33, Standard Specification for Concrete Aggregates.
   c. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   d. C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
   e. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   f. C143/C143M, Standard Test Method for Slump of Hydraulic Cement Concrete.
   g. C150, Standard Specification for Portland Cement.
   h. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   i. C192/C192M, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
   j. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   k. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
   l. C311, Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
   m. C452, Standard Test Method for Potential Expansion of Portland-Cement Mortars Exposed to Sulfate.
   n. C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
   o. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   p. C881, Epoxy-Resin-Base Bonding Systems for Concrete.
   q. C1012, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
   r. C1218/C1218M, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.

s. D4580, Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.

3. National Institute of Standards and Technology (NIST): Handbook 44, Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices.
4. National Ready Mixed Concrete Association (NRMCA).

1.2 Definitions

A. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 3/16 inch, cracks 0.010 inch wide, chips, air bubbles greater than 3/4 inch in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form popouts, texture irregularities, and stains and other color variations that cannot be removed by cleaning.

B. Exposed Concrete: Concrete surfaces that can be seen inside or outside of structures regardless whether concrete is above water, dry at all times, or can be seen at low tide.

C. New Concrete: Less than 60 days old.

D. SRA: Shrinkage Reducing Admixture.

1.3 Submittals

A. Action Submittals:

1. Concrete Mix Proportions:
   a. Proportions by weight of ingredients in mix.
2. Manufacturer's Technical Data Sheet:
   a. Concrete admixtures.
   b. Bonding agent.
   c. Evaporation retardant.
3. Shop Drawings:
   a. Product Data: Admixtures, bonding agent, bond breaker, and patching materials.
   b. Design Data: Concrete mix designs signed by qualified mix designer.
   c. Placement Drawings:
      1) Concrete, identifying location of each type of construction joint.
      2) Tremie concrete.
   d. Gradation for coarse and fine aggregates, and combined together. List gradings, percent passing through each sieve size.
   e. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F.
   f. Detailed plan for cold weather placements including curing and protection for concrete placed in cold ambient temperatures per ACI 306.1
   g. Concrete repair methods and materials.

B. Informational Submittals:

1. Preinstallation Conference Minutes.
2. Manufacturer's application instructions for bonding agent and bond breaker.
3. Manufacturers' Certificate of Compliance (Current within last 6 months):
   a. Portland cement.
   b. Fly ash.
   c. Admixtures:

1) Air Entrainment.
2) Water Reducing.
3) High-Range Water-Reducing (Superplaticizer).
4) Shrinkage Reducing Admixture.
5) Anti-washout.
6) Viscosity Modifying.
7) Manufacturers' Certificate of Proper Installation.

d. Aggregates.
e. Bonding agent.
f. Bond breaker.
g. Patching materials.
h. Evaporation retardant
i. Admixtures: Manufacturers' Certificate of Proper Installation.

4. Statements of Qualification (Current within last 6 months):
   a. Mix Designer.
   b. Batch plant.
   c. Contractor's resident superintendant for concrete installation.
5. Test Reports: (Certified and Current within 6 months):
   a. Admixtures, test reports showing chemical ingredients and percentage of chloride in each admixture.
   b. Source test analysis reports for cement and fly ash, including percentage of chloride content in each.
   c. Statement identifying aggregates reactivity. Determine water soluble chloride in each component of aggregates in accordance with ASTM C1218/C1218M.
   d. Each trial concrete mix design, signed by a Qualified Mix Designer.
   e. Cylinder compressive test results for each of the laboratory concrete mixes.
   f. Shrinkage sample test results for each of the laboratory concrete mixes.
6. Concrete Delivery Tickets:
   a. For each batch of concrete before unloading at site.
   b. Record of drum revolution counter, type, brand, test certification, and amount of fly ash used in accordance with ASTM C94/C94M, Section 16.
   c. Amount of water added at the site and resulting w/cm ratio.
   d. Amount of superplasticizer added at the site.

1.4 Quality Assurance

A. Qualifications:

1. Mix Designer: Licensed professional engineer registered in the State of Florida or Florida DOT approved mix designer.
2. Batch Plant: Currently certified by the National Ready Mixed Concrete Association.
3. Maintain in the field office, as a minimum, a copy of ACI 301 and AASHTO T 277 – Test for Density, Relative Density (Specific Gravity).

B. Preinstallation Conference:

1. Required Meeting Attendees:
   a. Contractor, including pumping, placing, finishing, and curing subcontractors.
   b. Ready-mix producer.
   c. Admixture representative.
   d. Testing and sampling personnel.
   e. Owner and Port Representative.
   f. Engineer.

2. Schedule and conduct prior to incorporation of respective products into Project. Notify Port Representative and Engineer of location and time, at least 5 working days in advance.
3. Agenda shall include:
    a. Admixture types, dosage, performance, and redosing at site.
    b. Mix designs, test of mixes, and Submittals.
    c. Placement methods, techniques, equipment, consolidation, and form pressures.
    d. Control Joint locations and concrete placement sequencing; as well as Contraction/Construction Joint locations.
    e. Slump and placement time to maintain slump.
    f. Finish, curing, water retention, and evaporation retardant.
    g. Protection procedures for weather conditions.
    h. Other specified requirements requiring coordination.
5. Conference Minutes.

PART II - PRODUCTS

1.5 Materials

A. Cement: Furnish from one source.

1. Portland Cement:
    a. Meet ASTM C150, Type II. (Type 1L will not be accepted)
    b. Equivalent Alkalies: Maximum 0.60 percent, in accordance with ASTM C150, Table 2.
    c. Tricalcium Aluminate Content: Maximum 8 percent.
    d. Combine fly ash with cement at batch plant.

B. Aggregates:

1. Natural Aggregates:
    a. Furnish from one source.
    b. Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.
    c. Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
    d. In compliance with ACI 223R recommendations.
    e. Use job aggregates in the three laboratory trial batch proportioning tests.
2. Nonpotentially Reactive: In accordance with ASTM C33, Appendix XI, Paragraph X1.1.
3. Aggregate Soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.
4. Fine Aggregates:
    a. Clean, sharp, granular, natural sand. Screenings not Allowed.
    b. ASTM C33.
    c. Materials Passing 200 Sieve: 4 percent maximum.
    d. Limit deleterious substances in accordance with ASTM C33, Table 1 with material finer than 200 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.
5. Coarse Aggregate:
    a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
    b. Materials Passing 200 Sieve: 0.5 percent maximum.

c. Limit deleterious substances that react with alkalis to cause excessive expansion of concrete exposed to wetting, in accordance with ASTM C33, Table 3, for concrete exposed to Exposure Classes S2.

C. Admixtures: Furnish from one manufacturer.

1. Furnish from one manufacturer.
2. Characteristics:
   a. Compatible with each other and free of chlorides or other corrosive chemicals.
   b. Submit manufacturer's current certification that each specific admixture to be used in the mix is compatible with all other admixtures used in the mix.
   c. In compliance with ACI 223R recommendations.
   d. Admixtures shall be tested in trial batches with job materials and mixture proportions. Such tests shall evaluate:
      1) The admixture's influence on expansion;
      2) Water requirement;
      3) Air content;
      4) Consistency;
      5) Rate of slump loss;
      6) Bleeding;
      7) Rate of hardening;
      8) Compressive Strength; and
      9) Drying shrinkage.
3. Air-Entraining Admixture:
   a. ASTM C260, nontoxic after 30 days and contains no chlorides.
   b. Concrete with air-entrainment admixture added shall maintain air percentage as batched, within plus or minus 2 percent for time required for placement into structure.
   c. Manufacturers and Products:
      1) W.R. Grace & Co.: "Darex" or "Daravair" Series.
      2) BASF Admixtures, Inc.: "MB-VR", "MB-AE90" or "Micro-Air".
      3) Sika Chemical Corporation: "Sika AER".
      4) Euclid Chemical Company: "Air Mix" or "AEA-92".
4. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   a. Manufacturers and Products:
      1) BASF Admixtures Inc.: Pozzolith or Polyheed.
      2) Euclid Chemical Co.: Eucon WR-91 or WR-75.
      3) W. R. Grace & Co.: MIRA Series.
      4) Sika Chemical Corp.: Plastocrete 161.
5. High-Range Water-Reducing Admixture (Superplasticizer):
   a. ASTM C494/C494M.
   b. Hold slump of 5 inches or greater for time required for placement.
   c. Furnish type as recommended by manufacturer for allowed temperature ranges.
   d. Type F or G.
   e. Manufacturers and Products:
      1) BASF Admixtures Inc.: Rheobuild 1000 or Glenium Series.
      2) Euclid Chemical Co.: Eucon 37/1037 or Plastol Series.
      3) W. R. Grace & Co.: ADVA Series.
      4) Sika Chemical Corp.: Sikament.
6. Shrinkage Reducing Admixture:
   a. ASTM C157/C157M.

b. An admixture that reduces drying shrinkage and the potential for drying skrinkage-induced cracking and curling, by reducing the capillary surface tension of pore water, specified formulated for use in air-entrained concrete.
c. Manufacturers and Products:
1) Euclid Chemical Company: Eucon SRA.
2) W.R. Grace & Co.: Eclipse 4500.

7. Antiwashout Admixture for Tremie Concrete:
a. Specially developed to prevent cement washout of concrete placed under water.
b. Manufacturer and Product: BASF Admixtures Inc., Rheomac UW 450.

8. Viscosity Modifying Admixture: Used to enhance plastic concrete properties such as workability, pumpability, and stability for “self-consolidating” concrete.
a. BASF Admixtures, Inc.: “Rheomac VMA” Series.
b. Euclid Chemical Company: “Eucon SL” or “Visctrol”.
c. Sika Chemical Co.: “VisoCrete” Series.
d. W.R. Grace & Co.: “VMAR” Series,

D. Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618, except as modified herein:

1. Shall not be produced from process that has utilized hazardous or potentially hazardous materials.
2. ASTM C618, Table 1, Loss of Ignition: Maximum 3 percent.
3. ASTM C618, Table 2, Water Requirement: Maximum 100 percent of control.
4. ASTM C618, Table 3, Effectiveness in Controlling Alkali-Silica Reaction: Maximum 100 percent expansion of test mixture as a percentage of low-alkali cement control at 14 days.
5. ASTM C618, Table 3, Uniformity Requirements: Apply when loss on ignition of fly ash furnished exceeds 3 percent.
6. ASTM C618, Table 3, Effectiveness in Contributing to Sulfate Resistance: Procedure A after 6-month sulfate exposure, maximum 0.05 percent.
7. ASTM C618, Table 3, Effectiveness in Contributing to Sulfate Resistance: Procedure B, expansion of test mixture as a percentage of sulfate resistance cement control, after at least 6-month exposure, maximum 100 percent.
8. $\frac{CaO(\%)-5}{FE_2O_3(\%)}: Maximum\ 1.5.$
9. Fly ash used in concrete containing aggregate classified as potentially reactive for ASR (alkali-silica reactivity) shall be limited to Class F and shall contain low levels of CaO.

E. Water: Clean and potable containing less than 500 ppm of chlorides, complying with the requirements of ASTM C1602.

1.6 Ancillary Materials

A. Bonding Agent:

1. Furnish two-component, 100 percent solids, moisture-tolerant, structural epoxy adhesive that conforms to ASTM C881 and AASHTO M235.
2. Consult manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
3. Manufacturers and Products:
a. BASF Building Systems Inc.: Concresive.
b. Euclid Chemical Co.: Euco Epoxy System.
c. Sika Chemical Corp.: Sikadur 32.

B. Bond Breaker:

1. Nonstaining type, providing positive bond prevention.
2. Manufacturers and Products:
   a. Burke Co.: Burke Clean Lift Bond Breaker.
   b. Nox-Crete Products Group: Silcoseal Select.
   c. Williams Distributors, Inc.: Williams Tilt-Up Compound.

C. Evaporation Retardant

1. Master Builders, Inc.: Confilm.
2. Euclid Chemical Co.: Eucobar.
3. Refer to Section 03 39 00, Concrete Curing.

1.7 Concrete Mix Design

A. Design: Select and proportion ingredients using trial batches; sample, cure and test concrete mix through approved independent testing laboratory in accordance with ACI 211.1, ACI 223R, and ASTM C157/C157M.

Structural Concrete at Boat Ramp Mix shall incorporate at least the following:
   a. 5,000 psi at 28 days, classified as ACI 318 Exposure Class S2.
   b. Minimum Cementitious Material Content:
      1) 564 pounds per cubic yard.
      2) Increase cementitious materials content as required to obtain strength requirements and maintain water-cement ratio.
   c. Fly Ash: Maximum 25 percent, minimum 20 percent, of total weight of fly ash plus cement.
   d. Maximum Water-to-Cementitious Materials Ratio (w/cm): 0.40
   e. Coarse Aggregate: 1 inch (Size #57 Stone), conforming with ASTM C33.
   f. Fire Aggregate : Clean, sharp granular, natural sand, conforming with ASTM C33. No screenings allowed.
   g. Air Entrainment Admixture: 6 percent, plus or minus 1.5 percent.
   h. High Range Water-Reducing Admixture.
   i. Water-Reducing Admixture.
   j. Shrinkage Reducing Admixture.
   k. Design lab-cured trial mix cylinders, in accordance with ASTM C192/C192M and ASTM C157/C157M.
   l. Use additional cement or cement plus fly ash above minimum specified if required to meet average compressive strength, F’cr.
   m. Use F’cr and herein specified shrinkage limits as basis for selection of concrete materials and proportions as set forth in ACI 211.1, ACI 301 and ACI 223R.
   n. F’cr: Equal to F’c plus 1,400 when data are not available to establish standard deviation.

B. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 3 inches; 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

C. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 3 inches; 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

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

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Minimum Cementitious Materials Content: 564 lb/cu. yd.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Maximum Water-Cementitious Materials Ratio: 0.45.
5. Air Content: Air content of hard troweled finished floors shall not exceed 3 percent.

E. Building Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches; 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

F. Admixtures:

1. Air Content:
   a. Required air content shall be 4.5 percent to 7.5 percent when tested in accordance with ASTM C231.
   b. Use 4 percent minimum for concrete placed under requirements of cold weather concreting, unless noted otherwise.
2. Water Reducers: Use in all concrete.
3. High Range Water Reducers (Superplastizicers):
   a. Use in all structural concrete.
   b. Control slump and workability to at least 5-inch slump at discharge into forms by adjusting high-range water-reducer at batch plant.
4. Shrinkage Reducing Admixture.
   a. Use in all structural concrete.
   b. Aggregate Shrinkage Effects: Design mix for shrinkage characteristics of aggregate. Test for shrinkage in accordance with ASTM C157/C157M, results at

28 days shall not exceed 0.048 percent. Aggregate will be rejected if test values exceed these limits.

G. Slump Range at Site:

1. 5 inches minimum, 9 inches maximum for structural concrete with a high- range water-reducing admixture.
2. 3 inches minimum and 5 inches maximum for concrete without high-range water-reducing admixture.

H. Coarse Aggregate Gradation:

1. As shown in the following table.
2. Coarse Gradation Limits shown are for coarse aggregates based on Table 3 of ASTM C33 for Size Number 57 Stone (1-inch).

I. Tremie Concrete:

1. Minimum cement content of 658 pounds per cubic yard.
2. Use high range water reducing admixture (superplasticizers) admixture in accordance with ASTM C494/C494M, Type F or Type G.
3. Fine Aggregate Range: 40 percent to 50 percent of total aggregates by weight.
4. Use natural round gravel (pea rock) if available in Project area.
5. Proportion mix for design strength and slump range of 6 inches to 9 inches with maximum water-cementitious ratio (w/cm).
6. Use Antiwashout Admixture and Viscosity Modifying Admixture, as required in accordance with manufacturer's recommendations.

1.8 Concrete Mixing

A. General: In accordance with ACI 304R.

B. Concrete Mix Temperatures: As shown below for various stages of mixing and placing:

Concrete Temperatures				
	Concrete Member Size, Minimum Dimension			
Ambient Air Temp.	**<12"**	**12"-36"**	**36"-72"**	**>72"**
Minimum concrete temperature as mixed for indicated air temperature:				
Above 30 degF	60 degF	55 degF	50 degF	45 degF
0 to 30 degF	65 degF	60 degF	55 degF	50 degF
Below 0 degF	70 degF	65 degF	60 degF	55 degF
Maximum allowable gradual temperature drop in first 24 hours after curing period and after end of protection:				
	50 degF	40 degF	30 degF	20 degF

C. Truck Mixers:

1. Equip with electrically actuated counters to readily verify number of revolutions of drum or blades.
2. Counter:
    a. Resettable, recording type, mounted in driver’s cab.
    b. Actuated at time of starting mixers at mixing speeds.
3. Truck mixer operation shall furnish concrete batch as discharged that is homogeneous with respect to consistency, mix, and grading.
4. If slump tests taken at approximately 1/4 point and 3/4 point of load during discharge give slumps differing by more than 2 inches when specified, slump is more than 4 inches, discontinue use of truck mixer unless causing condition is corrected and satisfactory performance is verified by additional slump tests.
5. Before attempting to reuse unit, check mechanical details of mixer, such as water measuring, and discharge apparatus, condition of blades, speed of rotation, general mechanical condition of unit, admixture dispensing equipment, and clearance of drum.
6. Do not use nonagitating or combination truck and trailer equipment for transporting ready-mixed concrete.
7. Concrete Volume in Truck:
    b. Limit to 63 percent of total volume capacity in accordance with ASTM C94/C94M when truck mixed.
    c. Limit to 80 percent of total volume capacity when central mixed.
8. Mix each batch of concrete in truck mixer for minimum 70 revolutions of drum or blades at rate of rotation designated by equipment manufacturer.
9. Perform additional mixing, if required, at speed designated by equipment manufacturer as agitating speed.
10. Place materials, including mixing water, in mixer drum before actuating revolution counter for determining number of mixing revolutions.

D. Aggregates: Thoroughly and uniformly wash before use.

E. Admixtures:

1. Air-Entraining Admixture: Add at plant through manufacturer-approved dispensing equipment.
2. Water Reducers: Add prior to addition of high-range water-reducing admixture (superplasticizers).
3. High-range water-reducing admixture (superplasticizers) and Air-Entraining Admixtures:
    b. Add at concrete plant only through equipment furnished or approved by admixture manufacturer.
    c. Accomplish variations in slump, working time, and air content for flowable mixes by increasing or reducing high-range water-reducing admixture (superplasticizers) dose or air-entraining admixture dose at ready-mix plant only.
    d. Equipment shall provide for easy and quick visual verification of admixture amount used for each dose.
    e. Add discharge amount to each load of concrete into separate dispensing container, verify amount is correct, and add to concrete.
    f. Additional dosage of high-range water-reducing admixture (superplasticizers) may be added in field using manufacturer-approved dispensing when unexpected delays cause too great of slump loss.
4. Shrinkage Reduction Admixture: Add at plant through manufacturer approved dispensing equipment.
5. Viscosity Modifying Admixture: Add at plant through manufacturer approved dispensing equipment.

1.9 Source Quality Control

A. Cement: Test for total chloride content.

B. Fly Ash: Test in accordance with ASTM C311.

C. Batch Plant Inspection: Engineer shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in these Specifications.

1. Weighing Scales: Tested and certified within tolerances set forth in the NIST Handbook No. 44.
2. Batch Plant Equipment: Either semiautomatic or fully automatic in accordance with ASTM C94/C94M.

PART III - EXECUTION

3.1 Placing Concrete

A. Preparation: Meet requirements and recommendations of ACI 304R and ACI 301, except as modified herein.

B. Inspection: Notify Engineer at least 1 full working day in advance before starting to place concrete, and for each subsequent concrete placement.

C. Discharge Time:

1. As determined by set time, do not exceed 1-1/2 hours after adding cement to water unless special Engineer approved time delay admixtures are used. Coordinate time delay admixture information with manufacturer and Engineer prior to placing concrete.
2. Adjust slump or air content at Site by adding admixtures for particular load when approved by Engineer. Then, adjust plant dosage for remainder of placement. Additional dosage at Site shall be through approved dispenser supplied by admixture manufacturer.
3. Maintain required slump throughout time of concrete placement and consolidation. Discontinue use of high range water reducing admixture (superplasticizers) and provide new mix design if it fails to maintain slump between 4 inches to 9 inches and produce good consolidation for length of time required. Redesign mix adjusting set control admixtures to maintain setting time in range required.

D. Placement into Formwork:

1. Before depositing concrete, remove debris from space to be occupied by concrete.
2. Prior to placement of concrete, dampen fill under slabs on ground, dampen sand where vapor retarder is specified, and dampen wood forms.
3. Reinforcement: Secure in position before placing concrete.
4. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs which shall be placed full depth. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
5. Use placement devices, for example, chutes, pouring spouts, and pumps.

6. Vertical Free Fall Drop to Final Placement: 5 feet in forms 8 inches or less wide and 8 feet in forms wider than 8 inches, except as specified.
   b. For placements where drops are greater than specified, use placement device such that free fall below placement device conforms to required value.
   c. Limit free fall to prevent segregation caused by aggregates hitting reinforcing steel.
7. Do not use aluminum conveying devices.
8. Provide sufficient illumination in the interior of forms so concrete deposition is visible, permitting confirmation of consolidation quality.
9. Joints in Concrete:
   b. Ensure space beneath plastic waterstop completely fills with concrete.
   c. During concrete placement, make visual inspection of entire waterstop area.
   d. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, place remaining concrete to full height of slab.
   e. Apply procedure to full length of waterstops.
10. If reinforcement is in direct sunlight or is more than 20 degF higher in temperature than concrete temperature before placement, wet reinforcement with water fog spray before placing concrete to cool reinforcement.

E. Conveyor Belts and Chutes:

1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
2. Do not use chutes longer than 50 feet.
3. Minimum Slopes of Chutes: Angled to allow concrete to readily flow without segregation.
4. Conveyor Belts:
   b. Approved by Engineer.
   c. Wiped clean with device that does not allow mortar to adhere to belt.
   d. Covered conveyor belts and chutes.

F. Retempering: Not permitted for concrete where cement has partially hydrated.

G. Pumping of Concrete:

1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to assure completion of concrete placement without cold joints in case of primary placing equipment breakdown.
2. Minimum Pump Hose (Conduit) Diameter: 4 inches.
3. Replace pumping equipment and hoses (conduits) that are not functioning properly.
4. Aluminum pipes or conduits not permitted.

H. Maximum Size of Concrete Placements:

1. Limit size of each monolithic concrete placement to allow for strength gain and volume change as a result of shrinkage.
2. Joints:
   b. Locate Control Joints and Contraction/Construction Joints where shown on the Drawings.
   c. Space Control Joints and Contraction/Construction Joints, as shown.

I. Minimum Time between Adjacent Concrete Placements:

1. Control Joints: 7 days water cure.
2. Contraction Joints and/or Construction Joints: 7 days water cure.

J. Removal of Water: Unless tremie method for placing concrete is approved by Engineer, construct watertight forms and remove all water from space to be occupied by concrete. Flush watertight forms and reinforcement, with fresh water, before placing concrete.

K. Consolidation and Visual Observation:

1. Consolidate concrete with internal vibrators with minimum frequency of 8,000 cycles per minute and amplitude as required to consolidate concrete in section being placed.
2. Provide at least one standby vibrator in operable condition at placement Site prior to placing concrete.
3. Consolidation Equipment and Methods: ACI 309R.
4. Provide sufficient windows in forms or limit form height to allow for concrete placement through windows and for visual observation of concrete.
5. Vibration consolidation shall not exceed distance of 3 feet from point of placement.
6. Vibrate concrete in vicinity of joints to obtain impervious concrete.

L. Hot Weather:

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.
2. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
3. Maintain concrete temperature below 80 deg F at time of placement, or furnish test data or provide other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.
4. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
5. Prevent differential temperature between reinforcing steel and concrete.
6. Evaporation Retardant: As specified herein and in Section 03 39 00, Concrete Curing.

M. Cold Weather (

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 306.1

3.2 Placing Tremie Concrete Seals

A. Place concrete when water level inside area to be filled with concrete is equal to water elevation outside.

B. Maintain relation of water levels until concrete design strength is obtained.

3.3 Concrete Bonding

A. New Concrete:

1. Surface of previous concrete placement shall be intentionally roughened, to provide a roughness profile of at least 1/4-inch amplitude.
2. Clean surface to be bonded of all dirt, laitance, oil, grease, curing compounds, form release agents, and any other contaminants that will interfere with bonding.

3. Apply epoxy bonding agent to concrete surface prior to placing fresh concrete. Place fresh concrete while the epoxy bonding agent is still tacky. If coating becomes glossy and loses tackiness, remove any surface contaminants, recoat surface with epoxy bonding agent, and proceed with placing fresh concrete.

B. Existing Concrete:

1. Thoroughly clean and high pressure wash surfaces.
2. Saturate existing concrete surface with clean water for 24 hours prior to placing fresh concrete.
3. Remove all excess, standing, and puddle water from surface, then follow the procedures specified for "New Concrete", hereinabove.

3.4 Construction Joints

A. As specified in Section 03 10 00, Concrete Forming and Accessories; and as indicated drawings.

3.5 Curing Concrete

A. Alternate Form Ties; Through-Bolts:

1. Mechanically roughen entire interior surface of through hole. Epoxy coat roughened surface and drive elastic vinyl plug to half depth. Dry pack entire hole from both sides of plug with nonshrink grout, as specified in Section 03 62 00, Nonshrink Grouting. Use only enough water to dry pack grout. Dry pack while epoxy is still tacky. If epoxy has dried, remove epoxy by mechanical means and reapply new epoxy.
2. Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.

B. Exposed Metal Objects:

1. Metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, shall be removed by chipping back concrete to depth of 2 inches and then cutting or removing metal object.
2. Repair area of chipped-out concrete per requirements of Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces.

C. Blockouts at Pipes or Other Penetrations:

1. Install per details shown on Drawings or submit proposed blockouts for review.
2. Use nonshrink, nonmetallic grout, Category I or II; Nonshrink Grouting.

3.6 Concrete Vertical Surface Finishes

A. Type W-1 (Ordinary Finish): Concrete surfaces not exposed to view:

1. Patch tie holes.
2. Knock off projections.
3. Patch defective areas.

B. Type W-2 (Smooth Finish): Concrete surfaces exposed to view. (Except Walking Surfaces)

1. Patch tie holes.

2. Grind off projections, fins, and rough spots.
3. Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.

3.7 Concrete Slab And Exposed Horizontal Surface Finishes

A. General:

1. Finish concrete per the requirements of ACI 302.1R.
2. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
3. Do not use "jitterbugs" or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
4. Do not dust surfaces with dry materials.
5. Use evaporation retardant.
6. Round off edges with steel edging tool, except where beveled or chamfered edges are shown. Steel edging tool radius shall be 1/4 inch for slabs subject to wheeled traffic.

B. Type S-1 (Steel Troweled with Broomed Finish):

1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation. Use evaporation retardant.
2. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.
3. Use sufficient pressure on wood floats to bring moisture to surface.
4. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
5. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
6. Finish surface by drawing fine-hair broom lightly across surface.
7. Broom in same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope.

3.8 Beam Or Bulkhead Cap And Encasement Finishes

A. General: Inject cracks with crack repair epoxy. Patch and repair defective areas.

B. Type B-1: (Fill/Earth Side) Match vertical surface finish Type W-1.

C. Type B-2: (Water Side- Exposed) Match vertical surface finish Type W-2.

3.9 Backfill Against Walls And Bulkhead Cap

A. Do not backfill until concrete has obtained specified 28-day compressive strength.

B. Place backfill simultaneously on both sides of wall, where required, to prevent differential pressures.

3.10 Field Quality Control

A. Generally Contractor shall provide the following by a Third Party Testing Lab:

1. Adequate facilities for safe storage and proper curing of concrete test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
2. Concrete for testing of slump, air content, and for making cylinders from the point of discharge into forms. When concrete is pumped, Samples used shall be taken from discharge end of pump hose.
3. Evaluation in accordance with ACI 301 and Specifications.
4. Specimens that shall be made, cured, and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.
5. The frequency of testing shall require that three (3) 6-in by 12-in cylinders be testing for each 50 cubic yards of concrete placed or part thereof, for each weight and strength test, and shall be tested at 3-days, 7-days, and 28-days, with three (3) spare cylinders in the event of cylinder damage. Frequency of testing may be changed at discretion of Engineer.
6. Take Concrete samples for slump (ASTM C143/C143M), for strength tests (ASTM C31/C31M and ASTM C39/C39M), and shrinkage tests (ASTM C157/C157M). Take samples at the truck discharge, or for pumped concrete at placement (discharge) end of line**.**
7. Reject concrete represented by cylinders failing to meet strength and air content specified.
8. Testing of concrete will be by Contractor with a 3rd party agency.

B. High-Range Water-Reducer (Superplasticizer) Admixture Segregation Test: Test each truck prior to use on job (By Contractor).

1. Segregation Test Objective: Concrete with 5-inch to 9-inch slump must stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump test.
2. Test Procedure: Make slump test and check for excessive slump and observe to see if mortar or moisture flows from slumped concrete.
3. Reject concrete if mortar or moisture separates and flows out of mix.

3.11 Manufacturer's Services

A. Contractor shall ensure that the manufacturer provides the following representative at Site for installation assistance, inspection, and certification of proper installation for concrete ingredients, mix design, mixing, and placement.

1. Batch Plant Representative:
   a. Observe how concrete mixes are performing.
   b. Be present during first placement of each type of concrete mix.
   c. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project.
   d. Establish control limits on concrete mix designs.
2. Admixture Manufacturer's Representative:
   b. Demonstrate special features, product performance, product mixing, testing, and placement or installation for each type of admixture.
   c. Observe how concrete mixes are performing.
   d. Be present during first placement of each type of concrete mix.
   e. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project, including instructions for redosing.
   f. Provide equipment for control of concrete redosing for air entrainment or high range water reducing admixture (superplasticizers) at Site to maintain proper slump and air content if so needed.
3. Bonding Agent Manufacturer's Representative: Demonstrate product performance, product mixing, and placement.

3.12 Protection Of Installed Work

A. After curing as specified in Section 03 39 00, Concrete Curing, protect concrete from damage as a result of other construction work.

B. Repair defective areas and areas damaged by construction.

3.13 Schedule Of Concrete Finishes

A. Form Tolerances: As specified in Section 03 10 00, Concrete Forming and Accessories.

B. Provide concrete finishes as scheduled:

Area	**Type of Finish**
Exterior Wall Surfaces	
Front Face of Walls and Exposed Surfaces (not sidewalks)	W-2
Backfilled Face of Walls and Footings	W-1
Top of Bulkhead Cap	S-1

END OF SECTION 03 30 00

SECTION 03 39 00

CONCRETE CURING

PART I - GENERAL

1.1 References

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASTHO):
   a. AASHTO M182, Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.
2. ASTM International (ASTM):
   a. ASTM C171, Standard Specification for Sheet Materials for Curing Concrete.
   b. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing concrete.
   c. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.2 Submittals

A. Action Submittals:

1. Manufacturers' data for the following products:
   a. Evaporation retardant.
   b. Curing Materials.
2. Curing methods proposed.

B. Informational Submittals:

1. Curing Materials: Manufacturer's Certificate of Compliance showing moisture retention requirements.
2. Retardants for Exposed Aggregate Finish: Manufacturer's Certification of Compliance.

PART II - PRODUCTS

2.1 Materials

A. Materials for Curing Concrete:

1. Impervious Sheeting: ASTM C171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.
2. Pervious Sheeting: AASHTO M182.
3. Liquid Membrane-Forming Curing Compound: ASTM C309, white-pigmented, Type 2, Class B, and ASTM C1315: water-based, high-solids content:
   a. Moisture Loss: 0.40 kg/square m/72 hours maximum.
   b. Capable of meeting moisture retention at manufacturer's specified application rate.
4. Manufacturers and Products:
   a. Chemrex, Inc.; Masterkure.
   b. Euclid Chemical Co.; Super Diamond Clear VOX.
   c. WR Meadows, Inc.;VOCOMP-30.
   d. Vexcon Chemical, Inc.; Starseal 1315.
   e. Dayton Superior; Safe Cure and Seal 30%.

B. Evaporation Retardant:

1. Optional: Fluorescent color tint that disappears completely upon drying.
2. Manufacturers and Products:
   a. Master Builders Co.; Confilm.
   b. Euclid Chemical Co.; Eucobar.

C. Water: Clean and potable, containing less than 500 ppm of chlorides.

PART III - EXECUTION

3.1 Curing Of Concrete

A. Use one of the following methods as approved by Engineer:

1. Method 1: Protect and soak surface by water ponding for 14 days, then apply liquid membrane-forming curing compound immediately after removal of forms.
2. Method 2: Cover with burlap or cotton mats and keep continuously soaked for 14 days, then apply liquid membrane-forming curing compound immediately after removal of mats.
3. Where water curing for concrete during cold weather (below freezing) is not possible, use Engineer-approved liquid membrane-forming curing compound at manufacturer's recommended coverage per gallon.

3.2 Evaporation Retardant Application

A. Spray onto surface of fresh concrete immediately after mat/blanket removal to react with surface moisture.

B. Reapply as needed to ensure a continuous moist surface until final finishing is completed.

3.3 Manufacturer's Services

A. Contractor shall provide manufacturer's representative at Site for installation assistance, inspection, and certification of proper installation for products specified.

END OF SECTION 033900

DIVISION 4 – MASONRY

SECTION 04100

MORTAR AND GROUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions

B. North Central Texas Council of Governments (NCTCOG) Public Works Construction Standards

1.02 SECTION INCLUDES:

A. Mortar and grout for masonry.

1.03.1 SUBMITTALS:

A. Submit manufacturer's cut sheet and product data.

B. Samples: Submit 2 strips, 1/4" x 6" in size, illustrating mortar color and color range.

1.04 ENVIRONMENTAL CONDITIONS:

A. Cold Weather Requirements: Make provisions to conform to ACI 530.1/ASCE 6/TMS 602.

B. Hot Weather Requirements: Make provisions to conform to ACI 530.1/ASCE 6/TMS 602.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. Portland Cement: ASTM C150, Type I.

B. Mortar Aggregate: ASTM C144, standard masonry type.

C. Hydrated Lime: ASTM C207, Type N

D. Mortar Color: To match existing grout. Submit sample to The Sabine River Authority and/or the project Landscape Architect/Engineer.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

G. Source Limitations: Mortar ingredients shall be of a uniform quality, including color, from one manufacturer for each cementitious component, and from one source or producer for each aggregate.

2.02 MORTAR MIXES:

A. Mortar for Load Bearing and Non-load Bearing Walls and Partitions: ASTM C270, Type N using the Property Specifications.

2.03 MORTAR MIXING:

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.

B. Add mortar color in accordance with manufacturer's instructions.

C. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.04 GROUT MIXES:

A. Grout for Load Bearing and Non-load Bearing Walls and Partitions: ASTM C476, using the Proportion Specification.

2.05 GROUT MIXING:

A. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 Fine Grout.

B. Do not use anti-freeze compounds to lower the freezing point of the grout.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Install mortar in accordance with ACI 530.1/ASCE 6.

END OF SECTION 04100

SECTION 04400

STONE MASONRY

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

A. Section 04100 – Mortar and Grout

B. North Central Texas Council of Governments (NCTCOG) Public Works Construction Standards

1.02 SECTION INCLUDES:

A. Furnishing and installation of stone for veneer, ledgestone barriers, and boulders.

1.03 SUBMITTALS:

A. Samples:
   a. Contractor shall submit samples of stone veneer for review by the Landscape Architect and The Sabine River Authority Project Manager.
   b. Contactor shall submit photo samples of available boulders and ledgestone for review by the Landscape Architect and The Sabine River Authority Project Manager.

B. Mock-up:
   a. Contractor shall provide a minimum 3'x3' mockup for stone veneer at the project site to see representative sample of the installed materials, for review by the Landscape Architect and/or The Sabine River Authority Project Manager.
   b. Contractor shall install a minimum 25' section of the ledgestone barriers, to show typical spacing, for review and approval by the Landscape Architect and/or The Sabine River Authority Project Manager.
   c. Contractor shall install a minimum 15'x15' section of native stone boulders, to show typical spacing, for review and approval by the Landscape Architect and/or The Sabine River Authority Project Manager.

C. Shop Drawings: Contractor shall provide shop drawings/submittals for all stone, for review by the Engineer/Landscape Architect.

D. Delivery: Copies of all delivery tickets, supplier information with a statement identifying and certifying quarry location for each delivery.

1.04 EXPERIENCE:

A. Native stone masons shall have demonstrated a high degree of experience in work similar to that required for this project. The mason shall have successfully completed a minimum of five (5) projects of similar size and scope, within the past 10 years. The contractor shall include three (3) to five (5) project references at the Project Kick-off Meeting.

PART 2 – PRODUCTS

2.01 STONE:

A. Oklahoma Sunset Flagstone Veneer
   a. Varying size, minimum 1.5” min. thickness – see drawings
   b. Color: Varying color

B. Full Stone
   a. Flagstone – 4” thick
   b. All faces to be smooth with a maximum ½” variation across each face.
   c. Stone to be varying in size

C.

2.01 STONE SUPPLIER:

A. All stone supplied for this project shall come from one quarry, to ensure color matching for all veneer and ledgestone.

PART 3 – EXECUTION

3.01 GENERAL:

A. Provide 72-hour notification to Landscape Architect and/or Owner’s Representative of all material deliveries.

B. Examination of Drawings: Carefully examine drawings, and verify design intent with the Landscape Architect and The Sabine River Authority. Check location of stone with masonry openings and work insets in connection with the stonework.

C. Sequencing: Project shop drawings that communicate the sequencing of stone delivery and setting of each course, in order to achieve the design intent of providing a stone lake edge with a random ashlar pattern, and varying offset widths.

D. Top Course of ledgestone wall shall be placed to match the elevation of the adjacent trail.

E. Laying: No unit with a film of water or frost on its surface shall be laid. Stones shall be set and secured to ensure no vertical or horizontal movement.

END OF SECTION 04400

DIVISION 5 – WELDING

SECTION

05 05 23 - WELDING

PART I – GENERAL

1.1 References

A. The following is a list of standards which may be referenced in this section:

1. American Society of Nondestructive Testing (ASNT): SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.
2. ASTM International (ASTM): A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
3. American Welding Society (AWS):
   a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
   b. A3.0, Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermalspraying.
   c. D1.1/D1.1M, Structural Welding Code - Steel.
   d. D1.2/D1.2M, Structural Welding Code - Aluminum.
   e. D1.3, Structural Welding Code - Sheet Steel.
   D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
   f. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
   g. QC1, Standard for AWS Certification of Welding Inspectors.

1.2 Definitions

A. CJP: Complete Joint Penetration.

B. CWI: Certified Welding Inspector.

C. MT: Magnetic Particle Testing.

D. NDE: Nondestructive Examination.

E. NDT: Nondestructive Testing.

F. PJP: Partial Joint Penetration.

G. PQR: Procedure Qualification Record.

H. PT: Liquid Penetrant Testing.

I. RT: Radiographic Testing.

J. UT: Ultrasonic Testing.

K. VT: Visual Testing.

L. WPQ: Welder/Welding Operator Performance Qualification.

M. WPS: Welding Procedure Specification.

1.3 Submittals

A. Action Submittals:

1. Shop and field WPSs and PQRs.
2. Welding Data (Shop and Field):
   a. Show on Shop Drawings or a weld map complete information regarding base metal specification designation, location, type, size, and extent of welds with reference called out for WPS and NDE numbers in tails of combined welding and NDE symbols as indicated in AWS A2.4.
   b. Distinguish between shop and field welds.
   c. Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
   d. For pipe fittings, provide a joint weld beveling diagram. Refer to AWS D1.1/D1.1M, Annex G Local Dihedral Angle that can be used to calculate bevels for weld joint details of intersecting pipes.
   e. Welding and NDE symbols shall be in accordance with AWS A2.4.
   f. Welding terms and definitions shall be in accordance with AWS A3.0.
   g. Submit welding data together with shop drawings as a complete package.

B. Informational Submittals:

1. WPQs.
2. CWI credentials.
3. Testing agency personnel credentials.
4. CWI reports.
5. Welding Documentation: Submit on appropriate forms in referenced welding codes.

1.4 Qualifications

A. WPSs: In accordance with AWS D1.1/D1.1M.

B. WPQs: In accordance with AWS D1.1/D1.1M.

C. CWI: Certified in accordance with AWS QC1, and having prior experience with the welding codes specified. Alternate welding inspector qualifications require approval by the Engineer.

D. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.5 Sequencing and Scheduling

A. Unless otherwise specified, all Submittals required in this section shall be submitted and approved prior to commencement of welding operations.

PART II - PRODUCTS

2.1 Source Quality Control

A. CWI shall be present whenever shop welding is performed. CWI shall perform inspection, as necessary, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:

1. Verifying conformance of specified job material and proper storage.
2. Monitoring conformance with approved WPS.
3. Monitoring conformance of WPQ.

4. Inspecting weld joint fit-up and performing in-process inspection.
5. Providing 100 percent visual inspection of welds.
6. Supervising nondestructive testing personnel and evaluating test results.
7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

PART III – EXECUTION

3.1 General

A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.

3.2 Nondestructive Weld Testing Requirements

A. Weld Inspection Criteria:

1. Selection of welds to be tested unless 100 percent NDT is specified herein, shall be as agreed upon between Engineer and Contractor.
2. Unless otherwise specified, perform NDT of welds at a frequency as shown below or in the attached table in accordance with the referenced welding codes as follows. Perform UT on CJP groove welds that cannot be readily radiographed. In case there is a conflict the higher frequency level of NDT shall apply:
   a. CJP Butt Joint Welds: 10 percent random RT.
   b. CJP Groove Welds: 10 percent random UT.
   c. Fillet Welds and PJP Groove Welds: [E: 10 percent random PT or MT.
   d. All Welds: 100 percent VT.
3. Weld Acceptance:
   a. VT:
      1) Structural Pipe and Tubing: AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Tubular Connections.
      2) All Other Structural Steel: AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
   b. UT: Perform UT of CJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 6.13.3, Class R Indications.
   c. RT: Perform RT of CJP butt joint welds in accordance with AWS D1.1/D1.1M, Paragraph 6.12.1.
   d. PT or MT:
      1) Perform on fillet and PJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 6.10.
      2) Acceptance shall be in accordance with VT standards specified above.

3.3 Field Quality Control (By Contractor)

A. Contractor shall provide a CWI for all welding procedures both in fabrication shop and in field/on site. CWI shall be present whenever welding (shop and field) is performed. The CWI shall perform inspection, as necessary, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:

1. Verifying conformance of specified job material and proper storage.
2. Monitoring conformance with approved WPS.
3. Monitoring conformance of WPQ.
4. Inspecting weld joint fit-up and performing in-process inspection.
5. Providing 100 percent visual inspection of all welds.
6. Supervising nondestructive testing personnel and evaluating test results.

7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

3.4 Weld Defect Repair

A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

END OF SECTION 05 05 23

DIVISION 22 – PLUMBING

SECTION 221313

FACILITY SANITARY SEWERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Section includes gravity-flow, outside the building, with the following components:

1. Cleanouts

2. Manholes

B. All public work to be performed and materials to be used within the street right-of-way, shall be in accordance with Newton County Design Standards.

C. All private work to be performed and materials to be used beyond the street right-of-way shall be in accordance with the Plumbing Code. In the event of a discrepancy between the above-referenced standards, the plans, and/or any portion of this specification section, the order of precedence will be the plans, the County Design Standards, and then these specifications. The Contractor shall contact the engineer in the event of a discrepancy.

1.02 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.03 PERFORMANCE REQUIRMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-food head of water (30 kPa).

1.04 SUBMITTALS

A. Product Data: For the following:

1. Special pipe fittings.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Field Quality-control test reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Pressure Pipe: AWWA C900, Class 150, for gasketed joints and using ASTM F 477, elastomeric seals.

1. Fittings NPS 4 to NPS 8 (DN 100 to DN 200): PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.

2. Fittings NPS 10 (DN 250) and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.

B. PVC Sewer Pipe and Fittings, NPS 16 and Smaller: ASTM D 3034, SDR 26, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.02 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.

2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.

3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.03 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast, reinforces concrete, of depth indicated, with provision for rubber gasketed joints, and pipe boots.

1. Inside diameter: 48 inches minimum, unless otherwise indicated.

2. Base section: 8 inches minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.

3. Riser sections: 5-inch minimum thickness.

4. Top Section: Eccentric-cone type, unless otherwise indicated.

5. Gaskets: ASTM C 443, rubber (when required by local authority having jurisdiction).

6. Pipe connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

7. Joints of the manhole sections shall be of the tongue and groove type, filled with an approved preformed butyl rubber base, sealing compound, conforming to Federal Specifications SS-S210A, Type 1, Rope form.

8. Inside of the manhole shall have a Thane Coat installed for all sanitary manholes located inside of the property boundary.

B. Standard manhole frames and covers shall conform to the standard detail of the regulatory authorities having jurisdiction for the project (if applicable). Otherwise, manhole frames and covers to be Neenah Foundary Co. No. R-1642 or Vulcan Foundary Inc. No. V-1357, 30” opening.

C. All sanitary sewer manhole covers shall have the word “SANITARY SEWER” cast on the top in letters 2 inches higher.

2.04 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug, with a 2’ x 2’ x 6” thick concrete apron.

1. Available Manufacturers:

a. Refer to Newton County Utility Standards, latest edition.

2. Top-Loading Classification: Extra-heavy duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.05 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in 02220 Section "Excavation Trenching and Backfilling."

3.02 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Unshielded flexible couplings for same or minor difference OD pipes.

b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.

c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping:

1. NPS 3 (DN 80): NPS 4 (DN 100) PVC sewer pipe and fittings, gaskets, and gasketed joints.

2. NPS 4 (DN 100): PVC sewer pipe and fittings, gaskets, and gasketed joints.

3. NPS 5 and NPS 6 (DN 125 and DN 150): NPS 6 (DN 150) PVC sewer pipe and fittings, gaskets, and gasketed joints.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.

2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.

3. Install piping with 36-inch (915-mm) minimum cover.

4. Install piping below frost line.

5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

6. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

3.04 PIPE JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.

2. Join dissimilar pipe materials with nonpressure-type, flexible [or rigid] couplings.

3.05 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 923.

C. Construct cast-in-place manholes as indicated.

D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.

E. Install FRP manholes according to manufacturer's written instructions.

F. Form continuous concrete channels and benches between inlets and outlet.

G. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm)] above finished surface elsewhere, unless otherwise indicated.

H. Install manhole cover inserts in frame and immediately below cover.

3.06 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.07 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

2. Use extra-heavy-duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 24” by 24” by 6” deep. Set with tops 1 inch (25 mm) above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.08 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains per pre-fabricated restroom facility manufacturer recommendations.

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

   a. Use concrete that will attain minimum 28-day compressive strength of 3000 psi (20.7 MPa), unless otherwise indicated.

   b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.09 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter. Hand pulled no earlier than 30 days after backfill was completed.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/millimeter of nominal pipe size per kilometer) of pipe, during 24-hour period.

b. Close openings in system and fill with water.

c. Purge air and refill with water.

d. Disconnect water supply.

e. Test and inspect joints for leaks.

f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig (69 kPa).

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

b. Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).

7. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 311000

SITE CLEARING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 01 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. This Section includes the following:

1. Clearing and grubbing.

2. Stripping and stockpiling topsoil.

3. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 1 Section "Construction Facilities and Temporary Controls" for temporary construction fencing.

1.03 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.04 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3. Do not proceed with work on adjoining property until directed by Engineer.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.02 TREE PROTECTION

A. Reference Division 2 “Site Preparation/Tree Protection Fencing”.

3.03 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer and Owner not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner’s written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.04 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.

4. Use only hand methods for grubbing within tree protection zone.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm) and compact each layer to a density equal to adjacent original ground.

3.05 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).

2. Do not stockpile topsoil within tree protection zones.

3. Dispose of excess topsoil as specified for waste material disposal.

4. Select subparagraph above or below.

5. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.06 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.07 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION

SECTION 31 2000

EARTH MOVING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 01 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. This Section includes the following:

1. Subgrade course for pavements.

2. Base material for asphalt paving.

B. All earthwork to be performed and materials used shall be in accordance with the Geotechnical Engineering Report. In the event of a discrepancy between the above-referenced standards, the plans, and/or any portion of this specification section, the order of precedence will be the above-referenced report, the County Design Standards, and then these specifications. The Contractor shall contact the engineer in the event of a discrepancy.

1.03 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Material: Course placed between the subgrade asphaltic concrete paving.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Fill: Soil materials used to raise existing grades.

F. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base material.

1.04 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.

2. Laboratory compaction curve according to ASTM D 698 for each borrow soil material proposed for fill and backfill.

1.05 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner's written permission.

3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: On-site soils are suitable for use as fill within the pavement areas, provided they are free from organics and debris. Select fill must be used for grade adjustments in the helipad area.

C. Unsatisfactory Soils: Materials, which do not comply with the requirements for acceptable material or which, cannot be compacted to the specified or indicated density.

D. Subgrade: Stabilize the subgrade to materials as specified by Texas Department of Transportation. The subgrade material should be compacted to at least 98 percent of the modified Proctor maximum dry density (AASHTO T-180).

E. Base Material: The limerock base course should have a minimum Limerock Bearing Ratio (LBR) of 100 and should be compacted to 98 percent of the modified Proctor maximum dry density (AASHTO T-180).

F. Select Fill: USCS Classification CL and/or SC, with a Plasticity Index between 10 and 20.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.04 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.05 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.06 SUBGRADE INSPECTION

A. Notify Testing Agency when excavations have reached required subgrade.

B. If Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).

2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 20 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.07 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.08 BACKFILL

A. Place all backfill in strict accordance with Geotechnical Report for this project.

B. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

C. Place backfill on subgrades free of mud, frost, snow, or ice.

3.09 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

A. All compaction in strict accordance with Geotechnical recommendations.

B. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment.

C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under pavements, scarify and recompact existing subgrade and each layer of backfill or fill soil material at 95 percent. Refer to Geotechnical Report for thickness.

2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.

3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. (186 sq. m) or less of paved area, as indicated in Geotechnical Report, but in no case fewer than 3 tests.

2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet (46 m) or less of trench length, but no fewer than 2 tests.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 31 3213

SOIL MIXING STABILIZATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 01 - General Requirements shall govern the work under this section.

B. This Section includes soil mixing stabilization and specialties outside the building, including the following:

1. Excavation, treatment, and backfilling of subgrade for lime stabilization.

C. All soil mixing stabilization to be performed and materials used shall be in accordance with the Geotechnical Engineering Report. In the event of a discrepancy between the above-referenced report and any portion of this specification section, the above-referenced report will govern. The Contractor shall contact the Engineer in the event of a discrepancy.

1.02 REFERENCE STANDARDS

A. American Society for Testing Materials (ASTM) latest edition

1. C150 Portland Cement

2. C618 Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete

3. C 977 Quicklime and Hydrated Lime for Soil Stabilization

4. D 1633 Compressive Strength of Molded Soil-Cement Cylinders

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. M 216 Lime for Soil Stabilization

C. National Lime Association (NLA)

1. Bulletin 326 Lime Stabilization Construction Manual

D. Texas Department of Transportation Standards

1. TXDOT Item 260 Lime Treatment (Road Mixed)

2. TXDOT Item 265 Fly Ash or Lime – Fly Ash Treatment (Road Mixed)

1.03 ENVIRONMENTAL REQUIREMENTS

A. Do not install mixed materials in wind in excess of 10 mph or when temperature is below 40 degrees Fahrenheit.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with state and local standards in conjunction with requirements specified herein.

1.05 SUBMITTALS

A. Submit 30-pound sample of each material to be used at the site in airtight containers to the independent testing laboratory or submit gradation and certification of material that is to be used to the independent testing laboratory for review.

B. Submit name of each materials supplier and specific type and source of each material. Change in source requires approval of Owner.

C. Submit mix design and materials mix ratio that will achieve specified requirements of state and local agencies for soil stabilization.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Hydrated Lime: TXDOT Item 260

2.02 EQUIPMENT

A. Perform operations using suitable, well maintained equipment capable of excavating subsoil, mixing and placing materials, wetting, consolidating, and compacting of material.

PART 3 – EXECUTION

3.01 PREPARATION

A. Obtain approval from the independent testing laboratory of mix design before proceeding with placement.

B. Start stabilization only when weather and soil conditions are favorable for successful application of proposed material.

C. Proofroll subgrade to identify areas in need of stabilization in accordance with Section 2.

3.02 EXCAVATION

A. Excavate subsoil to depth sufficient to accommodate soil stabilization.

B. Remove lumped subsoil, boulders, and rock that interfere with achieving uniform subsoil conditions.

C. Notify Construction Manager of unexpected subsurface conditions. Discontinue affected work in area until notified to resume work.

D. Correct areas over-excavated in accordance with Section 2.

E. Remove excess excavated material from site.

3.03 SOIL TREATMENT AND BACKFILLING

A. Lime Stabilized Subgrade: Where indicated on Construction Drawings or as required after continual failure, treat prepared subgrade with hydrated lime in accordance with state highway department specifications (TXDOT Item 260).

1. A minimum of 48 hours of tempering time shall be provided before final mixing.

2. Subgrade soils shall be treated with lime at a rate of 6 to 8 percent lime, by dry weight.

B. Subsoil shall be in accordance with Division 2 Sitework.

C. Maintain optimum moisture of mixed materials to attain required stabilization and compaction.

D. Finish subgrade surface in accordance with Division 2 Sitework.

E. Remove surplus mix materials from site at no additional cost to the Owner.

3.04 CURING

A. Immediately following compaction of mix, seal top surface with curing seal.

B. Do not permit traffic for 72 hours after sealing top surface.

3.05 FIELD QUALITY CONTROL

A. Compression test and analysis of hardened fill material will be performed in accordance with Section 02300.

B. If tests indicate work does not meet specified requirements, remove work, replace and retest, at no cost to owner.

END OF SECTION

SECTION 31 1000

EXCAVATION SUPPORT AND PROTECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.

1.03 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Review geotechnical report.
2. Review existing utilities and subsurface conditions.
3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
4. Review proposed excavations.
5. Review proposed equipment.
6. Review monitoring of excavation support and protection system.
7. Review coordination with waterproofing.
8. Review abandonment or removal of excavation support and protection system.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

B. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.

2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.

3. Indicate type and location of waterproofing.

4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

1.05 INFORMATIONAL SUBMITTALS

A. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

C. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.06 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of utility.

2. Do not proceed with interruption of utility without Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.

1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.

2. Prevent surface water from entering excavations by grading, dikes, or other means.

3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.02 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

1. Corners: [Site-fabricated mechanical interlock] [Roll-formed corner shape with continuous interlock].

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

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

G. Tiebacks: Steel bars, ASTM A 722/A 722M.

H. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 2 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.02 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.03 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.

B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

C. Cut tops of sheet piling to uniform elevation at top of excavation.

3.04 TIEBACKS

A. Drill, install, grout, and tension tiebacks.

B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.

C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.05 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.

2. Install internal bracing if required to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.06 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks as required during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.07 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.

2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."

3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVMENTS

SECTION 32 1314

CONCRETE SIDEWALK

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 01 – General Requirements, and Division 3 Concrete shall govern the work under this Section.

1.02 WORK INCLUDED

A. The work specified in this Section consists of the construction of concrete sidewalk in accordance with these Specifications and in conformity with the lines, grades, dimensions, and notes shown on the plans.

1.03 RELATED WORK

A. Section 024119 – Selective Demolition

B. Division 02200 – Earthwork

PART 2 - PRODUCTS

2.01 CONCRETE

A. Concrete shall be Class A Concrete unless otherwise shown on the plans.

2.02 FORMS

A. Forms for this work shall be made of either wood or metal and shall have a depth equal to the plan dimensions for the depth of concrete being deposited against them. They shall be straight, free from warp or bends, and of sufficient strength when staked, to resist the lateral pressure of the concrete without displacement from lines and grade. Forms shall be cleaned each time they are used and shall be oiled prior to placing the concrete.

2.03 SUBGRADE AND GRADING

A. Excavation shall be made to the required depth, and the foundation material upon which the sidewalk is to be set shall be compacted to a firm, even surface, true to grade and cross-section, and shall be moist at the time that the concrete is placed.

2.04 JOINTS

A. Expansion joints between the sidewalk and the curb, and at all other locations indicated on the plans, shall be 1/4-inch wide, formed with a preformed joint filler. Preformed joint filler shall meet the requirements of AASHTO M153 or AASHTO M213.

B. Contraction joints may be of the open type or may be sawed. Open type contraction joints shall be formed by staking a metal bulkhead in place and depositing the concrete on both sides. After the concrete has set sufficiently to preserve the width and shape of the joint, the bulkhead shall be removed. After the sidewalk has been finished over the joint, the slot shall be edged with a tool having a 1/2-inch radius.

If the CONTRACTOR elects to saw the contraction joints, a slot approximately 1/8-inch-wide and not less than 1-1/2 inches deep shall be cut with a concrete saw after the concrete has set, and within the following periods of time:
Contraction joints shall be constructed at not more than twenty (20) foot intervals and shall be in place within twelve (12) hours after finishing.

PART 3 - EXECUTION

3.01 PLACING

B. The concrete shall be placed in the forms to the required depth and shall be vibrated and spaded until mortar entirely covers its surface.

3.02 FINISHING

C. Screeding: The concrete shall be struck-off by means of a wood or metal screed, used perpendicular to the forms, and floated in order to obtain the required grade and remove surplus water and laitance.

D. Surface requirements: The concrete shall be given a broom finish. The surface variations shall not be more than 1/4 inch under a ten-foot straightedge, nor more than 1/8 inch on a five-foot transverse section. The exposed edge of the slab shall be carefully finished with an edging tool having a radius of 1-1/2 inch.

3.03 CURING

A. The concrete shall be continuously cured for a period of at least 72 hours. Curing shall be commenced after finishing has been completed and as soon as the concrete has hardened sufficiently, to permit application of the curing material without marring the surface.

B. Wet burlap, white-pigmented curing compound, waterproof paper or polyethylene sheets may be used for the curing.

END OF SECTION

SECTION 321373

CONCRETE PAVING JOINT SEALANTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 01 – General Requirements and Division 3 Concrete shall govern the work under this section.

1.02 WORK INCLUDED

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

2. Joints between cement concrete and asphalt pavement.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated. In the event of a discrepancy between this specification section and the County Design Criteria, the County's Design Criteria shall govern. The Contractor shall notify the Engineer in the event of a discrepancy.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).

2. When joint substrates are wet or covered with frost.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.02 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Available Products:

a. Crafco Inc.; RoadSaver Silicone.

b. Dow Corning Corporation; 888.

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Available Products:

a. Crafco Inc.; RoadSaver Silicone SL.

b. Dow Corning Corporation; 890-SL.

2.03 HOT-APPLIED JOINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Available Products:

a. Crafco Inc.; Superseal 444/777.

b. Meadows, W. R., Inc.; Poly-Jet 3406.

B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Available Products:

a. Koch Materials Company; Product No. 9005.

b. Koch Materials Company; Product No. 9030.

c. Meadows, W. R., Inc.; Sealtight Hi-Spec.

d. Approved equals.

2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

1. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.

2. Do not stretch, twist, puncture, or tear backer materials.

3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All applicable provisions of the bidding and Contract Requirements, and Division 01 – General Requirements shall govern the work under this Section.

1.2 WORK INCLUDED

A. The work covered by this Section shall include the furnishing of all labor, equipment and materials necessary to construct and install all pavement marking, and striping in accordance with the plans and these specifications.

1.3 RELATED WORK

A. Section 321216 – Asphalt Paving

B. Section 321313 – Concrete Paving

1.4 QUALITY ASSURANCE

A. Perform all work in accordance with the requirements of local agencies.

PART 2 - PRODUCTS

2.1 PAVEMENT MARKINGS

A. Chlorinated rubber-alkyd type, as per Fed Spec. No. TT-P-115, Type III, or conforming to the applicable Sections of the Texas Department of Transportation Standard Specifications.

1. Paint shall be factory mixed, quick drying and non-bleeding type.

2. Color shall be as per D.O.T. requirements.

3. Striping, arrows, lane markers and stop bars shall be provided with paint containing reflective additive.

B. Thermoplastic paint shall conform to the applicable Sections of the Texas Department of Transportation Standard Specifications.

C. Traffic paint shall conform to the applicable Sections of the Texas Department of Transportation Standard Specifications.

PART 3 - EXECUTION

3.1 TRAFFIC AND LANE MARKINGS

A. Sweep dust and loose material from the sealed surface.

B. Apply paint striping as indicated on the drawings, with suitable mechanical equipment to produce uniform straight edges.

1. Apply in not less than (2) two coats as per manufacturer's recommended rates of applications.

C. Protect pavement markings until completely dry in accordance with manufacturer’s recommendations.

END OF SECTION

DIVISION 33 – UTILITIES

SECTION 330500

COMMON WORK RESULTS FOR UTILITIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 33 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Concrete bases.
13. Metal supports and anchorages.

1.03 DEFINITIONS

B. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

C. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

D. ABS: Acrylonitrile-butadiene-styrene plastic.

E. CPVC: Chlorinated polyvinyl chloride plastic.
F. PE: Polyethylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.04 ACTION SUBMITTALS

H. Product Data: For the following:

1. Dielectric fittings.

2. Identification devices.

1.05 INFORMATIONAL SUBMITTALS

I. Welding certificates.

1.06 QUALITY ASSURANCE

J. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

K. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

L. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.07 DELIVERY, STORAGE, AND HANDLING

M. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

N. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.08 COORDINATION

O. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

P. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

Q. Coordinate size and location of concrete bases.

PART 2 - PRODUCTS

2.01 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8-inch-thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.

2. CPVC Piping: ASTM F 493.

3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

4. PVC to ABS Piping Transition: ASTM D 3138.

5. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.02 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.

2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 (DN 50) and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements.

3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements.

3. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements.

3. Description: MSS SP-107, PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements.

3. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.03 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements.

3. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.

   a. Pressure Rating: 150 psig minimum at 180 deg F.

   b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements.

3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.

a. Pressure Rating: 150 psig minimum.

b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements.

3. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 (DN 65) and larger.

a. Pressure Rating: 150 psig minimum.

b. Gasket: Neoprene or phenolic.

c. Bolt Sleeves: Phenolic or polyethylene.

d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements.

3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.

a. Pressure Rating: 300 psig at 225 deg F.

b. End Connections: Threaded.

F. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements.

3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

a. Pressure Rating: [300 psig (2070 kPa) at 225 deg F (107 deg C)] <Insert pressure and temperature>.

b. End Connections: Threaded or grooved.

2.04 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.05 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Fiberboard, Brass.

2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.

2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick, [polished brass] [or] [aluminum].

2. Material: 0.0375-inch- thick stainless steel.

3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.

4. Material: Valve manufacturer's standard solid plastic.

5. Size: 1-1/2 inches in diameter, unless otherwise indicated.

6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link, or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2. Thickness: 1/16 inch unless otherwise indicated.

3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.

4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.

2. Yellow: Heating equipment and components.

3. Brown: Energy reclamation equipment and components.

4. Blue: Equipment and components that do not meet criteria above.

5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.

6. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.

b. Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.

2. Fasteners: Brass grommets and wire.

3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.06 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

2.07 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.

2. Density: 115- to 145-lb/cu. ft.

3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel, or stone, coarse.

4. Aggregates: ASTM C 33, natural sand, fine.

5. Admixture: ASTM C 618, fly-ash mineral.

6. Water: Comply with ASTM C 94/C 94M.

7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.01 PIPED UTILITY DEMOLITION

A. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.

3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12: Dielectric flanges.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric.

2. NPS 2-1/2 to NPS 4: Dielectric nipples.

3. NPS 2-1/2 to NPS 8: Dielectric nipples.

4. NPS 10 and NPS 12: Dielectric flange kits.

3.03 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas [2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.

b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.04 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.

3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.

2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.05 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Install dielectric fittings at connections of dissimilar metal pipes.

3.06 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.07 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.08 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.

3. Locate pipe markers on exposed piping according to the following:

4. Near each valve and control device.

5. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.

6. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.

7. At manholes and similar access points that permit view of concealed piping.

8. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4-inch-high for name of unit if viewing distance is less than 24 inches, 1/2-inch-high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.09 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 331110

PVC WATER PIPE

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification covers the requirements to install polyvinyl chloride (PVC) water pipe and ductile iron fittings for the water line, including excavation, sheeting, shoring, dewatering, pipe laying, jointing, testing, backfilling and any other work that is required or necessary to complete the installation as shown on the Plans and as specified herein.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Division 1.

B. The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work is of the kind and quality that satisfies the specified functions and quality.

1.03 QUALITY ASSURANCE

A. All PVC pipe and fittings shall be from a single Manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 or ASTM F789 and/or ASTM F758 as applicable.

PART 2 – PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Polyvinyl chloride pipe for water lines, unless otherwise specifically shown on the Plans, or approved in writing, shall be AWWA C900, C905, or C909 Class 150 psi with a dimension ratio of 18 (DR-18), for water lines and shall be extruded, be of rubber gasket type, and be furnished in 20-foot nominal laying lengths. All such pipe shall bear a mark denoting approval by the Underwriters' Laboratories of Chicago, Illinois, so that it will be acceptable to the Texas State Fire Insurance Commission for use in fire protection lines without penalty. All joints shall be of the type which provides a recession in the bell for the employment of a single rubber gasket to be placed before the insertion of the succeeding spigot. Each size of polyvinyl chloride pipe shall have the same outside diameter as the corresponding size of cast iron pipe.

B. Fittings shall be ductile iron, mechanical joint or flanged type and shall be Class 250 in accordance with AWWA Specifications C110-77, C-111-80, and C115-75. Flanges shall be faced and drilled in accordance with ASA Standard B16.1, Class 125 unless otherwise shown on the Plans or in the Special Conditions. All fittings shall be tar coated on the outside surface and shall have an interior cement lining with seal coat per AWWA Specifications C104-80 unless otherwise shown or specified.

C. The Contractor shall obtain installation instructions, including support spacing and solvent welding, from the supplying Manufacturer, shall comply with the instructions, and shall meet the requirements of ASTM D-2855, Standard Recommended Practice for making Solvent Cemented Joints with PVC Pipe and Fittings. The PVC solvent cement shall comply with ASTM D-2564 and shall be furnished by the pipe and fitting Manufacturer for the class and type of pipe supplied to the project.

PART 3 – EXECUTION

3.01 HANDLING AND CUTTING PIPE

A. Pipe and fittings are slightly brittle. Care shall be taken in shipping, handling and laying to avoid damaging the pipe and fittings. Extra care will be necessary during cold weather construction.

B. Any pipe or fitting showing a crack or which has received a blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

C. All pipe ends shall be square after cutting.

D. While stored, pipe shall be adequately supported from below at not more than three (3) foot intervals to prevent deformation. Pipe shall not be stacked higher than six (6) feet. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of direct sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted.

3.02 JOINTING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. PVC pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the Manufacturer.

3.03 INSTALLING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Unless otherwise specified on the Plans, polyvinyl chloride pipe shall be installed to clear all utility lines and shall have three (3) feet minimum cover. For water lines to be constructed under a future roadway, the cover may be increased to allow for future paving grades. The depth of cover, where shown on the Plans, is that distance from the top of the pipe to the approximate proposed grade line.

B. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the Manufacturer shall be explicitly followed.

C. Any pipe or fittings discovered to be defective after laying shall be removed and replaced with a sound piece.

D. The Engineer or The San Jacinto River Authority may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such, and immediately removed from the job site.

E. All pipe shall be sound and clean before laying. When laying is not in progress, including lunch time, the open ends of the pipe shall be closed by watertight plugs or other approved means. Good alignment shall be preserved in laying.

F. Pipe and fittings shall be installed in accordance with the instructions of the Manufacturer, ASTM D2321 and as specified herein. As soon as the excavation is complete to normal grade of the bottom of the trench, embedment material shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Plans. The specified embedment shall be accurately shaped and trimmed to receive the pipe barrel and each pipe section, when in place, shall have a uniform bearing on the subgrade for the full length of the pipe barrel. Pipe shall not be laid unless the subgrade is free of water and in a satisfactory condition. Embedment material shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the embedment material under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Embedment material shall then be placed to 12-inches above the top of the pipe. Next, the varying depths of select material backfill above the embedment material backfill shall be placed according to the Plan Details and carefully compacted. Generally, the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient select material backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the varying depths of select material backfill shall be approved by the pipe Manufacturer's representative prior to use. Adjustments of the pipe to line and grade shall be made by scraping away or filling in with granular material, and not by wedging or blocking up the bell.

G. Perforated PVC Pipe and fittings shall be installed in accordance with the instructions of the Manufacturer, ASTM F758 and as specified herein. As soon as the excavation for the trench is complete to normal grade of the bottom of the trench, geotextile fabric shall be laid and then the pea gravel bedding shall be carefully placed (so not to damage the geotextile fabric) and graded to provide uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. Before the perforated pipe is laid on the trench, the perforated pipe shall be wrapped around and closed according to the Manufacturer's closure recommendations with the geotextile fabric. The pipe shall be laid accurately to the lines and grades indicated on the Plans. Blocking under the perforated PVC pipe will not be permitted. Pea gravel shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to gently place the pea gravel under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Making sure not to damage the geotextile fabric, pea gravel shall then be carefully placed above the top of the perforated pipe varying from two to three (2-3) feet depending on the Plans. Once the remaining pea gravel has been placed, overlap or close the geotextile fabric according to the Manufacturer's recommendations or six (6) inches minimum overlap. Then one (1) foot of topsoil shall be placed over the pea gravel to the ground level with proper grass sodding on top.

H. Joints shall not be "pulled" or "cramped". Each joint of pipe shall be completed in compliance with Manufacturer's recommendations.

I. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

J. Precautions shall be taken to prevent flotation of the pipe in the trench.

K. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and backfill or embedment material. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, embedment material shall be placed to fill any voids created and the embedment material and backfill shall be recompacted to provide uniform side support for the pipe.

3.04 CONCRETE AND BLOCKING

A. 2,500 psi concrete shall be placed for blocking at each change in direction in the pipeline, as shown in the Standard Details and in such manner as will substantially brace the pipe against undisturbed trench walls. In no event shall this quantity of concrete blocking be less than those shown in the Plans. Concrete blocking, made from Type I cement, shall have been in place four (4) days prior to testing the pipeline as hereinafter specified. Tests may be made in two (2) days after completion of blocking if Type III cement is used.

B. At all points where wet connections are made to existing lines, the existing lines shall be adequately blocked and the tapping connection fittings shall be supported by blocking up to the spring line with 2,500 psi concrete.

3.05 LEAKING TESTING AND STERILIZATION

A. General

1. All leakage testing and sterilization shall be per Utility Owner's requirements. Contractor to coordinate with Utility Owner for procedures, timing, and witnessing of testing and sterilization. This section outlines minimum requirements and guidelines for testing and sterilization.

2. After the pipe has been laid and backfilled and the backfill has been otherwise consolidated, all newly laid pipe, or any valved section thereof, shall be subjected to the hydrostatic pressure specified below for that particular type of pipe. The duration of the hydrostatic test shall be at least two (2) hours. Unless otherwise specified or noted on the Plans. All meters, fixtures, devices or appliances which are connected to the pipeline system and which might be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped during the testing procedures.

3. Each valved (capped or plugged) section of pipe shall be filled slowly with water and all air shall be expelled. If permanent air vents are not located at all high points, the Contractor shall install, at his own expense, corporation or blow-off cocks at such points so that air can be expelled as filling takes place. After verification that all air has been expelled, the cocks shall be closed and the pipe kept filled until tested. All exposed pipe, fittings, valves, hydrants and joints shall be examined while under test pressure and all visible leaks shall be stopped. Any cracked or defective pipe, fittings, valves or hydrants discovered during testing shall be removed and replaced by the Contractor. Replacement shall be with sound material and the test shall be repeated until satisfactory to the Engineer.

B. Special Requirements: Where any section of pipeline is provided with concrete reaction blocking, the hydrostatic pressure shall not be made until at least five (5) days have elapsed after installation of the blocking. However, if high-early-strength cement is used in the concrete, two (2) days shall have elapsed prior to testing.

C. Leakage Test: A Leakage Test will be conducted on each valved section over the entire Project. The leakage test shall be at 150 psi for at least four (4) hours.

D. Allowable Leakage

1. The allowable hydrostatic leakage rate shall be based on the following formula:

L= SD √P/133,200

L = testing allowance in gallons per hour
S = length of pipe tested in feet
D = nominal diameter of the pipe in inches
P = average test pressure during the hydrostatic test in pounds per square inch (gauge)

Table 6A - Hydrostatic testing allowance per 1,000 ft of pipeline* - *gph*†

	Nominal Pipe Diameter – in.																	
Avg Test Pressure	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	64

psi																		
450	.48	.64	.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60	9.56	10.19
400	.45	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11	9.01	9.61
350	.42	.56	.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58	8.43	8.99
300	.39	.52	.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02	7.80	8.32
275	.37	.50	.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72	7.47	7.97
250	.36	.47	.71	.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41	7.12	7.60
225	.34	.45	.68	.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03	6.76	7.21
200	.32	.43	.64	.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73	6.37	6.80
175	.30	.40	.59	.80	.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36	5.96	6.36
150	.28	.37	.55	.74	.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97	5.52	5.88
125	.25	.34	.50	.67	.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53	5.04	5.37
100	.23	.30	.45	.60	.75	.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05	4.50	4.80

If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.
†Calculated on the basis of Eq. 1.

a. These formulas are based on a testing allowance of 11.65 gpd/mi/in. (1.079 L/d/km/mm) of nominal diameter at a pressure of 150 psi (1,034 kPa).

b. When testing against closed metal-seated valves, an additional testing allowance per closed valve of 0.0078 gal/h/in. (1.2 mL/h/mm) of nominal valve size shall be allowed.

c. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.

d. Acceptance of installation. Acceptance shall be determined on the basis of testing allowance. If any test of laid pipe discloses a testing allowance greater than that specified, repairs or replacements shall be accomplished in accordance with the specifications.

e. All visible leaks are to be repaired regardless of the allowance used for testing.

2. If such testing discloses leakage in excess of this specified allowable, the Contractor, at his expense, shall locate and correct all defects in the pipeline until the leakage is within the specified allowance. All known leaks, regardless of this test, shall be repaired.

E. Pressure Test: After satisfactorily completing the leakage test, each valved section over the entire project, shall be tested at 200 psi for a sufficient period (approximately 10 min) to discover all leaking or defective materials and/or workmanship.

F. Disinfecting Water Mains: The Contractor shall disinfect all water mains before the new facilities are placed into service. Disinfection must be performed in accordance with AWWA C651, latest revision and water samples must be submitted to a laboratory approved by the Texas Department of Health. Sample must be collected by the Contractor or his representative in the presence of the The San Jacinto River Authority or his representative. The Contractor shall be responsible for delivering the samples to an approved laboratory for testing. Sample results must indicate the facility is free of microbiological contamination before it is placed into service. It shall be the Contractor's responsibility to obtain a current copy of AWWA C651 to determine the correct forms of chlorine for disinfection, the basic disinfection procedure, preventive and corrective measures during construction, methods of chlorination, final flushing procedures, procedures for bacteriological tests, procedures for redisinfection and disinfection procedures when cutting into existing mains. The Contractor, at its expense, will supply the concentrated chlorine disinfecting material, The San Jacinto River Authority's personnel will supervise and direct the overall sterilization procedure. The Contractor, at his own expense, shall provide all other equipment, supplies and necessary labor to perform the sterilization under general supervision by The San Jacinto River Authority.

G. General

1. All valves shall be arranged to prevent the strong disinfecting dosage from flowing back into the existing water supply piping. The new pipeline shall then be completely filled with disinfecting solution by feeding the concentrated chlorine and approved water from the existing system uniformly into the new piping in such proportions that every part of the line has a minimum concentration of chlorine as prescribed in AWWA C651.

2. Unless otherwise identified, all quantities called for herein refer to measurements by the testing procedures in the current edition of “Standard Methods of Examination of Water and Wastewater”. The chlorine concentration of each step in the sterilization procedure shall be verified by chlorine residual determinations. This disinfecting solution shall be retained in the piping for at least twenty-four (24) hours, and all valves, hydrants, etc., shall be operated to disinfect all their parts. After this retention period, the water shall contain no less than the chlorine residual prescribed in AWWA C651 throughout the treated section of the pipeline.

3. This heavily chlorinated water shall then be carefully flushed from the line until the chlorine concentration is not higher than the residual generally prevailing in the existing distribution system, or approximately 1.0 parts per million. Proper planning and appropriate preparations to handle, dilute and dispose of this strong chlorine solution without causing injury or damage to the public, the water system, the environment must be approved by The San Jacinto River Authority before flushing of the line may begin, and the flushing shall be witnessed by an authorized representative of The San Jacinto River Authority.

H. Bacteriological Testing

1. After final flushing of the strong disinfecting solution, water samples from the line shall be tested for bacteriological quality, at the Contractor’s expense, and must be found free of coliform organisms before the pipeline may be placed in service. One (1) test sample shall be drawn from the end of the main and additional samples collected at intervals of not more than one-thousand (1,000) feet along the pipeline. A minimum of three (3) samples must be collected.

2. The Contractor, at his own expense, shall install sufficient sampling taps at proper locations along the pipeline. Each sampling tap shall consist of a standard corporation cock installed in the line and extended with a copper tubing gooseneck assembly. After samples have been collected, the gooseneck assembly shall be removed and retained for future use.

3. Samples for bacteriological analysis shall be collected only from suitable taps, in sterile bottles. Collection of the test samples shall be made in the presence of The San Jacinto River Authority personnel. If the initial disinfection fails to produce acceptable sample tests, the disinfection procedure shall be repeated (without extra compensation) until satisfactory test results have been obtained, before the piping may be placed in service.

END OF SECTION

SECTION 331215

VALVES, HYDRANTS, AND APPURTENANCES

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification covers the requirements to provide all buried valves, valves in manholes and underground vaults, hydrants and appurtenances complete with actuators and all accessories as shown on the Plans and as specified herein.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Division 33.

B. The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work is of the kind and quality that satisfies the specified functions and quality.

1.03 REFERENCE STANDARDS

A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. American Water Works Association (AWWA)

1. AWWA C500 - Gate Valves, three (3)-inch through 48-inch NPS, for Water and Sewage Systems.

2. AWWA C502 - Dry-Barrel Fire Hydrants.

3. AWWA C509 - Resilient-Seated Gate Valves, three (3) inch through 12-inch NPS, for Water and Sewage Systems.

C. American National Standards Institute (ANSI)

1. ANSI B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.

2. ANSI C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

D. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Gray Iron Castings.

2. ASTM A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings

3. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware

4. ASTM A276 - Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes.

5. ASTM A536 - Ductile Iron Castings.

E. Steel Structures Painting Council (SSPC)

1. SSPC SP-6 - Commercial Blast Cleaning

F. Where reference is made to one (1) of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the work.

B. Protect threads and seats from corrosion and damage. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until time of use.

C. Provide covers for all openings.

1. All valves three (3) inches and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.

2. All valves smaller than three (3) inches shall be shipped and stored as above except that heavy card board covers may be furnished instead of wood.

D. Store equipment to permit easy access for inspection and identification. Any corrosion in evidence at the time of Owner acceptance shall be removed, or the valve shall be removed from the job.

E. Store all equipment in covered storage off the ground.

1.05 COORDINATION

A. Review installation procedures under other Sections and coordinate with the work which is related to this Section including buried piping installation and site utilities.

B. Contractor shall coordinate the location and placement of concrete thrust blocks when required.

1.06 GENERAL

A. All valves shall open counter-clockwise.

B. The use of a Manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

C. Valves shall be of the size shown on the Plans or as noted, and as far as possible equipment of the same type shall be identical and from one Manufacturer.

D. Valves shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard to which they are manufactured cast in raised letters on some appropriate part of the body.

E. Unless otherwise noted, valves shall have a minimum working pressure of 200 psi or be of the same working pressure as the pipe they connect to, whichever is higher, and suitable for the pressures noted where they are installed.

F. Valves shall be of the same nominal diameter as the pipe or fittings they are connected to. Except as otherwise noted, joints shall be mechanical joints, with joint restraint where the adjacent piping is required to be restrained.

G. Valves shall be constructed for buried service.

PART 2 – PRODUCTS

2.01 VALVE BOXES

A. All gate valves shall be provided with extension shafts (where the operating nut is greater than five (5) feet below grade), operating nuts and valve boxes as follows:

1. Extension shafts shall be steel and the operating nut shall be two (2) inches square. Shafts shall be designed to provide a factor of safety of not less than four (4). Operating nuts shall be pinned to the shafts.

2. Valve boxes shall be a heavy-pattern cast iron, three (3) piece, telescoping type box with dome base suitable for installation on the buried valves. Inside diameter shall be at least 5¼-inches. Barrel length shall be adapted to the depth of cover, with a lap of at least six (6) inches when in the most extended position. Covers shall be cast iron with integrally- cast direction-to-open arrow and “WATER” shall be cast in the cover when used on a water line or “SEWER” when used on a wastewater force main. Aluminum or plastic are not acceptable. A means of lateral support for the valve extension shafts shall be provided in the top portion of the valve box. The valve box lid shall be furnished with a pentagon-head bolt for locking.

3. The upper section of each box shall have a bottom flange of sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the stuffing box and operating nut of the valve and shall be oval.

4. An approved operating key or wrench shall be provided.

5. All fasteners shall be Type 304 stainless steel.

2.02 RESILIENT SEATED GATE VALVES

A. Valves shall be manufactured in accordance with AWWA C509. Acceptable Gate Valves are:

1. American Flow Control – Series 2500

2. Mueller – 2360 Series

3. Clow

B. Valves shall be provided with a minimum of two (2) O-ring stem seals.

C. Bonnet and gland bolts and nuts shall be either fabricated from a low alloy-steel for corrosion resistance or electroplated with zinc or cadmium. The hot-dip process in accordance with ASTM A153 is not acceptable.

D. Wedges shall be totally encapsulated with rubber.

E. Units shall be, in addition, UL and FM approved.

F. Resilient wedge gate valves shall be furnished and installed in sizes and shall be manufactured in accordance with the latest AWWA C-509 and cast iron shall conform to the latest ASTM A-126 standards. Gate valves furnished under these specifications shall be of the solid wedge, resilient seat type with cast iron/ductile iron body and bronze stem designed for 250 pounds per square inch working pressure. All gate valves shall be tested hydrostatically to 400 pounds per square inch. Gate valves shall meet the latest AWWA standard specifications (C-509).

G. The seat shall be made of Styrene Butadiene rubber and provide a positive water tight seal. The seat shall be permanently bonded or mechanically attached to the wedge with stainless steel screws. If bonded, ASTM P-429 requirements shall be followed. Non-rising stem gate valves shall be equipped with "O" ring type packing gland consisting of at least two (2) "O" rings. The thrust collar shall work in an "O" ring seal lubricant reservoir or against bearings or washers, above and below constructed of Delrin or approved equal material. Gate valve stems, shall be fabricated from solid bronze rod having a tensile strength of not less than 60,000 pounds per square inch, and a minimum yield strength of 30,000 pounds per square inch.

H. Cast iron body shall be of iron with an even grain and shall possess a tensile strength of not less than 32,000 pounds per square inch. All bronze castings, except the stem, shall have a tensile strength of not less than 30,000 pounds per square inch. The entire internal valve body surfaces shall be coated with a factory applied two (2) component epoxy system or approved equal. The seating surface shall be machined or otherwise constructed to provide a smooth, even surface for the resilient seat. All valves shall open left (counter clockwise) and have a two (2) inch square wrench nut unless specified otherwise.

2.03 TAPPING SLEEVES AND TAPPING VALVES

A. Tapping sleeves shall be of cast iron epoxy coated, designated for working pressure not less than 200 psi. Armored end gaskets shall be provided for the full area of the sleeve flanges. Sleeves shall be as manufactured by A.P. Smith Division of U.S. Pipe, Mueller, Clow, or equal. Nuts and bolts shall be Type 304 stainless steel.

B. Size-on-Size tapping sleeve shall be ductile iron or cast iron.

C. Tapping valves shall conform to the requirements specified above for gate valves except that one (1) end shall be flanged and one (1) mechanical. Tapping valves shall be provided with an oversized opening to permit the use of full size cutters. Tapping valves shall be Ford B81-777 or equal.

2.04 CHECK VALVES

A. Controlled Closing Swing Check Valves (lever & weight)

1. Check valves shall be of the controlled closing swing type. The controlled closing swing check valves shall be guaranteed to operate under severe conditions as check valves. The valve shall be designed to open smoothly, provide full pipe line flow, permit minimum head loss and close at a controlled rate of speed for the final predetermined portion of its stroke. All bolts and nuts used in the assembly shall be steel, commercial.

2. The valve body shall be Cast Iron ASTM A126-B/ductile iron ASTM A536. The disc arm and chamber level shall be of heavy steel construction and keyed to the hinge shaft. The hinge shaft shall be of 18-8 stainless steel and of adequate diameter to withstand a complete hydraulic unbalance pressure of 125 psi on the valve disc. A single cushioning device mounted on the external side of the valve shall control the valve closure by way of the interchange of oil to and from an oil reservoir. The use of air or gas pressurized oil reservoir shall not be permitted. The oil plunger assembly shall be rigidly attached to the valve body by shoulder bolts or dowel pins to prevent fretting.

3. The Manufacturer, if required by the Engineer or the County, shall submit design calculations of principle component stresses to substantiate the integrity of the valve for the working pressure involved.

4. The valve when closed shall be tight seating by way of a resilient replaceable seat against a bronze seat ring in the body.

5. Valves shall be as manufactured by GA Industries or Series 6000 as manufactured by APCO. The County reserves the right to inspect all valves before shipment is made. Any failure of valves to operate satisfactorily during the first year of installation due to faulty workmanship or defective material shall be replaced and made good by the Manufacturer. Under these specifications, any valve stuffing box that leaks for any reason or because of excessive wear or deterioration of packing, shall be reason for classification as defective material.

A. Slanted / Tilted Check Valves

1. Slanted or tilted check valves shall be furnished and installed where shown on the Plans.

2. The body of the valve shall be ductile iron or cast iron with access ports to the disc. The disc shall be cast iron. The seat and disc rings shall be bronze. Pivot pins and bushings shall be bronze or stainless steel. The valve shall include a localized indicator of the position of the valve.

3. The valves shall include a top mounted oil dash pot to prevent slamming of the disc. The dash pot shall control the last 10% of closure of the disc. The speed of closure within this 10% shall be adjustable.

4. Valves shall be APCO Slanting Disc, Valmatic or Golden Anderson Tilted Disc or approved equal.

2.05 FLANGES

A. Flanges shall be cast solid and faced accurately at right angles to the axis of the casting. Dimensions and drilling of flanges shall be in accordance with the American Standard Association for a working pressure of 125 pounds per square inch. Special drilling shall be provided where necessary.

2.06 FIRE HYDRANTS

A. Fire hydrants shall be dry-barrel type conforming to the requirements of the latest revision of AWWA C502. Hydrants shall be designed such that the hydrant valve closes with line pressure preventing loss of water and consequent flooding in the event of traffic damage.

B. Hydrants shall have six (6)-inch mechanical joint inlet connections, two 2½-inch hose connections and one 41/2-inch pumper connection. Threads for the hose and pumper connections shall be in accordance with National Standard Thread. Hydrants shall be according to Manufacturer's standard pattern. Hydrants shall be equipped with "O" ring packing. Each nozzle cap shall be provided with a Buna-N rubber washer.

C. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism or obstructing the discharge from any outlet. The body of the hydrant shall be equipped with a breakable flange, or breakable cast iron flange bolts, just above the grade line.

D. A bronze or rustproof steel nut and check nut shall be provided to hold the main hydrant valve on its stem.

E. Hydrant valve opening shall have an area at least equal to that area of a 41/2-inch minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gallons minimum through its two 2½-inch hose nozzles when opened together with a loss of not more than two (2) psi in the hydrant.

F. Hydrants shall be designed for installation in a trench that will provide minimum cover as noted on Plans and for the flange to be 3 ½-inches above ground surface. Hydrant extensions shall be as manufactured by the company furnishing the hydrants and of a style appropriate for the hydrants as furnished.

G. Hydrants shall be provided with an automatic and positively operating, non-corrodible drain or drip valve so as to drain the hydrant completely when the main valve is shut. A drain valve operating by springs or gravity is not acceptable.

H. Operating stems whose threads are located in the barrel or waterway shall be of manganese bronze, everdur, or other high-quality non-corrodible metal, and all working parts in the waterway shall be bronze to bronze.

I. Hydrants shall open by turning operating nut to left (counter-clockwise) and shall be marked with a raised arrow and the word "open" to indicate the direction to turn stem to open hydrant.

J. Hydrants shall be furnished with caps, double galvanized steel hose cap chain, galvanized steel pumper hose cap chain, a galvanized steel chain holder and any other hooks and/or appurtenances required for proper use.

K. Hydrant operating nut shall be AWWA Standard pentagonal type measuring 1½-inch point to flat.

L. Hydrants shall be hydrostatically tested as specified in AWWA C502.

M. Hydrants Manufacturer and Type shall be per County requirements

N. All iron work to be set below ground, after being thoroughly cleaned, shall be painted with two (2) coats of asphalt varnish specified in AWWA C502. Iron work to be left above ground shall be factory primed and painted per County requirements using a high-grade enamel paint of quality and color to correspond to the present standard of the County.

O. Fire hydrants shall be installed on the same side of the street or roadway as the water main and shall be installed plumb and true.

P. Heel and thrust blocks shall be placed in undisturbed soil as shown in the details of the Plans.

Q. Double blue reflector "HYE – LITES" brand as manufactured by pavement markers ink shall be installed at the centerline of the street or roadway perpendicular to the hydrant.

2.07 CORPORATION STOPS

A. Corporation stops shall be brass, not less than 1-inch in diameter and shall be installed where shown, specified or required.

B. Provide corporation stops as manufactured by the following:

1. Ford Company

2.08 COMBINATION AIR-VACUUM RELIEF VALVES

A. The air-vacuum release valves shall be installed as shown on the Plans. The valve body shall be of cast iron ASTM A126-B; the floats, float guide, and stem shall be of Type 316 stainless steel. The resilient seat shall be of Buna N. The valve shall be suitable for 150 psig working pressure. Valve shall have standard NPT inlets and outlet ports with diameters as indicated on the Plans. Valve shall be Model 200A Series by APCO Valve and Primer Corporation, Schaumburg, IL, or approved equal.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION AND SHOP COATINGS

A. The interior ferrous metal surfaces, except finished or bearing surfaces, shall be blast cleaned in accordance with SSPC SP-6 and painted with two (2) coats of an approved two (2) component coal tar epoxy coating specifically formulated for potable water use. The coating used must appear on the current edition of the United States Environmental Protection Agency's list entitled "Accepted Categories and Subcategories of Coatings, Liners and Paints for Potable Water Usage."

B. Exterior ferrous metal surfaces of all buried valves and hydrants shall be blast cleaned in accordance with SSPC SP-6 and given two (2) shop coats of a heavy coat tar enamel or an approved two (2) component coat tar epoxy paint.

3.02 INSPECTION AND PREPARATION

A. During installation of all valves and appurtenances, the Contractor shall verify that all items are clean, free of defects in material and workmanship and function properly.

B. All valves shall be closed and kept closed until otherwise directed by the Engineer or the County.

3.03 INTALLATION OF BURIED VALVES AND VALVE BOXES

A. Buried valves shall be cleaned and manually operated before installation. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping pipe bedding material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. The valve box shall be set so as not to transmit traffic loads to the valve.

B. Before backfilling, all exposed portions of any bolts shall be coated with two (2) coats of bituminous paint.

3.04 INSTALLATION OF TAPPING SLEEVES AND VALVES

A. Contact utility owner to coordinate and obtain permission prior to tapping a line. The required procedures and time table shall be followed exactly.

B. Installation shall be made under pressure and flow shall be maintained. The diameters of the tap shall be a minimum of ¼-inch less than the inside diameter of the branch line.

C. The entire operation shall be conducted by workers experienced in the installation of tapping sleeves and valves. The tapping machine shall be furnished by the Contractor.

D. Determine the location of the line to be tapped to confirm that the proposed location will be satisfactory and that no interference will be encountered such as joints or fittings. No tap or sleeve will be made closer than three (3) feet from a pipe joint.

E. A tapping sleeve and valve with boxes shall be set squarely centered on the line to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks or other permanent restraint shall be provided behind all tapping sleeves. Proper tamping of supporting pipe bedding material around and under the valve and sleeve is mandatory for buried installations.

F. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean. All proper regulatory procedures (including disinfection) shall be followed exactly.

3.05 INSTALLATION OF FIRE HYDRANTS

A. Fire hydrants shall be set at the locations as shown on the Plans and bedded on a firm foundation. Hydrants and connecting pipe shall have at least the same depth of cover as the distributing pipe. The hydrants shall be set upon a slab of concrete not less than four (4)-inches thick and 15-inches square. During backfilling, additional screened gravel shall be brought up around and six (6) inches over the drain port. Each hydrant shall be set in true vertical alignment and properly braced.

B. 2,500 psi concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Plans. Eight (8) mil. Polyethylene film shall be placed around the hydrant elbow before placing concrete. CARE SHALL BE TAKEN TO ENSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS.

C. All connections from the main to the fire hydrants shall be anchoring mechanical joints designed to prevent movement due to thrust or pressure.

D. The hydrant shall be tied to the pipe with suitable rods or clamps, and shall be coated with Koppers 300 or approved equal at a minimum of 8 mil. thick. Bolts shall have a zinc bolt cover per AWWA. Hydrant paint shall be touched up as required after installation.

E. Fire hydrants shall be factory primed and painted as required by County using a high-grade enamel.

3.06 FIELD TESTS AND ADJUSTMENTS

A. Conduct a functional field test of each valve, including actuators and valve control equipment, in presence of Engineer or the Representative of the County to demonstrate that each part and all components together function correctly. All testing equipment required shall be provided by the Contractor at his/her sole expense.

END OF SECTION

SECTION 334100

STORM UTILITY DRAINAGE PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Site storm sewer drainage piping, fittings, accessories, and bedding.

2. Catch basins, paved area drains, site surface drains and stormwater detention facilities.

3. Connection of building storm water drainage system.

4. Precast concrete, Cast-in-place concrete manholes.

B. All public work to be performed and materials to be used within the street right-of-way, shall be in accordance with Newton County Design Standards. In the event of a discrepancy between the above-referenced standards, the plans, and/or any portion of this specification section, the order of precedence will be the plans, the County Design Standards, and then these specifications. The Contractor shall contact the engineer in the event of a discrepancy.

1.02 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. HDPE: High density polyethylene.

C. RCP: Reinforced concrete pipe

1.03 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Non-pressure, Drainage-Piping Pressure Rating: 10-foot head of water (30 kPa). Pipe joints shall be at least silttight, unless otherwise indicated.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Pipe materials, fittings, and accessories.

2. Drains.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.06 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Engineer and Owner no fewer than two days in advance of proposed interruption of service.

PART 2 – PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings; NPS 6” to 12” ASTM D 3034, SDR 26, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.02 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M), with groove and tongue ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets.

1. Class III, Wall B.

2.03 HDPE PIPE AND FITTINGS

A. Pipe shall have a smooth interior and exterior corrugations.

1. 4-through 10-inch (100 to 250 mm) shall meet AASHTO M252m, Type S.

2. 12- through 60-inch (300 to 1500 mm) shall meet AASHTO M294, Type S or ASTM F2306.

B. Pipe shall be joined with joints meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F2306.

C. 4-through 60-inch (100 to 1500mm) shall be watertight according to the requirements of ASTM D3212. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

D. 12- through 60-inch (300 to 1500 mm) diameters shall have a reinforced bell with a bell tolerance device. The bell tolerance shall be installed by the manufacturer.

E. Fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306.

F. To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM C969. Appropriate safety precautions must be used when field-testing any pipe material.

G. Installation shall be in accordance with ASTM D2321 and manufacturer’s published installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot. (0.3 m) and for 60-inch (1500 mm) diameters, the minimum cover shall be 2 ft. (0.6 m) in single run applications.

2.04 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.

2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.

3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

4. For Dissimilar Pipes: ASTM D 5926, PVC, or other material compatible with pipe materials being joined.

2.05 CLEANOUTS AND PLUGS

A. Installation shall be in accordance with the details and at locations shown on the drawings.

B. All cleanouts shall have a 2’ x 2’ x 6” thick concrete apron.

2.06 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.

2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.

4. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.

5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.

7. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).

8. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.

9. Manhole Frames and Covers: Ferrous; 28-inch ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch-(102-mm-) minimum width flange and 30-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

B. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Ballast: Increase thickness of concrete, as required to prevent flotation.

2. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.

3. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).

4. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.

6. Manhole Frames and Covers: Ferrous; 28-inch ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 30-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

   a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

   b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to all surfaces, unless otherwise indicated.

2.07 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

2.08 CATCH BASINS

A. Installation shall be in accordance with the details and at locations shown on the drawings.

2.09 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to the details and at locations shown on plans.

B. Frames and Grates: Heavy-duty frames and grates according to the details and at locations shown on plans.

PART 3 – EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.02 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

    a. Unshielded flexible couplings for same or minor difference OD pipes.

    b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.

    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping: As shown on plans.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.

2. Install piping with 36-inch (915-mm) minimum cover.

3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

4. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

    a. Install HDPE pipe according to ASTM D2321.

3.04 PIPE JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.

2. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.

3. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

C. Join dissimilar pipe materials with pressure-type couplings.

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

2. Use extra-heavy-duty, top-loading classification cleanouts in fire lane areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 24 by 24 by 6 inches deep. Set with tops 1 inch (25 mm) above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.06 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.

2. Use extra-heavy-duty, top-loading classification drains in roads areas.

B. Embed drains in 4-inch (102-mm) minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4-inch (102-mm) minimum concrete around bottom and sides.

3.07 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections according to ASTM C 891.

C. Construct cast-in-place manholes as indicated.

3.08 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.09 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Install outlets that spill onto grade, anchored with concrete, where indicated.

C. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

D. Construct energy dissipaters at outlets, as indicated.

3.10 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION

SECTION 35 51 13

CONCRETE FLOATING DOCK SYSTEM

PART I – GENERAL

1.1 Description

A. The Work consists of a complete floating dock system to accommodate the indicated vessels and other requirements, including but not limited to the docks, gangways, mooring cleats, pile guides, piles, provisions for accommodating utilities, and dock accessories as indicated.

B. The floating dock system shall consist of individual precast foam-filled concrete floats interconnected with heavy treated timber wales, steel through rods, and fabricated structural steel bracing sub assemblies and pile guides.

C. The Contractor shall provide the final design and construction drawings for the complete floating system

D. The Contractor shall furnish all tools, equipment, materials, and supplies to perform all labor, supervision, fabrication, assembly, and installation of the floating dock system.

1.2 References

A. The following references may be referenced in this Section:

1. "Marinas and Small Craft Harbours," Second Edition, Bruce O. Tobiasson, P.E. and Ronald C. Kollmeyer, Ph.D.
2. "Ferry Terminals and Small Craft Berthing Facilities," MIL-HDBK-1025/5, Department of the Navy Naval Facilities Engineering Command (NAVFACENGCOM).
3. "Design: Small Craft Berthing Facilities," UFC 4-152-07N, June 2005, United Facilities Criteria (UFC).
4. "Planning and Design Guidelines for Small Craft Harbors," Revised Edition, 1994, ASCE Manuals and Reports on Engineering Practice-No. 50, American Society of Civil Engineers.

B. The following is a list of standards which may be referenced in this section:

1. International Building Code (IBC)
2. Army Corps Manual SR-2
3. American Institute of Steel Construction (AISC).
4. American Wood Preservers Association (AWPA).
5. AWPA C18, Standard for Pressure Treated Material in Marine Construction.
6. Concrete Reinforcing Steel Institute (CRSI).
7. American Concrete Institute (ACI).
8. ACI 211.2, Standard Practice for Selecting Proportions for Lightweight Concrete.
9. ACI 318-08, Building Code Requirements for Structural Concrete
10. ACI 301
11. American Forest and Paper Association (AFPA).
12. Southern Pine Inspection Bureau (SPIC).
13. Timber Products Inspection Bureau (TPIB).
14. National Electric Code (NEC), Article 555, Marinas and Boatyards.
15. American Society of Civil Engineers (ASCE): ASCE-7 Minimum Design Loads for Buildings and Other Structures
16. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
17. American Galvanizers Association (AGA): Inspection of products Hot-Dip Galvanized After Fabrication.
18. American Welding Society (AWS):
    a. D1.1, Structural Welding Code – Steel.

b. D1.2, Structural Welding Code – Aluminum.
c. D1.6, Structural Welding Code – Stainless Steel.

19. Precast/Prestressed Concrete Institute (PCI):
    a. PCI MNL-116, Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
    b. PCI MNL-120, Design Handbook, Precast and Prestressed Concrete.
20. ASTM International (ASTM)
    a. A36, Standard Specification for Structural Steel.
    b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
    c. A123, Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
    d. A153, Specification for Zing (Hot-Dip) on Iron and Steel Hardware.
    e. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
    f. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
    g. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
    h. A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
    i. A325, Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
    j. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
    k. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
    l. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
    m. A767, Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
    n. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
    o. A992, Specification for Steel for Structural Shapes for Use in Building Framing.
    p. C33, Standard Specification for Concrete Aggregates.
    q. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
    r. C94, Standard Specification for Ready-Mixed Concrete.
    s. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
    t. C150, Standard Specification for Portland Cement.
    u. C185, Standard Test Method for Air Content of Hydraulic Cement Mortar-AASHTO No.: T137.
    v. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
    w. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
    x. C272, Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
    y. C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
    z. C494, Standard Specification for Chemical Admixtures for Concrete.
    aa. D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
    bb. E985, Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

1.3 Contract Documents

A. The Contract plans are general in nature and show the basic system layout and details, with required nominal or minimal dimensions, size and number of boat slips, cleat locations, elevations, and materials.

B. The Contract Documents intent is to allow consideration of proprietary floating concrete dock systems of different manufactures, provided they meet the requirements of the contract plans and specifications, are constructed of the specified materials and minimum dimensions, and are of quality equal to or greater than that indicated.

C. The Contract Documents are not intended to be used as detailed shop or fabrication drawings for the manufacture of the floating dock system.

D. The floating dock system shall be manufactured, assembled, and installed based on the submitted design calculations, shop drawings, assembly drawings, and installation instructions furnished by the floating dock system manufacturer.

E. The floating dock system shall be designed and constructed in accordance with local, state, and federal codes and permits.

1.4 Coordination With Others

A. Coordination with the Owner’s personnel and other contractors’ personnel working on-site shall be part of this Contract and the responsibility of the Contractor.

B. Make whatever arrangements necessary to ensure that delivery and installation of the concrete floating dock system do not conflict with the work of other contractors. The Work under this Contract shall be completed in a manner such that it causes no delays to others.

1.5 Submittals

C. Submittals shall be in accordance with the following.

D. Reproduction of the Contract Documents is not permitted.

E. Catalog and product information shall be provided, on all commercially available products and equipment being offered for use. This information shall include manufacturer’s name, address, phone/fax numbers, email address, part numbers and/or other information suitable for placing a replacement purchase order with the manufacturer.

F. Engineering design calculations, shop drawings, and assembly drawings, signed and sealed by the designer, regarding the proposed floating dock system indicating that the system meets or exceeds the requirements of the Contract documents.

G. The Engineer will evaluate the technical acceptability of each system and make recommendations to the Owner, who will make the final approval of the floating dock system.

H. Test Data and Certifications: Submit test reports, certification of materials, manufacturer’s product data, etc., indicating compliance with the Contract Documents:

1. Concrete mix design.
2. Concrete strength test reports.
3. Cement.
4. Polystyrene or polyurethane foam.
5. Reinforcement (galvanized and epoxy coated).
6. Polypropylene fibers.
7. Timbers (grade and pressure treatment).

8. Fasteners and hardware.
9. Structural steel.
10. Aluminum structural sections, pipe and tubing.
11. Aluminum woven wire mesh guards.
12. Gangways.
13. Cleats.
14. Dock bumpers.
15. Electrical junction boxes and conduit.
16. Pile caps.
17. Trough liner.
18. Floatation water absorption test.
19. Non-slip finishes.
20. Coatings and paints.
21. Welding Certificates
22. Other such tests.

I. Manufacturer’s written instructions for shipping, handling, storage, protection, and installation of all components.

J. Manufacturer’s Certificate of Proper Installation.

K. Guarantee and Warranties and Operational Manuals.

1. Submit sample of each Guarantee or Warranty prior to the first application for payment. Submit actual Guarantee or Warranty prior to application for final payment.
2. Submit Operational Manuals prior to application for final payment.

A. Quality Assurance

3. Submit design engineer, manufacturer, installer and other appropriate information.

1.6 Quality Control And Assurance

A. Qualifications:

1. Design Engineer (designer): Registered professional engineer valid in the state of the project with not less than five years experience with similar projects.
2. Manufacturer: Manufacturer of the floating dock system shall have not less than five years of experience with similar projects. Submit listing of similar completed projects, include name and contact information of reference.
3. Installer: Approved by the manufacturer.

B. Floating dock system shall be the product of a manufacture specializing in the production of concrete floating dock systems with a minimum of 10 years experience in the design and manufacture of concrete floating piers.

C. Where precast concrete floats are manufactured by specialists in plants not currently enrolled in the PCI “Quality Control Program,” produce a product quality control system in accordance with PCI MNL-116 and perform concrete and aggregate quality control testing using an approved independent commercial testing laboratory. Submit test results to the Engineer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

E. At the option of the Owner or Engineer, the floats shall be inspected prior to being transported to the project site. The Contractor shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of the inspection at the plant will affect the Owner's right to enforce contractual provisions after the units are transported or erected.

1.7 Engineering Drawings And Calculations

A. The Contractor shall design the complete floating dock system by a qualified professional engineer, using the performance requirements and design criteria indicated.

B. Submit signed and sealed engineering drawings, calculations, and specifications for the floating docks, piles, gangways, and other items necessary to construct the floating dock system. All calculations, drawings, and specifications shall be signed by a qualified professional engineer registered in the State of the project in accordance with State Law.

C. Submit a general layout drawing of the proposed concrete floating dock system giving all dimensions, clearances, and anchorage locations.

D. Submit detail and sectional drawings for the proposed floating dock system showing the following items:

E. Floating dock system layout.

1. Main walkway docks.
2. Finger docks.
3. Utility troughs.
4. Gangways.
5. Pile guides and corner knee brace assemblies.
6. Anchor piles.
7. Flotation system.
8. Location and anchorage of mooring fittings.

A. Dead load and live load freeboard.

B. Float connections, including heavy timber wales and connections of the finger docks to main walkway docks, and main walkway docks to marginal docks.

C. Accommodations for utilities.

D. Structural calculations for the proposed floating dock system, including the heavy timber wale system, accounting for gravity dead and live loads, and lateral loads from waves, wind, berthing impact and current, as applicable.

E. Drawings shall be accurately drawn to scale and adequately dimensioned so as to indicate the relevant sizes of all structural members, types of material, finish thickness, gauge, and other pertinent information for complete evaluation of the system. Bidder shall indicate the number of anchor piles required to secure its dock system, the loads applied to the piles, and the location of the piles along the entire dock system, including the finger docks. The minimum number of piles shall be as shown on the Drawings.

F. Drawings shall be presented using a minimum 11 x 17 inch or 22 x 34 inch drawing format.

1.8 Guarantee

A. Contractor shall execute and deliver to the Owner, before Final Completion, a guarantee. The Contractor shall guarantee that all components of the floating dock system have been properly designed, manufactured and installed, and are free from defects in material and workmanship. For the period of the guarantee, defined as one year from the Owner's date of acceptance, the Contractor shall furnish and install, without additional cost to the Owner, any part or assembly, which examination shall disclose as defective in materials and/or installation.

B. The guarantee shall cover repair of any defects or damages which may develop within the guarantee period, from date of Final Acceptance of the Work performed under this Contract, provided said defects or damages are caused by inadequate design, manufacture, or installation of the concrete floating dock system. If the defects or damages are not repairable, the defective or damaged portion or assembly shall be removed and replaced, at no additional cost to the Owner, to its original "as-new" condition.

C. Acts of nature producing conditions exceeding the design criteria set forth in these Specifications, shall not be covered by this guarantee.

D. Guarantee Requirements:

1. Floatation Material and Float: At the end of the guarantee period, the deck surface shall float not more than 1 inch below the freeboard under dead load as specified in the Contract Documents and the float shall show no signs of unexpected deterioration which would cause future loss of freeboard. Floats shall be replaced and installed by the Contractor, at no cost to the Owner, if this requirement is not met.
2. Deck Material: At the end of the guarantee period, the deck material shall remain structurally sound and free from major cracks and spalls. Any part of the deck which is not structurally sound or which has developed spalls or significant cracks, in the judgment of the Engineer, shall be removed and replaced by the Contractor, at no additional cost to the Owner.
3. Framing and Connections: Structural damage resulting from defective material or workmanship during the guarantee period, such as broken welds, broken bolts, bent, fractured, or splintered member, shall be replaced or repaired by the Contractor, at no additional cost to the Owner.
4. Anchorage: Any damage resulting from defective pile guides during the guarantee period shall be repaired by the Contractor, at no additional cost to the Owner.

E. Owner will give notice in writing of apparent defects in the floating dock system, to the Contractor immediately upon observance. The Owner will complete an "end of guarantee" inspection on the anniversary of the guarantee and will notify the Contractor of all apparent defects within 2 weeks of the inspection.

1.9 Operation And Maintenance Manual

A. Contractor shall furnish three copies of a manual containing detailed written instructions for operating and maintaining (O&M) the floating dock system. Complete and detailed instructions shall be furnished on the repair or removal and replacement of walkway dock sections, finger docks, and all major components of the floating dock system and gangway.

B. The O&M Manual shall include schedules and maintenance procedures for all elements, including but not limited to, concrete surfaces, timbers, wales and rub rails, hinges, pile guides, and all commercially available components used.

1.10 Shipping, Handling, And Storage

A. Ship and handle all material comprising the floating dock system so as not to cause corrosion, damage, or discoloration.

B. Materials delivered and stored at either the staging area or the jobsite shall be properly stored on dunnage, or by other appropriate means, to prevent direct contact with the ground and causing damage or discoloration.

1.11 Design Parameters

A. General: The design of the floating dock system, including the anchorages, wales, cleats, and connections, shall include but not be limited to the following:

1. Deterioration of extreme fiber stresses in major members under combined loading conditions applied simultaneously to finger docks and main walkway docks.
2. Effects of combined loading conditions on the connections.
3. Transfer of vessel loads to cleats, from cleats to timber wales, and from timber wales to the floating dock system.
4. Transfer of finger dock and main walkway dock loads to anchor piles.
5. Detail design at anchor pile framing and connections, including loads into piling, to adequately and safely secure the entire floating dock system under the specified design loads.
6. Detail design of a corner knee brace assemblies to resist indicated combined loading conditions.
7. Transfer of forces by use of adequate bracing, struts, bolting, etc., including utility trough internal braces as required.
8. Flotation calculations for all typical system components, in particular those subject to concentrated dead or live loads, such as gangway landing floats.
9. Detail design of splices for loads transferred from wale to float and from wale to wale.

B. Design Loads: The floating docks, anchorages, timber wales through-rods, cleats, and connections shall be designed in accordance with applicable local, state, and federal codes and standards. The reference *Marinas and Small Craft Harbors*, by Tobiasson and Kollmeyer, Second Edition; shall be considered the minimum standard for design. The design shall accommodate the appropriate loading conditions and combinations, including those indicated herein. These specifications shall carry precedence in case of a conflict with referenced material. The contractor shall notify the Owner and the Engineer in writing of any such conflicts noted.

C. Design Vessel:

10. Ranging from 20 to 30± feet Length Overall (LOA) enforcement vessels.
    a. 8 to 10± foot beam.
    b. 7,500± pounds displacement.
    c. 18+ inch draft maximum on the dock sections fully loaded.

D. Dead Loads, Vertical:

1. The floating dock system shall support the calculated dead load with a freeboard of not less than 24 inches upon installation and acceptance. Maximum freeboard allowable of 21 inches.
    a. Dead loads shall include the weight of all framing, connections, decking, floatation units, walers, pile guides, and other structural components, in addition to all permanently attached features such as gangways, equipment, and utilities.
    b. At the time of acceptance, the dock shall be within ±1 inch of the calculated freeboard.
    c. When evaluated one year after acceptance, the dock may loose no more than 1 inch of freeboard from that measured at acceptance.
    d. When evaluated five years after acceptance, the dock may loose no more than 2 inches from that measured at acceptance.
2. Floats shall be designed to float level with no live load applied. The decks of the floating dock shall be within the followings tolerances of being level:
    a. Longitudinal slope shall be not more than 1/2 inch in 6 feet of length (0.4 degrees) when accepted or more than 3/4 inch in 6 feet (0.6 degrees) at the end of five years.
    b. Transverse slope shall be not more than 1/2 inch across the total width.

c. The finger piers shall have their outer ends level with not more than 2 inches higher than the elevation of the main walk where they attach.
d. Deck surfaces between adjacent dock units shall be at the same elevation with no more than 1/8 inch differential.

E. Live Loads, Vertical:

1. The floating dock system shall support a uniform live load of not less than 60 pounds per square foot with a freeboard of not less than 20 inches.
2. The floating dock system shall support a concentrated load of 400 pounds applied over a 2 square foot area at any location with a freeboard of not less than 6 inches. For the finger floats, the concentrated load shall be applied not closer than 12 inches from the outer end.
3. The finger floats shall support a 200 pound applied to one outer corner of the float with no more than 2 inches per 3 feet of width differential in freeboard between the outer corners of the finger float at the time of acceptance, nor more than 3 inches at the end of 5 years.
4. In addition, the main and finger floats shall not heel more than 6 degrees when loaded with the design uniform live load on one-half of the float width.

F. Loads on Gangways:

1. Gangway shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
   a. Uniform Load: 100 pounds per square foot.
   b. Concentrated Load: 400 pounds over a 1 square foot area.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
3. Limit deflection of framing members to L/240 or 1/4 inch, whichever is less.
4. Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
   a. Handrails and Top Rails of Guards:
   b. Uniform Load: 50 pounds per linear foot applied inward, outward, or parallel to the railing.
   c. Concentrated Load: 200 pounds applied inward, outward, or parallel to the railing.
   d. Uniform and concentrated loads need not be assumed to act concurrently.
5. Infill of Guards:
   e. Concentrated Load: 50 pounds applied horizontally outward on an area of 1 square foot.
   f. Infill load and other loads need not be assumed to act concurrently.
6. The dock on which a gangway rests shall have sufficient floatation so that the dead load of the gangway shall not induce more than 1/8 inch per foot of length longitudinal slope in 20 feet on the dock nor more than 1/4 inch per foot of width transverse slope on the dock. In addition, it shall have sufficient floatation so that the loss of freeboard due to a gangway load based on a 50 pound per square foot live load does not exceed 8 inches.

G. Wind Loads, Horizontal:

1. The floating dock system shall be designed for a wind load from any direction acting on the floats, piles, and moored vessels with 100 percent occupancy based on a basic wind speed (unfactored) of 85 miles per hour, 3 second gust (60 miles per hour fastest mile velocity).
2. The floating dock system shall be designed for a hurricane level wind load acting on the floats and piles, with 0 percent occupancy, based on a basic wind speed of 120 miles per hour, 3 second gust (100 miles per hour fastest mile velocity).

a. A surge level of elevation +10 feet NGVD shall be assumed for the calculation of the pile forces.

3. Compute loadings in not less than two different directions: parallel to and perpendicular to the centerline of the main walkway docks.

H. Current Loads on Floats, Piles, and Vessels, Horizontal:

1. Minimum current velocity shall be assumed as 2 feet per second, oriented parallel to the existing bulkhead which is perpendicular to the floating dock.
2. Minimum current pressure: 10 pounds per square foot acting on the projected area of the dock, piles, and moored vessels, assuming full occupancy.
3. Negative lift or Squat: The floats shall be designed to account for downward suction on the leading edge of the structure, with a force of not less than 5 pounds per square foot.

I. Vessel Berthing Impacts and Mooring Forces: The dock bumper system and applicable element shall be designed for anticipated design vessels impact and mooring forces at any point on the floats, including the ends of the finger floats.

1. Impact Velocity: 2 feet per second.
2. Impact Angle: 10 degrees to the centerline of the float.
3. Wind speed at mooring: See paragraph Wind and Surge Loads, herein.
4. Mooring Load: Line pull acting in any direction at up to a 45 degree angle from the horizontal

J. Wave and Surge Loads:

1. Wave height, period, and other factors shall be computed based on the methodology presented in the U.S. Army Corps of Engineers "*Shore Protection Manual*" or the Naval Facilities Engineering Command Design Manual 26.2 "*Coastal Protection*" or similar approve method.
2. The minimum wave shall be as follows:
   a. With moored vessels: 2.1 feet high wave with a period of 2.6 seconds.
   b. Without moored vessels: 3.4 feet high wave with a period of 3.2 seconds. The water surface elevation shall be assumed to be at +10 feet, minimum.
   c. Fetch shall be assumed to be not less than 1 mile.

K. Load Combinations: The floating dock system, including the pilings, shall be designed for the load combinations specified in the latest edition of *ASCE-7 Minimum Design Loads for Buildings and Other Structures*:

1. Load cases shall be combined based upon their probability of simultaneous occurrence, and in accordance with applicable codes and standards. Calculations shall be performed for wind and current loads both parallel and perpendicular to the pier.
2. The following load combinations shall be among those investigated:
   a. Dead load plus Live Load (uniform and concentrated).
   b. Dead load plus wind loads perpendicular to the main walkway docks with 100 percent occupancy.
   c. Dead loads plus wind loads parallel to the main walkway docks with 100 percent occupancy.
   d. Dead load plus wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with 100 percent occupancy.
   e. Dead load plus wind loads parallel to the dock in question, plus wave loads parallel to the dock in question with 100 percent occupancy.
   f. Dead load plus wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with 100 percent occupancy.

g. Dead load plus hurricane wind loads parallel to the dock in question, plus wave loads parallel to the dock in question with zero percent occupancy at surge level elevation.
h. Dead load plus hurricane wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with zero percent occupancy at surge level elevation.
i. Dead load, plus current forces, plus berthing impact forces.

L. Dimensions:

1. All relevant control dimensions shall be as indicated in the Contract Documents.
2. The proposed floating dock system manufacturer may make adjustments in the overall float dimensions to accommodate its proprietary dock system's standard dimensions, or adjustments to provide structural integrity.
3. If float widths are increased by the floating dock system manufacturer, the control dimensions of the marina, such as clear slip widths, fairway width, number and size of slips, etc., shall also be increased to maintain these control dimensions.
4. All proposed dimensional changes made by the floating dock system manufacturer shall be pointed out in writing to the Owner and Engineer and in the submittal of the floating dock drawings.

PART II – PRODUCTS

2.1 General

A. Use materials compatible with a marine saltwater environment. These materials shall be resistant to corrosion, sunlight, marine organisms, and other destructive features associated with a marine environment.

B. The floating dock system shall consist of modular sections designed in such a manner that modules may be replaced with standard modules in case of repairs. Individual float modules shall not be longer than 20 feet.

C. Walking surface of floating docks shall be level and flush with respect to the adjacent floats and shall provide a skid free surface under wet conditions.

D. The floating dock system shall be warranted against sinking, excessive water absorption, cracking, leaking, and against structural failure under design load conditions.

E. The floating dock system shall be anchored by the use of precast pre-stressed concrete pilings, or steel piles, or an approved alternate material. Timber piles will not be allowed. The tops of pilings shall extend a minimum of 5 feet above the 100-year storm surge elevation unless otherwise approved by the Engineer, and shall be capped with a plastic pile hat.

2.2 Prefabricated Float Modules

A. General:

1. Float modules shall be shop-fabricated in a factory-controlled environment, and shall not be site-fabricated.
2. Float modules shall be sized so that a single module (excluding walers) is used to attain the indicated pier width. The use of more than one module connected side by side to attain pier width is unacceptable.
3. Float modules shall be structurally connected by a treated timber wale or other system that will allow replacement without affecting the float modules. Connection methods that create structural failure of the float module when overstressed will not be allowed.

4. Special floats may be designed to support additional concentrated loads as imposed by gangways, utility boxes, or other equipment. Modules with special loadings shall have the same freeboard as standard modules without special loading, so that there will be no residual stresses or tilting when modules are interconnected.
5. Floats shall consist of a solid, closed-cell flotation material core, either preformed or expanded in place, fully encased by concrete or marine grade aluminum. Floatation material may be either polystyrene or polyurethane.
6. Floats shall be designed and manufactured such that no tensile stresses are induced into the concrete encasement or the concrete deck structure.

B. Concrete Deck:

1. The deck structure shall be of concrete that is not less than 2.5 inches thick. Decks shall have integral stiffening beams sized as required, but to provide at least 1 inch cover over the galvanized through-rods at 12 inch centers. In addition, an integral perimeter beam shall be provided.
2. Extend the deck structure concrete down the sides and beneath the bottom of all junction boxes, handholes, and utility troughs, to prevent embedded items from debonding and settling under foot traffic.
3. Concrete deck structure shall be reinforced with either mild steel reinforcement or fiber reinforcement. Mild steel reinforcement in the form of wire fabric shall be galvanized and in the form of bars which will be epoxy coated.
4. Concrete deck surface shall have an integral, nonslip finish prior to final brooming. Deck surface along edges and at junction boxes shall receive a trowel finish. Surface shall be finished to permit proper drainage so that water will not puddle on the deck. Provide chamfered or tooled radius corners on all top edges.

C. Precast Concrete Floats:

1. Concrete for encasement of floatation material shall be reinforced and cast monolithically in a single pour. There shall be no cold joints of any type.
2. Concrete encasement for float sides and bottom shall be sufficient (1.5 inches minimum) to protect the floatation core from damage due to marine organisms and borers, fuel spills and boat impact; and also shall resist attack by concrete corers of the pholad family.
3. Concrete deck structure and encasement shall be reinforced with either mild steel reinforcement or fiber reinforcement. Mild steel reinforcement in the form of wire fabric shall be galvanized and in the form of bars which will be epoxy coated.
4. Extend the deck structure concrete down the sides and beneath the bottom of all junction boxes, handholes, and utility troughs, to prevent embedded items from debonding and settling under foot traffic.
   a. Concrete encasement shall be structurally connected about all six sides (top, bottom, sides, and ends).
   b. Floats without concrete bottoms or ends will not be allowed.

D. Concrete Mix Design:

1. Prior to the manufacturing of any flotation units, the concrete mix design shall be approved by the Engineer. Concrete shall have a minimum twenty-eight (28) day compressive strength of 4,000 pounds per square inch, per ASTM C94 with a minimum cement content of 564 pounds per cubic yard and a maximum water/cement ratio of 0.45. Floats made of concrete with less than specified strength will be rejected.
2. Concrete for the top surface of the flotation units shall contain polypropylene fibrous reinforcement at a rate recommended by its supplier.
3. Portland cement shall comply with ASTM C150, Type II.

4. Fly Ash and Pozzolan shall comply with ASTM C618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Type N and F.
5. Ground Iron Blast-Furnace Slag shall comply with ASTM C989. Grade 100 or 120.
6. Coarse and fine aggregate shall comply with ASTM C33. Coarse aggregate shall be natural rock or expanded shale (ASTM C330), perlite is not acceptable. Fine aggregate shall be natural sand, screenings are not acceptable. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalies in the cement.
7. Water shall be clean, fresh and potable.
8. Admixtures shall comply with ASTM C260 and/or ASTM C494. Admixtures containing chlorides or chloride ions shall not be used.
9. Concrete shall be air entrained between 5 percent and 8 percent as measured in accordance with ASTM C231.
10. Corrosion Inhibitor: Calcium nitrite, ASTM G109, added at the rate of 4.5 gallons per cubic yard.
11. Concrete slump shall be 3 inches, plus or minus, 1 inch as measured in accordance with ASTM C143, at the forms.
12. At least 3 compression test cylinders shall be taken from each 50 cubic yards, or any part thereof, placed in a single day. The average of two compression test cylinder breaks will yield the 28 day strength. Concrete shall be placed and tested in accordance with ASTM C39. Cylinders shall be cured under similar conditions as floats.

E. Forms:

1. Concrete shall be cast in steel forms, with a smooth, true surface. Forms shall be designed in such a way to prevent unsightly finished surfaces or definite lines that could result in crack planes. Any rough edges, form marks, or defects shall be cleaned, ground smooth, or patched.
2. Forms shall have a tolerance of not more than 1/8 inch from the dimensions shown on the shop drawings. Concrete encasements cast from forms more than 1/2 inch out of square (when measured diagonally) shall be rejected.
3. Concrete shall be vibrated internally and/or externally to assure a smooth dense finish. The placement will be such that the concrete float is monolithic with no cold joints in any part of the finished float.

F. Concrete Reinforcement:

1. Galvanized welded wire fabrication used as concrete reinforcement shall be not less than 2 inches x 2 inches - 14/14. Welded wire fabric is required in the deck, sides, and the bottom sections with a minimum of a 2 inch return to the sides and ends. Where splicing occurs, the overlap will be a minimum of 8 inches.
2. Wire mesh shall meet ASTM A185 or ASTM A497 and shall be galvanized. Provide flat sheets of welded wire fabric, rolled fabric is not acceptable. Maximum fabric grid is 2 inch x 2 inch.
3. Reinforcing steel bars shall be Grade 40 or 60, conform to ASTM 615, and shall be epoxy coated in accordance with ASTM A775 or galvanized in accordance with ASTM A767.
4. Polypropylene fibers shall be specifically designed for compatibility with the aggressive alkaline environment of portland cement based composites, complying with PCI-MNI-128.

G. Curing, Handling, and Storage:

1. Except as otherwise approved, floats shall be cured for a minimum of seven (7) days before transporting or assembling. The Contractor shall select his own method of curing and be responsible for the results, except that all curing shall include the application of a curing compound as soon as practical after finishing and that the

modules be placed under cover with complete protection from direct sunlight, wind, and freezing for a period of not less than three (3) days.

2. The curing compound shall meet the following requirements:
    a. Must be a balanced combination of sodium, potassium, and meta silicate compounds with a surface reducing agent.
    b. Must not contain any chlorides, waxes, resins, or oils.
    c. Must not separate or settle out.
    d. Must not leave a residue on the concrete that would prevent the application of sealers or epoxies.
    e. Must combine chemically with the free lime in concrete to form a barrier to reduce moisture evaporation to a level that allows the complete hydration of the concrete.
3. Contactor shall take care in establishing handling methods that avoid damage to the floats during form removal, storage, handling, assembly, and installation.
4. Storage of the floatation units shall be on level surfaces on timber dunnage, and it shall be the responsibility of the Contractor to determine how high units shall be allowed to be stacked without damage.
5. Floatation units shall be protected from damage from any cause.
6. Any damaged unit shall be rejected and removed from the project site.

H. Cracking**:**

1. Cracking of the concrete shall be minimized by the Contractor through proper design and control methods. Cracks which are determined to be structural in nature and not located in the deck of the module, may be repaired upon approval of the Engineer. Cracks that are determined to be structural in nature which are located in the deck of the floatation unit shall be patched, if approved by the Engineer, in accordance with methods and materials approved by the Engineer.
    a. Hairline cracks which are visible and are less than 0.01 inches in width may be acceptable, except that cracks larger than 0.005 inches in width for surfaces exposed to the weather or water shall be repaired.
    b. Floats containing cracks greater than 0.01 inches in width shall be approved by the Engineer prior to being repaired.
2. Any float that is structurally impaired or contains honeycombed sections deep enough to expose reinforcing shall be rejected.
3. Cracks located below the structural deck that do not indicate migration to the deck surface may be repaired with the approval of the Engineer.
4. Cracks which are open or which exceed 1 foot in length shall be V-cut out and patched with a non-shrink patching compound approved by the Engineer.
5. Excessive cracking as solely determined by the Engineer in a single flotation unit shall be cause for rejecting that unit. Any frequently recurring pattern of cracking shall be considered indicative of inadequate design, improper handling or improper production procedures, and the Contractor shall immediately take corrective action to remedy.
6. Rock pockets exceeding 1 inch in diameter or 3/8 inch in depth or honeycombing, without exposed reinforcing, shall be patched with an approved non-shrink grout of a color similar to the cured concrete. Any pockets, which expose mesh or rebar shall be chipped out, cleaned, and filled with an approved epoxy-patching compound if approved by the Engineer.

I. Floatation Material (Foam)

1. Floatation material shall be closed cell, expanded polystyrene (EPS) meeting Federal Specification C-578-85 or ASTM C578.
    a. Density: 0.95 to 1.10 pounds per cubic foot.

b. Compressive Strength: 20 pound per square inch minimum at 5 percent deflection.
c. Tensile Strength: 40 pounds per square inch minimum at break.
d. Shear Strength: 25 pounds per square inch minimum at break.
e. Water absorption: Shall not exceed three (3) percent by volume when measured in accordance with ASTM C272.

2. Expanded polystyrene shall consist of solid sections with no more than four laminated sections and shall contain no reground material.
3. Surface shall be pressed, polished, free from pits, blisters, cracks, dents, waviness, heat marks, or deep scratches. Variation in color indicative of damage or deterioration shall not be accepted.
4. The floatation material shall be fully encased in a protective covering such as concrete, polyethylene, or similar material that will provide a watertight coating and protect against damage during shipping and construction; vessel impact; stresses from structural loading; degradation from sunlight; and damage from marine organisms, oil, salt water, and other deleterious materials likely to be encountered in a marine environment. Floatation must be fully encased on all sides.
5. Surfaces of the finished planks shall lie in normal planes so that the plank, when installed in final position in the float shall lie in a true horizontal plane with the water. Edges formed by molding or cut sections may be either rounded or squared.

J. Through-Rods:

1. Steel through-rods shall conform to ASTM A36, sized as required by design (3/4 inch diameter minimum), and shall be galvanized by the hot dip process in accordance with ASTM A123.
2. Through-rods shall either be sleeved or placed in PVC tubing to facilitate removal and replacement.

2.3 Wales, Bull Rails, Rub Rails, And Other Timber And Wood Components

K. Timber components shall be Southern Pine, Grade No. 1, or better, as required by structural analysis, and shall conform to the rules of the SPIB and ASLS PS-20-70. Member sizes shown on the Drawings are to indicate general design concept only. Timber type, grade and size shall be selected based upon the load criteria specified in the paragraph entitled "Design Parameters".

L. Timber shall also bear the quality mark of a certified inspection agency such as the Southern Pine Inspection Bureau or the Timber Products Inspection Bureau.

M. Timber shall be pressure treated with Chromated Copper Arsenate (CCA) conforming to AWPA Standard C2 and C18 (marine use treatment) to a 2.5 pounds per cubic foot retention minimum, and identified with a quality mark by and approved inspection agency certified by the American Standard Lumber Committee (ALSC). The presence of AWPA quality mark LP-22 may be accepted as evidence of conformance to the requirements for preservative treatment, at the Owner's option. After treatment all wood shall be kiln dried to a maximum moisture content of 15 percent and shall be stored, handled and transported in accordance with AWPA Standard M4. Every cut or hole made in the field shall be given field treatment in accordance with AWPA Standard M4. Application of paint shall not constitute field treatment for preservation.

N. Timbers shall be drilled and cut before pressure treatment, as much as possible.

O. All connections for timber wale to float and wale to wale shall be bolted with through-rods at 12 inch centers, maximum. Use two 5/8 inch shear plates or 4 inch split rings with adequately sized plate washers (1/4 inch thick minimum) and lock nuts to distribute loads without damaging the timbers.

2.4 Steel Assemblies

A. Steel assemblies such as pile guide frames, corner knee braces connecting finger docks to main docks and main docks to marginal docks, and utility trough internal braces shall be designed and shop fabricated in conformance with AISC "Specifications" to accommodate the loads specified herein.

B. Steel shall conform to ASTM A36 or ASTM A992 and assemblies shall be galvanized by the hot dip process in accordance with ASTM A123 after fabrication.

C. Minimum member thickness shall be 1/4 inch.

D. Welding shall conform to the AWS Steel Welding code requirements. If the structural requirements do not require a fully welded joint section, provide 1/8 inch seal welds in the joint so that the final joint is a fully welded joint, with no cracks, openings, crevices, etc., to collect saltwater. All welds shall be visually inspected and tested or reworked if questionable.

E. Pile guides shall be a multiple roller type with one roller per side of pile, and provide for full vertical movement of the floating dock system without inducing binding or torsion into the system. Pile guides shall be designed to transmit all lateral loads from the floating dock system to the anchor piles without causing damage to the float or the pile. Rollers shall be of ultra-high-molecular-weight (UHMW) polyethylene material with ultraviolet light inhibitor added and ANSI Type 304 or 316 stainless steel axles.

F. Corner knee braces shall be designed and fabricated to act as a rigid connection of finger dock to main walkway dock. Minimum brace size shall be 4 foot by 4 foot and shall be increased in size as required by the structural design calculations.

G. Braces shall be installed on each float on the inside of the utility troughs and shall provide structural continuity of the floats where the deck structure is interrupted by the trough, where required by the structural design calculations.

H. Fasten all structural steel assemblies and guides to the floating dock by means of through-rods at 12 inch centers, or closer if indicated by structural calculations. Internal utility trough braces shall be fabricated so that they may be removed by loosening only the nuts securing the specific brace.

I. All pile guide hardware, including bolts, nuts, axles, and other fasteners shall be stainless steel Type 316.

2.5 Hardware

J. Clip angles, plates, bars, etc., shall conform to ASTM A36 or ASTM A992, as applicable.

K. Unfinished bolts and nuts shall conform to ASTM A307.

L. High strength bolts and nuts shall conform to ASTM A325X, with threads excluded.

M. All steel members, assemblies, guides, and parts shall be galvanized by the hot dip process in accordance with ASTM A153.

N. Stainless steel screw and bolts shall comply with ANSI Type 316.

O. Fasteners

1. Bolts, nuts, washers, screws, nails, and other fasteners shall be Type 316 stainless steel or hot-dipped galvanized per ASTM A153. Bolts shall conform to ANSI/ASME B18.2.1. Wood screws shall conform to ANSI/ASME B18.6.1.

P. Steel Through-Rod Connections (For Concrete Dock):

1. The minimum dimension for all through-rods for structural attachment is 3/4-inch thread diameter. All through-rods shall be placed within PVC sleeves cast in the float units. Walers shall be securely fastened to the concrete floats using galvanized or stainless steel through-rods, plate washers, and heavy hex pin lock nuts.
2. The quantity and configuration of the through-rods will be determined by the load calculations on each dock section. Through-rods shall be placed through each float unit within 6 inches of each end of that unit, and within 6 inches of each lumber splice.

2.6 Aluminum

1. Aluminum members shall be aluminum alloy 6061-T6 or approved alternative suitable for use in a marine environment. Aluminum members shall be designed in accordance with the Aluminum Design Manual by the Aluminum Association and the governing building code.
2. Contact between aluminum and dissimilar metals or concrete shall be avoided, except for the use of compatible stainless steel pins, screws, or bolts. Where potential for galvanic corrosion exists, the aluminum shall be isolated from direct contact with other metals or concrete by use of suitable non-conducting insulators or bushings.

2.7 Mooring Cleats

A. Mooring cleats and their connections shall be constructed of a corrosion resistant material and shall be sized to resist the calculated mooring loads, based on Appendix 3 of “Marinas and Small Craft Harbors” by Tobiasson and Kollmeyer, for the indicated wind speed.

B. Provide not less than the indicated number of cleats along the sides of docks.

C. Cleats shall have at least a 10 inch long horn with not less than 4,000 pound capacity and shall be fastened to the timber wales with at least two 1/2 inch diameter ASTM A325X high strength through-bolts, with hardened washers and double nuts.

D. The ASTM A325X high strength through-bolt assemblies shall be hot dip galvanized in accordance with ASTM A153 after fabrication. Tap threads of bolts and nuts after galvanizing to ensure tight and locked connection.

E. Each cleat shall be connected to the wale with a hot dip galvanized connection angle (1/4 inch minimum thickness), with the cleat bolts and the float thru-bolts passing through the angles, as shown.

2.8 Dock Bumper

A. Provide dock bumper strip continuously along longitudinal edges and ends of the floats. Bumpers shall have the ability to protect boats from damage or discoloration due to normal docking procedures.

B. Material:

1. Flexible polyvinyl chloride – custom formulated 90 Durometer PVC with an added UV stabilizer and fungicide, in non-yellowing white color, or Owner-approved equal.
2. Bumper material shall not be affected by sunlight, saltwater, oil, gasoline or other agents or actions common to a marine saltwater environment.

C. Size:

1. Size to be determined by engineering calculations.
2. Horizontal Bumpers: 3.5 inch minimum vertical dimension (similar to Merco Marine #RR-5002).

3. Corner Bumpers: 3.5 inch minimum vertical dimension (similar profile to Merco Marine #RR-5002, except shaped for corner installation), 1-piece, L-shaped bumper specifically designed to protect vertical corners, at all outer vertical corners on the concrete floating docks.

2.9 Pile Caps

A. Pile caps shall be made from fiberglass or rotationally molded plastic formulated for a marine environment.

B. Off-white colored, cone-shaped caps shall be sized to fit the tops of all piles.

C. Provide one pile cap per pile.

2.10 Gangways

A. Design, supply and install aluminum gangway for access to the floating docks.

B. Gangway shall be designed for the live load and deflection criteria specified herein with required safety factors on working stress which conform to those set forth in the Aluminum Association “Specifications for Aluminum Structures”.

C. Gangways shall have a minimum clear inside walkway width indicated

D. Walking surface shall have an Owner-approved non-skid surface.

E. Gangway end connections shall allow unrestricted vertical movement through the water level changes.

1. Gangway shall be hinged at their shore end, with a stainless steel piano hinge or comparable design to carry the load, securing gangway to fixed structure, and allow full rotation of gangway to accommodate tidal variation.
2. The float end shall incorporate ultra high molecular weight polyurethane (UHMW-PE) wheels or rollers or be fitted with UHMW-PE pads of adequate bearing area. A stainless steel plate shall be provided on the deck surface of the float for the gangway wheels or rollers or pads to travel on.
3. A hinged transition plate shall be provided on each end of the gangway, as necessary to maintain a maximum 8 horizontal to 1 vertical (8:1) slope. Transition plates shall be designed so as to not damage or mar the floating pier surface.

F. Gangways shall be aluminum alloy 6061-T6 extruded in accordance with the applicable sections of Federal Specification QQ-A-200. Stainless steel bolts, rods, nuts and washers shall be ANSI Type 316.

G. Gangway shall have continuous handrails that are a minimum of 34 inches above the walking surface, but not more than 38 inches.

H. Landing and Gangway Guards:

1. Provide continuous gangway guards as part of the guardrails, of woven wire mesh panels.
2. Woven wire mesh guard panels shall be provided between the top and bottom rails on gangways to prevent passage of a 4 inch sphere. Mesh shall be of aluminum alloy 6061-T6 construction, with minimum 1/4 inch diameter wires spaced at 4.0 inch centers maximum, with lock-crimp intersections. Mesh shall be contained in an aluminum framework that is, in turn, fastened to the rails and posts.

PART III – EXECUTION

3.1 Inspections

A. At the option of the Owner, the Contractor shall not fabricate floats until an inspection is made by the Owner's inspector of the manufacturer's facility and procedures. The manufacturer's facility shall be open to the Owner, the Owner's representative, and the Owner's inspector at any time that the concrete floating dock system for this project is being manufactured.

B. Contractor shall inspect all of the concrete floating dock system components and assemblies immediately upon delivery to the site to ensure that each component and assembly is in an undamaged condition.

C. Contractor shall submit a written statement outlining all damaged dock system components to the Owner within 7 days of receipt. The statement shall also indicate his acceptance of the components received, method of repair for those components that are repairable, and a schedule of replacement components for those that are not repairable.

3.2 Workmanship

A. Contractor shall use only experienced personnel to perform the Work, and shall provide a qualified company employee to perform full time inspection and supervision of the manufacturing assembly and floatation process, and shall assume full and complete responsibility for successful manufacture, assembly and anchorage of the system.

B. Work not representing a finished and acceptable appearance shall be rejected.

C. Finished metal members shall be free from twists, bends, distortions, open joints, sharp edges and burrs. Ends of exposed metal members shall be rounded or beveled. All coping and mitering shall be done with care. Galvanizing shall take place after the metal components and assemblies are fabricated.

D. Minimize drilling and cutting of steel, after galvanizing. Where necessary, such holes and edges shall be painted with high zinc dust content paint. All welds over galvanized material shall be thoroughly cleaned and coated with two coats of cold galvanizing compound.

E. All welding shall conform to the requirements of the American Welding Society, "Welding code – Steel" (AWS D1.1). Welds shall be a solid and homogeneous part of the metals joined and shall be free from pits or scale, and shall be of full area and length required to develop the required strength for the intended use. If a structural weld is not continuous "all-around" for the full joint width, then 1/8 in. seal welds shall be used to complete the joint width so that no open joint or gap or crevice remains to collect saltwater.

F. Bolts, nuts and washers shall be set square with connecting structural members and the nuts shall be drawn tight. Lock washers shall be used to prevent nuts from loosening, after being properly tightened. High strength bolts shall be used where required to carry the design load, in accordance with the American Institute of Steel Construction Specifications "Structural Joints Using ASTM A325 or A490 Bolts".

G. Nails shall be driven to set the heads flush with the wood surface.

H. Timber members shall be counterbored wherever projecting bolt heads or nuts may damage boats or provide a hazard to dock users. Counterboring shall be sufficiently deep to permit installation of the bolts and nuts with washers well below the surface of the timber. The heads of dome head volts may project above the surface.

I. Connections between floats or other elements, such as lifting rings, shall not protrude above the level of the deck.

J. Connections shall be accomplished to permit removal and replacement of connectors without the necessity of removing other components for access. Connectors shall be of materials that are easily available and shall be positively contained so as to prevent their working free under anticipated wind and wave loading conditions.

K. Floats shall be rigidly connected to the wales, knee braces and pile guides by through-bolts.

L. The concrete floating dock system shall be anchored with a pile anchorage system. The pile anchorage system shall secure the floating docks under the most severe loading combinations, as specified under “Design Parameters” herein and at all water levels as indicated on the Drawings.

M. Float deck surfaces shall be sloped for proper drainage so that water will not puddle on the deck surface.

N. Floats shall set level in the water with the specified dead load freeboard as shown on the Drawings. Tolerance in freeboard shall be 1 inch, plus or minus, with maximum transverse tolerance of 1/8 inch per foot of float width.

O. Where gangways land on floating docks, additional flotation shall be provided such that the specified dead load and live load freeboard criteria are met under full live load for the gangway area.

P. Any potentially corrosive installation of dissimilar materials shall be properly insulated to eliminate corrosion in the marine environment. Aluminum in contact with steel shall be separated by a rubber gasket. Aluminum in contact with concrete shall be coated with thick coat of bituminous paint.

3.3 Manufacturer’s Services

A. Provide Manufacturer’s representative at the Site for installation assistance, inspection, and certification of proper installation.

3.4 Precast Concrete Floats

A. Place foam core in its correct position during the casting operation. Placement tolerance shall be 1/8 inch, plus or minus, in any direction. Core planks shall lie in a true horizontal plane with the water. Glue planks together with a water resistant glue that is compatible with the plank material.

B. Place PVC through-rod sleeves or sleeved through-rods in the floats at 12 inch centers maximum spacing, beginning 6 inches from each end of the float. Placement tolerance shall be 1/8 inch, plus or minus, in any direction.

C. Place steel forms in correct position to provide a smooth, true surface with 90 degree corners. Placements tolerance shall be 1/8 inch, plus or minus, in any direction. Forms shall be cleaned and oiled after each use.

D. Place reinforcement, as required by structural design, to provide the required concrete cover. Placement tolerance shall be 1/8 inch, plus or minus, in any direction.

E. Concrete shall be batched, mixed and delivered in conformance with ASTM C94.

F. Concrete shall be placed and vibrated in such a manner as to prevent air pockets, voids and honeycombing, and to provide a smooth dense finish and proper bond between the concrete and the foam core.

G. Moisture cure concrete floats for not less than 7 days in accordance with ACI 301. Moist curing shall begin immediately after finishing and shall not be interrupted.

H. A minimum of 4 through-bolts shall be provided in each float. Additional through- bolts shall be provided at timber wale splices, with a minimum of 2 through-bolts provided on each side of a wale, a knee brace and a pile guide.

I. Provide through-bolts at 12 inch centers, maximum spacing, with closer spacing as required by loads.

J. Through-bolt size (minimum 3/4 inch diameter) and spacing requirements shall be in accordance with the concrete floating dock system manufacturer's structural design calculations and approved shop drawings.

K. Coordinate placement of embedded items and anchor bolts with concrete floating dock system manufacture. Install anchor bolts located per manufacturer's requirements.

L. Covers of utility trench and junction boxes shall be flush with the walking surface and fastened with Type 316 stainless steel screws.

M. Construct mock-up floats with timber wales, corner knee braces and pile guides in the shop to make sure all components fit. Shop assemble sections of dock (walkway and fingers) as large as possible to permit shipping and handling to reduce field assemblage.

3.5 Crack And Float Damage Repairs

A. Cracks and damage caused to the concrete floats by shipping, handling or installing by the Contractor shall be repaired, or at the owner's direction, the concrete float shall be replaced.

B. Hairline cracks located below the structural deck that do not indicate continual migration to the deck surface may be repaired, with the approval of the Owner, or the concrete float shall be replaced.

C. Cracks which are open or which exceed 2 feet in length shall be V-cut and patched with an approved polymer modified cementitious mortar, applied in accordance with mortar manufacturer's instructions, with the approval of the Owner, or the concrete float shall be replaced.

D. Excessive cracking in a single concrete float shall be cause for rejecting that float. Any frequently recurring pattern of cracking shall be considered indicative of improper handling, fabricating or installing. It shall be corrected by replacement and appropriate changes in the Contractor's procedures.

E. Damage exceeding 1 inch in diameter 3/8 inch in depth shall be patched with an approved polymer modified cementitious repair mortar of a color similar to the cured concrete. Any damaged areas which expose mesh or rebar shall be chipped out, cleaned, and filled with an approved polymer modified cementitious repair mortar.

3.6 Timber Wales And Rub Rails

A. Rigidly fasten wales to concrete floats and wales to wales by means of through-bolts, shear plates and split ring connectors, as required by structural design calculations.

B. Stagger wale splices such that only one wale is spliced per concrete float. Locate splices no closer than 2 feet from the end of a float.

C. Rub rails shall be fastened to float with 16d galvanized nails spaced at 12 inch centers (maximum) in a staggered pattern. Rub rails shall be counterbored to conceal through -bolts, nuts, plate washers, lock washers, etc.

3.7 Structural Steel Assemblies

A. Fasten to concrete floats and wales by means of through-bolts at 12 inch centers, maximum spacing.

B. Provide at least 2 through-bolts to fasten each leg of an assembly to the floats.

3.8 Gangways

A. Provide for connections for gangways to bulkhead cap with stainless steel hinge assembly and stainless steel epoxy adhesive anchor bolts.

B. Provide stainless steel epoxy anchor bolts of adequate number, diameter and embedment to safely support gangway loads.

C. Install stainless steel plate on float for roller travel.

3.9 Cleats

A. Cleats shall be bolted to timber wales using 2 hot dip galvanized ASTM A325X high strength steel bolts. Bolts shall pass through the timber wale, with adequately sized plate washers and lock washers on the bottom.

3.10 Dock Bumper Strip

A. Install PVC dock bumper strip continuously along the longitudinal edges of dock floats, as indicated. Bumper shall protect boats from damage due to normal docking procedures.

B. Fasten dock horizontal bumper strips and vertical corner guards with aluminum nails of the number, size and spacing as recommended by the bumper manufacturer, not to exceed 6 inch center top and 12 inch center bottom.

C. Fasteners shall be flush with the surface of the bumper strips and corner guards, so that there are not sharp edges or protrusions.

3.11 Pile Caps

A. Fasten fiberglass or molded plastic pile caps to piles, as recommended by the pile cap manufacturer.

END OF SECTION 35 51 13

DIVISION 35 – WATERWAY AND MARINE CONSTRUCTION

SECTION 35 51 13

CONCRETE FLOATING DOCK SYSTEM

PART I – GENERAL

1.1 Description

A. The Work consists of a complete floating dock system to accommodate the indicated vessels and other requirements, including but not limited to the docks, gangways, mooring cleats, pile guides, piles, provisions for accommodating utilities, and dock accessories as indicated.

B. The floating dock system shall consist of individual precast foam-filled concrete floats interconnected with heavy treated timber wales, steel through rods, and fabricated structural steel bracing sub assemblies and pile guides.

C. The Contractor shall provide the final design and construction drawings for the complete floating system

D. The Contractor shall furnish all tools, equipment, materials, and supplies to perform all labor, supervision, fabrication, assembly, and installation of the floating dock system.

1.2 References

A. The following references may be referenced in this Section:

1. "Marinas and Small Craft Harbours," Second Edition, Bruce O. Tobiasson, P.E. and Ronald C. Kollmeyer, Ph.D.
2. "Ferry Terminals and Small Craft Berthing Facilities," MIL-HDBK-1025/5, Department of the Navy Naval Facilities Engineering Command (NAVFACENGCOM).
3. "Design: Small Craft Berthing Facilities," UFC 4-152-07N, June 2005, United Facilities Criteria (UFC).
4. "Planning and Design Guidelines for Small Craft Harbors," Revised Edition, 1994, ASCE Manuals and Reports on Engineering Practice-No. 50, American Society of Civil Engineers.

B. The following is a list of standards which may be referenced in this section:

1. International Building Code (IBC)
2. Army Corps Manual SR-2
3. American Institute of Steel Construction (AISC).
4. American Wood Preservers Association (AWPA).
5. AWPA C18, Standard for Pressure Treated Material in Marine Construction.
6. Concrete Reinforcing Steel Institute (CRSI).
7. American Concrete Institute (ACI).
8. ACI 211.2, Standard Practice for Selecting Proportions for Lightweight Concrete.
9. ACI 318-08, Building Code Requirements for Structural Concrete
10. ACI 301
11. American Forest and Paper Association (AFPA).
12. Southern Pine Inspection Bureau (SPIC).
13. Timber Products Inspection Bureau (TPIB).
14. National Electric Code (NEC), Article 555, Marinas and Boatyards.
15. American Society of Civil Engineers (ASCE): ASCE-7 Minimum Design Loads for Buildings and Other Structures
16. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
17. American Galvanizers Association (AGA): Inspection of products Hot-Dip Galvanized After Fabrication.
18. American Welding Society (AWS):
    a. D1.1, Structural Welding Code – Steel.

b. D1.2, Structural Welding Code – Aluminum.
c. D1.6, Structural Welding Code – Stainless Steel.

19. Precast/Prestressed Concrete Institute (PCI):
    a. PCI MNL-116, Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
    b. PCI MNL-120, Design Handbook, Precast and Prestressed Concrete.
20. ASTM International (ASTM)
    a. A36, Standard Specification for Structural Steel.
    b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
    c. A123, Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
    d. A153, Specification for Zing (Hot-Dip) on Iron and Steel Hardware.
    e. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
    f. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
    g. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
    h. A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
    i. A325, Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
    j. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
    k. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
    l. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
    m. A767, Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
    n. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
    o. A992, Specification for Steel for Structural Shapes for Use in Building Framing.
    p. C33, Standard Specification for Concrete Aggregates.
    q. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
    r. C94, Standard Specification for Ready-Mixed Concrete.
    s. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
    t. C150, Standard Specification for Portland Cement.
    u. C185, Standard Test Method for Air Content of Hydraulic Cement Mortar-AASHTO No.: T137.
    v. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
    w. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
    x. C272, Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
    y. C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
    z. C494, Standard Specification for Chemical Admixtures for Concrete.
    aa. D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
    bb. E985, Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

1.3 Contract Documents

A. The Contract plans are general in nature and show the basic system layout and details, with required nominal or minimal dimensions, size and number of boat slips, cleat locations, elevations, and materials.

B. The Contract Documents intent is to allow consideration of proprietary floating concrete dock systems of different manufactures, provided they meet the requirements of the contract plans and specifications, are constructed of the specified materials and minimum dimensions, and are of quality equal to or greater than that indicated.

C. The Contract Documents are not intended to be used as detailed shop or fabrication drawings for the manufacture of the floating dock system.

D. The floating dock system shall be manufactured, assembled, and installed based on the submitted design calculations, shop drawings, assembly drawings, and installation instructions furnished by the floating dock system manufacturer.

E. The floating dock system shall be designed and constructed in accordance with local, state, and federal codes and permits.

1.4 Coordination With Others

A. Coordination with the Owner's personnel and other contractors' personnel working on-site shall be part of this Contract and the responsibility of the Contractor.

B. Make whatever arrangements necessary to ensure that delivery and installation of the concrete floating dock system do not conflict with the work of other contractors. The Work under this Contract shall be completed in a manner such that it causes no delays to others.

1.5 Submittals

C. Submittals shall be in accordance with the following.

D. Reproduction of the Contract Documents is not permitted.

E. Catalog and product information shall be provided, on all commercially available products and equipment being offered for use. This information shall include manufacturer's name, address, phone/fax numbers, email address, part numbers and/or other information suitable for placing a replacement purchase order with the manufacturer.

F. Engineering design calculations, shop drawings, and assembly drawings, signed and sealed by the designer, regarding the proposed floating dock system indicating that the system meets or exceeds the requirements of the Contract documents.

G. The Engineer will evaluate the technical acceptability of each system and make recommendations to the Owner, who will make the final approval of the floating dock system.

H. Test Data and Certifications: Submit test reports, certification of materials, manufacturer's product data, etc., indicating compliance with the Contract Documents:

1. Concrete mix design.
2. Concrete strength test reports.
3. Cement.
4. Polystyrene or polyurethane foam.
5. Reinforcement (galvanized and epoxy coated).
6. Polypropylene fibers.
7. Timbers (grade and pressure treatment).

8. Fasteners and hardware.
9. Structural steel.
10. Aluminum structural sections, pipe and tubing.
11. Aluminum woven wire mesh guards.
12. Gangways.
13. Cleats.
14. Dock bumpers.
15. Electrical junction boxes and conduit.
16. Pile caps.
17. Trough liner.
18. Floatation water absorption test.
19. Non-slip finishes.
20. Coatings and paints.
21. Welding Certificates
22. Other such tests.

I. Manufacturer's written instructions for shipping, handling, storage, protection, and installation of all components.

J. Manufacturer's Certificate of Proper Installation.

K. Guarantee and Warranties and Operational Manuals.

1. Submit sample of each Guarantee or Warranty prior to the first application for payment. Submit actual Guarantee or Warranty prior to application for final payment.
2. Submit Operational Manuals prior to application for final payment.

A. Quality Assurance

3. Submit design engineer, manufacturer, installer and other appropriate information.

1.6 Quality Control And Assurance

A. Qualifications:

1. Design Engineer (designer): Registered professional engineer valid in the state of the project with not less than five years experience with similar projects.
2. Manufacturer: Manufacturer of the floating dock system shall have not less than five years of experience with similar projects. Submit listing of similar completed projects, include name and contact information of reference.
3. Installer: Approved by the manufacturer.

B. Floating dock system shall be the product of a manufacture specializing in the production of concrete floating dock systems with a minimum of 10 years experience in the design and manufacture of concrete floating piers.

C. Where precast concrete floats are manufactured by specialists in plants not currently enrolled in the PCI "Quality Control Program," produce a product quality control system in accordance with PCI MNL-116 and perform concrete and aggregate quality control testing using an approved independent commercial testing laboratory. Submit test results to the Engineer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

E. At the option of the Owner or Engineer, the floats shall be inspected prior to being transported to the project site. The Contractor shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of the inspection at the plant will affect the Owner's right to enforce contractual provisions after the units are transported or erected.

1.7 Engineering Drawings And Calculations

A. The Contractor shall design the complete floating dock system by a qualified professional engineer, using the performance requirements and design criteria indicated.

B. Submit signed and sealed engineering drawings, calculations, and specifications for the floating docks, piles, gangways, and other items necessary to construct the floating dock system. All calculations, drawings, and specifications shall be signed by a qualified professional engineer registered in the State of the project in accordance with State Law.

C. Submit a general layout drawing of the proposed concrete floating dock system giving all dimensions, clearances, and anchorage locations.

D. Submit detail and sectional drawings for the proposed floating dock system showing the following items:

E. Floating dock system layout.

1. Main walkway docks.
2. Finger docks.
3. Utility troughs.
4. Gangways.
5. Pile guides and corner knee brace assemblies.
6. Anchor piles.
7. Flotation system.
8. Location and anchorage of mooring fittings.

A. Dead load and live load freeboard.

B. Float connections, including heavy timber wales and connections of the finger docks to main walkway docks, and main walkway docks to marginal docks.

C. Accommodations for utilities.

D. Structural calculations for the proposed floating dock system, including the heavy timber wale system, accounting for gravity dead and live loads, and lateral loads from waves, wind, berthing impact and current, as applicable.

E. Drawings shall be accurately drawn to scale and adequately dimensioned so as to indicate the relevant sizes of all structural members, types of material, finish thickness, gauge, and other pertinent information for complete evaluation of the system. Bidder shall indicate the number of anchor piles required to secure its dock system, the loads applied to the piles, and the location of the piles along the entire dock system, including the finger docks. The minimum number of piles shall be as shown on the Drawings.

F. Drawings shall be presented using a minimum 11 x 17 inch or 22 x 34 inch drawing format.

1.8 Guarantee

A. Contractor shall execute and deliver to the Owner, before Final Completion, a guarantee. The Contractor shall guarantee that all components of the floating dock system have been properly designed, manufactured and installed, and are free from defects in material and workmanship. For the period of the guarantee, defined as one year from the Owner's date of acceptance, the Contractor shall furnish and install, without additional cost to the Owner, any part or assembly, which examination shall disclose as defective in materials and/or installation.

B. The guarantee shall cover repair of any defects or damages which may develop within the guarantee period, from date of Final Acceptance of the Work performed under this Contract, provided said defects or damages are caused by inadequate design, manufacture, or installation of the concrete floating dock system. If the defects or damages are not repairable, the defective or damaged portion or assembly shall be removed and replaced, at no additional cost to the Owner, to its original "as-new" condition.

C. Acts of nature producing conditions exceeding the design criteria set forth in these Specifications, shall not be covered by this guarantee.

D. Guarantee Requirements:

1. Floatation Material and Float: At the end of the guarantee period, the deck surface shall float not more than 1 inch below the freeboard under dead load as specified in the Contract Documents and the float shall show no signs of unexpected deterioration which would cause future loss of freeboard. Floats shall be replaced and installed by the Contractor, at no cost to the Owner, if this requirement is not met.
2. Deck Material: At the end of the guarantee period, the deck material shall remain structurally sound and free from major cracks and spalls. Any part of the deck which is not structurally sound or which has developed spalls or significant cracks, in the judgment of the Engineer, shall be removed and replaced by the Contractor, at no additional cost to the Owner.
3. Framing and Connections: Structural damage resulting from defective material or workmanship during the guarantee period, such as broken welds, broken bolts, bent, fractured, or splintered member, shall be replaced or repaired by the Contractor, at no additional cost to the Owner.
4. Anchorage: Any damage resulting from defective pile guides during the guarantee period shall be repaired by the Contractor, at no additional cost to the Owner.

E. Owner will give notice in writing of apparent defects in the floating dock system, to the Contractor immediately upon observance. The Owner will complete an "end of guarantee" inspection on the anniversary of the guarantee and will notify the Contractor of all apparent defects within 2 weeks of the inspection.

1.9 Operation And Maintenance Manual

A. Contractor shall furnish three copies of a manual containing detailed written instructions for operating and maintaining (O&M) the floating dock system. Complete and detailed instructions shall be furnished on the repair or removal and replacement of walkway dock sections, finger docks, and all major components of the floating dock system and gangway.

B. The O&M Manual shall include schedules and maintenance procedures for all elements, including but not limited to, concrete surfaces, timbers, wales and rub rails, hinges, pile guides, and all commercially available components used.

1.10 Shipping, Handling, And Storage

A. Ship and handle all material comprising the floating dock system so as not to cause corrosion, damage, or discoloration.

B. Materials delivered and stored at either the staging area or the jobsite shall be properly stored on dunnage, or by other appropriate means, to prevent direct contact with the ground and causing damage or discoloration.

1.11 Design Parameters

A. General: The design of the floating dock system, including the anchorages, wales, cleats, and connections, shall include but not be limited to the following:

1. Deterioration of extreme fiber stresses in major members under combined loading conditions applied simultaneously to finger docks and main walkway docks.
2. Effects of combined loading conditions on the connections.
3. Transfer of vessel loads to cleats, from cleats to timber wales, and from timber wales to the floating dock system.
4. Transfer of finger dock and main walkway dock loads to anchor piles.
5. Detail design at anchor pile framing and connections, including loads into piling, to adequately and safely secure the entire floating dock system under the specified design loads.
6. Detail design of a corner knee brace assemblies to resist indicated combined loading conditions.
7. Transfer of forces by use of adequate bracing, struts, bolting, etc., including utility trough internal braces as required.
8. Flotation calculations for all typical system components, in particular those subject to concentrated dead or live loads, such as gangway landing floats.
9. Detail design of splices for loads transferred from wale to float and from wale to wale.

B. Design Loads: The floating docks, anchorages, timber wales through-rods, cleats, and connections shall be designed in accordance with applicable local, state, and federal codes and standards. The reference *Marinas and Small Craft Harbors*, by Tobiasson and Kollmeyer, Second Edition; shall be considered the minimum standard for design. The design shall accommodate the appropriate loading conditions and combinations, including those indicated herein. These specifications shall carry precedence in case of a conflict with referenced material. The contractor shall notify the Owner and the Engineer in writing of any such conflicts noted.

C. Design Vessel:

10. Ranging from 20 to 30± feet Length Overall (LOA) enforcement vessels.
    a. 8 to 10± foot beam.
    b. 7,500± pounds displacement.
    c. 18+ inch draft maximum on the dock sections fully loaded.

D. Dead Loads, Vertical:

1. The floating dock system shall support the calculated dead load with a freeboard of not less than 24 inches upon installation and acceptance. Maximum freeboard allowable of 21 inches.
    a. Dead loads shall include the weight of all framing, connections, decking, floatation units, walers, pile guides, and other structural components, in addition to all permanently attached features such as gangways, equipment, and utilities.
    b. At the time of acceptance, the dock shall be within ±1 inch of the calculated freeboard.
    c. When evaluated one year after acceptance, the dock may loose no more than 1 inch of freeboard from that measured at acceptance.
    d. When evaluated five years after acceptance, the dock may loose no more than 2 inches from that measured at acceptance.
2. Floats shall be designed to float level with no live load applied. The decks of the floating dock shall be within the followings tolerances of being level:
    a. Longitudinal slope shall be not more than 1/2 inch in 6 feet of length (0.4 degrees) when accepted or more than 3/4 inch in 6 feet (0.6 degrees) at the end of five years.
    b. Transverse slope shall be not more than 1/2 inch across the total width.

c. The finger piers shall have their outer ends level with not more than 2 inches higher than the elevation of the main walk where they attach.
d. Deck surfaces between adjacent dock units shall be at the same elevation with no more than 1/8 inch differential.

E. Live Loads, Vertical:

1. The floating dock system shall support a uniform live load of not less than 60 pounds per square foot with a freeboard of not less than 20 inches.
2. The floating dock system shall support a concentrated load of 400 pounds applied over a 2 square foot area at any location with a freeboard of not less than 6 inches. For the finger floats, the concentrated load shall be applied not closer than 12 inches from the outer end.
3. The finger floats shall support a 200 pound applied to one outer corner of the float with no more than 2 inches per 3 feet of width differential in freeboard between the outer corners of the finger float at the time of acceptance, nor more than 3 inches at the end of 5 years.
4. In addition, the main and finger floats shall not heel more than 6 degrees when loaded with the design uniform live load on one-half of the float width.

F. Loads on Gangways:

1. Gangway shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
   a. Uniform Load: 100 pounds per square foot.
   b. Concentrated Load: 400 pounds over a 1 square foot area.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
3. Limit deflection of framing members to L/240 or 1/4 inch, whichever is less.
4. Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
   a. Handrails and Top Rails of Guards:
   b. Uniform Load: 50 pounds per linear foot applied inward, outward, or parallel to the railing.
   c. Concentrated Load: 200 pounds applied inward, outward, or parallel to the railing.
   d. Uniform and concentrated loads need not be assumed to act concurrently.
5. Infill of Guards:
   e. Concentrated Load: 50 pounds applied horizontally outward on an area of 1 square foot.
   f. Infill load and other loads need not be assumed to act concurrently.
6. The dock on which a gangway rests shall have sufficient floatation so that the dead load of the gangway shall not induce more than 1/8 inch per foot of length longitudinal slope in 20 feet on the dock nor more than 1/4 inch per foot of width transverse slope on the dock. In addition, it shall have sufficient floatation so that the loss of freeboard due to a gangway load based on a 50 pound per square foot live load does not exceed 8 inches.

G. Wind Loads, Horizontal:

1. The floating dock system shall be designed for a wind load from any direction acting on the floats, piles, and moored vessels with 100 percent occupancy based on a basic wind speed (unfactored) of 85 miles per hour, 3 second gust (60 miles per hour fastest mile velocity).
2. The floating dock system shall be designed for a hurricane level wind load acting on the floats and piles, with 0 percent occupancy, based on a basic wind speed of 120 miles per hour, 3 second gust (100 miles per hour fastest mile velocity).

a. A surge level of elevation +10 feet NGVD shall be assumed for the calculation of the pile forces.

3. Compute loadings in not less than two different directions: parallel to and perpendicular to the centerline of the main walkway docks.

H. Current Loads on Floats, Piles, and Vessels, Horizontal:

1. Minimum current velocity shall be assumed as 2 feet per second, oriented parallel to the existing bulkhead which is perpendicular to the floating dock.
2. Minimum current pressure: 10 pounds per square foot acting on the projected area of the dock, piles, and moored vessels, assuming full occupancy.
3. Negative lift or Squat: The floats shall be designed to account for downward suction on the leading edge of the structure, with a force of not less than 5 pounds per square foot.

I. Vessel Berthing Impacts and Mooring Forces: The dock bumper system and applicable element shall be designed for anticipated design vessels impact and mooring forces at any point on the floats, including the ends of the finger floats.

1. Impact Velocity: 2 feet per second.
2. Impact Angle: 10 degrees to the centerline of the float.
3. Wind speed at mooring: See paragraph Wind and Surge Loads, herein.
4. Mooring Load: Line pull acting in any direction at up to a 45 degree angle from the horizontal

J. Wave and Surge Loads:

1. Wave height, period, and other factors shall be computed based on the methodology presented in the U.S. Army Corps of Engineers "*Shore Protection Manual*" or the Naval Facilities Engineering Command Design Manual 26.2 "*Coastal Protection*" or similar approve method.
2. The minimum wave shall be as follows:
   a. With moored vessels: 2.1 feet high wave with a period of 2.6 seconds.
   b. Without moored vessels: 3.4 feet high wave with a period of 3.2 seconds. The water surface elevation shall be assumed to be at +10 feet, minimum.
   c. Fetch shall be assumed to be not less than 1 mile.

K. Load Combinations: The floating dock system, including the pilings, shall be designed for the load combinations specified in the latest edition of *ASCE-7 Minimum Design Loads for Buildings and Other Structures*:

1. Load cases shall be combined based upon their probability of simultaneous occurrence, and in accordance with applicable codes and standards. Calculations shall be performed for wind and current loads both parallel and perpendicular to the pier.
2. The following load combinations shall be among those investigated:
   a. Dead load plus Live Load (uniform and concentrated).
   b. Dead load plus wind loads perpendicular to the main walkway docks with 100 percent occupancy.
   c. Dead loads plus wind loads parallel to the main walkway docks with 100 percent occupancy.
   d. Dead load plus wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with 100 percent occupancy.
   e. Dead load plus wind loads parallel to the dock in question, plus wave loads parallel to the dock in question with 100 percent occupancy.
   f. Dead load plus wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with 100 percent occupancy.

g. Dead load plus hurricane wind loads parallel to the dock in question, plus wave loads parallel to the dock in question with zero percent occupancy at surge level elevation.
h. Dead load plus hurricane wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with zero percent occupancy at surge level elevation.
i. Dead load, plus current forces, plus berthing impact forces.

L. Dimensions:

1. All relevant control dimensions shall be as indicated in the Contract Documents.
2. The proposed floating dock system manufacturer may make adjustments in the overall float dimensions to accommodate its proprietary dock system's standard dimensions, or adjustments to provide structural integrity.
3. If float widths are increased by the floating dock system manufacturer, the control dimensions of the marina, such as clear slip widths, fairway width, number and size of slips, etc., shall also be increased to maintain these control dimensions.
4. All proposed dimensional changes made by the floating dock system manufacturer shall be pointed out in writing to the Owner and Engineer and in the submittal of the floating dock drawings.

PART II – PRODUCTS

2.1 General

A. Use materials compatible with a marine saltwater environment. These materials shall be resistant to corrosion, sunlight, marine organisms, and other destructive features associated with a marine environment.

B. The floating dock system shall consist of modular sections designed in such a manner that modules may be replaced with standard modules in case of repairs. Individual float modules shall not be longer than 20 feet.

C. Walking surface of floating docks shall be level and flush with respect to the adjacent floats and shall provide a skid free surface under wet conditions.

D. The floating dock system shall be warranted against sinking, excessive water absorption, cracking, leaking, and against structural failure under design load conditions.

E. The floating dock system shall be anchored by the use of precast pre-stressed concrete pilings, or steel piles, or an approved alternate material. Timber piles will not be allowed. The tops of pilings shall extend a minimum of 5 feet above the 100-year storm surge elevation unless otherwise approved by the Engineer, and shall be capped with a plastic pile hat.

2.2 Prefabricated Float Modules

A. General:

1. Float modules shall be shop-fabricated in a factory-controlled environment, and shall not be site-fabricated.
2. Float modules shall be sized so that a single module (excluding walers) is used to attain the indicated pier width. The use of more than one module connected side by side to attain pier width is unacceptable.
3. Float modules shall be structurally connected by a treated timber wale or other system that will allow replacement without affecting the float modules. Connection methods that create structural failure of the float module when overstressed will not be allowed.

4. Special floats may be designed to support additional concentrated loads as imposed by gangways, utility boxes, or other equipment. Modules with special loadings shall have the same freeboard as standard modules without special loading, so that there will be no residual stresses or tilting when modules are interconnected.
5. Floats shall consist of a solid, closed-cell flotation material core, either preformed or expanded in place, fully encased by concrete or marine grade aluminum. Floatation material may be either polystyrene or polyurethane.
6. Floats shall be designed and manufactured such that no tensile stresses are induced into the concrete encasement or the concrete deck structure.

B. Concrete Deck:

1. The deck structure shall be of concrete that is not less than 2.5 inches thick. Decks shall have integral stiffening beams sized as required, but to provide at least 1 inch cover over the galvanized through-rods at 12 inch centers. In addition, an integral perimeter beam shall be provided.
2. Extend the deck structure concrete down the sides and beneath the bottom of all junction boxes, handholes, and utility troughs, to prevent embedded items from debonding and settling under foot traffic.
3. Concrete deck structure shall be reinforced with either mild steel reinforcement or fiber reinforcement. Mild steel reinforcement in the form of wire fabric shall be galvanized and in the form of bars which will be epoxy coated.
4. Concrete deck surface shall have an integral, nonslip finish prior to final brooming. Deck surface along edges and at junction boxes shall receive a trowel finish. Surface shall be finished to permit proper drainage so that water will not puddle on the deck. Provide chamfered or tooled radius corners on all top edges.

C. Precast Concrete Floats:

1. Concrete for encasement of floatation material shall be reinforced and cast monolithically in a single pour. There shall be no cold joints of any type.
2. Concrete encasement for float sides and bottom shall be sufficient (1.5 inches minimum) to protect the floatation core from damage due to marine organisms and borers, fuel spills and boat impact; and also shall resist attack by concrete corers of the pholad family.
3. Concrete deck structure and encasement shall be reinforced with either mild steel reinforcement or fiber reinforcement. Mild steel reinforcement in the form of wire fabric shall be galvanized and in the form of bars which will be epoxy coated.
4. Extend the deck structure concrete down the sides and beneath the bottom of all junction boxes, handholes, and utility troughs, to prevent embedded items from debonding and settling under foot traffic.
    a. Concrete encasement shall be structurally connected about all six sides (top, bottom, sides, and ends).
    b. Floats without concrete bottoms or ends will not be allowed.

D. Concrete Mix Design:

1. Prior to the manufacturing of any flotation units, the concrete mix design shall be approved by the Engineer. Concrete shall have a minimum twenty-eight (28) day compressive strength of 4,000 pounds per square inch, per ASTM C94 with a minimum cement content of 564 pounds per cubic yard and a maximum water/cement ratio of 0.45. Floats made of concrete with less than specified strength will be rejected.
2. Concrete for the top surface of the flotation units shall contain polypropylene fibrous reinforcement at a rate recommended by its supplier.
3. Portland cement shall comply with ASTM C150, Type II.

4. Fly Ash and Pozzolan shall comply with ASTM C618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Type N and F.
5. Ground Iron Blast-Furnace Slag shall comply with ASTM C989. Grade 100 or 120.
6. Coarse and fine aggregate shall comply with ASTM C33. Coarse aggregate shall be natural rock or expanded shale (ASTM C330), perlite is not acceptable. Fine aggregate shall be natural sand, screenings are not acceptable. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalies in the cement.
7. Water shall be clean, fresh and potable.
8. Admixtures shall comply with ASTM C260 and/or ASTM C494. Admixtures containing chlorides or chloride ions shall not be used.
9. Concrete shall be air entrained between 5 percent and 8 percent as measured in accordance with ASTM C231.
10. Corrosion Inhibitor: Calcium nitrite, ASTM G109, added at the rate of 4.5 gallons per cubic yard.
11. Concrete slump shall be 3 inches, plus or minus, 1 inch as measured in accordance with ASTM C143, at the forms.
12. At least 3 compression test cylinders shall be taken from each 50 cubic yards, or any part thereof, placed in a single day. The average of two compression test cylinder breaks will yield the 28 day strength. Concrete shall be placed and tested in accordance with ASTM C39. Cylinders shall be cured under similar conditions as floats.

E. Forms:

1. Concrete shall be cast in steel forms, with a smooth, true surface. Forms shall be designed in such a way to prevent unsightly finished surfaces or definite lines that could result in crack planes. Any rough edges, form marks, or defects shall be cleaned, ground smooth, or patched.
2. Forms shall have a tolerance of not more than 1/8 inch from the dimensions shown on the shop drawings. Concrete encasements cast from forms more than 1/2 inch out of square (when measured diagonally) shall be rejected.
3. Concrete shall be vibrated internally and/or externally to assure a smooth dense finish. The placement will be such that the concrete float is monolithic with no cold joints in any part of the finished float.

F. Concrete Reinforcement:

1. Galvanized welded wire fabrication used as concrete reinforcement shall be not less than 2 inches x 2 inches - 14/14. Welded wire fabric is required in the deck, sides, and the bottom sections with a minimum of a 2 inch return to the sides and ends. Where splicing occurs, the overlap will be a minimum of 8 inches.
2. Wire mesh shall meet ASTM A185 or ASTM A497 and shall be galvanized. Provide flat sheets of welded wire fabric, rolled fabric is not acceptable. Maximum fabric grid is 2 inch x 2 inch.
3. Reinforcing steel bars shall be Grade 40 or 60, conform to ASTM 615, and shall be epoxy coated in accordance with ASTM A775 or galvanized in accordance with ASTM A767.
4. Polypropylene fibers shall be specifically designed for compatibility with the aggressive alkaline environment of portland cement based composites, complying with PCI-MNI-128.

G. Curing, Handling, and Storage:

1. Except as otherwise approved, floats shall be cured for a minimum of seven (7) days before transporting or assembling. The Contractor shall select his own method of curing and be responsible for the results, except that all curing shall include the application of a curing compound as soon as practical after finishing and that the

modules be placed under cover with complete protection from direct sunlight, wind, and freezing for a period of not less than three (3) days.

2. The curing compound shall meet the following requirements:
   a. Must be a balanced combination of sodium, potassium, and meta silicate compounds with a surface reducing agent.
   b. Must not contain any chlorides, waxes, resins, or oils.
   c. Must not separate or settle out.
   d. Must not leave a residue on the concrete that would prevent the application of sealers or epoxies.
   e. Must combine chemically with the free lime in concrete to form a barrier to reduce moisture evaporation to a level that allows the complete hydration of the concrete.
3. Contactor shall take care in establishing handling methods that avoid damage to the floats during form removal, storage, handling, assembly, and installation.
4. Storage of the floatation units shall be on level surfaces on timber dunnage, and it shall be the responsibility of the Contractor to determine how high units shall be allowed to be stacked without damage.
5. Floatation units shall be protected from damage from any cause.
6. Any damaged unit shall be rejected and removed from the project site.

H. Cracking**:**

1. Cracking of the concrete shall be minimized by the Contractor through proper design and control methods. Cracks which are determined to be structural in nature and not located in the deck of the module, may be repaired upon approval of the Engineer. Cracks that are determined to be structural in nature which are located in the deck of the floatation unit shall be patched, if approved by the Engineer, in accordance with methods and materials approved by the Engineer.
   a. Hairline cracks which are visible and are less than 0.01 inches in width may be acceptable, except that cracks larger than 0.005 inches in width for surfaces exposed to the weather or water shall be repaired.
   b. Floats containing cracks greater than 0.01 inches in width shall be approved by the Engineer prior to being repaired.
2. Any float that is structurally impaired or contains honeycombed sections deep enough to expose reinforcing shall be rejected.
3. Cracks located below the structural deck that do not indicate migration to the deck surface may be repaired with the approval of the Engineer.
4. Cracks which are open or which exceed 1 foot in length shall be V-cut out and patched with a non-shrink patching compound approved by the Engineer.
5. Excessive cracking as solely determined by the Engineer in a single flotation unit shall be cause for rejecting that unit. Any frequently recurring pattern of cracking shall be considered indicative of inadequate design, improper handling or improper production procedures, and the Contractor shall immediately take corrective action to remedy.
6. Rock pockets exceeding 1 inch in diameter or 3/8 inch in depth or honeycombing, without exposed reinforcing, shall be patched with an approved non-shrink grout of a color similar to the cured concrete. Any pockets, which expose mesh or rebar shall be chipped out, cleaned, and filled with an approved epoxy-patching compound if approved by the Engineer.

I. Floatation Material (Foam)

1. Floatation material shall be closed cell, expanded polystyrene (EPS) meeting Federal Specification C-578-85 or ASTM C578.
   a. Density: 0.95 to 1.10 pounds per cubic foot.

b. Compressive Strength: 20 pound per square inch minimum at 5 percent deflection.
c. Tensile Strength: 40 pounds per square inch minimum at break.
d. Shear Strength: 25 pounds per square inch minimum at break.
e. Water absorption: Shall not exceed three (3) percent by volume when measured in accordance with ASTM C272.

2. Expanded polystyrene shall consist of solid sections with no more than four laminated sections and shall contain no reground material.
3. Surface shall be pressed, polished, free from pits, blisters, cracks, dents, waviness, heat marks, or deep scratches. Variation in color indicative of damage or deterioration shall not be accepted.
4. The floatation material shall be fully encased in a protective covering such as concrete, polyethylene, or similar material that will provide a watertight coating and protect against damage during shipping and construction; vessel impact; stresses from structural loading; degradation from sunlight; and damage from marine organisms, oil, salt water, and other deleterious materials likely to be encountered in a marine environment. Floatation must be fully encased on all sides.
5. Surfaces of the finished planks shall lie in normal planes so that the plank, when installed in final position in the float shall lie in a true horizontal plane with the water. Edges formed by molding or cut sections may be either rounded or squared.

J. Through-Rods:

1. Steel through-rods shall conform to ASTM A36, sized as required by design (3/4 inch diameter minimum), and shall be galvanized by the hot dip process in accordance with ASTM A123.
2. Through-rods shall either be sleeved or placed in PVC tubing to facilitate removal and replacement.

2.3 Wales, Bull Rails, Rub Rails, And Other Timber And Wood Components

K. Timber components shall be Southern Pine, Grade No. 1, or better, as required by structural analysis, and shall conform to the rules of the SPIB and ASLS PS-20-70. Member sizes shown on the Drawings are to indicate general design concept only. Timber type, grade and size shall be selected based upon the load criteria specified in the paragraph entitled “Design Parameters”.

L. Timber shall also bear the quality mark of a certified inspection agency such as the Southern Pine Inspection Bureau or the Timber Products Inspection Bureau.

M. Timber shall be pressure treated with Chromated Copper Arsenate (CCA) conforming to AWPA Standard C2 and C18 (marine use treatment) to a 2.5 pounds per cubic foot retention minimum, and identified with a quality mark by and approved inspection agency certified by the American Standard Lumber Committee (ALSC). The presence of AWPA quality mark LP-22 may be accepted as evidence of conformance to the requirements for preservative treatment, at the Owner’s option. After treatment all wood shall be kiln dried to a maximum moisture content of 15 percent and shall be stored, handled and transported in accordance with AWPA Standard M4. Every cut or hole made in the field shall be given field treatment in accordance with AWPA Standard M4. Application of paint shall not constitute field treatment for preservation.

N. Timbers shall be drilled and cut before pressure treatment, as much as possible.

O. All connections for timber wale to float and wale to wale shall be bolted with through-rods at 12 inch centers, maximum. Use two 5/8 inch shear plates or 4 inch split rings with adequately sized plate washers (1/4 inch thick minimum) and lock nuts to distribute loads without damaging the timbers.

2.4 Steel Assemblies

A. Steel assemblies such as pile guide frames, corner knee braces connecting finger docks to main docks and main docks to marginal docks, and utility trough internal braces shall be designed and shop fabricated in conformance with AISC "Specifications" to accommodate the loads specified herein.

B. Steel shall conform to ASTM A36 or ASTM A992 and assemblies shall be galvanized by the hot dip process in accordance with ASTM A123 after fabrication.

C. Minimum member thickness shall be 1/4 inch.

D. Welding shall conform to the AWS Steel Welding code requirements. If the structural requirements do not require a fully welded joint section, provide 1/8 inch seal welds in the joint so that the final joint is a fully welded joint, with no cracks, openings, crevices, etc., to collect saltwater. All welds shall be visually inspected and tested or reworked if questionable.

E. Pile guides shall be a multiple roller type with one roller per side of pile, and provide for full vertical movement of the floating dock system without inducing binding or torsion into the system. Pile guides shall be designed to transmit all lateral loads from the floating dock system to the anchor piles without causing damage to the float or the pile. Rollers shall be of ultra-high-molecular-weight (UHMW) polyethylene material with ultraviolet light inhibitor added and ANSI Type 304 or 316 stainless steel axles.

F. Corner knee braces shall be designed and fabricated to act as a rigid connection of finger dock to main walkway dock. Minimum brace size shall be 4 foot by 4 foot and shall be increased in size as required by the structural design calculations.

G. Braces shall be installed on each float on the inside of the utility troughs and shall provide structural continuity of the floats where the deck structure is interrupted by the trough, where required by the structural design calculations.

H. Fasten all structural steel assemblies and guides to the floating dock by means of through-rods at 12 inch centers, or closer if indicated by structural calculations. Internal utility trough braces shall be fabricated so that they may be removed by loosening only the nuts securing the specific brace.

I. All pile guide hardware, including bolts, nuts, axles, and other fasteners shall be stainless steel Type 316.

2.5 Hardware

J. Clip angles, plates, bars, etc., shall conform to ASTM A36 or ASTM A992, as applicable.

K. Unfinished bolts and nuts shall conform to ASTM A307.

L. High strength bolts and nuts shall conform to ASTM A325X, with threads excluded.

M. All steel members, assemblies, guides, and parts shall be galvanized by the hot dip process in accordance with ASTM A153.

N. Stainless steel screw and bolts shall comply with ANSI Type 316.

O. Fasteners

1. Bolts, nuts, washers, screws, nails, and other fasteners shall be Type 316 stainless steel or hot-dipped galvanized per ASTM A153. Bolts shall conform to ANSI/ASME B18.2.1. Wood screws shall conform to ANSI/ASME B18.6.1.

P. Steel Through-Rod Connections (For Concrete Dock):

1. The minimum dimension for all through-rods for structural attachment is 3/4-inch thread diameter. All through-rods shall be placed within PVC sleeves cast in the float units. Walers shall be securely fastened to the concrete floats using galvanized or stainless steel through-rods, plate washers, and heavy hex pin lock nuts.
2. The quantity and configuration of the through-rods will be determined by the load calculations on each dock section. Through-rods shall be placed through each float unit within 6 inches of each end of that unit, and within 6 inches of each lumber splice.

2.6 Aluminum

1. Aluminum members shall be aluminum alloy 6061-T6 or approved alternative suitable for use in a marine environment. Aluminum members shall be designed in accordance with the Aluminum Design Manual by the Aluminum Association and the governing building code.
2. Contact between aluminum and dissimilar metals or concrete shall be avoided, except for the use of compatible stainless steel pins, screws, or bolts. Where potential for galvanic corrosion exists, the aluminum shall be isolated from direct contact with other metals or concrete by use of suitable non-conducting insulators or bushings.

2.7 Mooring Cleats

A. Mooring cleats and their connections shall be constructed of a corrosion resistant material and shall be sized to resist the calculated mooring loads, based on Appendix 3 of “Marinas and Small Craft Harbors” by Tobiasson and Kollmeyer, for the indicated wind speed.

B. Provide not less than the indicated number of cleats along the sides of docks.

C. Cleats shall have at least a 10 inch long horn with not less than 4,000 pound capacity and shall be fastened to the timber wales with at least two 1/2 inch diameter ASTM A325X high strength through-bolts, with hardened washers and double nuts.

D. The ASTM A325X high strength through-bolt assemblies shall be hot dip galvanized in accordance with ASTM A153 after fabrication. Tap threads of bolts and nuts after galvanizing to ensure tight and locked connection.

E. Each cleat shall be connected to the wale with a hot dip galvanized connection angle (1/4 inch minimum thickness), with the cleat bolts and the float thru-bolts passing through the angles, as shown.

2.8 Dock Bumper

A. Provide dock bumper strip continuously along longitudinal edges and ends of the floats. Bumpers shall have the ability to protect boats from damage or discoloration due to normal docking procedures.

B. Material:

1. Flexible polyvinyl chloride – custom formulated 90 Durometer PVC with an added UV stabilizer and fungicide, in non-yellowing white color, or Owner-approved equal.
2. Bumper material shall not be affected by sunlight, saltwater, oil, gasoline or other agents or actions common to a marine saltwater environment.

C. Size:

1. Size to be determined by engineering calculations.
2. Horizontal Bumpers: 3.5 inch minimum vertical dimension (similar to Merco Marine #RR-5002).

3. Corner Bumpers: 3.5 inch minimum vertical dimension (similar profile to Merco Marine #RR-5002, except shaped for corner installation), 1-piece, L-shaped bumper specifically designed to protect vertical corners, at all outer vertical corners on the concrete floating docks.

2.9 Pile Caps

A. Pile caps shall be made from fiberglass or rotationally molded plastic formulated for a marine environment.

B. Off-white colored, cone-shaped caps shall be sized to fit the tops of all piles.

C. Provide one pile cap per pile.

2.10 Gangways

A. Design, supply and install aluminum gangway for access to the floating docks.

B. Gangway shall be designed for the live load and deflection criteria specified herein with required safety factors on working stress which conform to those set forth in the Aluminum Association "Specifications for Aluminum Structures".

C. Gangways shall have a minimum clear inside walkway width indicated

D. Walking surface shall have an Owner-approved non-skid surface.

E. Gangway end connections shall allow unrestricted vertical movement through the water level changes.

1. Gangway shall be hinged at their shore end, with a stainless steel piano hinge or comparable design to carry the load, securing gangway to fixed structure, and allow full rotation of gangway to accommodate tidal variation.
2. The float end shall incorporate ultra high molecular weight polyurethane (UHMW-PE) wheels or rollers or be fitted with UHMW-PE pads of adequate bearing area. A stainless steel plate shall be provided on the deck surface of the float for the gangway wheels or rollers or pads to travel on.
3. A hinged transition plate shall be provided on each end of the gangway, as necessary to maintain a maximum 8 horizontal to 1 vertical (8:1) slope. Transition plates shall be designed so as to not damage or mar the floating pier surface.

F. Gangways shall be aluminum alloy 6061-T6 extruded in accordance with the applicable sections of Federal Specification QQ-A-200. Stainless steel bolts, rods, nuts and washers shall be ANSI Type 316.

G. Gangway shall have continuous handrails that are a minimum of 34 inches above the walking surface, but not more than 38 inches.

H. Landing and Gangway Guards:

1. Provide continuous gangway guards as part of the guardrails, of woven wire mesh panels.
2. Woven wire mesh guard panels shall be provided between the top and bottom rails on gangways to prevent passage of a 4 inch sphere. Mesh shall be of aluminum alloy 6061-T6 construction, with minimum 1/4 inch diameter wires spaced at 4.0 inch centers maximum, with lock-crimp intersections. Mesh shall be contained in an aluminum framework that is, in turn, fastened to the rails and posts.

PART III – EXECUTION

3.1 Inspections

A. At the option of the Owner, the Contractor shall not fabricate floats until an inspection is made by the Owner's inspector of the manufacturer's facility and procedures. The manufacturer's facility shall be open to the Owner, the Owner's representative, and the Owner's inspector at any time that the concrete floating dock system for this project is being manufactured.

B. Contractor shall inspect all of the concrete floating dock system components and assemblies immediately upon delivery to the site to ensure that each component and assembly is in an undamaged condition.

C. Contractor shall submit a written statement outlining all damaged dock system components to the Owner within 7 days of receipt. The statement shall also indicate his acceptance of the components received, method of repair for those components that are repairable, and a schedule of replacement components for those that are not repairable.

3.2 Workmanship

A. Contractor shall use only experienced personnel to perform the Work, and shall provide a qualified company employee to perform full time inspection and supervision of the manufacturing assembly and floatation process, and shall assume full and complete responsibility for successful manufacture, assembly and anchorage of the system.

B. Work not representing a finished and acceptable appearance shall be rejected.

C. Finished metal members shall be free from twists, bends, distortions, open joints, sharp edges and burrs. Ends of exposed metal members shall be rounded or beveled. All coping and mitering shall be done with care. Galvanizing shall take place after the metal components and assemblies are fabricated.

D. Minimize drilling and cutting of steel, after galvanizing. Where necessary, such holes and edges shall be painted with high zinc dust content paint. All welds over galvanized material shall be thoroughly cleaned and coated with two coats of cold galvanizing compound.

E. All welding shall conform to the requirements of the American Welding Society, "Welding code – Steel" (AWS D1.1). Welds shall be a solid and homogeneous part of the metals joined and shall be free from pits or scale, and shall be of full area and length required to develop the required strength for the intended use. If a structural weld is not continuous "all-around" for the full joint width, then 1/8 in. seal welds shall be used to complete the joint width so that no open joint or gap or crevice remains to collect saltwater.

F. Bolts, nuts and washers shall be set square with connecting structural members and the nuts shall be drawn tight. Lock washers shall be used to prevent nuts from loosening, after being properly tightened. High strength bolts shall be used where required to carry the design load, in accordance with the American Institute of Steel Construction Specifications "Structural Joints Using ASTM A325 or A490 Bolts".

G. Nails shall be driven to set the heads flush with the wood surface.

H. Timber members shall be counterbored wherever projecting bolt heads or nuts may damage boats or provide a hazard to dock users. Counterboring shall be sufficiently deep to permit installation of the bolts and nuts with washers well below the surface of the timber. The heads of dome head volts may project above the surface.

I. Connections between floats or other elements, such as lifting rings, shall not protrude above the level of the deck.

J. Connections shall be accomplished to permit removal and replacement of connectors without the necessity of removing other components for access. Connectors shall be of materials that are easily available and shall be positively contained so as to prevent their working free under anticipated wind and wave loading conditions.

K. Floats shall be rigidly connected to the wales, knee braces and pile guides by through-bolts.

L. The concrete floating dock system shall be anchored with a pile anchorage system. The pile anchorage system shall secure the floating docks under the most severe loading combinations, as specified under "Design Parameters" herein and at all water levels as indicated on the Drawings.

M. Float deck surfaces shall be sloped for proper drainage so that water will not puddle on the deck surface.

N. Floats shall set level in the water with the specified dead load freeboard as shown on the Drawings. Tolerance in freeboard shall be 1 inch, plus or minus, with maximum transverse tolerance of 1/8 inch per foot of float width.

O. Where gangways land on floating docks, additional flotation shall be provided such that the specified dead load and live load freeboard criteria are met under full live load for the gangway area.

P. Any potentially corrosive installation of dissimilar materials shall be properly insulated to eliminate corrosion in the marine environment. Aluminum in contact with steel shall be separated by a rubber gasket. Aluminum in contact with concrete shall be coated with thick coat of bituminous paint.

3.3 Manufacturer's Services

A. Provide Manufacturer's representative at the Site for installation assistance, inspection, and certification of proper installation.

3.4 Precast Concrete Floats

A. Place foam core in its correct position during the casting operation. Placement tolerance shall be 1/8 inch, plus or minus, in any direction. Core planks shall lie in a true horizontal plane with the water. Glue planks together with a water resistant glue that is compatible with the plank material.

B. Place PVC through-rod sleeves or sleeved through-rods in the floats at 12 inch centers maximum spacing, beginning 6 inches from each end of the float. Placement tolerance shall be 1/8 inch, plus or minus, in any direction.

C. Place steel forms in correct position to provide a smooth, true surface with 90 degree corners. Placements tolerance shall be 1/8 inch, plus or minus, in any direction. Forms shall be cleaned and oiled after each use.

D. Place reinforcement, as required by structural design, to provide the required concrete cover. Placement tolerance shall be 1/8 inch, plus or minus, in any direction.

E. Concrete shall be batched, mixed and delivered in conformance with ASTM C94.

F. Concrete shall be placed and vibrated in such a manner as to prevent air pockets, voids and honeycombing, and to provide a smooth dense finish and proper bond between the concrete and the foam core.

G. Moisture cure concrete floats for not less than 7 days in accordance with ACI 301. Moist curing shall begin immediately after finishing and shall not be interrupted.

H. A minimum of 4 through-bolts shall be provided in each float. Additional through- bolts shall be provided at timber wale splices, with a minimum of 2 through-bolts provided on each side of a wale, a knee brace and a pile guide.

I. Provide through-bolts at 12 inch centers, maximum spacing, with closer spacing as required by loads.

J. Through-bolt size (minimum 3/4 inch diameter) and spacing requirements shall be in accordance with the concrete floating dock system manufacturer’s structural design calculations and approved shop drawings.

K. Coordinate placement of embedded items and anchor bolts with concrete floating dock system manufacture. Install anchor bolts located per manufacturer’s requirements.

L. Covers of utility trench and junction boxes shall be flush with the walking surface and fastened with Type 316 stainless steel screws.

M. Construct mock-up floats with timber wales, corner knee braces and pile guides in the shop to make sure all components fit. Shop assemble sections of dock (walkway and fingers) as large as possible to permit shipping and handling to reduce field assemblage.

3.5 Crack And Float Damage Repairs

A. Cracks and damage caused to the concrete floats by shipping, handling or installing by the Contractor shall be repaired, or at the owner’s direction, the concrete float shall be replaced.

B. Hairline cracks located below the structural deck that do not indicate continual migration to the deck surface may be repaired, with the approval of the Owner, or the concrete float shall be replaced.

C. Cracks which are open or which exceed 2 feet in length shall be V-cut and patched with an approved polymer modified cementitious mortar, applied in accordance with mortar manufacturer’s instructions, with the approval of the Owner, or the concrete float shall be replaced.

D. Excessive cracking in a single concrete float shall be cause for rejecting that float. Any frequently recurring pattern of cracking shall be considered indicative of improper handling, fabricating or installing. It shall be corrected by replacement and appropriate changes in the Contractor’s procedures.

E. Damage exceeding 1 inch in diameter 3/8 inch in depth shall be patched with an approved polymer modified cementitious repair mortar of a color similar to the cured concrete. Any damaged areas which expose mesh or rebar shall be chipped out, cleaned, and filled with an approved polymer modified cementitious repair mortar.

3.6 Timber Wales And Rub Rails

A. Rigidly fasten wales to concrete floats and wales to wales by means of through-bolts, shear plates and split ring connectors, as required by structural design calculations.

B. Stagger wale splices such that only one wale is spliced per concrete float. Locate splices no closer than 2 feet from the end of a float.

C. Rub rails shall be fastened to float with 16d galvanized nails spaced at 12 inch centers (maximum) in a staggered pattern. Rub rails shall be counterbored to conceal through -bolts, nuts, plate washers, lock washers, etc.

3.7 Structural Steel Assemblies

A. Fasten to concrete floats and wales by means of through-bolts at 12 inch centers, maximum spacing.

B. Provide at least 2 through-bolts to fasten each leg of an assembly to the floats.

3.8 Gangways

A. Provide for connections for gangways to bulkhead cap with stainless steel hinge assembly and stainless steel epoxy adhesive anchor bolts.

B. Provide stainless steel epoxy anchor bolts of adequate number, diameter and embedment to safely support gangway loads.

C. Install stainless steel plate on float for roller travel.

3.9 Cleats

A. Cleats shall be bolted to timber wales using 2 hot dip galvanized ASTM A325X high strength steel bolts. Bolts shall pass through the timber wale, with adequately sized plate washers and lock washers on the bottom.

3.10 Dock Bumper Strip

A. Install PVC dock bumper strip continuously along the longitudinal edges of dock floats, as indicated. Bumper shall protect boats from damage due to normal docking procedures.

B. Fasten dock horizontal bumper strips and vertical corner guards with aluminum nails of the number, size and spacing as recommended by the bumper manufacturer, not to exceed 6 inch center top and 12 inch center bottom.

C. Fasteners shall be flush with the surface of the bumper strips and corner guards, so that there are not sharp edges or protrusions.

3.11 Pile Caps

A. Fasten fiberglass or molded plastic pile caps to piles, as recommended by the pile cap manufacturer.

END OF SECTION 35 51 13

SECTION 35 51 14

STEEL FRAME POLY FLOAT - FLOATING DOCK SYSTEM

PART I – GENERAL

1.1 Description

A. The Work consists of a complete floating dock system to accommodate the indicated vessels and other requirements, including but not limited to the docks, gangways, mooring cleats, pile guides, piles, provisions for accommodating utilities, and dock accessories as indicated.

B. The floating dock system shall consist of individual precast foam-filled concrete floats interconnected with heavy treated timber wales, steel through rods, and fabricated structural steel bracing sub assemblies and pile guides.

C. The Contractor shall provide the final design and construction drawings for the complete floating system

D. The Contractor shall furnish all tools, equipment, materials, and supplies to perform all labor, supervision, fabrication, assembly, and installation of the floating dock system.

1.2 References

A. The following references may be referenced in this Section:

1. “Marinas and Small Craft Harbours,” Second Edition, Bruce O. Tobiasson, P.E. and Ronald C. Kollmeyer, Ph.D.
2. “Ferry Terminals and Small Craft Berthing Facilities,” MIL-HDBK-1025/5, Department of the Navy Naval Facilities Engineering Command (NAVFACENGCOM).
3. “Design: Small Craft Berthing Facilities,” UFC 4-152-07N, June 2005, United Facilities Criteria (UFC).
4. “Planning and Design Guidelines for Small Craft Harbors,” Revised Edition, 1994, ASCE Manuals and Reports on Engineering Practice-No. 50, American Society of Civil Engineers.

B. The following is a list of standards which may be referenced in this section:

1. International Building Code (IBC)
2. Army Corps Manual SR-2
3. American Institute of Steel Construction (AISC).
4. American Wood Preservers Association (AWPA).
5. AWPA C18, Standard for Pressure Treated Material in Marine Construction.
6. American Forest and Paper Association (AFPA).
7. Southern Pine Inspection Bureau (SPIC).
8. Timber Products Inspection Bureau (TPIB).
9. American Society of Civil Engineers (ASCE): ASCE-7 Minimum Design Loads for Buildings and Other Structures
10. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
11. American Galvanizers Association (AGA): Inspection of products Hot-Dip Galvanized After Fabrication.
12. American Welding Society (AWS):
    a. D1.1, Structural Welding Code – Steel.
    b. D1.2, Structural Welding Code – Aluminum.
    c. D1.6, Structural Welding Code – Stainless Steel.
13. ASTM International (ASTM)
    a. A36, Standard Specification for Structural Steel.
    b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

c. A123, Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
d. A153, Specification for Zing (Hot-Dip) on Iron and Steel Hardware.
e. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
f. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
g. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
h. A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
i. A325, Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
j. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
k. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
l. D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
m. E985, Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

1.3 Contract Documents

A. The Contract plans are general in nature and show the basic system layout and details, with required nominal or minimal dimensions, size and number of boat slips, cleat locations, elevations, and materials.

B. The Contract Documents intent is to allow consideration of proprietary floating concrete dock systems of different manufactures, provided they meet the requirements of the contract plans and specifications, are constructed of the specified materials and minimum dimensions, and are of quality equal to or greater than that indicated.

C. The Contract Documents are not intended to be used as detailed shop or fabrication drawings for the manufacture of the floating dock system.

D. The floating dock system shall be manufactured, assembled, and installed based on the submitted design calculations, shop drawings, assembly drawings, and installation instructions furnished by the floating dock system manufacturer.

E. The floating dock system shall be designed and constructed in accordance with local, state, and federal codes and permits.

1.4 Coordination With Others

A. Coordination with the Owner’s personnel and other contractors’ personnel working on-site shall be part of this Contract and the responsibility of the Contractor.

B. Make whatever arrangements necessary to ensure that delivery and installation of the concrete floating dock system do not conflict with the work of other contractors. The Work under this Contract shall be completed in a manner such that it causes no delays to others.

1.5 Submittals

C. Submittals shall be in accordance with the following.

D. Reproduction of the Contract Documents is not permitted.

E. Catalog and product information shall be provided, on all commercially available products and equipment being offered for use. This information shall include manufacturer’s name, address, phone/fax numbers, email address, part numbers and/or other information suitable for placing a replacement purchase order with the manufacturer.

F. Engineering design calculations, shop drawings, and assembly drawings, signed and sealed by the designer, regarding the proposed floating dock system indicating that the system meets or exceeds the requirements of the Contract documents.

G. The Engineer will evaluate the technical acceptability of each system and make recommendations to the Owner, who will make the final approval of the floating dock system.

H. Test Data and Certifications: Submit test reports, certification of materials, manufacturer's product data, etc., indicating compliance with the Contract Documents:

1. Timbers (grade and pressure treatment).
2. Fasteners and hardware.
3. Structural steel.
4. Aluminum structural sections, pipe and tubing.
5. Aluminum woven wire mesh guards.
6. Gangways.
7. Cleats.
8. Dock bumpers.
9. Floatation water absorption test.
10. Non-slip finishes.
11. Coatings and paints.
12. Welding Certificates
13. Other such tests.

I. Manufacturer's written instructions for shipping, handling, storage, protection, and installation of all components.

J. Manufacturer's Certificate of Proper Installation.

K. Guarantee and Warranties and Operational Manuals.

1. Submit sample of each Guarantee or Warranty prior to the first application for payment. Submit actual Guarantee or Warranty prior to application for final payment.
2. Submit Operational Manuals prior to application for final payment.

L. Quality Assurance

1. Submit design engineer, manufacturer, installer and other appropriate information.

1.6 Quality Control And Assurance

A. Qualifications:

1. Design Engineer (designer): Registered professional engineer.
2. Manufacturer: Manufacturer of the floating dock system shall have not less than five years of experience with similar projects. Submit listing of similar completed projects, include name and contact information of reference.
3. Installer: Approved by the manufacturer.

B. Floating dock system shall be the product of a manufacture specializing in the production of the specified floating dock systems with a minimum of 10 years experience in the design and manufacture of the specified floating piers.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

D. At the option of the Owner or Engineer, the floats shall be inspected prior to being transported to the project site. The Contractor shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of the inspection at the plant will affect the Owner's right to enforce contractual provisions after the units are transported or erected.

1.7 Engineering Drawings And Calculations

A. The Contractor shall design the complete floating dock system by a qualified professional engineer, using the performance requirements and design criteria indicated.

B. Submit signed and sealed engineering drawings, calculations, and specifications for the floating docks, piles, gangways, and other items necessary to construct the floating dock system. All calculations, drawings, and specifications shall be signed by a qualified professional engineer registered in the State of the project in accordance with State Law.

C. Submit a general layout drawing of the proposed concrete floating dock system giving all dimensions, clearances, and anchorage locations.

D. Submit detail and sectional drawings for the proposed floating dock system showing the following items:

E. Floating dock system layout.

1. Main walkway docks.
2. Finger docks.
3. Gangways.
4. Pile guides and corner knee brace assemblies.
5. Anchor piles.
6. Flotation system.
7. Location and anchorage of mooring fittings.

A. Dead load and live load freeboard.

B. Float connections, including heavy timber wales and connections of the finger docks to main walkway docks, and main walkway docks to marginal docks.

C. Structural calculations for the proposed floating dock system, including the heavy timber wale system, accounting for gravity dead and live loads, and lateral loads from waves, wind, berthing impact and current, as applicable.

D. Drawings shall be accurately drawn to scale and adequately dimensioned so as to indicate the relevant sizes of all structural members, types of material, finish thickness, gauge, and other pertinent information for complete evaluation of the system. Bidder shall indicate the number of anchor piles required to secure its dock system, the loads applied to the piles, and the location of the piles along the entire dock system, including the finger docks. The minimum number of piles shall be as shown on the Drawings.

E. Drawings shall be presented using a minimum 11 x 17 inch or 22 x 34 inch drawing format.

1.8 Guarantee

A. Contractor shall execute and deliver to the Owner, before Final Completion, a guarantee. The Contractor shall guarantee that all components of the floating dock system have been properly designed, manufactured and installed, and are free from defects in material and workmanship. For the period of the guarantee, defined as one year from the Owner's date of acceptance, the Contractor shall furnish and install, without additional cost to the Owner, any part or assembly, which examination shall disclose as defective in materials and/or installation.

B. The guarantee shall cover repair of any defects or damages which may develop within the guarantee period, from date of Final Acceptance of the Work performed under this Contract, provided said defects or damages are caused by inadequate design, manufacture, or installation of the concrete floating dock system. If the defects or damages are not repairable, the defective or damaged portion or assembly shall be removed and replaced, at no additional cost to the Owner, to its original “as-new” condition.

C. Acts of nature producing conditions exceeding the design criteria set forth in these Specifications, shall not be covered by this guarantee.

D. Guarantee Requirements:

1. Floatation Material and Float: At the end of the guarantee period, the deck surface shall float not more than 1 inch below the freeboard under dead load as specified in the Contract Documents and the float shall show no signs of unexpected deterioration which would cause future loss of freeboard. Floats shall be replaced and installed by the Contractor, at no cost to the Owner, if this requirement is not met.
2. Deck Material: At the end of the guarantee period, the deck material shall remain structurally sound and free from major cracks and spalls. Any part of the deck which is not structurally sound or which has developed spalls or significant cracks, in the judgment of the Engineer, shall be removed and replaced by the Contractor, at no additional cost to the Owner.
3. Framing and Connections: Structural damage resulting from defective material or workmanship during the guarantee period, such as broken welds, broken bolts, bent, fractured, or splintered member, shall be replaced or repaired by the Contractor, at no additional cost to the Owner.
4. Anchorage: Any damage resulting from defective pile guides during the guarantee period shall be repaired by the Contractor, at no additional cost to the Owner.

E. Owner will give notice in writing of apparent defects in the floating dock system, to the Contractor immediately upon observance. The Owner will complete an “end of guarantee” inspection on the anniversary of the guarantee and will notify the Contractor of all apparent defects within 2 weeks of the inspection.

1.9 Operation And Maintenance Manual

A. Contractor shall furnish three copies of a manual containing detailed written instructions for operating and maintaining (O&M) the floating dock system. Complete and detailed instructions shall be furnished on the repair or removal and replacement of walkway dock sections, finger docks, and all major components of the floating dock system and gangway.

B. The O&M Manual shall include schedules and maintenance procedures for all elements, including but not limited to, concrete surfaces, timbers, wales and rub rails, hinges, pile guides, and all commercially available components used.

1.10 Shipping, Handling, And Storage

A. Ship and handle all material comprising the floating dock system so as not to cause corrosion, damage, or discoloration.

B. Materials delivered and stored at either the staging area or the jobsite shall be properly stored on dunnage, or by other appropriate means, to prevent direct contact with the ground and causing damage or discoloration.

1.11 Design Parameters

A. General: The design of the floating dock system, including the anchorages, wales, cleats, and connections, shall include but not be limited to the following:

1. Deterioration of extreme fiber stresses in major members under combined loading conditions applied simultaneously to finger docks and main walkway docks.
2. Effects of combined loading conditions on the connections.
3. Transfer of vessel loads to cleats, from cleats to timber wales, and from timber wales to the floating dock system.
4. Transfer of finger dock and main walkway dock loads to anchor piles.
5. Detail design at anchor pile framing and connections, including loads into piling, to adequately and safely secure the entire floating dock system under the specified design loads.
6. Detail design of a corner knee brace assemblies to resist indicated combined loading conditions.
7. Transfer of forces by use of adequate bracing, struts, bolting, etc., including utility trough internal braces as required.
8. Flotation calculations for all typical system components, in particular those subject to concentrated dead or live loads, such as gangway landing floats.
9. Detail design of splices for loads transferred from wale to float and from wale to wale.

B. Design Loads: The floating docks, anchorages, timber wales through-rods, cleats, and connections shall be designed in accordance with applicable local, state, and federal codes and standards. The reference *Marinas and Small Craft Harbors*, by Tobiasson and Kollmeyer, Second Edition; shall be considered the minimum standard for design. The design shall accommodate the appropriate loading conditions and combinations, including those indicated herein. These specifications shall carry precedence in case of a conflict with referenced material. The contractor shall notify the Owner and the Engineer in writing of any such conflicts noted.

C. Design Vessel:

1. Ranging from 20 to 30± feet Length Overall (LOA) enforcement vessels.
   a. 8 to 10± foot beam.
   b. 7,500± pounds displacement.
   c. 18+ inch draft maximum on the dock sections fully loaded.

D. Dead Loads, Vertical:

1. The floating dock system shall support the calculated dead load with a freeboard of not less than 24 inches upon installation and acceptance. Maximum freeboard allowable of 21 inches.
   a. Dead loads shall include the weight of all framing, connections, decking, floatation units, walers, pile guides, and other structural components, in addition to all permanently attached features such as gangways, equipment, and utilities.
   b. At the time of acceptance, the dock shall be within ±1 inch of the calculated freeboard.
   c. When evaluated one year after acceptance, the dock may loose no more than 1 inch of freeboard from that measured at acceptance.
   d. When evaluated five years after acceptance, the dock may loose no more than 2 inches from that measured at acceptance.
2. Floats shall be designed to float level with no live load applied. The decks of the floating dock shall be within the followings tolerances of being level:
   a. Longitudinal slope shall be not more than 1/2 inch in 6 feet of length (0.4 degrees) when accepted or more than 3/4 inch in 6 feet (0.6 degrees) at the end of five years.
   b. Transverse slope shall be not more than 1/2 inch across the total width.

c. The finger piers shall have their outer ends level with not more than 2 inches higher than the elevation of the main walk where they attach.
d. Deck surfaces between adjacent dock units shall be at the same elevation with no more than 1/8 inch differential.

E. Live Loads, Vertical:

1. The floating dock system shall support a uniform live load of not less than 60 pounds per square foot with a freeboard of not less than 20 inches.
2. The floating dock system shall support a concentrated load of 400 pounds applied over a 2 square foot area at any location with a freeboard of not less than 6 inches. For the finger floats, the concentrated load shall be applied not closer than 12 inches from the outer end.
3. The finger floats shall support a 200 pound applied to one outer corner of the float with no more than 2 inches per 3 feet of width differential in freeboard between the outer corners of the finger float at the time of acceptance, nor more than 3 inches at the end of 5 years.
4. In addition, the main and finger floats shall not heel more than 6 degrees when loaded with the design uniform live load on one-half of the float width.

F. Wind Loads, Horizontal:

1. The floating dock system shall be designed for a wind load from any direction acting on the floats, piles, and moored vessels with 100 percent occupancy based on a basic wind speed (unfactored) of 50 miles per hour, 3 second gust 35 miles per hour fastest mile velocity).
2. The floating dock system shall be designed for a hurricane level wind load acting on the floats and piles, with 0 percent occupancy, based on a basic wind speed of unfactored 85 miles per hour, 3 second gust (70 miles per hour fastest mile velocity). A surge level of elevation +176 feet NAVD shall be assumed for the calculation of the pile forces.
3. Compute loadings in not less than two different directions: parallel to and perpendicular to the centerline of the main walkway docks.

G. Current Loads on Floats, Piles, and Vessels, Horizontal:

1. Minimum current velocity shall be assumed as 2 feet per second, oriented parallel to the existing bulkhead which is perpendicular to the floating dock.
2. Minimum current pressure: 10 pounds per square foot acting on the projected area of the dock, piles, and moored vessels, assuming full occupancy.
3. Negative lift or Squat: The floats shall be designed to account for downward suction on the leading edge of the structure, with a force of not less than 5 pounds per square foot.

H. Vessel Berthing Impacts and Mooring Forces: The dock bumper system and applicable element shall be designed for anticipated design vessels impact and mooring forces at any point on the floats, including the ends of the finger floats.

1. Impact Velocity: 2 feet per second.
2. Impact Angle: 10 degrees to the centerline of the float.
3. Wind speed at mooring: See paragraph Wind and Surge Loads, herein.
4. Mooring Load: Line pull acting in any direction at up to a 45 degree angle from the horizontal

I. Wave and Surge Loads:

1. Wave height, period, and other factors shall be computed based on the methodology presented in the U.S. Army Corps of Engineers "*Shore Protection Manual*" or the

Naval Facilities Engineering Command Design Manual 26.2 "*Coastal Protection*" or similar approve method.

2. The minimum wave shall be as follows:
   a. With moored vessels: 1.1 feet high wave with a period of 2.0 seconds.
   b. Without moored vessels: 1.7 feet high wave with a period of 3.0 seconds. The water surface elevation shall be assumed to be at +10 feet, minimum.
   c. Fetch shall be assumed to be not less than 1/4 mile.

J. Load Combinations: The floating dock system, including the pilings, shall be designed for the load combinations specified in the latest edition of *ASCE-7 Minimum Design Loads for Buildings and Other Structures*:

1. Load cases shall be combined based upon their probability of simultaneous occurrence, and in accordance with applicable codes and standards. Calculations shall be performed for wind and current loads both parallel and perpendicular to the pier.
2. The following load combinations shall be among those investigated:
   a. Dead load plus Live Load (uniform and concentrated).
   b. Dead load plus wind loads perpendicular to the main walkway docks with 100 percent occupancy.
   c. Dead loads plus wind loads parallel to the main walkway docks with 100 percent occupancy.
   d. Dead load plus wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with 100 percent occupancy.
   e. Dead load plus wind loads parallel to the dock in question, plus wave loads parallel to the dock in question with 100 percent occupancy.
   f. Dead load plus wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with 100 percent occupancy.
   g. Dead load plus hurricane wind loads parallel to the dock in question, plus wave loads parallel to the dock in question with zero percent occupancy at surge level elevation.
   h. Dead load plus hurricane wind loads perpendicular to the dock in question, plus wave loads perpendicular to the dock in question with zero percent occupancy at surge level elevation.
   i. Dead load, plus current forces, plus berthing impact forces.

K. Dimensions:

1. All relevant control dimensions shall be as indicated in the Contract Documents.
2. The proposed floating dock system manufacturer may make adjustments in the overall float dimensions to accommodate its proprietary dock system's standard dimensions, or adjustments to provide structural integrity.
3. If float widths are increased by the floating dock system manufacturer, the control dimensions of the marina, such as clear slip widths, fairway width, number and size of slips, etc., shall also be increased to maintain these control dimensions.
4. All proposed dimensional changes made by the floating dock system manufacturer shall be pointed out in writing to the Owner and Engineer and in the submittal of the floating dock drawings.

PART II – PRODUCTS

2.1 General

A. Use materials compatible with a marine saltwater environment. These materials shall be resistant to corrosion, sunlight, marine organisms, and other destructive features associated with a marine environment.

B. The floating dock system shall consist of modular sections designed in such a manner that modules may be replaced with standard modules in case of repairs.

C. Walking surface of floating docks shall be level and flush with respect to the adjacent floats and shall provide a skid free surface under wet conditions.

D. The floating dock system shall be warranted against sinking, excessive water absorption, cracking, leaking, and against structural failure under design load conditions.

E. The floating dock system shall be anchored by the use of precast pre-stressed concrete pilings, piles, or an approved alternate material. Timber piles will not be allowed. The tops of pilings shall be as indicated.

2.2 Heavy Duty Poly Float Steel Formed Dock Sections

A. Heavy Duty systems will be built using an aluminum C-Channel frame system with .125" wall thickness, with height of either 4", 6" or 8" C-Channel. Aluminum will be 6061-T6 marine grade. Spacing of cross member(s) will depend on desired decking, but in no circumstance be greater than 24" center to center. All sections will have corner strength gussets, and sections are pre-drilled for ease of field installation.

B. Floatation of the heavy duty dock sections will be accomplished using our standard fabrication process as illustrated below.

1. Each float section shall be composed of hand welded High Density Polyethylene (HDPE) sheet plastic, using non-rotationally molded floats. sections are manufactured using individual sheets for sides, ends, bottoms, and tops. With a 100% guaranteed universal wall thickness of .150 inches (min.), and completely encapsulated expanded polystyrene (EPS) foam.

2. HDPE plastic will be black in color. All plastic material meets requirements of ASTM D4976 – PE 235 & FDA 21CFR 177.1520.

3. The density of an section is equal to approximately .950 grams per cubic inch or .058 grams per cubic centimeter per ASTM D4883.

4. The tensile strength at yield will be no less than 3800 pounds per square inch, and at break no less than 4400 pounds per square inch, per ASTM D638

5. The material will have a cold brittleness temperature at no less than -103° F

6. Completely encapsulated EPS shall be 100% virgin material and be of a closed cell nature allowing no more than 3% water penetration. This specification will ensure all sections will never sink. Floatation shall not be accomplished by use of air pockets in any form.

7. All EPS foam blocks used in the manufacturing process will be pre-cut and hand trimmed to exact size, then hand loaded into each float section to ensure 100% foam filled, air-tight encapsulation.

C. Floatation will be lag bolted into the bottom of the C-Channel with 3/8" x 1-1/2" stainless steel lag bolts. All heavy duty sections are bolted together with 3/8" x 5" stainless steel 304 series hardware. Several decking options are available to which Phillips oval-head deck screws are provided at time of shipment, so that the decking can be bolted down into the C-Channel.

D. The percentage of the footprint of floatation to the overall footprint of the dock surface area will be no less than 75% to maximize overall stability.

2.3 Dock Attachments

A. Attachments will be specific to each customer, however all approved sales will have an recommended attachment method which will be covered under warranty. All attachment methods shall have the ability to bolt directly into the framing system on every float section. There will be no set area where an attachment must take place. All Attachments will bolt into the framing system with 304 series Stainless Steel hardware.

B. Attachment methods include all of the following, as well as custom brackets not mentioned: Anchoring to pilings, seawalls, bulkheads, existing floating docks, spud poles, cross anchoring underneath dock, anchor chains, eco-mooring rodes with helix anchors, gangway hinge points, control arm hinges, standoffs.

C. Manufacturer approved attachment methods often rely on correct information provided by the customer. Drawings and/or Engineered stamped plans can be supplied upon request.

2.4 Dock Accessories:

A. All accessories will bolt directly into the framing system on every float section. There will be no set area where an accessory must be positioned. All accessories will bolt in the framing system with 304 series Stainless Steel hardware.

B. Common accessories include but are not limited to:

1. Bumpstrip – will be installed with $^{5}/_{16}$" carriage bolts and a double sided adhesive tape on the exterior wall of the 2" x 2" x .125" aluminum frame on specified float sections prior to shipment. Bumpstrip will have a P Profile with either a clay tone or beige color.
2. Miscellaneous Accessories – will have the ability to attach to the 2'' x 2'' x .125'' aluminum framing system on each float section with 304 series Stainless Steel hardware. This feature will allow the customer to place any accessory where the desire along the perimeter of each float section.

2.5 The walking surface utilizes WOLF PVC deck boards measuring 1-inch- thick x 5.5 inches wide with a solid cross section and an embossed simulated wood grain non-skid pattern surface on both sides of each individual deck board. WOLF deck boards are ICC code approved – CCRR – 0141, and are rated for a uniform live load of 100 lbs/ft² where structural performance has been demonstrated for a temperature range from-20°F to 125°F. WOLF Decking is currently available in seven different color options, however other decking options are available upon request. The deck boards are coated with an ASA cap stock resin which helps retain its original color under prolonged exposure to sun and weather. WOLF Decking shall have a 25-year stain and fade warranty.

2.6 Wales, Bull Rails, Rub Rails, And Other Timber and Wood Components

A. Timber components shall be Southern Pine, Grade No. 1, or better, as required by structural analysis, and shall conform to the rules of the SPIB and ASLS PS-20-70. Member sizes shown on the Drawings are to indicate general design concept only. Timber type, grade and size shall be selected based upon the load criteria specified in the paragraph entitled “Design Parameters”.

B. Timber shall also bear the quality marl of a certified inspection agency such as the Southern Pine Inspection Bureau or the Timber Products Inspection Bureau.

C. Timber shall be pressure treated with Chromated Copper Arsenate (CCA) conforming to AWPA Standard C2 and C18 (marine use treatment) to a 2.5 pounds per cubic foot retention minimum, and identified with a quality mark by and approved inspection agency certified by the American Standard Lumber Committee (ALSC). The presence of AWPA quality mark LP-22 may be accepted as evidence of conformance to the requirements for preservative treatment, at the Owner’s option. After treatment all wood shall be kiln dried to a maximum moisture content of 15 percent and shall be stored, handled and transported in accordance with AWPA Standard M4. Application of paint shall not constitute field treatment for preservation.

D. Timbers shall be drilled and cut before pressure treatment, as much as possible.

E. All connections for timber wale to float and wale to wale shall be bolted with through-rods at 12 inch centers, maximum. Use two 5/8 inch shear plates or 4 inch split rings with adequately sized plate washers (1/4 inch thick minimum) and lock nuts to distribute loads without damaging the timbers.

2.7 Hardware

A. Clip angles, plates, bars, etc., shall conform to ASTM A36 or ASTM A992, as applicable.

B. Unfinished bolts and nuts shall conform to ASTM A307.

C. High strength bolts and nuts shall conform to ASTM A325X, with threads excluded.

D. All steel members, assemblies, guides, and parts shall be galvanized by the hot dip process in accordance with ASTM A153.

E. Stainless steel screw and bolts shall comply with ANSI Type 316.

F. Fasteners: Bolts, nuts, washers, screws, nails, and other fasteners shall be Type 316 stainless steel or hot-dipped galvanized per ASTM A153. Bolts shall conform to ANSI/ASME B18.2.1. Wood screws shall conform to ANSI/ASME B18.6.1.

2.8 Aluminum

A. Aluminum members shall be aluminum alloy 6061-T6 or approved alternative suitable for use in a marine environment. Aluminum members shall be designed in accordance with the Aluminum Design Manual by the Aluminum Association and the governing building code.

B. Contact between aluminum and dissimilar metals or concrete shall be avoided, except for the use of compatible stainless steel pins, screws, or bolts. Where potential for galvanic corrosion exists, the aluminum shall be isolated from direct contact with other metals or concrete by use of suitable non-conducting insulators or bushings.

2.9 Mooring Cleats

A. Mooring cleats and their connections shall be constructed of a corrosion resistant material and shall be sized to resist the calculated mooring loads, based on Appendix 3 of “Marinas and Small Craft Harbors” by Tobiasson and Kollmeyer, for the indicated wind speed.

B. Provide not less than the indicated number of cleats along the sides of docks.

C. Cleats shall have at least a 10 inch long horn with not less than 4,000 pound capacity and shall be fastened to the timber wales with at least two 1/2 inch diameter ASTM A325X high strength through-bolts, with hardened washers and double nuts.

D. The ASTM A325X high strength through-bolt assemblies shall be hot dip galvanized in accordance with ASTM A153 after fabrication. Tap threads of bolts and nuts after galvanizing to ensure tight and locked connection.

E. Each cleat shall be connected to the wale with a hot dip galvanized connection angle (1/4 inch minimum thickness), with the cleat bolts and the float thru-bolts passing through the angles, as shown.

2.10 Dock Bumper

A. Provide dock bumper strip continuously along longitudinal edges and ends of the floats. Bumpers shall have the ability to protect boats from damage or discoloration due to normal docking procedures.

B. Material:

1. Flexible polyvinyl chloride – custom formulated 90 Durometer PVC with an added UV stabilizer and fungicide, in non-yellowing white color, or Owner-approved equal.
2. Bumper material shall not be affected by sunlight, saltwater, oil, gasoline or other agents or actions common to a marine saltwater environment.

C. Size:

1. Size to be determined by engineering calculations.
2. Horizontal Bumpers: 3.5 inch minimum vertical dimension (similar to Merco Marine #RR-5002).
3. Corner Bumpers: 3.5 inch minimum vertical dimension (similar profile to Merco Marine #RR-5002, except shaped for corner installation), 1-piece, L-shaped bumper specifically designed to protect vertical corners, at all outer vertical corners on the concrete floating docks.

2.11 Gangways: See concrete Float Specifications

PART III – EXECUTION

3.1 Inspections

A. At the option of the Owner, the Contractor shall not fabricate floats until an inspection is made by the Owner’s inspector of the manufacturer’s facility and procedures. The manufacturer’s facility shall be open to the Owner, the Owner’s representative, and the Owner’s inspector at any time that the floating dock system for this project is being manufactured.

B. Contractor shall inspect all of the floating dock system components and assemblies immediately upon delivery to the site to ensure that each component and assembly is in an undamaged condition.

C. Contractor shall submit a written statement outlining all damaged dock system components to the Owner within 7 days of receipt. The statement shall also indicate his acceptance of the components received, method of repair for those components that are repairable, and a schedule of replacement components for those that are not repairable.

3.2 Workmanship

A. Contractor shall use only experienced personnel to perform the Work, and shall provide a qualified company employee to perform full time inspection and supervision of the manufacturing assembly and floatation process, and shall assume full and complete responsibility for successful manufacture, assembly and anchorage of the system.

B. Work not representing a finished and acceptable appearance shall be rejected.

C. Finished metal members shall be free from twists, bends, distortions, open joints, sharp edges and burrs. Ends of exposed metal members shall be rounded or beveled. All coping and mitering shall be done with care. Galvanizing shall take place after the metal components and assemblies are fabricated.

D. Minimize drilling and cutting of steel, after galvanizing. Where necessary, such holes and edges shall be painted with high zinc dust content paint. All welds over galvanized material shall be thoroughly cleaned and coated with two coats of cold galvanizing compound.

E. All welding shall conform to the requirements of the American Welding Society, “Welding code – Steel” (AWS D1.1). Welds shall be a solid and homogeneous part of the metals joined and shall be free from pits or scale, and shall be of full area and length required to develop the required strength for the intended use. If a structural weld is not continuous “all-around” for the full joint width, then 1/8 in. seal welds shall be used to complete the joint width so that no open joint or gap or crevice remains to collect saltwater.

F. Bolts, nuts and washers shall be set square with connecting structural members and the nuts shall be drawn tight. Lock washers shall be used to prevent nuts from loosening, after being properly tightened. High strength bolts shall be used where required to carry the design load, in accordance with the American Institute of Steel Construction Specifications “Structural Joints Using ASTM A325 or A490 Bolts”.

G. Nails shall be driven to set the heads flush with the wood surface.

H. Timber members shall be counterbored wherever projecting bolt heads or nuts may damage boats or provide a hazard to dock users. Counterboring shall be sufficiently deep to permit installation of the bolts and nuts with washers well below the surface of the timber. The heads of dome head volts may project above the surface.

I. Connections between floats or other elements, such as lifting rings, shall not protrude above the level of the deck.

J. Connections shall be accomplished to permit removal and replacement of connectors without the necessity of removing other components for access. Connectors shall be of materials that are easily available and shall be positively contained so as to prevent their working free under anticipated wind and wave loading conditions.

K. Floats shall be rigidly connected to the wales, knee braces and pile guides by through-bolts.

L. The concrete floating dock system shall be anchored with a pile anchorage system. The pile anchorage system shall secure the floating docks under the most severe loading combinations, as specified under “Design Parameters” herein and at all water levels as indicated on the Drawings.

M. Float deck surfaces shall be sloped for proper drainage so that water will not puddle on the deck surface.

N. Floats shall set level in the water with the specified dead load freeboard as shown on the Drawings. Tolerance in freeboard shall be 1 inch, plus or minus, with maximum transverse tolerance of 1/8 inch per foot of float width.

O. Where gangways land on floating docks, additional flotation shall be provided such that the specified dead load and live load freeboard criteria are met under full live load for the gangway area.

P. Any potentially corrosive installation of dissimilar materials shall be properly insulated to eliminate corrosion in the marine environment. Aluminum in contact with steel shall be separated by a rubber gasket. Aluminum in contact with concrete shall be coated with thick coat of bituminous paint.

3.3 Manufacturer’s Services: Provide Manufacturer’s representative at the Site for installation assistance, inspection, and certification of proper installation.

3.4 Timber Wales And Rub Rails

A. Rigidly fasten wales to concrete floats and wales to wales by means of through-bolts, shear plates and split ring connectors, as required by structural design calculations.

B. Stagger wale splices such that only one wale is spliced per concrete float. Locate splices no closer than 2 feet from the end of a float.

C. Rub rails shall be fastened to float with 16d galvanized nails spaced at 12 inch centers (maximum) in a staggered pattern. Rub rails shall be counterbored to conceal through -bolts, nuts, plate washers, lock washers, etc.

3.5 Structural Steel Assemblies

A. Fasten to floats and wales by means of through-bolts at 12 inch centers, maximum spacing.

B. Provide at least 2 through-bolts to fasten each leg of an assembly to the floats.

3.6 Gangways: See Concrete Floating Dock Specifications

3.7 Cleats: Cleats shall be bolted to timber wales using 2 hot dip galvanized ASTM A325X high strength steel bolts. Bolts shall pass through the timber wale, with adequately sized plate washers and lock washers on the bottom.

3.8 Dock Bumper Strip

A. Install PVC dock bumper strip continuously along the longitudinal edges of dock floats, as indicated. Bumper shall protect boats from damage due to normal docking procedures.

B. Fasten dock horizontal bumper strips and vertical corner guards with aluminum nails of the number, size and spacing as recommended by the bumper manufacturer, not to exceed 6 inch center top and 12 inch center bottom.

C. Fasteners shall be flush with the surface of the bumper strips and corner guards, so that there are not sharp edges or protrusions.

END OF SECTION 35 51 14

MANUFACTURER’S SPECIFICATIONS

1.0 SCOPE

This specification covers the construction and placing of the Taos flush precast concrete building as produced by CXT® Incorporated.

2.0 SPECIFICATIONS

ASTM C33	Concrete Aggregates
ASTM C39	Method of Test for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C143	Method of Test for Slump of Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, or Concrete
ASTM C192	Method of Making and Curing Test Specimens in the Laboratory
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bar for Concrete Reinforcement
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcine Natural Pozzolan for Use in Concrete
ASTM C979	Standard Specification for Pigments for Integrally Colored Concrete
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 306	Cold Weather Concreting
ACI 318	Building Code Requirements Structural Concrete and Commentary (includes Errata)
PCI MNL 116	Quality Control for Plants and Production of Precast Prestressed Concrete Products

3.0 MANUFACTURER CRITERIA

The manufacturer supplying the requested precast concrete flush facility must meet the following:

A. Manufacturer must be ISO 9001 certified at the time of bid.

B. Manufacturing plant must be PCI certified at the time of bid.

C. Manufacturer must not have defaulted on any contract within the last five (5) years.

D. Manufacturer must provide stamped, engineered drawings prior to acceptance.

E. Manufacturer must be pre-approved prior to bidding.

F. Manufacturer must show four (4) examples of precast concrete flush facilities produced, installed and in use as an example of their ability to perform this contract.

G. Manufacturer (CXT) shall provide a one (1) year warranty on all concrete components. The warranty is valid only when concrete is used within the specified loadings. Furthermore, said warranty includes only the related material necessary for the construction and fabrication of said concrete components.

H. UL 752 Bullet Resistance on 4″ thick concrete samples.

Manufacturer meeting these criteria is:

CXT Incorporated
6701 E. Flamingo Avenue, Building 300
Nampa, ID 83687
Phone 800-696-5766

4.0 DESIGN CRITERIA

The flush building has been designed to individually meet the following criteria. Calculations and engineer's stamped drawings are available, for standard buildings, upon request by the customer and are for their sole and specific use only. The design criteria are to ensure that the flush building not only will withstand the forces of nature listed below, but to provide protection from vandalism and other unforeseen hazards. Building's structural and foundation design will be relevant to the region and properties associated with its final placement. Design will also meet all applicable accessibility and building code requirements. Buildings will also meet various structural loads such as below, but not limited to/or restricted by them.

A. Roof Snow Load
   1. The flush building is designed to withstand a 250 PSF snow load.

B. Floor Load
   1. The flush building is designed to withstand 400 PSF floor load.

C. Wind Load
   1. The flush building will withstand the effects of 150 miles per hour (3-second gust) wind exposure C.

D. Earthquake
   1. The flush building will withstand the effects of a seismic group 1 design category E earthquake.

E. Additional Design Standards
   1. The flush building is designed to meet the accessibility requirements put forth by federal, state, and local statutes.
   2. The flush building is an all concrete design with a minimum 3/12 roof pitch. The flush building shall have a minimum 4″ wall, 4½″ roof, and 5″ floor thickness.
   3. All wall to floor interior surface seams shall have a minimum 1″ radius coving made of high strength grout.

   + Recycled Material
   + LED Lighting

5.0 MATERIALS

A. Concrete – General
   1. The concrete mix design is designed to ACI 211.1 to produce concrete of good workability.
   2. Concrete will contain a minimum of 675 pounds of cementitious material per yard. Cement is a low alkali type I/II or III conforming to ASTM C-150.
   3. Coarse aggregates used in the concrete mix design will conform to ASTM C33 with the designated size of coarse aggregate #67.
   4. Maximum water/cement ratio will not exceed .45.
   5. Air-entraining admixtures will conform to ASTM C260. Water reducing admixtures will conform to ASTM C494, Type A.
   6. If Self Compacting Concrete (SCC) is used, it must conform to ASTM C1611.

B. Concrete Reinforcement
   1. All reinforcing steel will conform to ASTM A615. All welded wire fabric will conform to ASTM A185.
   2. All reinforcement is new, free of dirt, oil, paint, grease, loose mill scale and loose or thick rust when placed.
   3. Details not shown on drawings or specified are to ACI318.
   4. Steel reinforcement is centered in the cross-sectional area of the walls and will have at least 1¼" of cover on the under surface of the floor.
   5. The maximum allowable variation for center-center spacing of reinforcing steel is ½".
   6. Full lengths of reinforcing steel are used when possible. When splices are necessary on long runs, splices are alternated from opposite sides of the components for adjacent steel bars.
      a. Lap bars under #4 a minimum of 12" bar diameters.
      b. Lap bars larger than #4 a minimum of 24" bar diameters.
   7. Reinforcing bars are bent cold. No bars partially embedded in concrete are field bent unless approved by the customer.

C. Caulking, Grout, Adhesive and Sealer
   1. Caulking service temperatures from -40ºF to +194ºF.
   2. Interior and exterior joints are caulked with a paintable polyurethane sealant.
   3. Grout is a non-shrink type and are painted to match the color of surrounding concrete as nearly as possible.
   4. Cement base coating is formulated with a very fine aggregate system and is a built-in bonding agent.

D. Paint
   1. All paints and materials will conform to all federal specifications or be similar "top-of-the-line-components."
   2. Type of paints for toilets.
      a. Inside concrete surfaces.
         i. Interior floors will be a chemical resistant urethane. The color will be gray.

ii. Interior walls and ceilings will be a modified acrylic, water repellent penetrating stain. The color will be white followed by a clear acrylic anti-graffiti sealer.

b. Metal surfaces both inside and out.

i. DTM ALKYD.

c. Exterior concrete surfaces.

i. Exterior slab will be clear sealer

ii. Exterior walls and roof will be a water repellent penetrating stain in the same color as the walls or roof followed by a clear acrylic anti-graffiti sealer.

E. Grab Bars

1. Grab bars will be 18-gauge, type 304 stainless steel with 1½" clearance. Grab bars will each be able to withstand 300-pound top loading.

F. Toilet Paper Dispenser

1. Dispenser will be constructed of ¼" thick, type 304 stainless steel. Dispenser will be capable of holding three (3) standard rolls of toilet paper. Toilet paper holder fastening system will be able to withstand 300-pound top loading.

G. Steel Doors

1. Doors will be flush panel type 1¾" thick, minimum 16-gauge galvanized steel, top painted with DTM ALKYD.

2. Door frames will be knockdown or welded type, single rabbet, minimum 16-gauge prime coated steel top painted with DTM ALKYD, width to suit wall thickness. Three (3) rubber door silencers will be provided on latch side of frame.

H. Door Hinges

1. Door hinges will be three (3) per door with dull chrome plating 4½" x 4½", adjustable tension, and automatic closing for each door.

I. Lockset

1. Lockset will meet ANSI A156.2 Series 4000, Grade 1 cylindrical lockset for exterior door.

2. Lever handle both inside and out.

3. U.S. 26D finish.

J. Dead Bolt

1. Certified ANSI/BHMA A156.5-2001 Grade 1.

2. Heavy duty tamper resistant.

3. 2¾" backset.

4. U.S. 26D finish.

K. Doorstop

1. Doorstop will be a dome style stop meeting ANSI 156.16.

L. Double Coat Hook

1. Coat hook will be 304 stainless steel 16-gauge (1.5mm), formed construction with a satin finish and have 3⁄16" x ⅞" nail in anchor. Upper hook will extend at least 2½" from the wall. Lower hook will extend at least 1¼" from the wall.

M. Door Sweep

1. Door sweep will be provided at the bottom of door and will be an adjustable brush type.

N. Wall Vent
   1. Wall vent will be crank operated allowing the unit to be opened or closed. Crank will be removable. Vent cover will be 14-gauge 304 stainless steel and anchored into the concrete wall with high strength anti-rust tap con fasteners. Vent to come with insect screen. Cover to be recessed a minimum ¾" on exterior walls with a 45-degree bevel. Interior to be flush mounted. Wall vent will not protrude from the wall.

O. Signs
   1. Signs to have raised pictograms, letters, and braille to meet ADA.

P. Windows
   1. Window frames will be constructed from steel.
   2. Window glazing will be 3⁄16" thick translucent pebble finished mar-resistant Lexan.
   3. Windows to have ¾" recess with 45-degree bevel.
   4. Window frames to have vandal resistant fasteners.

Q. Mirrors
   1. Mirror to be 18" x 36" frameless 430 18-gauge stainless steel with #8 bright polish.

R. Stalls and Stall Doors
   1. Stall doors to be solid HDPE in matching white color.
   2. Stalls to be made of concrete in matching texture to walls.

S. Plumbing Flush Section/Room
   1. All fixtures to meet ANSI A112.19.2
   2. Plumbing will be concealed in the service area.
   3. *Flush valve* – Concealed closet flush-o-meter constructed of rough brass. Furnish valve with integral vacuum breaker and wall mounted push button. Valve will be of a water saver type. Water closet flow of 1.6 gallons per flush. Urinal .5 gallons per flush.
   4. *Hammer arrester* – Installed on water line.
   5. *Hose bib* – Available in the chase area.
   6. *Lavatory* – Vitreous china with back splashguard, front overflow opening, equipped with brass trap and drainpipe without stopper. Sink will be 20" wide x 18" front to back x 5¾" deep with ADA trap cover. Optional stainless steel fixtures available.
   7. Main shut-off valve and drain.
   8. *Toilet* – Constructed of vitreous china, wall hung, with siphon jet action. Toilet will have a back spud for a concealed flush valve connection and will be mounted with the top of the seat 18" above the finished floor. Seat will be heavy duty solid plastic with an open front. Optional stainless steel fixtures available.
   9. *Urinal* – Urinals will be constructed of vitreous china, wall hung with siphon jet action. Urinal will have a back spud for a concealed flush valve connection and will be mounted at proper height per code. Optional Stainless steel fixtures available.
   10. Trap primer distribution unit.
   11. *Waste and vent material* – ABS or PVC plastic and will be plumbed to meet Uniform Building Codes.

12. *Water material* – Copper tubing Type L, hard drawn. A gate valve will be provided at the inlet end of the water line. All water lines will be of a size to provide proper flushing action based on a nominal water pressure of 40 psi.
13. *Water valve* – Self-closing water set with indexed push button.
14. *Water heater* – High efficiency commercial grade water heater(s) provided per code.

T. Electrical

1. All components are UL listed.
2. *Breaker panel* – Sized to meet load requirements and mounted to meet electrical code.
3. *Interior lighting* – Vandal resistant fixtures with built-in occupancy sensor, energy efficient LED lights, and lifetime warranty.
4. *Exterior lighting* – Vandal resistant fixtures with built-in photoelectric switch, energy efficient LED lights.
5. *Exhaust fans* – All wet location motion activated with speed control in chase area to control CFM.
6. *Wiring* – Conduit, surface mounted in the service area and concealed in the user compartments. All wire will be copper.
7. GFI outlets provided per code requirements.
8. Optional warm air, ADA compliant, vandal resistant hand dryers available.

6.0 MANUFACTURE

A. Finishing Concrete

1. All exterior building walls and exterior screen walls will be any one of the available textures.
2. All exterior surfaces of the roof panels will be cast to simulate any one of the available textures. The underside of the overhang will have a smooth finish.

B. Cracks and Patching

1. Cracks in concrete components which are judged to affect the structural integrity of the building will be rejected.
2. Small holes, depressions, and air voids will be patched with a suitable material. The patch will match the finish and texture of the surrounding surface.
3. Patching will not be allowed on defective areas if the structural integrity of the building is affected.

7.0 FINISHING AND FABRICATION

A. Structural Joints

1. Wall components will be joined together with two (2) welded plate pairs at each joint. Each weld plate will be 6" long and located one (1) pair in the top quarter and one (1) pair in the bottom quarter of the seam. Weld plates will be anchored into the concrete panel and welded together with a continuous weld.
2. The inside seams will be a paintable caulk. The outside seams will use a caulk in a coordinating building color or clear.

3. Walls and roof will be joined with weld plates, 3" x 6" at each building corner.
4. The joint between the floor slab and walls will be joined with a grout mixture on the inside, a matching colored caulk on the outside and two (2) weld plates 6" long per wall.

B. Painting/Staining
   1. An appropriate curing time will be allowed before paint is applied to concrete.
   2. Schedule of finishes.
      a. Inside concrete surfaces.
         i. Inside floors will be one (1) coat of 1-part water based chemical resistant urethane.
         ii. Interior walls and ceilings will be two (2) coats of a modified acrylic, water repellent penetrating stain, followed by one (1) coat of clear sealer.
      b. Metal surfaces both inside and out.
         i. Two (2) coats of DTM ALKYD.
      c. Exterior concrete surfaces.
         i. Exterior walls will be two (2) coats of water repellent penetrating stain in the same color as the walls or roof followed by one (1) coat of clear acrylic anti-graffiti sealer.

8.0 TESTING

The following tests will be performed on concrete used in the manufacture of toilets. All testing will be performed in the CXT (PCI certified) laboratories. Testing will only be performed by qualified individuals who have been certified ACI Technician Grade 1. Sampling will be in accordance with ASTM C172.

A. The air content of the concrete will be checked per ASTM C231 on the first batch of concrete. The air content will be in the range of 5.0% +/- 2.0%.

B. The compressive strength of the cylinders will be tested to ASTM C39. We will make one (1) cylinder for release, one (1) for seven (7) days and one (1) for 28 days. The release must be a minimum strength of 2500 psi, the 7-day must be a minimum of 4500 psi and the 28-day must be a minimum of 5000 psi.

C. A copy of all test reports will be available to the customer as soon as 28-day test results are available.

9.0 INSTALLATION

A. Scope of Work
   1. Work specified under this section relates to the placement of the unit by CXT on customer prepared foundations. *See Installation Specifications or by others.*

B. Location
   1. It is the responsibility of the customer to:
      a. Provide exact location by stakes or other approved method.
      b. Provide clear and level site free of overhead and/or underground obstructions. *See Installation Questionnaire for details.*
      c. Provide access to the site for truck delivery and sufficient area for the crane to install and the equipment to perform the contract requirements. *See Installation Questionnaire for details.*
      d. Water, electrical, and sewage site connections to be placed per CXT drawings. Must be placed to easily connect to the building. *See Installation Questionnaire for details.*

C. Compacting
   1. The bottom of the area must be compacted after it has been dug out. After the base has been placed, it must be compacted as well. The bearing of the soil and base should be a minimum of 1,500 pounds per square foot.

D. Base
   1. After compacting the bottom of the area, a minimum of 6″ thick and consist of ¾″ minus crushed rock (i.e. road base material) compacted to 95% of optimal density in accordance with ASTM D1557. Finished surface of sub-base shall be flat and level, with a maximum deviation of -½″, +0″ from a true horizontal plane.
   2. The base should be placed for support, leveling and drainage purposes and also to limit frost action. The base must be confined so as to prevent washout, erosion, or any other undermining.

E. Access to Site
   1. Delivery to site made on normal highway trucks and trailers. If at the time of delivery conditions of access are hazardous or unsuitable for truck and equipment due to weather, physical constraints, roadway width or grade, CXT may require an alternate site with better access provided to ensure a safe and quality installation. In any such case, additional costs for cranes, trucking, etc. will be charged to the account of the customer. *See Installation Questionnaire for details.*

10.0 WARRANTY—PRECAST DIVISION

CXT provides a one (1) year warranty. CXT warrants that all goods sold pursuant hereto will, when delivered, conform to specifications set forth above. Goods shall be deemed accepted and meeting specifications unless notice identifying the nature of any non-conformity is provided to CXT in writing within the specified warranty. CXT, at its option, will repair or replace the goods or issue credit for the customer provided CXT is first given the opportunity to inspect such goods. It is specifically understood that CXT's obligation hereunder is for credit, repair, or replacement only, F.O.B. CXT's manufacturing plants, and does not include shipping, handling, installation or other incidental or consequential costs unless otherwise agreed to in writing by CXT.

This warranty shall not apply to:

1. Any goods which have been repaired or altered without CXT's express written consent, in such a way as in the reasonable judgment of CXT, to adversely affect the stability or reliability thereof;
2. To any goods which have been subject to misuse, negligence, acts of God or accidents; or
3. To any goods which have not been installed to manufacturer's specifications and guidelines, improperly maintained, or used outside of the specifications for which such goods were designed.

11.0 DISCLAIMER OF OTHER WARRANTIES

The warranty set forth above is in lieu of all other warranties, express or implied. All other warranties are hereby disclaimed. CXT makes no other warranty, express or implied, including, without limitation, no warranty of merchantability of fitness for a particular purpose or use.

12.0 LIMITATION OF REMEDIES

In the event of any breach of any obligation hereunder, breach of any warranty regarding the goods or any negligent act or omission or any party, the parties shall otherwise have all rights and remedies available at law; however, IN NO EVENT SHALL CXT BE SUBJECT TO OR LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

HEAVY TIMBER AND TRUSS CONSTRUCTION

Approved Heavy Timber/Truss Manufacturer

This project is to be designed, engineered, manufactured, delivered, and installed by **Structural Wood Components**, 11961 FM 529, Suite B, Houston TX 77041. Contact Randy Blanchard 281.259.0668 W, or randy@structuralwoodcomponents.com; or other approved and qualified manufacturer.

Notes:

All material and workmanship shall be in accordance with the "Timber Construction Standards" of the American Institute of Timber Construction, and Chapter 23 of the IBC.

All connections shall be designed and detailed by Structural Wood Components for the loads and/or reactions required for the project. Structural Wood Components shall submit to the Architect for review, engineering calculations of all connections and checked drawings showing shop fabrication details, field assembly and erection diagrams for all structural members. The shop drawings and calculations shall bear the certification of a licensed structural engineering in the State of Texas.

Materials:

Sawn lumber and timber shall be Southern Yellow Pine #2BTR and selected for appearance.

There shall be no cutting or modifying of the members in the field without the prior approval of the Architect and the manufacturer.

No wood treatments shall be applied without the prior approval of the Architect.

All materials shall be inspected and in compliance with the specifications, and all fabricating shall be completed by The San Jacinto River Authority approved and audited fabricator for Heavy Timber Trusses.

Wood Trusses:

Wood truss design and configuration is the responsibility of the truss manufacturer. Final truss heights and spans conditions may vary slightly from the preliminary designs and elevations shown.

The truss manufacturer shall coordinate the truss layout and design with the architect, the structural engineer for the foundation, and with the mechanical and electrical contractors.

All internal truss connections shall be designed by the truss manufacturer.

Truss handling, temporary bracing and permanent bridging/bracing of the trusses and frame during erection is the responsibility of the manufacturer.

Detailed shop drawings shall contain the following information: Details of the trusses with the sizes of all members indicated, species, grade, and specs of all wood used, loading conditions used in the truss design and all truss connections and column to beam, truss to beam, and truss to column connections details.

PART 3 – GEOTECHNICAL REPORT

GEOTECHNICAL ENGINEERING REPORT

SRA SAM COLLINS PARK

BURKEVILLE, TEXAS

GEOTECHNICAL ENGINEERING REPORT

SRA SAM COLLINS PARK

BURKEVILLE, TEXAS

Prepared by:

Riner Engineering, Inc.

Prepared for:

Kimley-Horn
11700 Katy Freeway, Suite 800
Houston, Texas 77079

Attention: Ms. Kristina Malek, PLA

September 19, 2022

RINER Project No. 21-0782

TEXAS ENGINEERING FIRM REGISTRATION NO. F-17076

Riner Engineering

GEOTECHNICAL AND MATERIALS ENGINEERING, TESTING AND INSPECTION

September 19, 2022

Ms. Kristina Malek, PLA
Kimley-Horn
11700 Katy Freeway, Suite 800
Houston, Texas 77079

Re: GEOTECHNICAL ENGINEERING REPORT
SRA Sam Collins Park
Burkeville, Texas
RINER Project No. 21-0782

Dear Ms. Malek:

Riner Engineering, Inc. (RINER) is pleased to submit this Geotechnical Engineering Report for the referenced project. We appreciate the opportunity of working with you. Please contact us if you have any questions or require additional services.

Respectfully submitted,

Harry (Hai) Minh Nguyen, Ph.D., P.E.
Senior Project Engineer

Hamed Ardalan, Ph.D., P.E.
Vice President – Engineering Director

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APPENDICES

GEOTECHNICAL ENGINEERING REPORT

SRA SAM COLLINS PARK
BURKEVILLE, TEXAS

1.0 INTRODUCTION

Project Location. The project is located in Sam Forse Collins Recreational Park, in Burkeville, Texas. The general location and orientation of the site are provided in Appendix A - Project Location Diagrams.

Project Description. The project consists of the following proposed improvements:

- A fish pier, a courtesy dock, two pavilions, two restrooms,
- Adding a lane to existing boat launch ramp, and
- Parking and drive areas.

Project Authorization. This geotechnical investigation was authorized by Ms. Kristina Malek, PLA, with Kimley-Horn and Associates and performed in accordance with RINER Proposal No. P21-1040, dated November 19, 2021.

Purpose and Methodology. The principal purposes of this investigation were to evaluate the general soil conditions at the proposed site and to develop geotechnical engineering design recommendations. To accomplish its intended purposes, the study was conducted in the following phases:

1. Drill sample borings to evaluate the soil conditions at the boring locations and to obtain soil samples;
2. Conduct laboratory tests on selected samples recovered from the borings to establish the pertinent engineering characteristics of the soils; and
3. Perform engineering analyses, using field and laboratory data, to develop design criteria.

Required Review. Detailed design plans were not available at the time of preparation of this report. Recommendations in our report are contingent upon RINER reviewing and approving in writing the following design items prior to construction:

- Site grading plan, and
- Foundation plan, details, and related structural loads.

Cautionary Statement Regarding Use of this Report. As with any geotechnical engineering report, this report presents technical information and provides detailed technical recommendations for civil and structural engineering design and construction purposes.

RINER, by necessity, has assumed the user of this document possesses the technical acumen to understand and properly utilize information and recommendations provided herein. RINER strives to be clear in its presentation and, like the user, does not want potentially detrimental misinterpretation or misunderstanding of this report. Therefore, we encourage any user of this report with questions regarding its content to contact RINER for clarification. Clarification will be provided verbally and/or issued by RINER in the form of a report addendum, as appropriate.

Report Specificity. This report was prepared to meet the specific needs of the client for the specific project identified. Recommendations contained herein should not be applied to any other project at this site by the client or anyone else without the explicit approval of RINER.

2.0 FIELD INVESTIGATION

Subsurface Investigation. The subsurface investigation for this project is summarized in the following table. Boring locations are provided in Appendix B - Boring Location Diagram.

Landside Borings			
Boring Nos.	Termination Depth, feet bgs[1]	Date Drilled	Location[2]
B-01	50	2/28/2022	Fishing Pier Area
B-02	50	2/28/2022	Event Pavilion Area
B-03	30	2/28/2022	Pavilion Area
B-04 and B-05	30	3/2/2022	Restroom Areas
B-06 to B-13	6	3/2/2022	Paving Area

Notes:
1. bgs = below ground surface.
2. Boring locations provided in Appendix B - Boring Location Diagram were not surveyed and should be considered approximate. Borings were located by recreational hand-held GPS unit. Horizontal accuracy of such units is typically on the order of 20-feet.

Waterside Borings				
Boring Nos.	Termination Depth, feet bgs[1]	Water Depth, feet	Date Drilled	Location[3]
B-14	75	4.3	2/17/2022	Boat Launch Ramp Area
B-15	75	4.0	2/16/2022	Courtesy Dock Area
B-16	75	3.5	2/19/2022	Fishing Pier Area

Notes:
1. bgs = below ground surface.
2. Water depth at boring location at time of our investigation.
3. Boring locations provided in Appendix B - Boring Location Diagram were not surveyed and should be considered approximate. Borings were located by recreational hand-held GPS unit. Horizontal accuracy of such units is typically on the order of 20-feet.

Boring Logs. Subsurface conditions were defined using the sample borings. Boring logs generated during this study are included in Appendix C - Boring Logs and Laboratory Results. Borings were advanced between sample intervals using continuous flight auger drilling procedures.

Cohesive Soil Sampling. Cohesive soil samples were generally obtained using Shelby tube samplers in general accordance with American Society for Testing and Materials (ASTM) D1587. The Shelby tube sampler consists of a thin-walled steel tube with a sharp cutting edge connected to a head equipped with a ball valve threaded for rod connection. The tube is pushed into the undisturbed soils by the hydraulic pulldown of the drilling rig. The soil specimens were extruded from the tube in the field, logged, tested for consistency using a hand penetrometer, sealed and packaged to maintain "in situ" moisture content.

Consistency of Cohesive Soils. The consistency of cohesive soil samples was evaluated in the field using a calibrated hand penetrometer. In this test a 0.25-inch diameter piston is pushed into the undisturbed sample at a constant rate to a depth of 0.25-inch. The results of these tests are tabulated at the respective sample depths on the boring logs. When the capacity of the penetrometer is exceeded, the value is tabulated as 4.5+.

Granular Soil Sampling. Granular soil samples were generally obtained using split-barrel sampling procedures in general accordance with ASTM D1586. In the split-barrel procedure, a disturbed sample is obtained in a standard 2-inch outside diameter (OD) split barrel sampling spoon driven 18-inches into the ground using a 140-pound (lb) hammer falling freely 30 inches. The number of blows for the last 12-inches of a standard 18-inch penetration is recorded as the Standard Penetration Test resistance (N-value). The N-values are recorded on the boring logs at the depth of sampling. Samples were sealed and returned to our laboratory for further examination and testing.

Groundwater Observations. Groundwater observations are shown on the boring logs.

Borehole Plugging. Upon completion of the borings, the boreholes were backfilled from the top and plugged at the surface.

3.0 LABORATORY TESTING

RINER performs visual classification and any of a number of laboratory tests, as appropriate, to define pertinent engineering characteristics of the soils encountered. Tests are performed in general accordance with ASTM or other standards and the results included at the respective sample depths on the boring logs or separately tabulated, as appropriate, and included in Appendix C - Boring Logs and Laboratory Results. Laboratory tests and procedures routinely utilized, as appropriate, for geotechnical investigations are tabulated in the following table.

Test Procedure	Description
ASTM D7928	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D1140	Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D1883	Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D2166	Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
ASTM D2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2217	Standard Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
ASTM D2434	Standard Test Method for Permeability of Granular Soils (Constant Head)
ASTM D2435	Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D2850	Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soil
ASTM D2937	Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
ASTM D4220	Standard Practices for Preserving and Transporting Soil Samples
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D4546	Standard Test Methods for One-Dimensional Swell or Settlement Potential of Cohesive Soils
ASTM D4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D4644	Standard Test Method for Slake Durability of Shales and Similar Weak Rocks
ASTM D4647	Standard Test Method for Identification and Classification of Dispersive Clay Soils by the Pinhole Test
ASTM D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D4767	Standard Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils
ASTM D4972	Standard Test method for pH of Soils
Manufacturer's Instructions	Soil Strength Determination Using a Torvane
Tex-145-E	Determining Sulfate Content in Soils - Colorimetric Method

4.0 SITE CONDITIONS

4.1 General

Review of Aerial Photographs. Historical aerial photographs of the site were reviewed for potential past alterations to the site which could impact geotechnical design conditions. Specifically, aerial photographs were reviewed to visually assess obvious areas of significant past fill on site. Aerial photographs reviewed for this study are included in Appendix D - Aerial Photographs.

Site Fills. Our review of aerial photographs revealed no obvious areas of significant fill on-site.

Limitations. Due to the intermittent nature and relatively low resolution of aerial photographs, as well as our lack of detailed information regarding the past land use of the site, our review should not be interpreted as eliminating the possibility of cuts and/or fills on site which could detrimentally affect future construction.

Topography. A United States Geological Survey (USGS) topographic map of the site is provided in Appendix E - USGS Topographic Map.

Site Photographs. Representative photographs of the site at the time of this investigation are provided in "Appendix F - Site Photographs".

4.2 Geology

Geologic Formation. Based on available surface geology maps and our experience, it appears this site is located in the Catahoula Formation and the Terrace Deposits. A geologic atlas and USGS formation description are provided in "Appendix G - Geologic Information". Soils within the Catahoula Formation can generally be characterized as sand and mudstone. Soils within the Terrace Deposits can generally be characterized as sand, silt, clay and gravel.

Geologic Faults. A geologic fault study was beyond the scope of this investigation.

4.3 Soil

Stratigraphy. Descriptions of the various strata and their approximate depths and thickness per the Unified Soil Classification System (USCS) are provided on the boring logs included in "Appendix C - Boring Logs and Laboratory Results". Terms and symbols used in the USCS are presented in "Appendix H - Unified Soil Classification System". A brief summary of the stratigraphy indicated by the borings is provided in the following tables.

Generalized Subsurface Conditions at Proposed Fishing Pier, Courtesy Dock, and Boat Launch Ramp Location **Waterside** (Borings B-14 to B-16)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	18 to 38	VARIABLE SAND AND FAT CLAY	Firm to Hard SANDY FAT CLAY (CL) / FAT CLAY WITH SAND (CH)/ FAT CLAY (CH) AND Loose to Dense SILTY SAND.
18 to 38	75	SAND	Medium Dense to Very Dense SILTY SAND (SM) / SAND WITH SILT (SM) / POORLY GRADED SAND WITH SILT (SP-SM).
Note: Boring Termination Depths = 75 feet bgs			

Generalized Subsurface Conditions at Proposed Fishing Pier Location in Landside (Boring B-01)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	2	LEAN CLAY	Hard SANDY LEAN CLAY (CL).
2	50	FAT CLAY	Hard FAT CLAY (CH).
Note: Boring Termination Depths = 50 bgs			

Generalized Subsurface Conditions at Proposed Event Pavilion Location (Boring B-02)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	6	SAND	Medium Dense SILTY SAND (SM).
6	18	FAT CLAY	Soft to Stiff FAT CLAY WITH SAND (CH).
18	23	CLAYEY SAND	Soft CLAYEY SAND (SC).
23	50	FAT CLAY	Stiff to Hard FAT CLAY WITH SAND (CH).
Note: Boring Termination Depth = 50 feet bgs.			

Generalized Subsurface Conditions at Proposed Pavilion Location (Boring B-03)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	30	FAT CLAY	Hard SANDY FAT CLAY WITH SAND (CH).
Note: Boring Termination Depth = 30 feet bgs.			

Generalized Subsurface Conditions at Proposed Restroom Locations (Borings B-04 and B-05)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	18	LEAN CLAY AND FAT CLAY	Soft to Stiff SANDY LEAN CLAY (CL) and Soft to Hard SANDY FAT CLAY (CH) / FAT CLAY (CH)/ FAT CLAY WITH SAND (CH).
18	30	VARIABLE FAT CLAY AND SAND	Medium Dense SILTY SAND (SM) and Soft to Hard SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH).
Boring Termination Depths = 30 feet bgs			

Generalized Subsurface Conditions at Proposed Paving Location (Borings B-06 to B-13)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	1 to 6	CLAYEY SAND	Soft to Hard CLAYEY SAND (SC),
1 to 2	6	FAT CLAY	Very Stiff to Hard SANDY FAT CLAY (CH)/ Very Stiff to Hard FAT CLAY (CH)/ Very Stiff FAT CLAY WITH SAND (CH). Note: SILTY SAND (SM) was encountered at 2- to 6-feet in Boring B-11.
Note: Boring Termination Depth = 6 feet bgs.			

Moisture Change Susceptibility of Near Surface Soils. The sandier/siltier soils encountered at and near the ground surface at this site are very susceptible to changes in moisture. The presence of surface water due to precipitation or groundwater may result in a decrease in the ability to compact and work with the soil. It is common for these soils to pump when subjected to high levels of moisture. In addition, these soils located at and near the ground surface will allow surface water to infiltrate until the water becomes perched on a less permeable layer at depth. Soils of this type are especially prone to requiring the implementation of wet weather/soft subgrade recommendations provided in this report.

Swell Potential based on Atterberg Limits. Atterberg (plastic and liquid) limits were performed on 14 shallow soil samples (Landside) obtained at depths between 2- and 8-feet bgs. The plasticity index of the samples was between 8 and 71 with an average of 40 indicating that the soils have a high potential for shrinking and swelling with changes in soil moisture content.

Swell Tests. Swell tests were performed on selected clay soil samples. Swell test details are provided in "Appendix C - Boring Logs and Laboratory Results". The results of the tests are summarized in the following table.

Boring No.	Avg. Depth (ft.)	Moisture Content, w, %	Liquid Limit, LL	Plasticity Index, PI	Applied Overburden Stress (psi)	Swell (%)
B-02	7	36	75	42	6.7	0.00
B-03	1	37	64	27	0.8	0.10
B-03	7	32	53	25	6.7	0.00
B-04	3	44	71	36	2.6	0.00
B-04	7	46	59	24	6.7	0.00
B-05	3	18	49	34	2.6	0.40
B-05	7	32	62	42	6.7	0.08

4.4 Groundwater

Groundwater Levels. The borings were advanced using auger drilling and intermittent sampling methods in order to observe groundwater seepage levels. Groundwater levels encountered in the borings during this investigation are identified in the following table.

Boring No.	Depth Groundwater Initially Encountered (feet, bgs)	Groundwater Depth after 15 Minutes (feet, bgs)
B-01	Not Encountered Up to 35-feet [1]	--
B-02	Not Encountered Up to 20-feet [1]	--
B-03 to B-13	Not Encountered	Not Encountered
B-14 through B-16	Underwater Drilling & Sampling	Underwater Drilling & Sampling
Note: 1. Groundwater was not encountered during dry augering of the borings. Water was introduced into the borings at the noted depths to aid in drilling operations. Groundwater may be present below the noted depths but was not detected due to the drilling procedure employed.		

Long-term Groundwater Monitoring. Long-term monitoring of groundwater conditions via piezometers was not performed during this investigation and was beyond the scope of this study. Long-term monitoring can reveal groundwater levels materially different than those encountered during measurements taken while drilling the borings.

Groundwater Fluctuations. Future construction activities may alter the surface and subsurface drainage characteristics of this site. It is difficult to accurately predict the magnitude of subsurface water fluctuations that might occur based upon short-term observations. The groundwater level should be expected to fluctuate throughout the years with variations in precipitation.

5.0 ANALYSIS AND RECOMMENDATIONS

5.1 Seismic Site Classification

The seismic site classification is based on the 2018 International Building Code (IBC) and is a classification of the site based on the type of soils encountered at the site and their engineering properties. Per Table 20.3-1 of ASCE 7-10, the seismic site classification for this site is D.

5.2 Potential Vertical Soil Movements

Problem Discussion. Most clay soils swell when subjected to increases in moisture content. Swelling clay soils exert an outward pressure that can easily exceed 5,000 psf when subjected to moisture increases. Swell potential and swell pressures are a function of several factors including clay mineralogy and antecedent moisture condition. Generally, for a given clay soil, the drier the soil the greater its potential to swell and the higher its swell pressure. Conversely, wetter soils generally have a lower potential to swell and have lower swell pressures. The potential for a clay soil to swell is a variable and cannot be separated from its moisture condition.

The overburden pressure at a given depth above the groundwater table is calculated as the unit weight of the soil times the depth. For a soil with a unit weight of 125 pcf, the overburden pressure at 10-feet would be 1250 psf (125 pcf x 10-feet). Thus, the swell pressure can exceed the overburden at depths of over 40-feet. This means soils at 40-feet exposed to changes in moisture can impact movements at the ground surface.

For a clay soil to swell or shrink, it must be subjected to increases or decreases in moisture content, respectively. The predominant way clay soils are subjected to increases or decreases in moisture content is the weather. As would be expected, extended periods of wet weather cause soil to get wetter and extended dry weather cause soil to get drier. The longer the period of wet or dry weather, the deeper the influence of the weather. Vegetation also causes variations in soil moisture content. Shallow rooted grass and bushes have a shallower impact, deep rooted trees have a deeper impact.

For a clay soil at a given depth to influence surface heave, two things must happen: (1) the soil must be subjected to an increase in moisture, and (2) the swell pressure of the soil must exceed the overburden pressure. Swell is typically calculated by assuming an "active" zone, a depth of soil impacted by weather which predominantly affects surface movements due to soil swell. Expansive soils below the active zone are typically ignored as they are assumed to be exposed to lower increases in moisture, experience higher overburden pressures, and have a less significant impact on the surface heave than the soils in the active zone.

"Deep-seated" soil movement is swelling of the clay soils below the active zone and above the equilibrium depth. The equilibrium depth is the depth at which the overburden pressure and clay swell pressure are equal. Deep-seated soil movement is caused by changes in moisture that are typically not related to weather or vegetation. They can be caused by man-made influences such as leaking deep water or sewer lines. They can be caused by natural influences such as fluctuations in soil moisture content or groundwater levels. They are notoriously hard to accurately predict and may or may not actually occur. Unless stated otherwise, we have not included the effects of deep-seated soil movement in our Potential Vertical Rise (PVR) calculation. The inclusion of deep-seated soil movement drastically increases the depth of the building pad preparation required and may make a slab-on-grade target PVR of 1-inch theoretically unattainable. The inclusion or exclusion of deep-seated soil movement is a matter of professional opinion, on which there is no consensus among consultants. It is also a matter of risk tolerance and cost, of which, the user of this report is being made aware.

As evidenced in this discussion, calculation of PVR is based on soil data, model assumptions, experience, and professional judgment. PVR is a calculated estimate and should not be construed to be an absolute number or a guarantee of performance. PVR can be higher or lower depending on actual site conditions. The PVR estimate we provide is our best estimate of what will be encountered and the user of this report with doubts is encouraged to get another professional opinion prior to using this report. However, based on this discussion, the reader understands variations between the model and reality can introduce significant differences in calculated PVR. The user of this report understands and accepts this risk. If this risk is intolerable, the user of this report should be prepared to utilize a structural slab suspended adequately above the subgrade surface and supported on deep foundations.

Differential swelling of clay soil is generally most pronounced around the perimeter of slabs or pavement where weather and/or vegetative influences are greatest. Unstiffened slabs or paving are generally prone to cracking around 5- to 10-feet from and parallel to the slab edge due to differential soil movements. If this expected cracking is unacceptable or needs to be minimized, the structural engineer should consider slab stiffening using grade beams and/or a flexible slab/wall connection design. We should be consulted by the structural engineer for clarifications and input regarding this type of slab movement if it is deemed critical.

Maintaining a consistent moisture content in the soil is the key to minimizing both heave and shrinkage related structural problems. Therefore, building maintenance and control of water are paramount in the performance of a slab-on-grade and shallow foundations.

PVR or Equivalent Calculations. The PVR or its equivalent can be estimated several ways. RINER utilizes the TxDOT method, swell tests, and a Volflo analysis to provide the best possible understanding of expected PVR and its variability.

Calculated PVR using TxDOT Method Tex-124-E. PVR calculations were performed in general accordance with the Texas Department of Transportation (TxDOT) Method Tex-124-E. The Tex-124-E method is empirical and is based on the Atterberg limits and moisture content of the subsurface soils. The calculated PVR is an empirical estimate of a soil's potential for swell based upon the soil's plasticity index, applied loading (due to structures or overburden), and antecedent moisture condition. The PVR calculated using TxDOT Method Tex-124-E is about 1.5 to 2-inches assuming an average antecedent moisture condition. The calculated PVR is consistent with soil moisture conditions at the time this investigation was conducted. An 8-feet zone of seasonal moisture variation was used in our analysis based on local experience.

Calculated PVR using Swell Test Results. The equivalent PVR based on the swell test results is about 1-inch. The PVR based on swell test results is dependent on the moisture conditions at the time of testing. An 8-feet zone of seasonal moisture variation was used in our analysis based on local experience.

Calculated PVR using Volflo Analysis. The equivalent PVR based on the Volflo analysis results is about 1- to 1.5-inches. The calculated PVR based on the Volflo analysis is dependent on the moisture conditions at the time of testing. An 8-feet zone of seasonal moisture variation was used in our analysis based on local experience.

Soil Moisture Confirmation Prior to Construction. The calculated PVR can vary considerably with prolonged wet or dry periods. We recommend the moisture content for the upper X-feet (active zone) of soils within the building pad be assessed for consistency with this report prior to construction if: (1) an extended period of time has elapsed between the performance of this investigation and construction of the foundation, or (2) unusually wet or dry weather is experienced between the performance of this investigation and construction of the foundation.

5.3 Construction Excavations

Applicability. Recommendations in this section apply to short-term construction-related excavations for this project.

Sloped Excavations. All sloped short-term construction excavations on-site should be designed in accordance with Occupational Safety and Health Administration (OSHA) excavation standards. Borings from this investigation indicated that the soils may be classified per OSHA regulations as Type C from the ground surface to a depth of 10-feet bgs. Short-term construction excavations may be constructed with a maximum slope of 1.5:1, horizontal to vertical (H:V), to a depth of 10-feet bgs. If excavations are to be deeper than 10-feet, we should be contacted to evaluate the excavation. Recommendations provided herein are not valid for any long-term or permanent slopes on-site.

Shored Excavations. As an alternative to sloped excavations, vertical short-term construction excavations may be used in conjunction with trench boxes or other shoring systems. Shoring systems should be designed using an equivalent fluid weight of 85 pounds per cubic foot (pcf) above the groundwater table and 105 pcf below the groundwater table. Surcharge pressures at the ground surface due to dead and live loads should be added to the lateral earth pressures where they may occur. Lateral surcharge pressures should be assumed to act as a uniform pressure along the upper 10-feet of the excavation based on a lateral earth coefficient of 0.5. Surcharge loads set back behind the excavation at a horizontal distance equal to or greater than the excavation depth may be ignored. We recommend that no more than 200-feet of unshored excavation should be open at any one time to prevent the possibility of failure and excessive ground movement to occur. We also recommend that unshored excavations do not remain open for a period of time longer than 24-hours.

Limitations. Recommendations provided herein assume there are no nearby structures or other improvements which might be detrimentally affected by the construction excavation. Before proceeding, we should be contacted to evaluate construction excavations with the potential to affect nearby structures or other improvements.

Excavation Monitoring. Excavations should be monitored to confirm site soil conditions consistent with those encountered in the borings drilled as part of this study. Discrepancies in soil conditions should be brought to the attention of RINER for review and revision of recommendations, as appropriate.

5.4 Groundwater Control

Groundwater was not encountered up to 20-feet during dry augering of the borings in landside. If groundwater is encountered during excavation, dewatering to bring the groundwater below the bottom of excavations may be required. Dewatering could consist of standard sump pits and pumping procedures, which may be adequate to control seepage on a local basis during excavation. Supplemental dewatering will be required in areas where standard sump pits and pumping is not effective. Supplemental dewatering could include submersible pumps in slotted casings, well points, or eductors. The contractor should submit a groundwater control plan, prepared by a licensed engineer experienced in that type of work.

5.5 Earthwork

5.5.1 Site Preparation

In the area of improvements, all concrete, trees, stumps, brush, debris, septic tanks, abandoned structures, roots, vegetation, rubbish and any other undesirable matter should be removed and properly disposed. All vegetation should be removed and the exposed surface should be scarified to an additional depth of at least 6 inches. It is the intent of these recommendations to provide a loose surface with no features that would tend to prevent uniform compaction by the equipment to be used.

5.5.2 Proofroll

Building pad (event pavilion and restrooms) and paving subgrades should be proofrolled with a fully loaded tandem axle dump truck or similar pneumatic-tire equipment to locate areas of loose subgrade. In areas to be cut, the proofroll should be performed after the final grade is established. In areas to be filled, the proofroll should be performed prior to fill placement. Areas of loose or soft subgrade encountered in the proofroll should be removed and replaced with engineered fill, moisture conditioned (dried or wetted, as needed) and compacted in place.

5.5.3 Grading and Drainage

Every attempt should be made to limit the extreme wetting or drying of the subsurface soils because swelling and shrinkage of these soils will result. Standard construction practices of providing good surface water drainage should be used. A positive slope of the ground away from any foundation should be provided. Ditches or swales should be provided to carry the run-off water both during and after construction. Stormwater runoff should be collected by gutters and downspouts and should discharge away from the buildings.

Root systems from trees and shrubs can draw a substantial amount of water from the clay soils at this site, causing the clays to dry and shrink. This could cause settlement beneath grade-supported slabs such as floors, walks and paving. Trees and large bushes should be located a distance equal to at least one-half their anticipated mature height away from grade slabs.

Lawn areas should be watered moderately, without allowing the clay soils to become too dry or too wet.

5.5.4 Wet Weather/Soft Subgrade

Soft and/or wet surface soils may be encountered during construction, especially following periods of wet weather. Wet or soft surface soils can present difficulties for compaction and other construction equipment. If specified compaction cannot be achieved due to soft or wet surface soils, one of the following corrective measures will be required:

1. Removal of the wet and/or soft soil and replacement with select fill,
2. Chemical treatment of the wet and/or soft soil to improve the subgrade stability, or
3. If allowed by the schedule, drying by natural means.

Chemical treatment is usually the most effective way to improve soft and/or wet surface soils. RINER should be contacted for additional recommendations if chemical treatment is planned due to wet and/or soft soils.

5.5.5 Fill

<u>Select Fill</u>. Any fill placed in the PVR sensitive structure pad areas should consist of select fill. Select fill should consist of soil with a liquid limit less than 35 and a Plasticity Index between 7 and 20. The select fill should be placed in loose lifts not exceeding 8-inches and should be compacted to at least 95 percent maximum dry density (per ASTM D-698) and at a moisture content between optimum and 4 percent above optimum moisture content. The subgrade to receive select fill should be scarified to a depth of 6 inches and compacted to 92 to 96 percent of the material's maximum standard Proctor dry density (ASTM D-698) at a workable moisture level at least 4 percentage points above optimum.

<u>Lime-treated Native Clay Soil</u>. Based on the laboratory testing conducted for this investigation, the native clay on-site soils will not meet specifications for select fill outlined in the section titled "Fill". As an alternative to importing select fill, the native clay soil may be blended with lime to reduce the plasticity index to meet select fill requirements. Based on our experience, we expect that it will require between 4- and 6-percent lime (by dry unit weight) to reduce the plasticity index of the native clay soils to select fill requirements. Prior to selecting this alternative, lime series tests should be performed to assess the amount of lime required.

<u>General Fill</u>. General fill may be placed in improved areas outside of building pad areas. General fill should consist of material approved by the Geotechnical Engineer with a liquid limit less than 50. General fill should be placed in loose lifts not exceeding 8-inches and should be uniformly compacted to a minimum of 95 percent maximum dry density (per ASTM D-698) and within ±2 percent of the optimum moisture content.

<u>Fill Restrictions</u>. Select fill and general fill should consist of those materials meeting the requirements stated. Select fill and general fill should not contain material greater than 4-

inches in any direction, debris, vegetation, waste material, environmentally contaminated material, or any other unsuitable material.

Unsuitable Materials. Materials considered unsuitable for use as select fill or general fill include low and high plasticity silt (ML and MH), silty clay (CL-ML), organic clay and silt (OH and OL) and highly organic soils such as peat (Pt). These soils may be used for site grading and restoration in unimproved areas as approved by the Geotechnical Engineer. Soil placed in unimproved areas should be placed in loose lifts not exceeding 10-inches and should be compacted to at least 92 percent maximum dry density (per ASTM D-698) and at a moisture content within ±4 percentage points of optimum.

Cautionary Note. It is extremely important that select fill placed within building pads be properly characterized using one or more representative proctor samples. The use of a proctor sample which does not adequately represent the select fill being placed can lead to erroneous compaction (moisture and density) results which can significantly increase the potential for swelling of the select fill. The plasticity index of select fill soils placed during construction should be checked every day to confirm conformance to the project specifications and consistency with the proctor being utilized.

5.5.6 Testing

Required Testing and Inspections. Field compaction and classification tests should be performed by RINER. Compaction tests should be performed in each lift of the compacted material. We recommend the following minimum soil compaction testing be performed: one test per lift per 2,500 square feet (SF) in the area of the building pad, one test per lift per 5,000 SF outside the building pad, and one test per lift per 100 linear feet of utility backfill. If the materials fail to meet the density or moisture content specified, the course should be reworked as necessary to obtain the specified compaction. Classification confirmation inspection/testing should be performed daily on select fill materials (whether on-site or imported) to confirm consistency with the specifications.

Liability Limitations. Since proper field inspection and testing are critical to the design recommendations provided herein, RINER cannot assume responsibility or liability for recommendations provided in this report if construction inspection and/or testing is performed by another party.

5.6 Demolition Considerations

Applicability. Recommendations in this section apply to the removal of any existing foundations, utilities or pavement which may be present on this site.

General. Special care should be taken in the demolition and removal of existing floor slabs, foundations, utilities and pavements to minimize disturbance of the subgrade. Excessive disturbance of the subgrade resulting from demolition activities can have serious detrimental effects on planned foundation and paving elements.

Existing Foundations. Existing foundations are typically slabs, shallow footings, or drilled piers. If slab or shallow footings are encountered, they should be completely removed. If drilled piers are encountered, they should be cut off at an elevation at least 24-inches below proposed grade beams or the final subgrade elevation, whichever is deeper. The remainder of the drilled pier should remain in place. Foundation elements to remain in place should be surveyed and superimposed on the proposed development plans to determine the potential for obstructions to the planned construction. RINER should be contacted if drilled piers are to be excavated and removed completely. Additional earthwork activities will be required to make the site suitable for new construction if the piers are to be removed completely.

Existing Utilities. Existing utilities and bedding to be abandoned should be completely removed. Existing utilities and bedding may be abandoned in place if they do not interfere with planned development. Utilities which are abandoned in place should be properly pressure-grouted to completely fill the utility.

Backfill. Excavations resulting from the excavation of existing foundations and utilities should be backfilled in accordance with Section 5.5.5 - Fill.

Other Buried Structures. Other types of buried structures (wells, cisterns, etc.) could be located on the site. If encountered, RINER should be contacted to address these types of structures on a case-by-case basis.

5.7 Loading on Buried Structures

Uplift. Buried water-tight structures are subjected to uplift forces caused by differential water levels adjacent to and within the structure. Soils with any appreciable silt or sand content will likely become saturated during periods of heavy rainfall and the effective static water level will be at the ground surface. For design purposes, we recommend the groundwater level be assumed at the ground surface. Resistance to uplift pressure is provided by soil skin friction and the dead weight of the structure. Skin friction should be neglected for the upper 3 feet of soil. A skin friction of 200 pounds per square foot (psf) may be used below a depth of 3 feet.

Lateral Pressure. Lateral pressures on buried structures due to soil loading can be determined using an equivalent fluid weight of 105 pounds per cubic foot (pcf). This includes hydrostatic pressure but does not include surcharge loads. The lateral load produced by a surcharge may be computed as 50 percent of the vertical surcharge pressure applied as a constant pressure over the full depth of the buried structure. Surcharge loads located a horizontal distance equal to or greater than the buried structure depth may be ignored.

Vertical Pressure. Vertical pressures on buried structures due to soil loading can be determined using an equivalent fluid weight of 125 pcf. This does not include surcharge loads. The vertical load produced by a surcharge may be computed as 100 percent of the vertical surcharge pressure applied as a constant pressure over the full width of the buried structure.

5.8 Retaining Structures

Applicability. RINER was not notified of any specific retaining structures in conjunction with this project. Recommendations provided in this section are applicable to structures 5-feet or less in height. Retaining structures in excess of 5-feet should be brought to the attention of RINER for a more detailed assessment. *It is imperative that global stability be reviewed by RINER on any retaining structure in excess of 5-feet in height.*

At-Rest Lateral Pressure. Lateral pressures on retaining structures due to soil loading can be determined using an equivalent fluid weight of 85 pcf if fill behind the wall is free-draining and above the groundwater table and 105 pcf if fill behind the wall is not free draining or is below the groundwater table. This does not include surcharge loads. This also assumes a horizontal ground surface behind the structure. The lateral load produced by a surcharge may be computed as 50 percent of the vertical surcharge pressure applied as a constant pressure over the full depth of the buried structure. Surcharge loads set back behind the retaining structure at a horizontal distance equal to or greater than the structure height may be ignored.

Lateral Resistance. Resistance to lateral loads may be provided by the soil adjacent to the structure. We recommend using an equivalent fluid weight of 150 pcf for lateral resistance. The passive resistance should be ignored if the material in front of the wall will be excavated at any time in the future. A coefficient of sliding friction of 0.25 between the retaining structure concrete footings and underlying soil may be combined with the passive lateral resistance. *Appropriate safety factor should be utilized by the structural engineer for external stability analyses of the retaining structures.*

Bearing Capacity. Assuming a minimum embedment depth of 24-inches, an allowable bearing capacity of 2,000 psf may be used for retaining structure footings (using a Factor of Safety of 3).

5.9 Buried Pipe

Applicability. Recommendations in this section are applicable to the design of buried piping placed by open cut methods associated with this project.

Pressure on Buried Pipe. Design recommendations provided in the "Loading on Buried Structures" section of this report apply to buried piping.

Thrust Restraints. Resistance to lateral forces at thrust blocks will be developed by friction developed along the base of the thrust block and passive earth pressure acting on the vertical face of the block. We recommend a coefficient of base friction of 0.25 along the base of the thrust block. Passive resistance on the vertical face of the thrust block may be calculated using the allowable passive earth pressures presented in the following table.

Allowable Passive Earth Pressure by Material Type	
Material	Allowable Passive Pressure (psf)
Sand	100 x Depth in Feet
Native Clay and Clayey Sand	2,000
Compacted Clay Fill	1,500
Note: Passive resistance should be neglected for any portion of the thrust block within 3 feet of the final site grade. The allowable passive resistance for native clays and clayey sand is based on the thrust block bearing directly against vertical, undisturbed cuts in these materials.	

Bedding and Backfill. Pipe bedding and pipe-zone backfill for the water and sanitary sewer piping should be in accordance with TxDOT standard specification Item 400 or the local equivalent. The pipe-zone consists of all materials surrounding the pipe in the trench from six (6) inches below the pipe to 12 inches above the pipe.

Trench Backfill. Excavated site soils will be utilized to backfill the trenches above the pipe-zone. Backfilled soil should be placed in loose lifts not exceeding 8-inches and should be compacted to at least 95 percent maximum dry density (per ASTM D-698) and at a moisture content between optimum and 4 percent above optimum moisture content.

Trench Settlement. Settlement of backfill should be anticipated. Even for properly compacted backfill, fills in excess of 8 to 10 feet are still subject to settlements over time of about 1 to 2 percent of the total fill thickness. This level of settlement can be significant for fills beneath streets. Therefore, close coordination and monitoring should be performed to reduce the potential for future movement.

5.10 Foundation System

Appropriate Foundation Types. The following foundation types are appropriate to the site based on the geotechnical conditions encountered:

- Restrooms - Slab foundation,
- Pavilions - Shallow foundation or straight shaft drilled piers, and.
- Fish Pier, Courtesy Dock, and Boat Launch Ramp - Driven piles.

Foundation Determination. We have assumed that structural loads will be typical for the type and size of buildings and structures proposed. Recommendations for the foundation types are presented below. Final determination of the foundation type to be utilized for this project should be made by the Structural Engineer based on loading, economic factors and risk tolerance.

Avoidance of Mixing Foundation Types. Mixing of foundation types for a given structure should be avoided. Where mixing different foundation types is required for a given structure, we should be contacted to review the foundation plans prepared by the Structural Engineer prior to construction. Different foundation types can have incompatible movement characteristics.

Foundations Adjacent to Slopes. Foundations placed too close to adjacent slopes steeper than 5H:1V may experience reduced bearing capacities and/or excessive settlement. Recommendations provided herein assume foundations are not close enough to adjacent slopes in excess of 5H:1V to be detrimentally affected. Therefore, foundations closer than 5 times the depth of adjacent slopes, pits, or excavations in excess of 5H:1V should be brought to our attention in order that we may review the appropriateness of our recommendations.

Assumed Maximum Cut/Fill Depth. We have also assumed that cut/fill of less than 1-foot will be required to bring the site to grade. In the event cut/fill in the building pad exceed 1-foot, we should be notified and allowed to review the design to assess the suitability of the foundation recommendations provided. ***RINER must be allowed to review the finalized grading plan to assess the appropriateness of our recommendations.***

Foundation Plans Review. Our office should be contacted to review the foundation plans, details and related structural loads, prior to finalizing the design to check conformance with the recommendations presented herein.

5.10.1 Slab Foundation

General. The proposed restrooms can be supported on a reinforced ground-supported slab foundation. The slab foundation should be conventionally reinforced or post-tension reinforced. The slab foundation should be designed with exterior and interior grade beams adequate to provide sufficient rigidity to the foundation system to sustain the vertical soil movements expected at this site as described above. All grade beams and floor slabs should be adequately reinforced with steel to minimize cracking as normal movements occur in the foundation soils.

Bearing Capacity. The slab should be designed using a net dead load plus sustained live load bearing pressure of 1,500 psf or a net total load pressure of 2,250 psf, whichever condition results in a larger bearing surface. These bearing pressures are based on a safety factor of 3 and 2, respectively, against shear failure of the foundation bearing soils.

Foundation Depth. Grade beams should be founded a minimum of 18 inches below surrounding grade (supported on native soils or select fill, depending on the subgrade treatment implemented). The bottom of the beam trenches should be free of any loose or soft material prior to the placement of the concrete.

PTI Recommendations. A slab constructed on-grade will be subject to potential slab movements of about 2-inches based upon the information gathered during this investigation. Subgrade treatment (excavation of natural ground and replacement with select fill) shall be performed to reduce the PVR. Subgrade treatment recommendations are provided in the section titled “Slab-on-Grade”. ***The allowable PVR for the project should be determined by the Structural Engineer.*** The recommended foundation design parameters based on information published in the Post Tensioning Institute (PTI) Design of Post-Tensioned Slabs-on-Ground, 3rd Edition, are as follows:

Allowable PVR in Inches (per Structural Engineer)	Foundation Design Parameters per PTI 3rd Edition			
	Edge Moisture Variation Distance (feet)		Differential Soil Movement (inches)	
	Center Lift	Edge Lift	Center Lift	Edge Lift
1	8.3	4.8	0.8	0.6
1.5	8.3	4.8	1.0	0.8
2.0	8.3	4.8	1.5	1.1

IMPORTANT: The above foundation design parameters assume the suggested subgrade treatment provided in the Slab-on-Grade section has been performed. The recommended foundation design parameters are applicable to climate-controlled soil conditions only. These parameters are not applicable when non-climate related factors, such as vegetation, landscaping, trees, drainage, construction methods, land use, or other factors, may influence soil movement. RINER should be contacted to evaluate the effect of non-climate related factors.

Deflection Analysis. Slab deflections should be analyzed per recommendations provided in Section 5.11 - Slab-on-Grade.

5.10.2 Shallow Footings

General Requirement. Shallow strip and spread footing foundations may be used for support of the proposed pavilions if recommendations in the section entitled “Slab-on-Grade” are followed.

Foundation Depth. Shallow strip and spread footing foundations should bear on select fill or native soil at a minimum depth of 3-feet below the surrounding grade.

Bearing Capacity. Continuous strip footings can be proportioned using a net dead load plus sustained live load bearing pressure of 2,000 psf or a net total load bearing pressure of 3,000 psf, whichever condition results in a larger bearing surface. Individual spread footings can be proportioned using a net dead load plus sustained live load bearing pressure of 2,600 psf or a net total load bearing pressure of 3,900 psf, whichever condition results in a larger bearing surface. These bearing pressures are based on a safety factor of 3 and 2, respectively.

Geometry. Individual spread footings should be at least 30 inches wide and continuous strip footing foundations should be at least 16 inches wide.

Settlement. Settlement of footing foundations is influenced by a number of factors, including load (pressure), soil consolidation properties, depth to groundwater, geometry (width and length), depth, spacing, and quality of construction. Although a detailed settlement analysis is beyond the scope of this study, settlement for foundations constructed as described above should be about 1 inch or less. Our settlement estimate assumes that proper construction practices are followed and there are no overlapping stresses due to adjacent footings. To mitigate any overlapping stresses due to adjacent footings, we recommend a minimum clear spacing of one footing width (width of larger footing) between adjacent footings.

Lateral Resistance. Resistance to lateral loads may be provided by the soil adjacent to the footings. We recommend using an equivalent fluid weight of 150 pcf for lateral resistance. A coefficient of sliding friction of 0.25 between the concrete footings and underlying soil may be combined with the passive resistance.

Construction and Observation. The geotechnical engineer should monitor foundation construction to verify conditions are as anticipated and that the materials encountered are suitable for support of foundations. Soft or unsuitable soils encountered at the foundation bearing level should be removed to expose suitable, firm soil. Foundation excavations should be dry and free of loose material. Excavations for foundations should be filled with concrete before the end of the workday or sooner if necessary to prevent deterioration of the bearing surface. Prolonged exposure or inundation of the bearing surface with water will result in changes in strength and compressibility characteristics. If delays occur, the excavation should be deepened as necessary and cleaned, in order to provide a fresh bearing surface. If more than 24 hours of exposure of the bearing surface is anticipated in the excavation, a “mud slab” should be used to protect the bearing surfaces. If a mud slab is used, the foundation excavations should initially be over-excavated by approximately 4 inches and a lean concrete mud slab of approximately 4 inches in thickness should be placed in the bottom of the excavation immediately following exposure of the bearing surface by excavation. The mud slab will protect the bearing surface, maintain more uniform moisture in the subgrade, facilitate dewatering of excavations if required and provide a working surface for the placement of formwork and reinforcing steel.

5.10.3 Straight Shaft Drilled Piers

Applicability. Straight shaft drilled pier foundations as described in this section may be used for support of the proposed pavilions if recommendations in the section entitled "Slab-on-Grade" are followed.

Axial Resistance. For design of the drilled shaft foundations, we recommend the following geotechnical parameters:

Depth (feet) (1)	Soil Type	Effective Soil Unit Weight (pcf)	Allowable Skin Friction (psf) (2)	Allowable End Bearing Capacity (psf) (3,4)
0 - 8	CLAY	125	0	0
8 - 30	CLAY	65	500	3,000

(1) Depth below existing grade.
(2) Allowable Skin Friction based on a factor of safety = 2.
(3) Allowable End Bearing Capacity based on a factor of safety = 3.
(4) Recommendations assume the foundation depth is greater than or equal to 4 times the foundation width.

Uplift. The uplift force on the piers due to swelling of the active clays can be approximated by assuming a uniform uplift pressure of 1,000 psf acting over the perimeter of the shaft to a depth of 8 feet. The shafts should contain enough full-length reinforcing steel to resist uplift forces.

Lateral Resistance. For resistance of lateral loads straight shaft drilled piers, we recommend the following LPILE design parameters.

Depth (feet bgs) 1	LPILE Parameters
0 - 4	LPILE Material Type: Clay/Sand Effective Soil Unit Weight: 125 pcf Undrained Cohesion: Ignore Strain @ ½ Peak Strength (ε_{50}): Ignore p-y Modulus (k): Ignore
4 - 30	Soil Type: Stiff Clay Effective Soil Unit Weight: 125 pcf Undrained Cohesion: 1,500 psf Strain @ ½ Peak Strength (ε50): 0.007 p-y Modulus (k): 500 pci (static), 200 pci (cyclic)

Note:
(1) Depth below existing ground surface.

Pier Spacing. Piers should not be spaced closer than three shaft diameters center to center to use the above recommended bearing capacities (diameter of larger shaft). A reduction factor of 75 percent should be used for piers placed 2 to 3 diameters apart, measured center to center. A reduction factor of 40 percent should be used for piers placed less than 2 shaft diameters apart, measured center to center. The reduction factors should be applied to allowable end bearing and allowable skin friction.

Settlement. Foundation settlement for drilled piers constructed as described herein should be less than 1-inch.

Groundwater. Groundwater was not encountered up to 20-feet during dry augering of the borings. Groundwater may be encountered during pier excavation and the risk of groundwater seepage is increased during or after periods of precipitation. Submersible pumps may be capable of controlling seepage in the pier excavation to allow for concrete placement. If water-bearing granular soil layers are encountered, temporary casing and/or slurry displacement method will likely be required for drilled shafts.

Applicable TxDOT Standards. Drilled pier foundations should be constructed in accordance with the requirements of TxDOT Item 416 (standard specification for construction of drilled pier foundations). This specification includes requirements for construction using casing or the slurry displacement method, as appropriate.

Construction Observation. The construction of all piers should be observed to verify compliance with design assumptions and to verify:

1. the bearing stratum;
2. the removal of all smear zones and cuttings;
3. that groundwater seepage, when encountered, is correctly handled;
4. that the shafts are vertical (within acceptable tolerance); and
5. ensure that the top of the shafts in contact with clay are not enlarged (mushroom shaped).

Concrete Placement. Concrete should be placed immediately after the excavation has been completed. In no event should a pier excavation be allowed to remain open for more than 8 hours. Concrete should have a slump of 5- to 7-inches and should not be allowed to strike the shaft sidewall or steel reinforcement during placement.

Drilling Spoils. Due to previous remediation activities on the property, drill spoils may have to be handled and disposed as environmentally affected media.

5.10.4 Driven Piles

General Requirement. The proposed Fish Pier, Courtesy Dock, and Boat Launch Ramp may be supported using a system of driven steel pipe piles or concrete piles.

Axial Resistance. Analyses were performed to determine the estimated single pile load capacities for driven open-end steel pipe piles and square concrete piles in 18-inch and 24-inch diameters. Results of our analyses are provided in Appendix I - Axial Pile Load Carrying Capacities. A safety factor of 2 was used for pile skin friction and pile end bearing has been ignored. The allowable axial load capacities neglect the capacity within the upper 5-feet bgs to account for scour. Final determination of the foundation type to be utilized for this project should be made by the Structural Engineer based on loading, economic factors and risk tolerance. ***We should be contacted if other sizes or types of piles are considered.*** The contractor should make an independent interpretation of the boring logs in this report to determine installation requirements.

Structural Capacity. The analyses for pile capacities are based only on the soil-pile relationship. Therefore, the structural capacity of each pile and any connections to transmit load should be determined by the structural engineer.

Pile Spacing: Piles should have a minimum center-to-center spacing of at least 3 pile widths. Closer pile spacing should be reviewed by RINER on a case-by-case basis and will result in lower individual pile capacities. An evaluation of lateral group effects may also be required.

Settlement: Foundation settlement for driven piles constructed as described herein should be less than 0.5-inch.

Precast Concrete Pile Requirements. We recommend the precast concrete piles meet the requirements outlined in the Texas Department of Transportation Standard Specifications Item 409 “Prestressed Concrete Piling”.

Steel Pipe Pile Requirements. Proposed steel pipe piles for the project should be designed and constructed in accordance with the TxDOT Geotechnical Manual and the TxDOT Standard Specifications, Item 407, “Steel Piling”.

Pile Driving and Quality Control. We recommend the pile driving operations and quality control during piles driving operations should confirm to the specifications provided in the Texas Department of Transportation Standard Specifications Item 404 “Driving Piling”. Close field supervision should be maintained by experienced personnel to ensure proper procedures are followed and accurate records are kept during all pile driving operations. The driving record should include the hammer model, driving energy, pile type, overall length, pile size (side dimensions), and number of blows per foot of penetration. An accurate driving record is especially important to verify all piles are installed to the required tip embedment and to give an indication of any unusual driving characteristics which may indicate pile breakage.

Lateral Resistance

For resistance of lateral loads on driven piles, we recommend the following LPILE design parameters.

Depth (feet bgs) (1)	LPILE Parameters
0 - 4	Soil Type: Clay/Sand Effective Soil Unit Weight: 65 pcf Undrained Cohesion: Ignore Strain @ ½ Peak Strength (ε_{50}): Ignore p-y Modulus (k): Ignore
4 - 25	Soil Type: Medium Dense Submerged Sand Effective Soil Unit Weight: 55 pcf Effective Friction Angle: 30° p-y Modulus (k): 60 pci
25 - 70	Soil Type: Medium Dense to Very Dense Submerged Sand Effective Soil Unit Weight: 60 pcf Effective Friction Angle: 35° p-y Modulus (k): 125 pci
(1) Depth below mudline.	

5.11 Slab-on-Grade

Assumed Maximum Cut/Fill Depth. We have also assumed that cut/fill of less than 1-foot will be required to bring the site to grade. In the event cut/fill in the building pad exceed 1-foot, we should be notified and allowed to review the design to assess the suitability of the recommendations provided in this section. ***RINER must be allowed to review the finalized grading plan to assess the appropriateness of our recommendations.***

Potential Vertical Slab Movements. Based on the information gathered during this investigation, a slab constructed on-grade will be subject to potential vertical slab movements of up to about 2-inches.

Subgrade Treatment Using Select Fill. The depth of subgrade treatment is dependent on desired post-construction PVR. The table below presents recommended depth of subgrade treatment for various allowable post-construction PVR levels (as determined by Structural Engineer).

Subgrade Treatment - Select Fill Option		
PVR (inches)	Minimum Thickness of Select Fill Soil (feet, bgs) [1]	Thickness of Compacted Subgrade below Select Fill (inches) [2]
1	3.5	6
1.5	1.5	6
2.0	Not Required	Not Required

Note:
1. Depth measured below bottom of the slab-on-grade,
2. The subgrade to receive select fill soil should be scarified to a depth indicated above. The scarified subgrade should be compacted to 92 to 96 percent of the material's maximum standard Proctor dry density (ASTM D-698) at a workable moisture level at least 4 percentage points above optimum and placed in loose lifts not exceeding 9 inches.

Subgrade treatment should extend at least 3-feet horizontally beyond the perimeter of the buildings or PVR sensitive structures.

Subgrade Treatment at Exterior Doorways. Subgrade treatment should extend beneath sidewalk areas that abut exterior doorways to the building. Failure to perform subgrade treatment in these areas can increase the probability of differential heaving between exterior sidewalks and doorways, resulting in exterior doors that won't or have difficulty opening outward due to "sticking" caused by heaving sidewalk slabs.

Subgrade Moisture. The slab subgrade is prone to drying after being exposed and should be kept moist prior to slab placement.

Moisture Barrier. A moisture barrier should be used beneath the slab foundation in areas where floor coverings will be utilized (such as, but not limited to, wood flooring, tile, linoleum and carpeting).

Slab Deflection Analysis. Coefficient of subgrade reaction, k, values are soil, load and settlement dependent. Upon request by the Structural Engineer for this project, k value recommendations will be provided for the specific loading application in question.

5.12 Pavement

Recommendations for rigid and flexible pavement and preparation of the pavement subgrade are provided in the following sections. A traffic study indicating the number and type of vehicles on which to base the pavement design was not provided. Therefore, our recommendations are based upon our experience with similar projects assuming normal vehicular loading. Any unusual loading conditions should be brought to our attention prior to finalizing the pavement design so that we may assess and modify our recommendations as necessary.

Flexible asphaltic pavements subjected to soil-related shrinking and swelling do not perform as well as rigid pavements. As a result, the lifespan of flexible asphaltic pavement can be reduced substantially when compared to rigid pavement. The need for increased maintenance of flexible asphaltic pavements should be considered prior to its selection.

5.12.1 Rigid Pavement

Portland cement concrete (PCC) with a minimum 28-day compressive strength of 3,500 pounds per square inch (psi) should be utilized for rigid pavement. Grade 60 reinforcing steel should be utilized in the transverse and longitudinal directions. The following pavement thicknesses and reinforcing are recommended:

Paving Use	Thickness (inches)	Reinforcing
Parking Areas for Automobiles and Light Trucks	5	No. 3 bars spaced on 24-inch intervals
Drive Lanes and Areas Subjected to Light to Medium Trucks	6	No. 3 bars spaced on 18-inch intervals
Areas Receiving Heavy Trucks and Dumpsters	7	No. 3 bars spaced on 18-inch intervals

Contraction joints should be spaced at about 24 times the pavement thickness up to a maximum of 15 feet in any direction. Saw cut control joints should be cut within 6 to 12 hours of concrete placement. Expansion joints should be spaced as necessary and should be placed where the pavement abuts any structure. Dowels should have a diameter equal to $^{1}/_{8}$ the slab thickness, be spaced on 12-inch intervals, and be embedded at least 9-inches. Appropriate joint sealant is recommended to keep water from saturating the pavement subgrade and to prevent the introduction of incompressible material into the joints. Routine monitoring and maintenance of joint sealants are recommended. Where not specified herein, concrete pavement should comply with Texas Department of Transportation (TxDOT) Standard Specifications, Item 360, "Concrete Pavement", or local equivalent.

5.12.2 Flexible Pavement

The following Hot Mix Asphalt (HMA) paving sections are recommended:

Paving Use	Asphalt Thickness (inches)	Aggregate Base Thickness (inches)
Parking Areas for Automobiles and Light Trucks	2	8
Drive Lanes and Areas Receiving Medium to Heavy Trucks and Dumpsters	3	10

Asphaltic concrete pavement should comply with TxDOT Standard Specifications, Item 340, "Dense-Graded Hot-Mix Asphalt (Method)", or local equivalent. The flexible base course should comply with TxDOT Standard Specifications, Item 247, Grade 1-2, Type A, "Flexible Base", or equivalent.

5.12.3 Pavement Subgrade

Potential Vertical Soil Movements. We have assumed that site treatment as recommended in Section 5.11 - Slab-on-Grade will not be performed within the pavement areas for this project. As a result, pavements will be subjected to the calculated PVR for this site. Based on the information gathered during this investigation, a pavement constructed on-grade will be subject to potential vertical movements of up to about 2-inches. Because heave is generally associated with a source of water, it can occur differentially. Edge lift, excessive cracking, corner breaks, and poor ride quality are just a few of the many examples of pavement issues that can occur when in-situ PVR values are high. We should be contacted to provide PVR mitigation strategies to help reduce potential movements if desired. Strategies available for reducing potential soil movements include soil stabilization with lime or cement, removal of the on-site expansive soils and replacement with select fill or moisture conditioned soils.

Clayey sand and clay is expected to be encountered or exposed at pavement subgrade. The pavement subgrade should be placed in loose lifts not exceeding 8-inches and should be uniformly compacted to a minimum of 95 percent maximum dry density (per ASTM D-698) and within ±2 percent of the optimum moisture content. We recommend the subgrade be stabilized using either of the following:

Reagent	Application Rate (pounds per square yard)	Application Depth (inches)
Portland Cement	23	6
70% Flyash/30% Lime Blend	36	6

Cement stabilization should be performed in accordance with TxDOT Standard Specifications, Item 275, "Portland Cement Treated Materials" or local equivalent, and lime-fly ash stabilization should be performed in accordance with TxDOT Standard Specifications, Item 265, "Lime-Fly Ash Treatment of Materials Used as Subgrade" or local equivalent.

6.0 GENERAL COMMENTS

Data Assumptions. By necessity, geotechnical engineering design recommendations are based on a limited amount of information about subsurface conditions. In the analysis, the geotechnical engineer must assume subsurface conditions are similar to those encountered in the borings. The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of the field investigation and on the assumption that the exploratory borings are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the borings at the time they were completed.

Subsurface Anomalies. Anomalies in subsurface conditions are often revealed during construction. If during construction, different subsurface conditions from those encountered in our borings are observed, or appear to be present in excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary.

Change of Conditions. If there is a substantial lapse of time between submission of this report and the start of the work at the site, if conditions have changed due either to natural causes or to construction operations at or adjacent to the site, or if structure locations, structural loads or finish grades are changed, we should be promptly informed and retained to review our report to determine the applicability of the conclusions and recommendations, considering the changed conditions and/or time lapse.

Design Review. Recommendations in our report are contingent upon RINER reviewing and approving in writing the following design items prior to construction:

- Site grading plan, and
- Foundation plan, details and related structural loads.

Construction Materials Testing and Inspection. RINER should be retained to observe earthwork and foundation installation and perform materials evaluation and testing during the construction phase of the project. This enables RINER's geotechnical engineer to stay abreast of the project and to be readily available to evaluate unanticipated conditions, to conduct additional tests if required and, when necessary, to recommend alternative solutions to unanticipated conditions. It is proposed that construction phase observation and materials testing commence by the project geotechnical engineer (RINER) at the outset of the project. Experience has shown that the most suitable method for procuring these services is for the owner to contact directly with the project geotechnical engineer. This results in a clear, direct line of communication between the owner and the owner's design engineers and the geotechnical engineer.

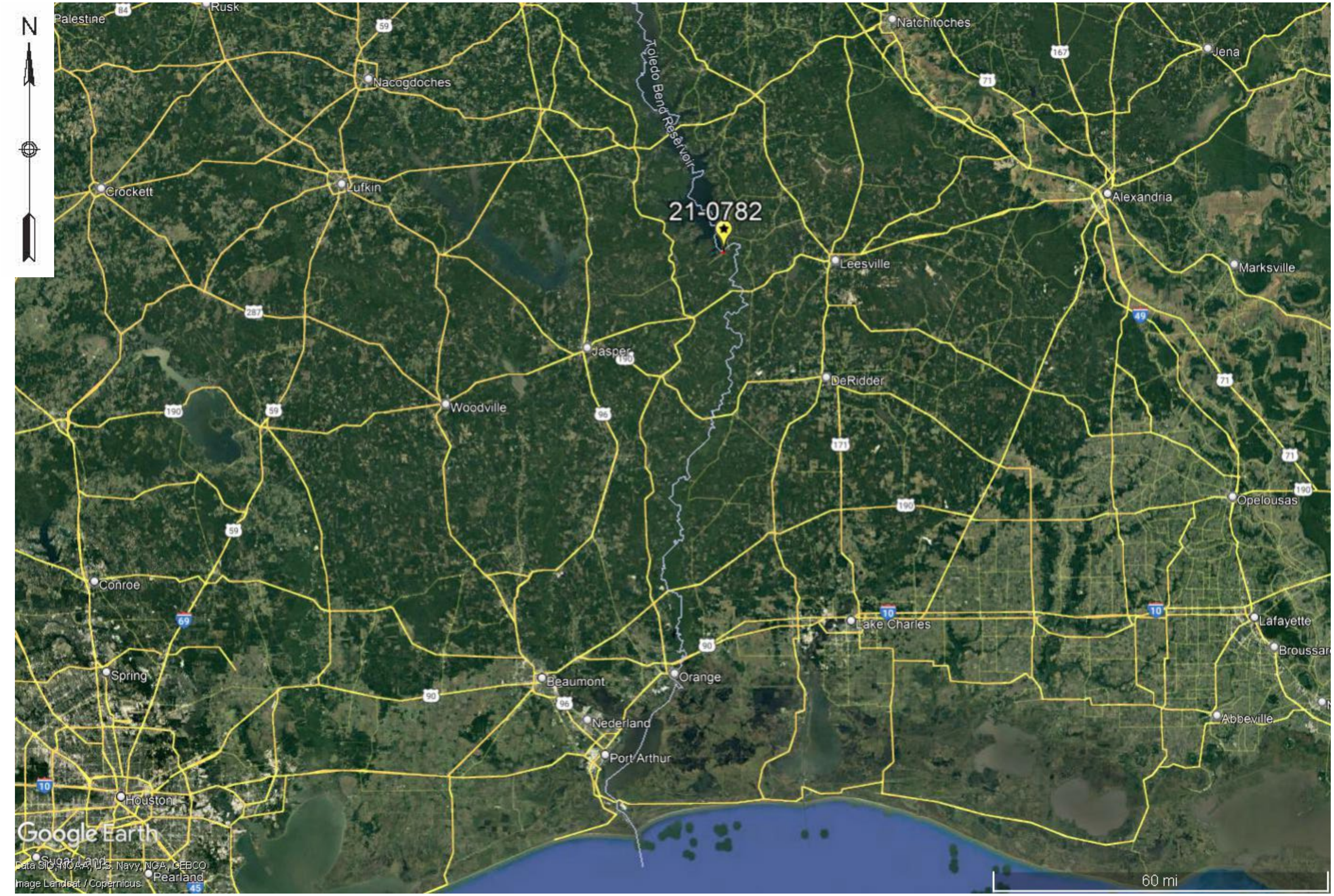
Report Recommendations are Preliminary. Until the recommended construction phase services are performed by RINER, the recommendations contained in this report on such items as final foundation bearing elevations, final depth of undercut of expansive soils for non-expansive earth fill pads and other such subsurface-related recommendations should be considered as preliminary.

Liability Limitation. RINER cannot assume responsibility or liability for recommendations provided in this report if construction inspection and/or testing recommended herein is performed by another party.

Warranty. This report has been prepared for the exclusive use of the Client and their designated agents for specific application to design of this project. We have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended.

Appendix A - Project Location Diagrams

PROJECT LOCATION DIAGRAM - GENERAL



RINER Project No. 21-0782

SRA - Sam Collins Park

PROJECT LOCATION DIAGRAM - LOCAL

RINER Project No. 21-0782

SRA - Sam Collins Park

Appendix B - Boring Location Diagram

BORING LOCATION DIAGRAM

RINER Project No. 21-0782 SRA - Sam Collins Park

Appendix C - Boring Logs and Laboratory Results

Riner Engineering, Inc.
4641 Kennedy Commerce Drive, Houston, TX 77032
Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-01

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 2/28/22 **COMPLETED** 2/28/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0 to 35 feet, Rotary Wash 35 to 50 feet
INITIALLY ENCOUNTERED Not encountered up to 35 feet.
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. ---
NOTES
AFTER ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0	SANDY LEAN CLAY (CL) - Hard, shaley, gray.	ST			4.50+	1.3				43				
	Tan at depth of 2 feet.	ST			4.50+	1.3				28	49	28	21	60
	FAT CLAY (CH) - Hard, shaley, gray.	ST			4.50+	1.5				22				
		ST			4.50+	1.5				24				
10		ST			4.50+	1.5								
		ST			4.50+	1.5								
20		ST			4.50+	2.4								
	Wet at depth of 20 feet.													
		ST			4.50+	2.4					66	33	33	89
30		ST			4.50+	2.4								
		ST			4.50+	2.4								
40		ST			4.50+	2.4								
		ST			4.50+	2.4								
50		ST			4.50+	2.0								

Bottom of hole at 50.0 feet.

Riner Engineering, Inc.
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Telephone: 281-469-3347; Fax: 281-469.3594

BORING NUMBER B-02

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 2/28/22 **COMPLETED** 2/28/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0 - 20, Rotary Wash 20 - 50 feet
INITIALLY ENCOUNTERED Not encountered up to 20 feet.
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. ---
NOTES
AFTER ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0	SILTY SAND (SM) - Medium dense, gray, tan.	ST								9				
	Reddish at depth of 2 feet.	SS		3-6-6 (12)						45				
		ST								39				
	FAT CLAY WITH SAND (CH) - Soft to stiff, gray.	ST			2.00	0.8				36	75	33	42	72
10		ST			3.00	1.0								
		ST			3.00	1.3								
20	CLAYEY SAND (SC) - Soft, dark gray.	ST			1.00	0.1	2.1		87	32				
	FAT CLAY WITH SAND (CL) - Stiff to hard, dark gray.	ST			3.00	1.0								
30		ST			3.50	1.0	.9	12.6	96	27				
		ST			3.00	1.0								
40		ST			4.00	1.3								
		ST			4.50+	1.3								
50		ST			4.50+	1.3								

Bottom of hole at 50.0 feet.

Riner Engineering, Inc.
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BORING NUMBER B-03

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 2/28/22 **COMPLETED** 2/28/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-30 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SANDY FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Hard, shaley, gray, tan, with root fibers to 2 feet.	ST			4.50+	2.4				37	64	37	27	59
			ST			4.50+	2.4				31				
5			ST			4.50+	2.4				32	53	28	25	56
		With calcareous nodules at depth of 6 feet.	ST			4.50+	2.4				27				
10			ST			4.50+	2.4								
15			ST			4.50+	2.4								
20			ST			4.50+	2.4								
25			ST			4.50+	2.4								
30			ST			4.50+	2.4	2.1		91	29				

Bottom of hole at 30.0 feet.

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BORING NUMBER B-04

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-30 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Soft to hard, light brown, with root fibers to 2 feet.	ST			2.50	0.8				30				
		Shaley at depth of 2 feet.	ST			2.50	0.8				44	71	35	36	91
5			ST			0.50		1.0		74	47				
		Shaley at depths from 6- to 20 feet.	ST			4.50+	2.4				46	59	35	24	81
10			ST			4.00	0.8								
15		Tan at depth below 13 feet.	ST			4.50+	2.4								
20			ST			4.50	2.4								
25		SILTY SAND (SM) - Medium dense, tan.	ST												
30		Gray at depth of 28 feet.	SS		7-11-16 (27)										

Bottom of hole at 30.0 feet.

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BORING NUMBER B-05

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-30 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SANDY LEAN CLAY (CL) - Soft to stiff, dark gray.	ST			0.50									
			ST			3.00	1.0				18	49	15	34	51
5		SANDY FAT CLAY (CH) - Stiff, reddish brown, gray, with sand seam.	ST			2.50	0.8				42				
			ST			3.00	0.8				32	62	20	42	67
10			ST			3.00	0.8								
15			ST			2.50	0.8								
20		SILTY SAND (SM) - Tan.	ST												
25		SANDY FAT CLAY (CH) - Soft to stiff, gray.	ST			1.00	0.3								
30			ST			2.50	0.8								

Bottom of hole at 30.0 feet.

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BORING NUMBER B-06

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-6 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		CLAYEY SAND (SC) - Very stiff to hard, dark gray.													
1			ST			4.00	1.3				31				
2															
3			ST								11				
4															
5			ST			4.50+	1.3				15				
6															

Bottom of hole at 6.0 feet.

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BORING NUMBER B-07

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-6 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		CLAY SAND (SC) - Dark gray.													
1		SANDY FAT CLAY (CH) - Very stiff to hard, reddish.	ST			4.50+	1.4				10				
2															
3			ST			4.00	1.5				35	71	29	42	69
4															
5			ST			3.50	1.3				45				
6															

Bottom of hole at 6.0 feet.

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BORING NUMBER B-08

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-6 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0–2		CLAYEY SAND (SC) - Soft, dark brown.	ST			0.50					18				
2–4		FAT CLAY (CH) - Very stiff to hard, light gray, with iron nodules.	ST			4.00	1.3				45	102	31	71	96
4–6		Shaley, tan at depth of 4 feet.	ST			4.50+	2.4				42				

Bottom of hole at 6.0 feet.

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BORING NUMBER B-09

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-6 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		CLAYEY SAND (SC) - Soft to stiff, dark brown.													
1			ST			0.50					20				
2		Gray at depth of 2 feet.													
3			ST			0.50	0.1				11	21	13	8	44
4		Dark gray at depth of 4 feet.													
5			ST			2.50	1.0				17				
6															

Bottom of hole at 6.0 feet.

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BORING NUMBER B-10

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-6 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		CLAYEY SAND (SC) - Hard, reddish brown, gray.													
1			ST			4.50+	2.4				15				
2		FAT CLAY WITH SAND (CH) - Very stiff, light gray.													
3			ST			4.00	1.3				26	55	22	33	72
4		Shaley, with calcareous nodules at depth of 4 feet.													
5			ST			4.00	1.5				23				
6															

Bottom of hole at 6.0 feet.

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BORING NUMBER B-11

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-6 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES CONTENT (%)
0–2		CLAYEY SAND (SC) - Tan, with root fibers.	ST			0.50					13				
2–4		POORLY GRADED SAND WITH SILT (SP-SM) - Reddish brown.	ST								8				12
4–6		Brown at depth of 4 feet.	ST								9				

Bottom of hole at 6.0 feet.

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BORING NUMBER B-12

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-6 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES CONTENT (%)
0		CLAYEY SAND (SC) - Soft to very stiff, reddish, with root fibers.													
1			ST			1.00	0.1				26				
2															
3			ST			3.00	0.8				16				
4		Gray at depth of 4 feet.													
5			ST			3.50	1.0				19	46	14	32	37
6															

Bottom of hole at 6.0 feet.

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BORING NUMBER B-13

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 3/2/22 **COMPLETED** 3/2/22
GROUND ELEVATION **NORTHING**
CONTRACTOR Diamon Drilling
GROUND WATER LEVELS: **EASTING**
METHOD Auger 0-6 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY J.Ch. **CHECKED BY** H.N.
AFTER 15 MIN. Not Encountered
NOTES
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES CONTENT (%)
0		CLAYEY SAND (SC) - Firm to stiff, dark brown.													
1			ST			2.00	0.3				11				
2		Brown at depth below 2 feet.													
3			ST			1.50	0.1				13	24	13	11	42
4															
5			ST			2.00	0.1				11				
6		Bottom of hole at 6.0 feet.													

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BORING NUMBER B-14

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 2/17/22 **COMPLETED** 2/17/22
GROUND ELEVATION **NORTHING**
CONTRACTOR D.A.S
GROUND WATER LEVELS: **EASTING**
METHOD Rotary Wash 12 - 25 feet
INITIALLY ENCOUNTERED -
LOGGED BY H.N. **CHECKED BY** H.N.
AFTER 15 MIN. -
NOTES Underwater Soil Sampling and Drilling. Water Depth was 4.3 feet.
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Firm, gray. Light brown, light gray at depths below 2 feet.	SS		2-2-3 (5)						54	105	26	79	84
			ST			1.50	0.6								
			ST			1.50	0.8				47	88	35	53	93
		SILTY SAND (SM) - Loose, gray.	ST								19				17
10			SS		4-4-6 (10)										
		FAT CLAY (CH) - Hard, gray.	ST			4.50+	1.6				33	64	36	28	100
20		POORLY GRADED SAND WITH SILT (SP-SM) - Medium dense to very dense, gray.	SS		8-8-16 (24)						26				9
			SS		11-10-14 (24)										
30			SS		18-18-23 (41)										
			SS		16-16-25 (41)						22				5
40			SS		15-17-20 (37)										
			SS		22-19-27 (46)										
50			SS		28-32-38 (70)										
			SS		32-50/5"						24				5
60			SS		27-50/5"										
			SS		25-35-50/4"										
70			SS		33-41-50/5"						23				6
			SS		37-40-50/4"										

Bottom of hole at 75.0 feet.

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BORING NUMBER B-15

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 2/16/22 **COMPLETED** 2/16/22
GROUND ELEVATION **NORTHING**
CONTRACTOR D.A.S
GROUND WATER LEVELS: **EASTING**
METHOD Rotary Wash 12 - 25 feet
INITIALLY ENCOUNTERED -
LOGGED BY H.N. **CHECKED BY** H.N.
AFTER 15 MIN. -
NOTES Underwater Soil Sampling and Drilling. Water Depth was 4.0 feet.
AFTER ---

DEPTH (ft) 0	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
		SILTY SAND (SM) - Loose, gray.	SS		1-1-1 (2)						38				43
		SANDY FAT CLAY (CH) - Stiff, light brown, light gray.	ST			2.00	1.8				27	60	19	41	67
		Gray at depth of 4 feet.	ST			2.50	1.3	1.2		91	31				
		SILTY SAND (SM) - Gray.	ST								23				33
10			ST												
		FAT CLAY (CH) - Hard, light brown, light gray, laminated.	ST			4.50+	1.8				33	79	29	50	86
20		Gray at depth of 18 feet.	ST			4.50+	1.8					66	26	40	94
		SILTY SAND (SM) / SAND WITH SILT (SM) / POORLY GRADED SAND WITH SILT (SP-SM) - Dense to very dense, gray.	SS		50/3"						38				45
30			SS		7-12-35 (47)										
			SS		11-19-35 (54)										
40			SS		29-27-50/5"										
			SS		25-50/6"						23				15
50		Light brown and light gray at depth of 48 feet.	SS		22-50/6"										
			SS		29-50/3"										
60		Light brown and light gray at depth of 58 feet.	SS		24-50/5"						21				10
			SS		50/6"										
70			SS		34-50/4"						23				6
			SS		50/4"										

Bottom of hole at 75.0 feet.

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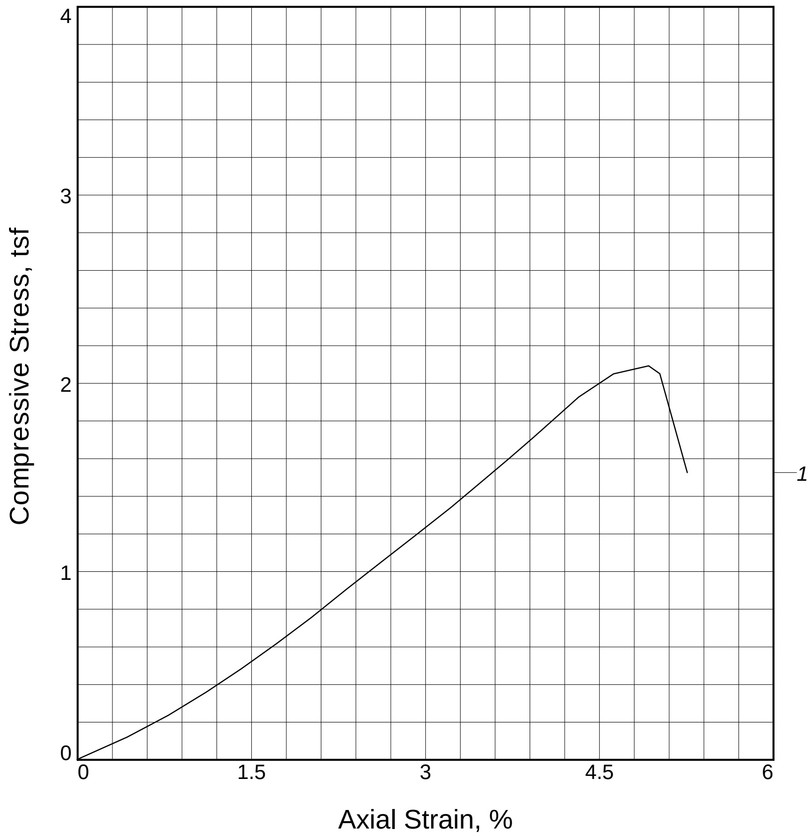
BORING NUMBER B-16

CLIENT Kimley-Horn
PROJECT NAME SRA Sam Collins Park
PROJECT NUMBER 21-0782
PROJECT LOCATION Burkeville, Texas
DATE STARTED 2/19/22 **COMPLETED** 2/19/22
GROUND ELEVATION **NORTHING**
CONTRACTOR D.A.S
GROUND WATER LEVELS: **EASTING**
METHOD Rotary Wash 12 - 25 feet
INITIALLY ENCOUNTERED -
LOGGED BY H.N. **CHECKED BY** H.N.
AFTER 15 MIN. -
NOTES Underwater Soil Sampling and Drilling. Water Depth was 3.5 feet.
AFTER ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES CONTENT (%)
0	FAT CLAY (CH) / FAT CLAY WITH SAND (CH) - Stiff to hard, gray, laminated. Brown and light gray at depth of 2 feet.	SS		7-12-14 (26)						27	56	27	29	95
		SS		9-11-13 (24)										
		ST			4.00	1.5				30	55	31	24	97
	Light brown at depth of 6 feet.	ST			4.50+	1.8								
10		ST			4.50+	1.8	.2		88	30				98
		ST			4.50+	1.3				32	55	35	20	98
20		ST												
		ST			3.50	1.3				32	55	27	28	83
30		ST			3.50	1.2								71
	LEAN CLAY (CL) - Very stiff, gay.	ST			4.00	1.3				28	49	24	25	94
40	SILTY SAND (SM) - Dense to very dense, gray.	SS		14-29-42 (71)						17				34
		SS		11-24-38 (62)										
50		SS		13-13-22 (35)										
		SS		14-16-25 (41)						19				14
60		SS		20-22-28 (50)										
		SS		19-21-29 (50)										
70		SS		23-28-32 (60)						22				17
		SS		20-28-39 (67)										

Bottom of hole at 75.0 feet.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.0929			
Undrained shear strength, tsf	1.0465			
Failure strain, %	4.9			
Strain rate, %/min.	1.00			
Water content, %	32.0			
Wet density, pcf	114.4			
Dry density, pcf	86.7			
Saturation, %	N/A			
Void ratio	N/A			
Specimen diameter, in.	2.80			
Specimen height, in.	5.64			
Height/diameter ratio	2.01			

Description: Dark gray CLAYEY SAND (SC)

LL =	**PL =**	**PI =**	**Assumed GS=** 2.72	**Type:** Shelby Tube

Project No.: 21-0782
Date Sampled: 2/28/2022
Remarks:

Figure _______

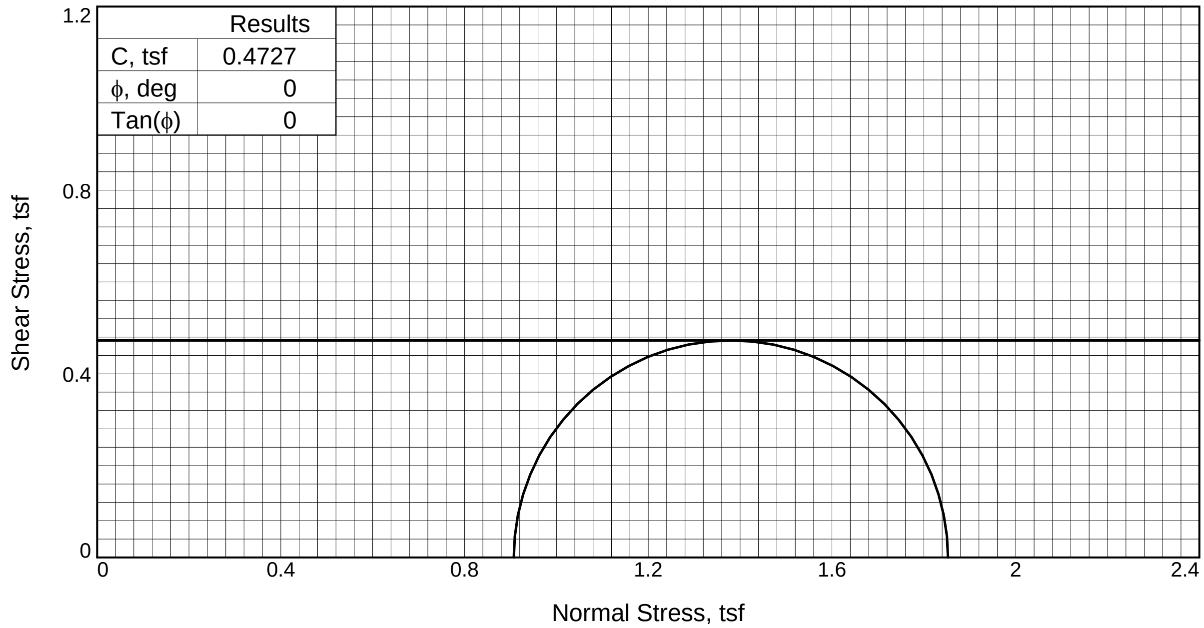
Client: Kimley-Horn

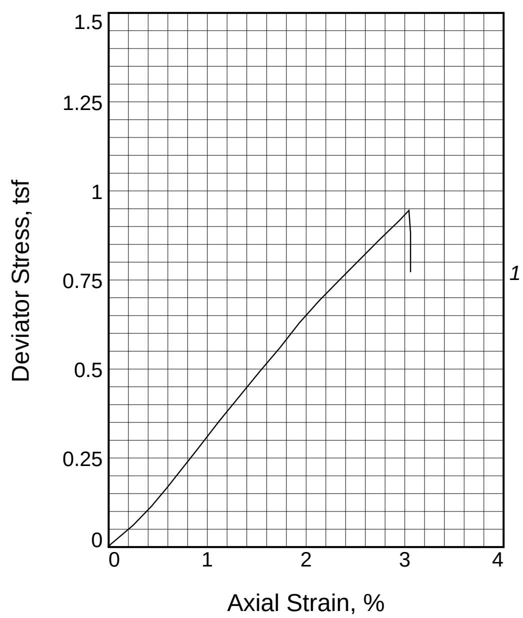
Project: SRA Sam Collins Park

Location: Boring B-02
Sample Number: 7 **Depth:** 18' - 20'

UNCONFINED COMPRESSION TEST
Riner Engineering, Inc.
Houston, Texas

Tested By: L.G. **Checked By:** N.H.





Sample No.	1
Initial	
Water Content, %	27.0
Dry Density, pcf	96.2
Saturation, %	86.3
Void Ratio	0.63
Diameter, in.	2.78
Height, in.	5.74
At Test	
Water Content, %	
Dry Density, pcf	
Saturation, %	
Void Ratio	
Diameter, in.	
Height, in.	
Strain rate, %/min.	1.00
Back Pressure, tsf	0.000
Cell Pressure, tsf	0.907
Fail. Stress, tsf	0.945
Ult. Stress, tsf	
σ_1 Failure, tsf	1.853
σ_3 Failure, tsf	0.907

Type of Test:
Unconsolidated Undrained

Sample Type: Shelby Tube

Description: Dark gray FAT CLAY WITH SAND (CH)

Assumed Specific Gravity= 2.72

Remarks:

Figure _______

Client: Kimley-Horn

Project: SRA Sam Collins Park

Location: Boring B-02

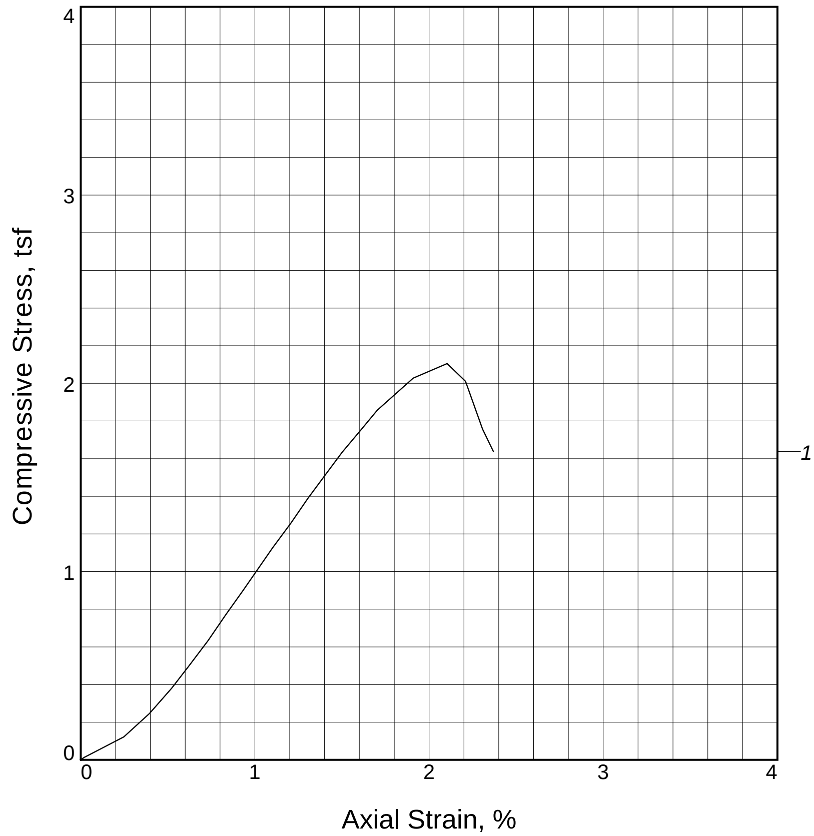
Sample Number: 9 **Depth:** 28' - 30'

Proj. No.: 21-0782 **Date Sampled:** 2/28/2022

TRIAXIAL SHEAR TEST REPORT
Riner Engineering, Inc.
Houston, Texas

Tested By: L.G. **Checked By:** N.H.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.1049			
Undrained shear strength, tsf	1.0524			
Failure strain, %	2.1			
Strain rate, %/min.	1.00			
Water content, %	29.0			
Wet density, pcf	117.6			
Dry density, pcf	91.1			
Saturation, %	N/A			
Void ratio	N/A			
Specimen diameter, in.	2.77			
Specimen height, in.	5.83			
Height/diameter ratio	2.10			

Description: Tan, gray SANDY FAT CLAY (CH)

LL =	PL =	PI =	Assumed GS= 2.72	Type: Shelby Tube

Project No.: 21-0782
Date Sampled: 2/28/2022
Remarks:

Figure _______

Client: Kimley-Horn

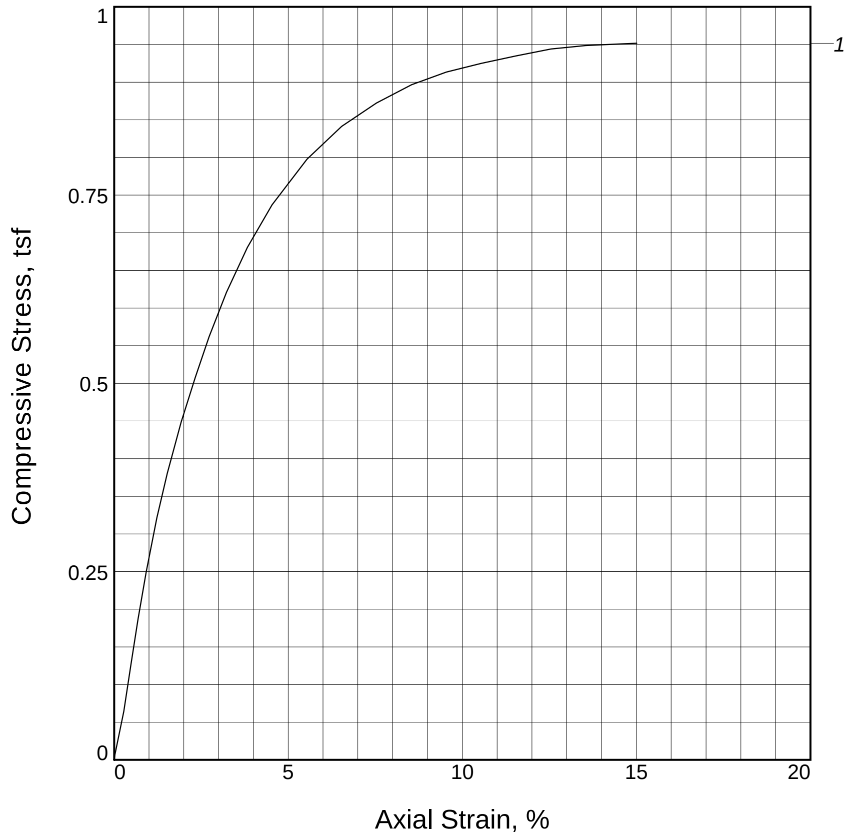
Project: SRA Sam Collins Park

Location: Boring B-03
Sample Number: 9 **Depth:** 28' - 30'

UNCONFINED COMPRESSION TEST
Riner Engineering, Inc.
Houston, Texas

Tested By: L.G. **Checked By:** N.H.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.9518			
Undrained shear strength, tsf	0.4759			
Failure strain, %	15.0			
Strain rate, %/min.	1.00			
Water content, %	46.5			
Wet density, pcf	108.7			
Dry density, pcf	74.2			
Saturation, %	98.2			
Void ratio	1.2886			
Specimen diameter, in.	2.75			
Specimen height, in.	5.70			
Height/diameter ratio	2.07			

Description: Light gray FAT CLAY (CH)

LL =	**PL =**	**PI =**	**Assumed GS=** 2.72	**Type:** Shelby Tube

Project No.: 21-0782
Date Sampled: 3/2/2022
Remarks:

Figure _______

Client: Kimley-Horn

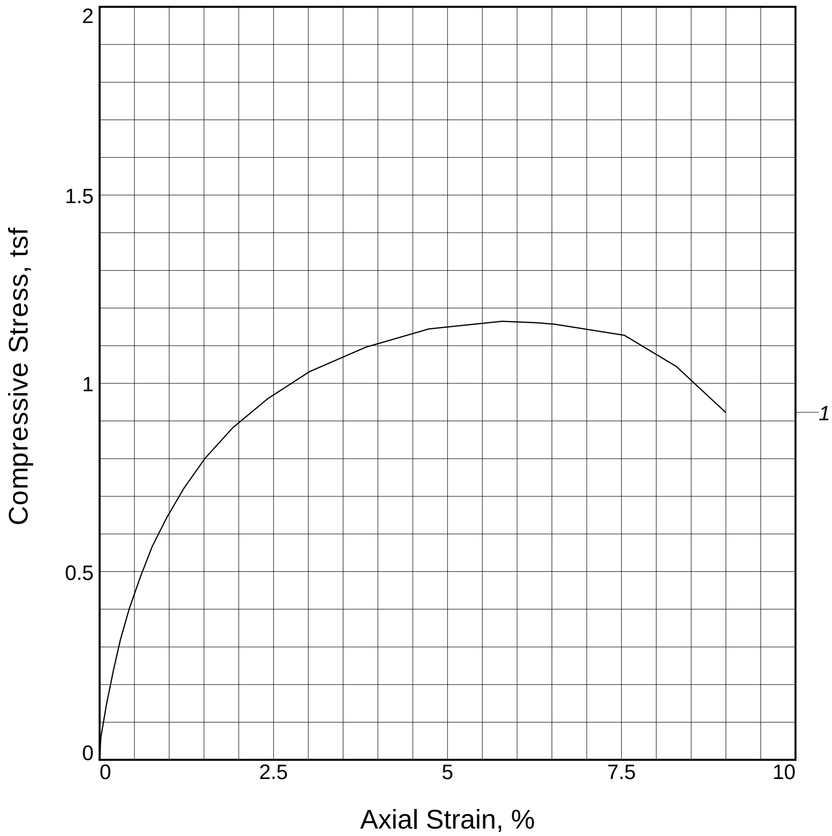
Project: SRA Sam Collins Park

Location: Boring B-04
Sample Number: 3 **Depth:** 4' - 6'

UNCONFINED COMPRESSION TEST
Riner Engineering, Inc.
Houston, Texas

Tested By: L.G. **Checked By:** N.H.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.1648			
Undrained shear strength, tsf	0.5824			
Failure strain, %	5.8			
Strain rate, %/min.	1.00			
Water content, %	30.6			
Wet density, pcf	118.7			
Dry density, pcf	90.8			
Saturation, %	95.9			
Void ratio	0.8696			
Specimen diameter, in.	2.75			
Specimen height, in.	5.75			
Height/diameter ratio	2.09			

Description: Light brown, light gray SANDY FAT CLAY (CH)

LL =	**PL =**	**PI =**	**Assumed GS=** 2.72	**Type:** Shelby Tube

Project No.: 21-0782
Date Sampled: 2/16/2022
Remarks:

Figure _______

Client: Kimley-Horn

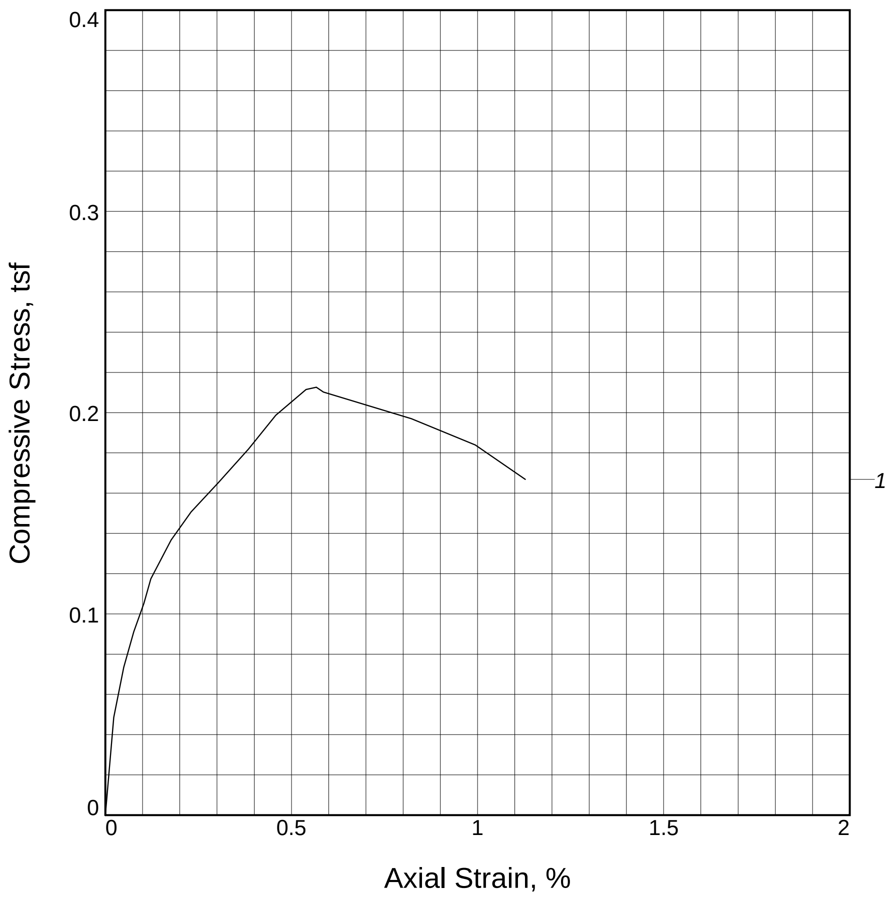
Project: SRA Sam Collins Park

Location: Boring B-15
Sample Number: 3 **Depth:** 4' - 6'

UNCONFINED COMPRESSION TEST
Riner Engineering, Inc.
Houston, Texas

Tested By: Luis **Checked By:** N.H.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.2126			
Undrained shear strength, tsf	0.1063			
Failure strain, %	0.6			
Strain rate, %/min.	1.00			
Water content, %	30.4			
Wet density, pcf	114.2			
Dry density, pcf	87.6			
Saturation, %	88.0			
Void ratio	0.9392			
Specimen diameter, in.	2.84			
Specimen height, in.	5.75			
Height/diameter ratio	2.02			

Description: Gray, light brown FAT CLAY (CH)

LL =	**PL =**	**PI =**	**Assumed GS=** 2.72	**Type:** Shelby Tube

Project No.: 21-0782
Date Sampled: 2/19/2022
Remarks: Sample was laminated.

Figure _______

Client: Kimley-Horn

Project: SRA Sam Collins Park

Location: Boring B-16
Sample Number: 5 **Depth:** 8' - 10'

UNCONFINED COMPRESSION TEST
Riner Engineering, Inc.
Houston, Texas

Tested By: Luis **Checked By:** N.H.

ABSORPTION SWELL TEST (ASTM D4546) RESULTS						
Boring No.	B-02	B-03	B-03	B-04	B-04	B-05
Average Sample Depth (ft)	7	1	7	3	7	3
Sample Height (in)	0.8	0.8	0.8	0.8	0.8	0.8
Sample Diameter (in)	2.5	2.5	2.5	2.5	2.5	2.5
Initial Sample Volume (cu in)	3.93	3.93	3.93	3.93	3.93	3.93
Initial Sample Weight (gr)	98.2	111.8	109.2	113.7	114.4	126.9
Initial Moisture (%)	33	33	28	39	40	31
Final Moisture (%)	33	34	28	39	40	32
Initial Wet Unit Weight (pcf)	95	108	106	110	111	123
Initial Dry Unit Weight (pcf)	72	84	88	80	79	94
Applied Over Burden (psi)	6.1	0.9	6.1	2.6	6.1	2.6
Initial Dial Reading (in)	0.0204	0.0297	0.0497	0.0494	0.0152	0.0415
Final Dial Reading (in)	0.0204	0.0305	0.0497	0.0494	0.0152	0.0447
Swell (%)	0.00	0.10	0.00	0.00	0.00	0.40

ABSORPTION SWELL TEST (ASTM D4546) RESULTS						
Boring No.	B-05					
Average Sample Depth (ft)	7					
Sample Height (in)	0.8					
Sample Diameter (in)	2.5					
Initial Sample Volume (cu in)	3.93					
Initial Sample Weight (gr)	126.6					
Initial Moisture (%)	29					
Final Moisture (%)	29					
Initial Wet Unit Weight (pcf)	123					
Initial Dry Unit Weight (pcf)	99					
Applied Over Burden (psi)	6.1					
Initial Dial Reading (in)	0.0259					
Final Dial Reading (in)	0.0265					
Swell (%)	0.08					

Appendix D - Aerial Photographs

AERIAL PHOTOGRAPH - 2021

RINER Project No. 21-0782 SRA - Sam Collins Park

AERIAL PHOTOGRAPH - 2012

AERIAL PHOTOGRAPH - 2009

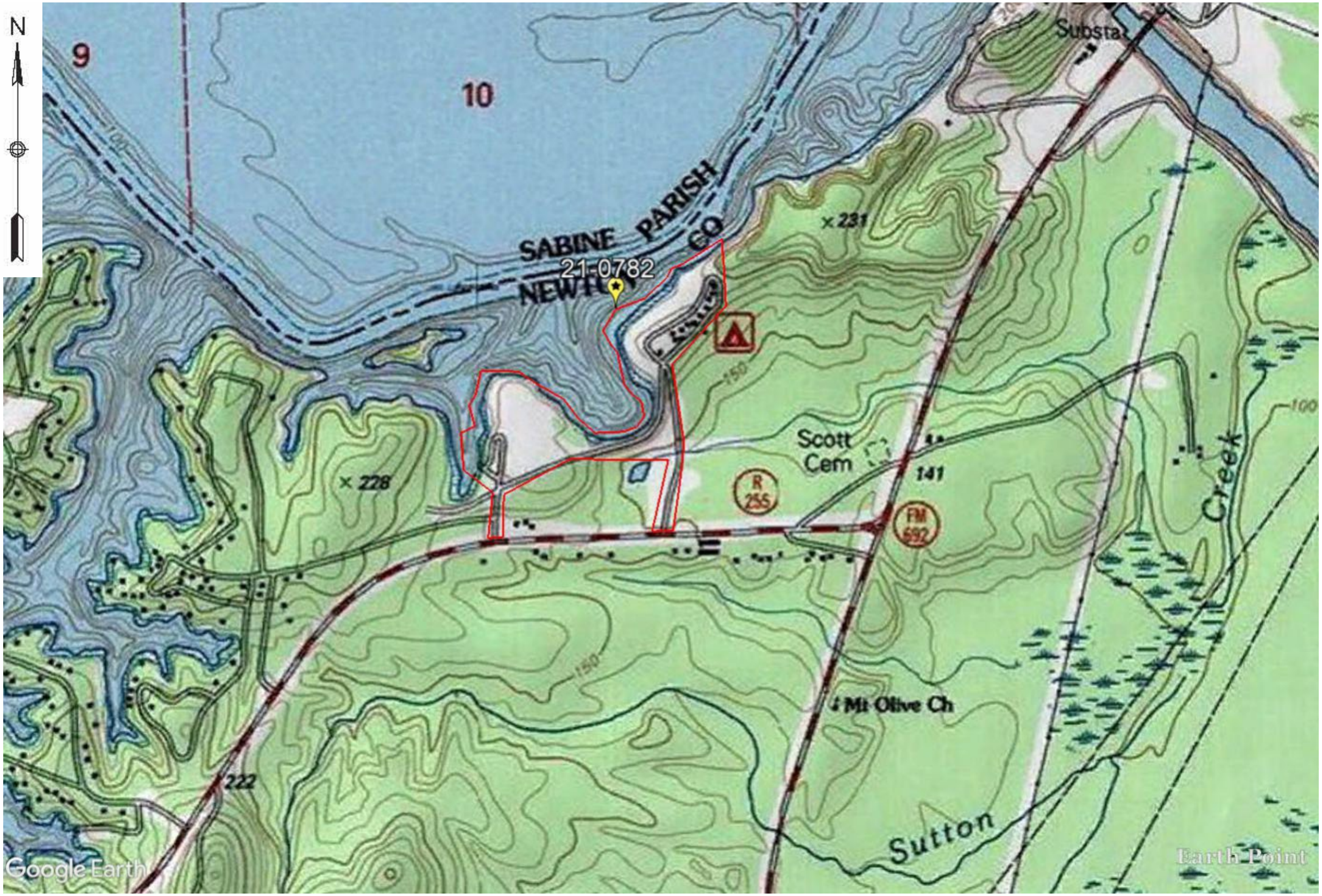
AERIAL PHOTOGRAPH - 2007

AERIAL PHOTOGRAPH - 2005

AERIAL PHOTOGRAPH - 1996

Appendix E - USGS Topographic Map

USGS TOPOGRAPHIC MAP



Appendix F - Site Photographs

SITE PHOTOGRAPHS

Facing South at Boring B-01

Facing Southwest at Boring B-02

Facing East at Boring B-03

Facing Northwest at Boring B-03

SITE PHOTOGRAPHS

Facing South at Boring B-05

Facing Southwest at Boring B-06

Facing East at Boring B-08

Facing South at Boring B-11

SITE PHOTOGRAPHS

Facing South at Boring B-15

Facing Southeast at Boring B-16

Facing South at Boring B-14

Facing South at Boring B-14

Appendix G - Geologic Information

GEOLOGIC ATLAS

Mineral Resources On-Line Spatial Data

Catahoula Formation

Catahoula Formation

State	Texas
Name	Catahoula Formation
Geologic age	Phanerozoic | Cenozoic | Tertiary | Oligocene
Original map label	Oc
Comments	Crystal City-Eagle Pass Sheet (1976), upper member, Chusa Tuff Mbr is tuffaceous mudstone and sand and sandstone about 180 ft thick. next member descending is Soledad Volcanic Conglo. Mbr, abdt. pebbles, cobbles, and boulders up to one foot in size, rhyolite, trachyte, trachyandesite, thickness up to 75 ft; Fant Tuff Mbr, lowest mbr., tuff, claystone, and sandstone about 600 ft thick. Catahoula Fm. 120-300 ft thick on Seguin Sheet (1974) thins northward. In East Texas and Gulf Coast to Rio Grande: Mudstone and sand. Upper 300-500 ft mudst., tuffaceous, sandy, lt. gray, weathers dk gray. Some bentonitic clay. Lower 10-80 ft quartz sand, coarse grained, grains polished, opal cement common; fossil wood abdt. forms cuesta. Thickness 300-600 ft.
Primary rock type	mudstone
Secondary rock type	sand
Other rock types	tuff; sandstone; conglomerate
Lithologic constituents	Major Sedimentary > Clastic > Mudstone *(Bed)* Unconsolidated > Coarse-detrital > Sand *(Bed)* Minor Sedimentary > Clastic > Conglomerate *(Bed)* Incidental Igneous > Volcanic > Felsic-volcanic > Trachyte Igneous > Volcanic > Felsic-volcanic > Rhyolite Sedimentary > Clastic > Mudstone > Claystone > Bentonite *(Bed)*

Igneous > Volcanic > Mafic-volcanic > Andesite
(Pyroclastic, tuff)

Map references Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000

Unit references Bureau of Economic Geology, 1976, Crystal City-Eagle Pass Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000.

Bureau of Economic Geology, 1967, Palestine Sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin, scale 1:250,000.

Counties Angelina - Atascosa - Bee - Brazos - DeWitt - Fayette - Gonzales - Grimes - Jasper - Karnes - Live Oak - McMullen - Newton - Polk - Sabine - Trinity - Tyler - Walker - Washington - Webb

Show this information as [XML] - [JSON]

Mineral Resources On-Line Spatial Data

Terrace deposits

Terrace deposits

State	Texas
Name	Terrace deposits
Geologic age	Phanerozoic | Cenozoic | Quaternary | Pleistocene Holocene
Original map label	Qt
Comments	Sand, silt, clay, and gravel in various proportions, with gravel more prodominent in older, higher terrace deposits. Locally indurated with calcium carbonate (caliche) in terraces along streams. Along Colorado River clasts mostly limest., chert, quartz, and various igneous and metamorphic rocks from Llano region and Edwards Plateau. Includes point bar, natural levee, stream channel deposits along valley walls; probably in large part correlatives of Deweyville, Beaumont, Lissie, and Willis deposits. In upland regions (Rolling Plains, Edwards Plateau, etc.) unit includes fluvial terrace deposits, undivided. Light-brown, reddish-brown, gray, or yellowish-brown, gravelly quartz and lithic sand and silt to sandy gravel (Moore and Wermund, 1993). Deposits become increasingly fine grained on Coastal and Nueces Plains. Locally, calcium carbonate-cemented quartz sand, silt, clay, and gravel intermixed and interbedded. Low terraces of major rivers are capped by 2-4 m of clayey sand and silt. Sandy gravel on higher terraces varies somewhat in composition from river to river. Gravel commonly is rounded to angular limestone and chert pebbles and cobbles, some boulders, sparse igneous pebbles along Brazos river in places. In Bastrop Co., a deposit 27 m above Colorado River contains the Lava Creek B (Pearlette O) volcanic ash (age 0.6 Ma). Along the Frio, Leona, and Sabinal Rivers east of Uvalde, gravel is chiefly basalt and pyclastic clasts, locally cemented by iro oxide. Gravel along the Rio Grande is subrounded clasts of locally derived limestone and chert and rounded clasts of basalt, volcanic

porphyry, quartzite, milky quartz, and banded chalcedony derived from the west.

Primary rock type terrace

Secondary rock type sand

Other rock types gravel; silt; clay or mud

Lithologic constituents Major

Unconsolidated > Fine-detrital > Silt *(Bed)*
Unconsolidated > Coarse-detrital > Sand *(Bed)*

Minor

Unconsolidated > Coarse-detrital > Gravel *(Bed)*
Unconsolidated > Fine-detrital > Clay *(Bed)*

Map references Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000

Unit references Moore, D.W. and Wermund, E.G., Jr., 1993a, Quaternary geologic map of the Austin 4 x 6 degree quadrangle, United States: U.S. Geological Survey Miscellaneous Investigations Series Map I-1420 (NH-14), scale 1:1,000,000.
[http://pubs.er.usgs.gov/publication/i1420(NH14)]

Bureau of Economic Geology, 1975, Beeville-Bay City Sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin, scale 1:250,000.

Bureau of Economic Geology, 1974, Seguin Sheet, Geologic Atlas of Texas, University of Texas, Bureau of Economic Geology, scale 1:250,000.

Counties Anderson - Angelina - Archer - Armstrong - Atascosa - Austin - Bandera - Bastrop - Baylor - Bee - Bell - Bexar - Blanco - Borden - Bosque - Bowie - Brazos - Brewster - Briscoe - Brown - Burleson - Burnet - Caldwell - Callahan - Camp - Cass - Cherokee - Childress - Clay - Coke - Coleman - Collin - Collingsworth - Colorado - Comal - Comanche - Concho - Cooke - Coryell - Cottle - Crane - Crosby - Dallam - Dallas - Delta - Denton - DeWitt - Dickens - Dimmit - Donley - Duval - Eastland - Ellis - Erath - Falls - Fannin - Fayette - Fisher - Foard - Franklin - Freestone - Frio - Garza - Gillespie - Glasscock - Goliad - Gonzales - Gray - Grayson - Gregg - Grimes - Guadalupe - Hall - Hamilton - Hansford - Hardeman - Hardin - Harris - Harrison - Hartley - Haskell - Hays - Hemphill - Henderson - Hidalgo - Hill - Hood - Hopkins - Houston - Hunt - Hutchinson - Jackson - Jasper - Jeff Davis - Jim Wells - Johnson - Jones - Karnes - Kaufman - Kendall - Kent - Kerr - Kimble - Kinney - Knox - Lamar - Lampasas - La Salle - Lavaca - Lee - Leon - Limestone - Lipscomb - Live Oak - Llano - McCulloch - McLennan - McMullen - Madison - Marion - Mason - Maverick - Medina - Menard - Midland - Milam - Mills - Mitchell - Montague - Montgomery - Moore - Morris - Motley - Nacogdoches - Navarro - Newton - Nolan - Oldham - Palo Pinto - Panola - Parker - Pecos - Polk - Potter - Rains - Reagan - Red River - Reeves - Refugio - Roberts - Robertson - Rockwall - Runnels - Rusk - Sabine - San Augustine - San Jacinto - San Patricio - San Saba - Schleicher - Scurry - Shackelford - Shelby -

Show this information as [XML] - [JSON]

Appendix H - Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS
(more than 50% of material is larger than No. 200 sieve size.)

GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS
(50% or more of material is smaller than No. 200 sieve size.)

SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

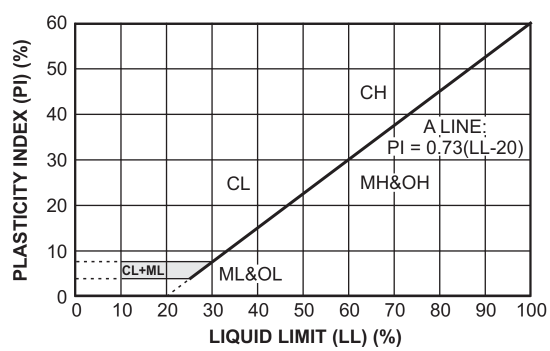
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \dfrac{D_{60}}{D_{10}}$ greater than 4; $C_c = \dfrac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \dfrac{D_{60}}{D_{10}}$ greater than 4; $C_c = \dfrac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent . . . . GW, GP, SW, SP
More than 12 percent . . . . GM, GC, SM, SC
5 to 12 percent . . . . Borderline cases requiring dual symbols

PLASTICITY CHART



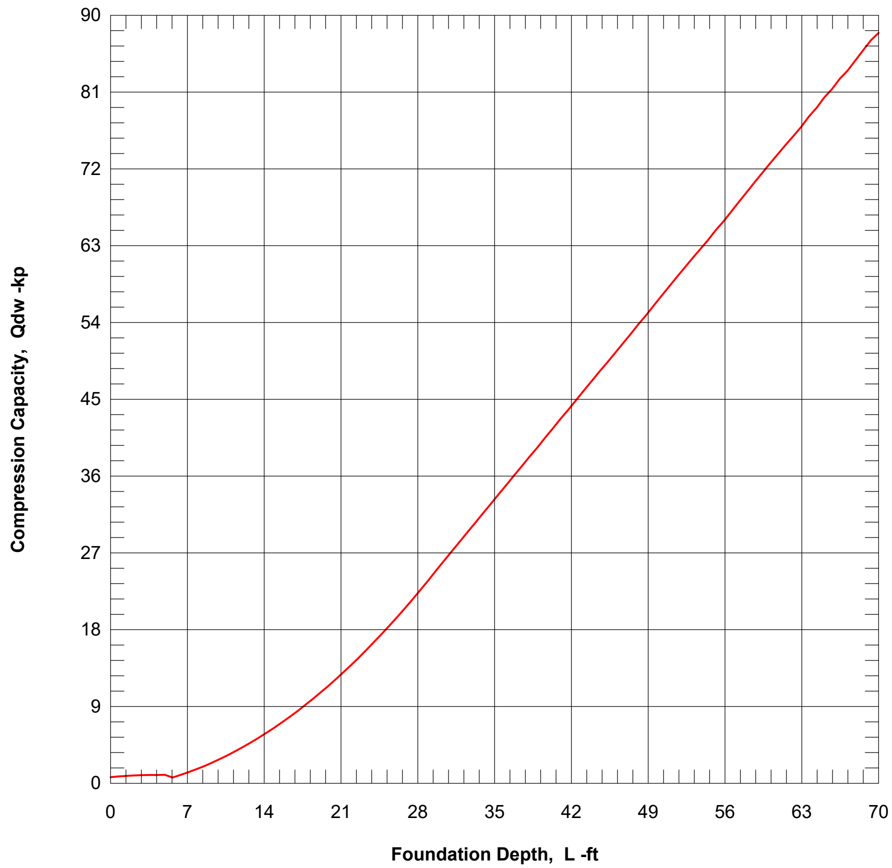
TERMS DESCRIBING SOIL CONSISTENCY

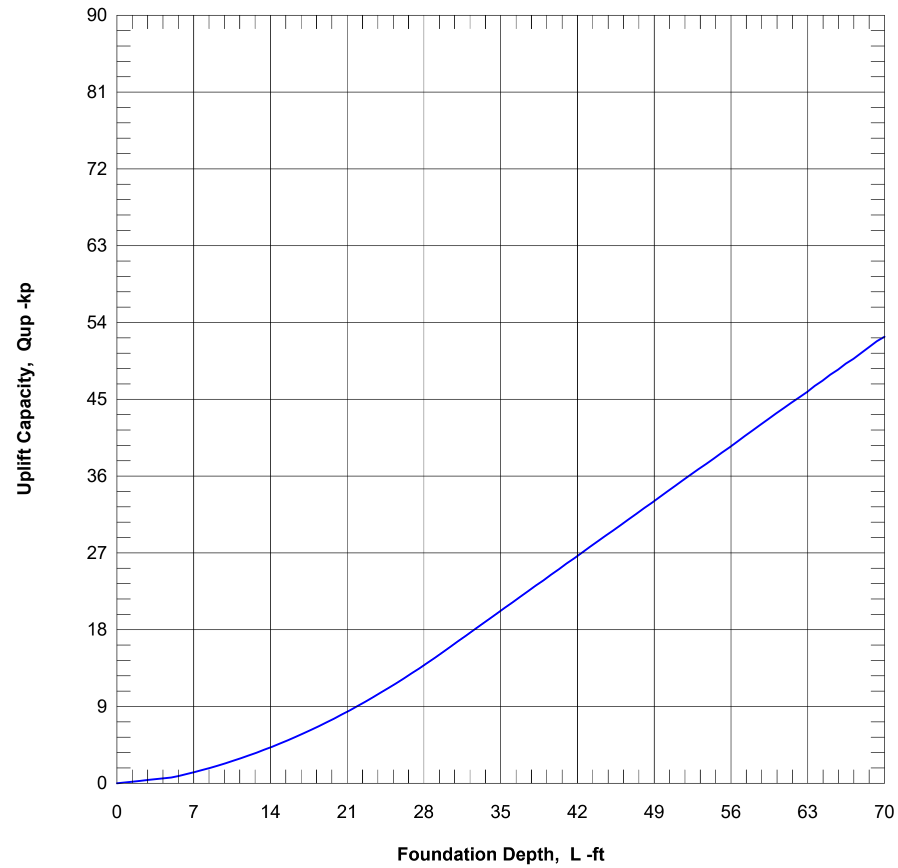
Fine Grained Soils		Coarse Grained Soils		
Description	Penetrometer Reading (tsf)	Penetration Resistance (blows/ft)	Description	Relative Density
Soft	0.0 to 1.0	0 to 4	Very Loose	0 to 20%
Firm	1.0 to 1.5	4 to 10	Loose	20 to 40%
Stiff	1.5 to 3.0	10 to 30	Medium Dense	40 to 70%
Very Stiff	3.0 to 4.5	30 to 50	Dense	70 to 90%
Hard	4.5+	Over 50	Very Dense	90 to 100%

Appendix I - Axial Pile Load Carrying Capacities

DRIVING OPEN END STEEL PIPE PILES

ALLOWABLE CAPACITY vs FOUNDATION DEPTH
18-INCH DIAMETER STEEL PIPE PILE

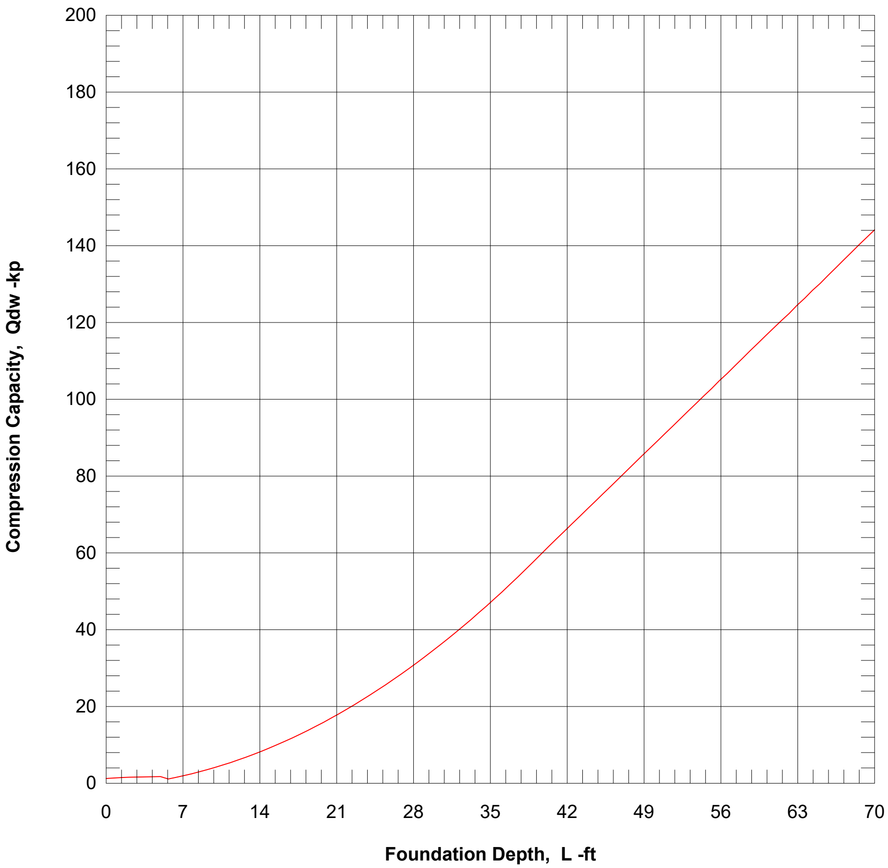


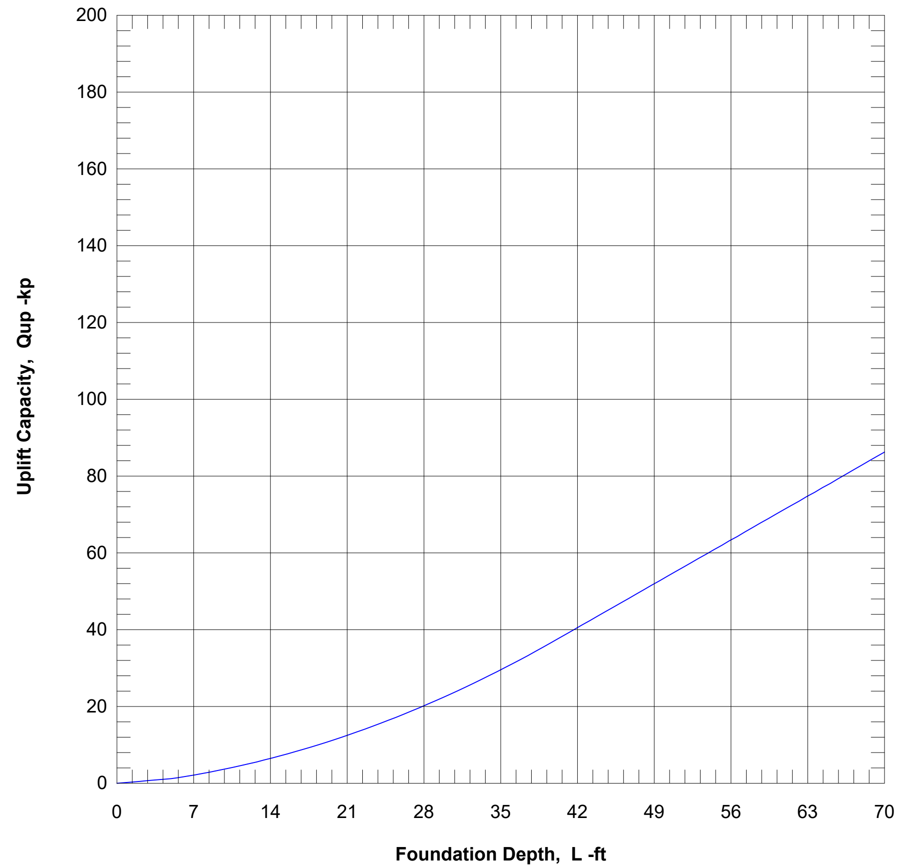


CivilTech Software

Driving Steel Pipe (Open ended)
Diameter = 18"

ALLOWABLE CAPACITY vs FOUNDATION DEPTH
24-INCH DIAMETER STEEL PIPE PILE

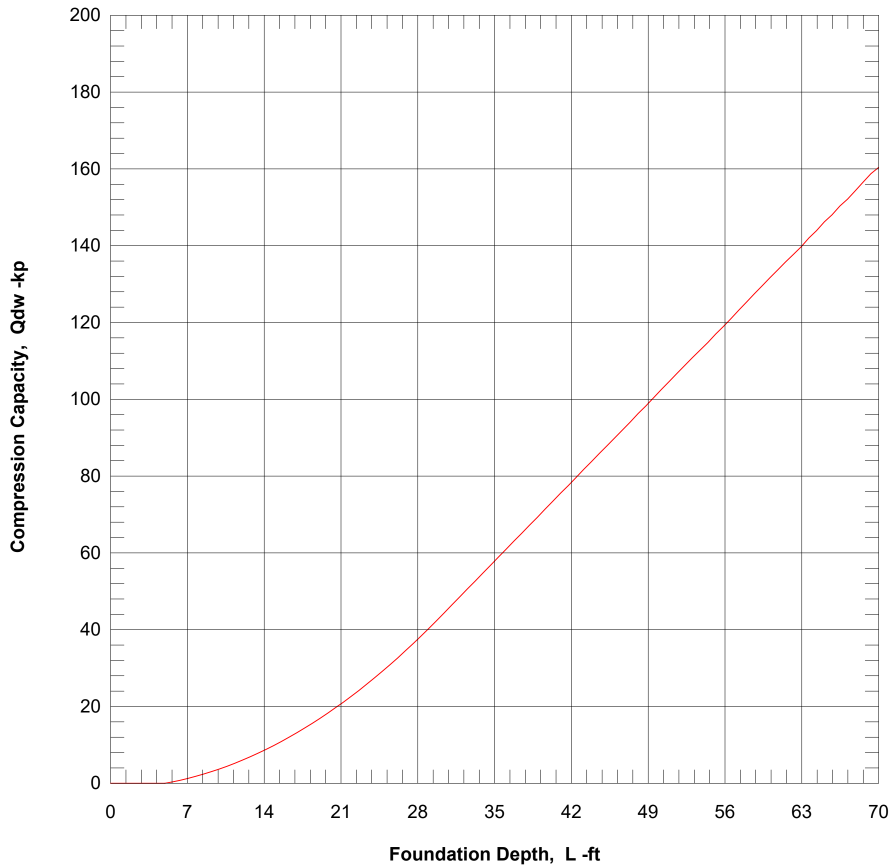


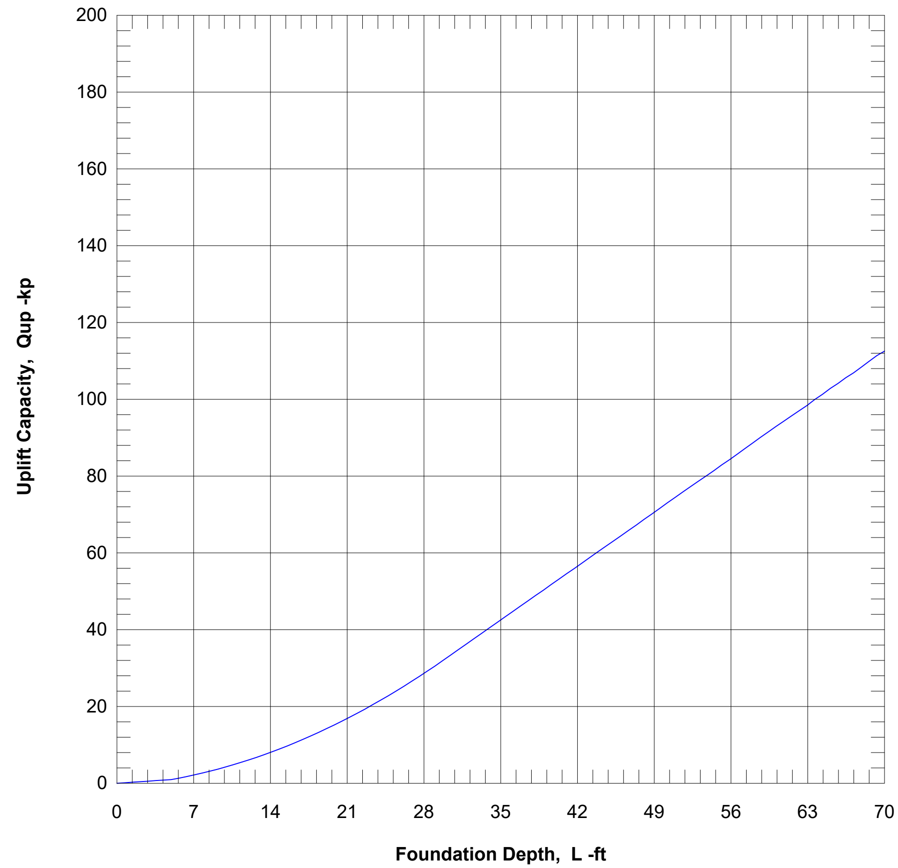


Driving Steel Pipe (Open ended)
Diameter = 24"

DRIVING CONCRETE PILES

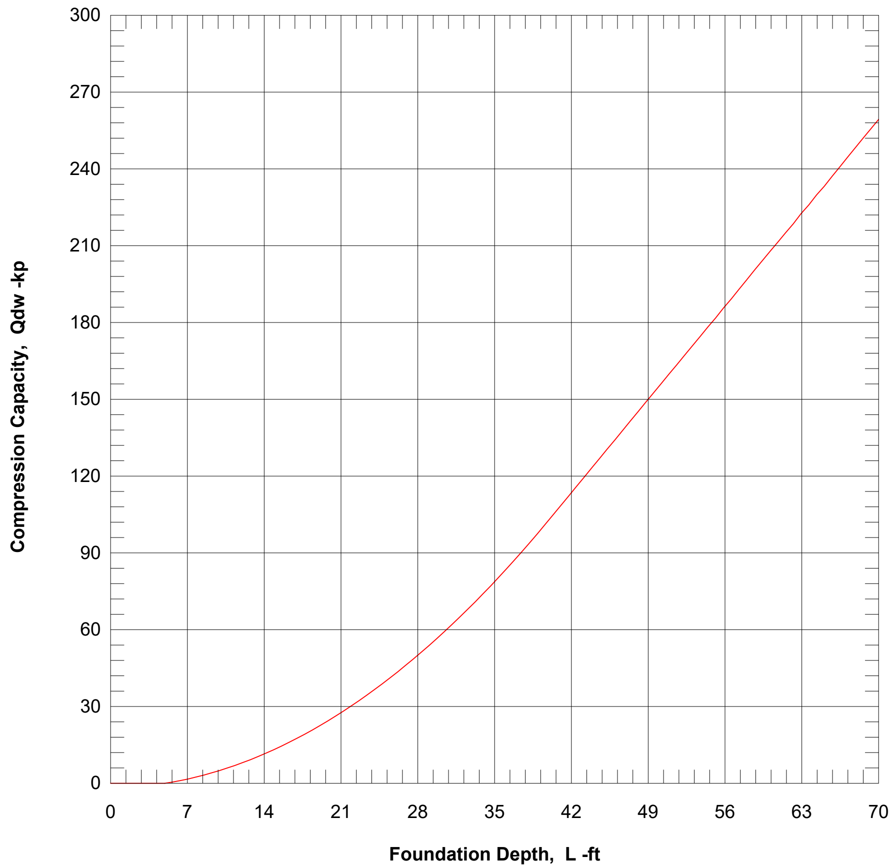
ALLOWABLE CAPACITY vs FOUNDATION DEPTH
18-INCH SQUARE CONCRETE PILE

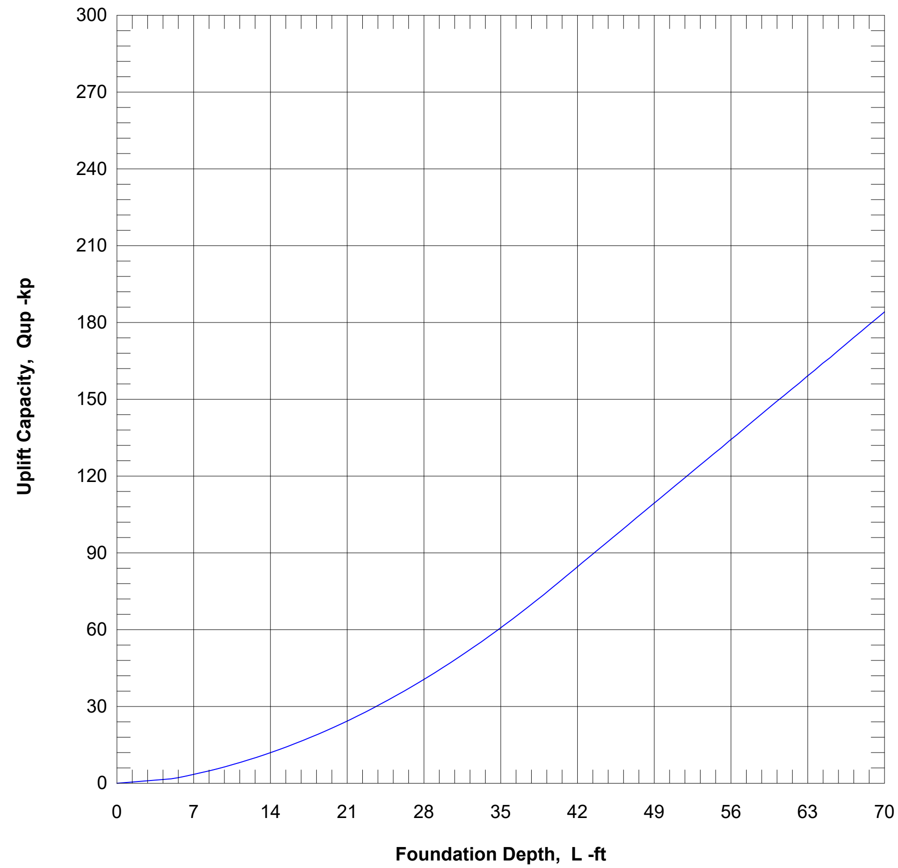




Driven Square Concrete Pile
Width = 18"

ALLOWABLE CAPACITY vs FOUNDATION DEPTH
24-INCH SQUARE CONCRETE PILE





CivilTech Software

Driven Square Concrete Pile
Width =24"