Project Manual

for

PSJA ISD Softball & Baseball Field Upgrades

PBK Project No.: 19141SP

PSJA NORTH ECHS, PSJA MEMORIAL ECHS, PSJA SOUTHWEST ECHS AND PSJA ECHS SOFTBALL & BASEBALL FIELDS UPGRADES **PROPOSAL #18-19-057**

for the

PHARR-SAN JUAN-ALAMO INDEPENDENT SCHOOL DISTRICT

07 August 2019

Issued for Proposals

08/07/2019

11 Greenway Plaza, 22nd Floor \\ Houston, Texas 77046 \\ P 713-965-0608 \\ F 713-961-4571 \\ PBK.com

Project Manual

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PBK Project No.: 19141SP

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Board of Trustees

Mr. Jesus “Jesse” Zambrano	President
Mr. Jorge “George” Palacios	Vice President
Mr. Jorge Zambrano	Secretary- Treasure
Mr. Ricardo “Rick” Pedraza	Assistant Secretary- Treasure
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Mr. Carlos G. Villegas, Jr.	Trustee
	Trustee

Administration

Dr. Daniel P. King	Superintendent

Project Manual

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PSJA ISD Softball & Baseball Field Upgrades

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for the

PHARR-SAN JUAN-ALAMO INDEPENDENT SCHOOL DISTRICT

07 August 2019

Issued for Proposals

Consultants

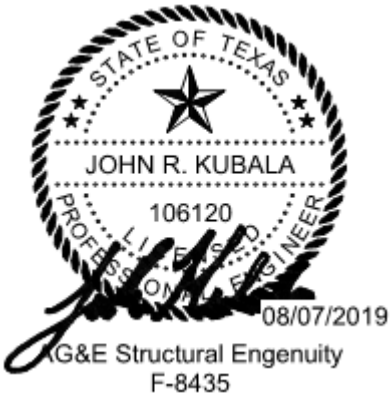
Sports
PBK Sports
11 Greenway Plaza Blvd, 15th Floor
Houston, Texas 77046
Phone: (713) 965-0608

Architect
PBK Architects
3900 nway Plaza Blvd, 15th Floor
Houston, Texas 77046
Phone: (713) 965-0608

Geotechnical
Terracon Consultants, Inc.
1506 Mid-Cities Dr.
Pharr, Texas 78577
Phone: (956) 283 - 8254

Issue for Proposal

Each specification section included herein is listed in the Project Manual Table of Contents with a letter code, indicated below, designating the Designer of Record responsible for its preparation, under whose seal and/or authority it is issued for the purpose(s) stated above. Seals and signatures do not apply to documents not included herein, nor (except as otherwise indicated) to documents prepared by the Owner or others ("O"), including but not necessarily limited to documents in Division 00, geotechnical and other reports, etc.

Engineer of Record: Civil H.F. Schneider, III, PE Registration # 69402	 08/07/2019	
Engineer of Record, Structural: John R. Kubala, P.E. P.E. # 106120	 G&E Structural Engenuity F-8435	

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PSJA NORTH ECHS

PSJA ECHS

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SECTION 00 11 00 - REQUEST FOR COMPETITIVE SEALED PROPOSALS

Competitive Sealed Proposals for the work identified below in accordance with Proposal Documents and addenda as may be issued prior to date of proposal opening will be received by the Purchasing Department, Pharr-San Juan-Alamo Independent School District, until proposal closing date and time, as identified below. Proposals from Offerors will then be opened in public and read aloud.

OWNER:

Pharr- San Juan-Alamo Independent School District
601 East Kelly Street
Pharr, Texas 78577
Phone: 956-354-2000
Representative: Daniel King, PhD, Superintendent

PROJECT:

PSJA ISD Softball & Baseball Field Upgrades

1) PSJA ECHS
   805 West Ridge Road
   San Juan, TX 78589

2) PSJA Memorial ECHS
   800 South Alamo Road
   Alamo, TX 78516

3) PSJA North ECHS
   500 East Nolana Loop
   Pharr, TX 78577

4) PSJA Southwest ECHS
   300 East Rancho Road
   Pharr, TX 78577

EST. BUDGET:

$2,750,000.00

PREPROPOSAL CONFERENCE:

Monday, August 15, 2019, at 2:00 PM
Representatives of the Engineers and Owner will be present at this meeting. All proposers are encouraged to attend. A walk through at each campus will follow.

LOCATION OF PRE PROPOSAL OPENING:

601 East Kelly Street, Conference Room #205
Pharr, Texas 78577

PROPOSAL DATE AND TIME:

Thursday, August 29, 2019, at 2:00 PM

LOCATION OF PROPOSAL OPENING:

601 East Kelly Street
Pharr, Texas 78577

ARCHITECT / ENGINEERS:

PBK Architects, Inc.
3900 North 10th Street, Suite 810
McAllen, Texas 78501
Phone: 956-687-1330

PBK Sports
11 Greenway Plaza, 15th Floor
Houston, Texas 77046
Phone: 713-365-0608

Qualified Offerors (General Contractors) may obtain a digital file of the plans and specifications at **PSJA Electronic Bid System** website (https://psjaebid.ionwave.net/Login.aspx). New users must register as prompted.

No proposal shall be withdrawn within 45 days after the proposal opening without the specific consent of the Owner.

PROPOSAL BOND: A Proposal Bond from a bonding company acceptable to the Owner or a certified check in an amount equal to 5% of the greatest amount proposal shall accompany each Offeror's proposal.

PAYMENT BOND AND PERFORMANCE BOND: A Payment Bond and Performance Bond, each in an amount equal to 100% of the Contract Sum conditioned upon the faithful performance of the Contract will be required. Please note that all bonding companies presented must be acceptable to the Owner.

The prevailing rates of wages are the minimums that must be paid in compliance with applicable laws of the State of Texas.

Offerors submitting a proposal are encouraged to visit the site. All Offerors submitting a proposal are encouraged to attend the proposal opening.

Subcontractors and Suppliers intending to submit proposals to General Construction Offerors are required to prepare proposals based on a complete set of proposal documents. If after reviewing the complete set of proposal documents, Subcontractors and Supplier Offerors desiring to purchase individual drawings and specification sections for their proposal convenience, may do so by ordering the specific drawings and specifications directly from the reproduction company.

Subcontractors and Suppliers purchasing a partial set of proposal documents are responsible for determining the documents it requires and is responsible for costs associated with printing and delivery. Subcontractors and Suppliers exercising this option shall agree that 1) all documents shall be returned to the Architect, without refund, after submitting a proposal, 2) the documents shall not be used on other construction projects, and 3) that the subcontractor or supplier agrees that the Owner and the Architect have no responsibility for errors or interpretations resulting from the use of incomplete set of proposal documents.

Successful Subcontractors and Supplier Offerors may retain their Proposal Documents until completion of the construction.

END OF DOCUMENT 00 11 00

DOCUMENT 00 40 00 - COMPETITIVE SEALED PROPOSAL FORM
PSJA SOFTBALL & BASEBALL FIELD UPGRADES
PHARR-SAN JUAN- ALAMO INDEPENDENT SCHOOL DISTRICT

Submitted by:
_____

Date: _____ Phone No.:_____

To: Emily Garza, Director of Purchasing
Pharr-San Juan-Alamo
601 East Kelly Street
Pharr, Texas 78577

Having examined Proposal and Contract Documents prepared by PBK, Inc., dated **August 6, 2019** and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

In submitting his Proposal, the undersigned agrees to the following:

1. Hold proposal open for acceptance 60 days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal and accepted Alternate Proposals.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By signing, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.

I. BASE PROPOSAL

Undersigned agrees to complete the Work for the lump sum amount as follows:

Total Lump Sum Amount of: (Including Allowances)

_____Dollars $_____
(Amount written in words governs) (Amount in figures)

Time of completion: 125 consecutive calendar days upon issuance of Notice to Proceed.

NOTE: THIS DOCUMENT MUST BE SUBMITTED

PSJA ECHS Softball: $_____

PSJA Memorial ECHS Baseball: $_____

PSJA Memorial ECHS Softball: $_____

PSJA North ECHS Baseball: $_____

PSJA North ECHS Softball: $_____

PSJA Southwest ECHS Baseball: $_____

PSJA Southwest ECHS Softball: $_____

II. ALTERNATES

A. Alternate No 01: Provide a 28 inch masonry backstop wall at all softball and baseball fields to include a 40 foot netting system for softball and a 60 foot netting system for baseball.

(ADD/ DEDUCT)_____Dollars $_____
(Amount written in words governs) (Amount in figures)

B. Alternate No 02: Provide a concrete turf curb extension along all edges of existing dugout aprons as indicated on each field.

(ADD/ DEDUCT)_____Dollars $_____
(Amount written in words governs) (Amount in figures)

C. Alternate No 03: Provide Brockfill infill with SP14 shock pad by Brock in lieu of rubber sand.

(ADD/ DEDUCT)_____Dollars $_____
(Amount written in words governs) (Amount in figures)

III. ALLOWANCES

Undersigned certifies that the specified allowances are included in the Base Proposal and agrees that any unexpended balance of allowance sums will revert to Owner in the final settlement of the contract.

Owner's Contingency Allowance included in the Base Proposal: **$175,000.00**

NOTE: THIS DOCUMENT MUST BE SUBMITTED

IV. ADDENDA

Undersigned acknowledges receipt of Addenda No._____
dated _____, 2019.

Undersigned acknowledges receipt of Addenda No._____
dated _____, 2019.

Undersigned acknowledges receipt of Addenda No._____
dated _____, 2019.

V. CHANGES IN THE WORK

Undersigned understands that changes in the work shall be performed in accordance with the Supplementary Conditions.

VI. LIQUIDATED DAMAGES

Undersigned understands that liquidated damages as defined in the Supplementary Conditions will be included in the form of Agreement between Owner and Contractor and that the contractor will be bound thereto.

It is understood that the right is reserved by the Owner to reject any or all proposals, or waive any informalities in the proposal process.

_____
Authorized Signature

_____
Title

(Seal, if a Corporation)
State whether Corporation,
Partnership or Individual

_____
Name of Contracting Firm

_____
Address

_____
Telephone

_____

NOTE: THIS DOCUMENT MUST BE SUBMITTED

Date

END OF DOCUMENT 00 40 00

NOTE: THIS DOCUMENT MUST BE SUBMITTED

DOCUMENT 00 50 00 - TEXAS STATUTORY PERFORMANCE BOND **Bond No.:** _____
(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that: _____
(hereinafter called the Principal), as principal, and
_____
a corporation organized and existing under the laws of the State of _____ authorized and admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter called the Surety), as Surety, are held and firmly bound unto

_____

_____

(hereinafter called the Obligee) in the amount of _____

_____

Dollars($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the_____ day of _____ , 20__, for

PSJA ISD SOFTBALL & BASEBALL FIELD UPGRADES
PHARR-SAN JUAN-ALAMO INDEPENDENT SCHOOL DISTRICT

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 2253 of the Texas Government Code and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____day of _____ , 20__.

_____ (Seal)
Principal

_____
Surety Address

By: _____

_____ (Seal)
Surety

_____
Surety Telephone Number

By: _____
Attorney-in-Fact

END OF DOCUMENT 00 50 00

DOCUMENT 00 65 02 - WAIVER AND RELEASE OF LIENS

PART 1 GENERAL

1.1 SUMMARY

A. Document Includes: Applicability and use of statutory Waiver and Release of Lien forms promulgated by the Legislature of the State of Texas for construction projects in Texas.

B. Related Requirements:
   1. The Contract for Construction (also referred to as the Agreement or the Contract)
   2. Conditions of the Contract (General, Supplementary, and other conditions, if any)
   3. Section 01 29 00 Payment Procedures
   4. Section 01 77 00 Contract Closeout
   5. Section 01 77 01 Closeout Procedures

1.2 REFERENCES

A. Texas Property Code, Chapter 53, Subchapter L, Sections 53.281 thru 53.287 (includes the standard forms attached herewith immediately following this section):
   1. Form 1: Conditional Waiver for Progress Payments
   2. Form 2: Unconditional Waiver for Progress Payments
   3. Form 3: Conditional Waiver for Final Payments
   4. Form 4: Unconditional Waiver for Final Payments

PART 2 PRODUCTS *(not used)*

PART 3 EXECUTION

3.1 SELECTION AND USE OF WAIVER AND RELEASE OF LIEN FORMS

A. Based on answers to the following questions, use the applicable form for the occasion:
   1. Is the payment a *progress* payment (partial, not final), or a *final* payment?
   2. Is the release *unconditional* (for a payment already received), or *conditional* (given in anticipation of a payment not yet received)?

B. Submit the applicable form, properly executed (filled out, signed and dated) and notarized, on each occasion required (see other portions of the Contract Documents, including but not necessarily limited to the related requirements documents cited above).

C. The wording of these forms is prescribed by the State of Texas. Questions regarding their use, execution, etc. should be directed to user's own attorney experienced in construction or lien law. This document is not to be interpreted as rendering legal advice.

D. Even if the Contract Documents do not explicitly require submittal of Waivers and Releases of Liens for every payment (for example, omitting them for monthly progress payments), the Owner reserves the right, at its sole discretion, to require applicable Waivers and Releases of Liens, executed and notarized, for any or all payments.

END OF DOCUMENT 00 65 02
(see following pages for standard forms)

FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENTS

PROJECT NAME: _____

OWNER'S NAME: _____PROJECT NUMBER_____

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of $_____ payable to _____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____ (owner) located at _____ (location) to the following extent:

_____ (job description).

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This _____ day of _____, 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS

PROJECT NAME: _____

OWNER'S NAME: _____ PROJECT NUMBER_____

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

The signer of this document has been paid and has received a progress payment in the sum of $_____ for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of _____ (Owner) located at _____ (location) to the following extent: _____ (job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the above referenced project to the following extent:

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENTS

PROJECT NAME: _____

OWNER'S NAME: _____ PROJECT NUMBER_____

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job. No. _____

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of $_____ payable to _____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____ (owner) located at _____ (location) to the following extent:

_____ (job description).

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted).

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENTS

PROJECT NAME: _____

OWNER'S NAME: _____ PROJECT NUMBER_____

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job. No. _____

The signer of this document has been paid in full for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of _____ (owner) located at _____ (location) to the following extent: _____ (job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

(END OF ATTACHED FORMS)

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Purchase contracts.
7. Owner furnished products.
8. Owner furnished, Contractor installed products.
9. Access to site.
10. Coordination with occupants.
11. Work restrictions.
12. Specification and drawing conventions.
13. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification: PJSA ISD Softball & Baseball Field Upgrades
1. Project Location:
1) PSJA ECHS
805 West Ridge Road
San Juan, Texas 78589

2) PSJA Memorial High School
800 South Alamo Road
Alamo, Texas 78516

3) PSJA North ECHS
500 East Nolana Loop
Pharr, Texas 78577

4) PSJA Southwest ECHS
300 East Rancho Blanco Road
Pharr, Texas 78577

B. Owner:
1. Owner's Representative: Mr. Daniel King, PhD, Superintendent
2. Owner’s Representative: Mr. Jerry Lopez, Project Manager

C. Engineer: PBK Sports, Houston, Texas.

1. Representative: Mr. Trey Schneider, PE

2. Representative: Mr. David I. Iglesias, Client Executive

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following: Conversion of existing natural grass baseball and softball fields at the aforementioned project locations to synthetic turf softball fields and synthetic turf baseball infields, including earthwork, subdrainage and drainage systems and necessary fencing adjustments, and reconstruction of the existing baseball outfield natural turf, including new topsoil, sod, irrigation and warning track.

B. Alternate No. 1 shall include new 28 inch masonry backstop wall at all softball and baseball fields to include 4” thick padding and a 40-foot netting system for softball and a 60-foot tall netting system for baseball.

C. Alternate No. 2 shall include new concrete turf curb extension along all edges of the existing dugout aprons as indicated on each field.

D. Alternate No. 3 shall include BrockFILL infill with SP14 shock pad by Brock in lieu of rubber-sand infill, including additional excavation to accommodate the additional thickness of the pad and maintain 6” drainage stone depth and 6” stabilized subgrade.

E. Type of Contract: Project will be constructed under a competitive sealed proposal (CSP) contract.

1.5 WORK BY OWNER AND UNDER SEPARATE CONTRACTS

A. Owner Furnished, Contractor Installed Products (OFCI): The Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner furnished products and making building services connections when applicable.
   1. Owner Furnished Products: Coordinate with Owner.

1.6 ACCESS TO SITE

A. Use of Site: Limit use of Project site to Work in areas and areas within the Contract limits indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
   1. Limits: The drawings indicate the limits of the construction operations.
   2. Driveways, Walkways, and Entrances: Keep driveways. parking areas, student drop off and pick up points, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, the students, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in weathertight condition throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform Work to prevent interference with Owner's day to day operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, ensure mechanical and electrical systems are fully operational, and required tests and inspections and start up procedures are successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. Upon occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.8 WORK RESTRICTIONS

A. Work Restrictions: Comply with restrictions on construction operations. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On Site Work Hours: Limit Work in the existing building to normal working hours, Monday through Friday, unless otherwise indicated. Coordinate with Owner when it is necessary to extend working hours or Work on weekends.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and after providing temporary utility services according to requirements indicated:
1. Notify Owner not less than two weeks in advance of proposed utility interruptions.
2. Obtain Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Owner not less than two weeks in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Controlled Substances, Firearms, and Explosive Devices: Use of tobacco products, controlled substances, firearms, and explosive devices on the site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on site.
1. Maintain list of approved screened personnel with Owner's representative.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of each specification section.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE

A. The Owner has a critical need for the Work to begin upon Notice to Proceed and shall be Substantially Complete within **125 Consecutive Calendar Days**. Extensions of Time to follow provisions indicated within the Agreement between Owner and Contractor.

END OF SECTION 01 10 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include
   1. Lump sum allowances.
   2. Unit cost allowances.
   3. Quantity allowances.
   4. Contingency allowances.
   5. Testing and inspecting allowances.

1.3 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.4 LUMP SUM, UNIT COST, AND QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight**,** and delivery to site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.5 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation**,** taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.6 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.7 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit cost allowances.
   4. Owner reserves the right to establish the quantity of Work in place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher or lower priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related Work.

3.3 SCHEDULE OF ALLOWANCES

A. Owner's Contingency Allowances: $175,000.00

END OF SECTION 01 21 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes: Administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain Work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described are part of the Work when enumerated in the Agreement.

2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent Work as necessary to completely integrate Work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Forty-eight (48) hours following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other Work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Masonry Backstop Wall and Netting

1. Provide a 28 inch masonry backstop wall at all softball and baseball fields to include 4" thick padding and a 40-foot tall netting system for softball and a 60-foot tall netting system for baseball.

B. Alternate No. 2: Concrete Turf Curb

1. Provide a concrete turf curb extension along all edges of existing dugout aprons as indicated on each field.

C. Alternate No. 3: Brockfill and Shock Pad

1. Provide BrockFILL infill with SP14 shock pad by Brock in lieu of rubber-sand infill, including additional excavation to accommodate the additional thickness of the pad and maintain 6" drainage stone depth and 6" stabilized subgrade.

END OF SECTION 01 23 00

SECTION 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Specified product compliance, and product quality assurance.

B. Specific administrative and procedural requirements for handling requests for substitutions made prior to award of Contract.

C. Requirements for product delivery, storage and handling.

1.3 RELATED REQUIREMENTS

A. Instructions to Offerors: Product options and procedures for submittal of requests for substitutions during the Proposal period.

1.4 DESCRIPTION OF REQUIREMENTS

A. Definitions: Definitions used in this Section are not intended to negate the meaning of other terms used in the Contract Documents, including such terms as “specialties”, “systems”, “structure”, “finishes”, “accessories”, “furnishings”, “special construction”, and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.

1. Products: Shall mean items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor’s previously purchased stock. The term “product” as used herein includes the terms “material”, “equipment”, “system”, and other terms of similar intent.
    a. Named Products: Are those identified by the use of the manufacturer’s name for a product, including such items as a make or model designation, as recorded in published product literature, of the latest issue as of the date of the Contract Documents.
    b. Specified Products: same as Named Products.

2. Materials: Shall mean products that must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form units of work.
3. Equipment: Is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

1.5 PRODUCT QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

1. When it is discovered that specific products are available only from sources that do not or cannot produce an adequate quantity to complete project requirements in a timely manner, consult with the Architect/Engineer for a determination of what product quantities are most important before proceeding. The Architect/Engineer will designate those qualities, such as visual, structural, durability, or compatibility, that are most important. When the Architect/Engineer’s determination has been made, select products from those sources that produce products that possess the most important qualities, to the fullest extent possible.

B. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two (2) or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

C. Or Equal:
   1. Where the phrase “or equal”, “or equivalent”, “or Architects approved equal”, or similar phrasing, occurs in the Proposal Documents, do not assume that materials, equipment, or methods of construction will be approved by the Architect unless the item has been specifically approved for this Work by the Architect.
   2. The decision of the Architect shall be final.

D. Where a proposed substitution involves the work of more than one (1) contractor, each contractor involved shall cooperate and coordinate the work with each other contractor involved, so as to provide uniformity and consistency and to assure the compatibility of products.

E. Foreign Product Limitations: “Foreign products” as distinguished from “domestic products” are defined as products that are either manufactured substantially (50 percent or more of value) outside of the United States and its possessions, or produced or supplied by entities known to be substantially owned (more than 50 percent) by persons who are not citizens of nor living within the United States and its possessions.
   1. Except under one (1) of the following conditions, select and provide domestic, not foreign, products for inclusion in the Work.
      a. There is no domestic product available that complies with the requirements of the Contract Documents.
      b. Available domestic products that comply with the requirements of the Contract Documents are available only at prices or other procurement terms that are substantially higher (25 percent or more) than for available foreign products that comply with the requirements of the Contract Documents.
      c. At the discretion of the Architect or Owner.

   2. Final determination and acceptance will be the responsibility of the Architect.

F. Standards: Refer to Section 01 41 00, Regulatory Requirements for the applicability of industry standards to the products specified for the Project, and for the acronyms used in the text of the Specification Sections.

1.6 SUBSTITUTIONS OF PRODUCTS

A. The products described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. It is not intended to preclude the use of equal or better materials or equipment provided that same meets the requirements of the particular project and is approved in an Addendum as a substitution prior to the submission of proposals.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect at least seven (7) days prior to the date for receipt of proposals. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

C. If the Architect approves any proposed substitution prior to receipt of proposals, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.

D. The Architect and Owner reserve the right to disapprove the use of any manufacturer who in their judgment is unsuitable for use on the Project and that decision will be final

E. The following are not considered as substitutions:
   1. Revisions to the Contract Documents, when requested by the Owner, Architect, or any of their consultants are considered as “changes” not substitutions.
   2. Specified Contractor options on products and construction methods included in Contract Documents are choices made available to the Contractor and are not subject to the requirements specified in this Section for substitutions.
   3. Except as otherwise provided in the Contract Documents, the Contractor’s determination of and compliance with governing authorities do not constitute “substitutions” and do not constitute a basis for change orders.

F. The following may be considered as a reason for a request for substitution:
   1. The request is directly related to an “or approved equal” clause or similar language in the Contract Documents.
   2. The specified product or method of construction cannot be provided within the Contract Time in accordance with paragraph below concerning availability of specified items.
   3. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
   4. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other consideration of merit, after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Architect/Engineer for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.
   5. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
   6. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
   7. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

G. Availability of specified items:
   1. Verify prior to submittal of Proposal that all specified items will be available in time for installation during orderly and timely progress of the work.
   2. In the event specified items will not be so available, notify the Architect prior to receipt of Proposals. Submit Request for Substitutions in accordance with this section.
   3. The request will not be considered if the product or method cannot be provided as a result of the Contractor’s failure to pursue the work promptly or coordinate activities properly.
   4. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by the Owner.

H. A request constitutes a representation that Offeror:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product, except when inability to provide specified Warranty is reason for request for substitution as described above.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse the Owner and pay for all costs, including Architect/Engineer's redesign and evaluation costs resulting from the use of the proposed substitution, or for review or redesign services associated with re-approval by authorities having jurisdiction.

I. **No substitutions will be considered after the Award of Contract.**

1.7 SUBSTITUTION REQUEST SUBMITTAL

A. Requests for Substitutions: Submit three (3) copies of each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; include related Specifications Section and Drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include, as appropriate, with each request, the following information:
1. Product data, drawings and descriptions of products, fabrication and installation procedures.
2. Samples, where applicable or requested.
3. A detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect, where applicable.
4. Coordination information, including a list of changes or modifications needed by other parts of the work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
5. A statement indicating the effect the substitution will have on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
6. Cost information, including a proposal of the net change, if any in the Contract Sum.
7. Certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal-to or better than the work required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
8. A statement indicating the Contractor will reimburse the Owner and pay for all costs, including Architect/Engineer's re-design and evaluation costs resulting from the use of the proposed substitution.

B. Work-Related Submittals: The Contractor's submittal of, and the Architect/Engineer's acceptance of, Shop Drawings, Product Data, or Samples which are related to work not complying with the Contract Documents, does not constitute an acceptance or valid request for a substitution, nor approval thereof.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control to prevent overcrowding of construction spaces or overloading of structure. In particular, coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.
1. Deliver products to the site in the manufacturer's sealed containers or other packaging system, complete with labels intact, and instructions for handling, storage, unpacking, installing, cleaning and protecting.

2. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.
3. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
4. Store products at the site or in a bonded and insured off-site storage facility or warehouse in a manner that will facilitate inspection and measurement of quantity or counting of units. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
5. Store heavy materials away from the project structure or in a manner that will not endanger the supporting construction.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a contract requirement. These requirements may be specified in any one (1) of several different specifying methods, or in any combination of these methods. These methods include the following:
   1. Proprietary.
   2. Descriptive.
   3. Performance.
   4. Compliance with Reference Standards.

B. Compliance with codes, compliance with graphic details, allowances, and similar provisions of the Contract Documents also have a bearing on the selection process

C. Procedures for Selecting Products: The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects. Required procedures include, but are not limited to the following for the various indicated methods of specifying:
   1. Proprietary and Semi-Proprietary Specification Requirements:
      a. Single Product Name: Where only a single product or manufacturer is named, provide the product indicated, unless the specification indicates the possible consideration of other products. Advise the Architect/Engineer before proceeding, when it is discovered that the named product is not a reasonable or feasible solution.
      b. Two (2) or More Product Names: Where two (2) or more products or manufacturers are named, provide one (1) of the products named, at the Contractor's option. Exclude products that do not comply with specification requirements. Do not provide or offer to provide an unnamed product, unless the specification indicates the possible consideration of other products. Advise the Architect/Engineer before proceeding where none of the named products comply with specification requirements, or are not feasible for use. Where products or manufacturers are specified by name, accompanied by the term "or approved equal" or similar language, comply with this Section regarding "substitutions" to obtain approval from the Architect/Engineer for the use of an unnamed product.
   2. Non-Proprietary Specification Requirements: Where the specifications name products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to the use of these products only, the Contractor may, at his option, use any available product that complies with the Contract requirements.
   3. Descriptive Specification Requirements: Where the specifications describe a product or assembly generically, in detail, listing the exact characteristics required, but without use of a brand name, provide products or assemblies that provide the characteristics indicated and otherwise comply with Contract requirements.

4. Performance Specification Requirements: Where the specifications require compliance with indicated performance requirements, provide products that comply with the specific performance requirements indicated, and that are recommended by the manufacturer for the application indicated. The manufacturer's recommendations may be contained in published product literature, or by the manufacturer's individual certification of performance. General overall performance of a product is implied where the product is specified for specific performances.
5. Compliance with Standards, Codes, and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including standards, codes, and regulations.
6. Visual Matching: Where matching an established sample is required, the final judgement of whether a product proposed by the Contractor matches the sample satisfactorily will be determined by the Architect. Where there is no product available within the specified product category that matches the sample satisfactorily and also complies with other specified requirements, comply with the provisions of this Section regarding "substitutions" and other Contract Documents for "change orders" for the selection of a matching product in another product category, or for non-compliance with specified requirements.
7. Visual Selection: Except as otherwise indicated, where specified product requirements include the phrase "…as selected from the manufacturer's standard colors, patterns, textures…" or similar phrases, the Contractor has the option of selecting the product and manufacturer, provided the selection complies with other specified requirements. The Architect is subsequently responsible for selecting the color, pattern and texture from the product line selected by the Contractor.
8. Allowances: Refer to individual sections of the specifications and Section 01 21 00, Allowances for an indication of product selections that are controlled by established allowances, and for the procedures required for processing such selections.

D. Producer's Statement of Applicability: Where individual specification sections indicate products that require a "Statement of Applicability" from the manufacturer or other producer, submit a written-certified statement from the producer stating that the producer has reviewed the proposed application of the product on the project. This statement shall state that the producer agrees with or does not object to the Architect/Engineer's specification and the Contractor's selection of the product on the project is suitable and proper.

2.2 SUBSTITUTIONS

A. Condition: The Contractor's request for substitution will be received and considered when extensive revisions to Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request is timely, fully documented and properly submitted, and when one (1) or more of the above conditions are satisfied, all as judged and determined by the Architect/Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated.

B. Anchor each product securely in place, accurately located and aligned with other work.

C. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

D. Products and assemblies shall be installed complete, in-place, watertight and structurally sound.

3.2 INSTALLATION OF APPROVED SUBSTITUTIONS

A. Coordinate all approved substitutions with adjacent work.

B. Comply with the manufacturer's and/or supplier's instructions and recommendations for installation of the products in the applications indicated.

C. Provide all items required by manufacturer and/or supplier regarding installation, i.e. supplemental supports, anchors, fasteners, painting, etc. whether or not indicated or specified.

END OF SECTION 01 25 13

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for handling and processing Contract modifications.

B. Related Work:
   1. Section 01 25 13 – Product Substitution Procedures.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 *Architect's Supplemental Instructions*.

1.4 PROPOSAL REQUESTS

A. Owner Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop Work in progress or to execute the proposed change.
   2. After receipt of Proposal Request, submit quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include statement outlining reasons for the change and the effect of the change on the Work. Provide complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times,

and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Section 01 25 00 if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use AIA Document G709.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: When an allowance is specified, refer to Section 01 21 00 for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1. Allowance Adjustment: To adjust allowance amounts, base each Change Proposal Request (CPR) on the difference between purchase amount and the allowance, multiplied by final measurement of Work in place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
    a. Include installation costs in purchase amount only where indicated as part of the allowance.
    b. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
    c. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit cost allowances.
    d. Owner reserves the right to establish the quantity of Work in place by independent quantity survey, measure, or count.

2. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 7 days of receipt of the Change Order authorizing work to proceed. Owner will reject claims submitted later than 7 days after authorization.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will execute a Change Order also requiring signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work and designates the method to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of Work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

B. Pencil Copy: A preliminary review copy of the application for payment for review by Architect and Owner prior to submission of final copy.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Updated Submittal schedule.
      c. Items required to be indicated as separate activities in updated Contractor's construction schedule.

   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment. Contractor's standard form or electronic media printout will be considered but must be approved by the Owner.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.

   2. Arrange schedule of values consistent with format of AIA Document G703.

   3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.

      f. Change Orders (numbers) that affect value.

g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
   1) Labor.
   2) Materials.
   3) Equipment rentals.
   4) General Conditions.
      a. Supervisor.
      b. Submittals.
      c. Close-out.
      d. Field Engineering.
      e. Daily Clean-up.
      f. Final Clean-up.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on site and items stored off site. Include evidence of insurance.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line item value of unit cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual Work in place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Submit preliminary (pencil) copy of proposed values to Architect or Architects field representative and Owner for review by 20th date of the month. Allow 48 hours for comments.

B. Once preliminary (pencil) approved, submit electronic copy of notarized originals of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702 or other similar form approved by the Owner.

C. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

D. Submit updated construction or recovery schedule with each Application for Payment.

E. Payment Period: Submit at intervals stipulated in the Agreement in accordance with Document 00 73 00, Supplementary Conditions of the Contract.

F. Only materials stored on the project site shall be paid for unless the materials are stored in a bonded warehouse.

G. Substantiating Data: When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Items which may be requested by the Architect or Owner to substantiate costs include, but are not limited to the following:
   1. Current Record Documents as specified in Section 01 77 00, Closeout Procedures maintained.

2. Labor time sheets, purchase orders, or similar documentation.
3. Affidavits attesting to off-site stored products.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 29 00

SECTION 01 29 73 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. Work Included: Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specified herein and in other provisions of the Contract Documents.

B. Coordinate requirements of this Section with the requirements of the General and Supplementary Conditions of the Contract concerning Schedule of Values.

1.3 QUALITY ASSURANCE

A. Use required means to assure arithmetical accuracy of the sums described.

B. When so required by the Owner, provide copies of the subcontracts or other data acceptable to the Owner, substantiating the sums described.

1.4 SUBMITTALS

A. Prior to the first Application for Payment, submit a proposed schedule of values to the Owner, as outlined below:
   1. Meet with the Owner and determine additional data, if any, required to be submitted.
   2. Secure the Owner's approval of the schedule of values prior to submitting first Application for Payment.

1.5 SCHEDULE OF VALUES

A. The Schedule of Values shall be broken down into item costs for each specification section as a minimum. After review by the Owner, the Schedule of Values shall be broken down into further items as required. (See following list and refer to the enclosed sample.). In addition, total each Specification Division separately.

B. Schedule of Values - Items in addition to Specification Sections.
   1. Mobilization
   2. Clean Up
   3. Building Permit
   4. Bonds, Insurance
   5. Misc. Mechanical Accessories
   6. Demolition
   7. Rough-In Labor - (Electrical)
   8. Rough-In Material - (Electrical)
   9. Finish Labor - (Electrical)
   10. Finish Material - (Electrical)
   11. Allowances (listed separately)
   12. Record drawings and close-out documents
   13. Submittals listed separately per mechanical, electrical and plumbing
   14. Roof warranty as a line item

15. Donated items individually itemized at $0.00 (zero dollars).

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

A. Refer to following sample.

END OF SECTION 01 29 73

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Div. 1 - General Reqs.								
	Site Work General Conditions								
	Suoervision								
	Mobilization								
	Bonds & Insurance								
	Permits								
	Contractor's Fee								
	Close-Out Documents								
	Div. 1 - Total								
	Div. 2 - Existing Conditions								
	Demolition (As applicable)								
	Erosion Control								
	Div. 2 - Total								
	Divs. 31, 32 and 33 - Earthwork, Exterior Improvments and Utilities								
	Site Clearing & Grubbing								
	Building Pad - Materials								
	Building Pad - Labor								
	Paving Subgrade								
	Signage / Striping								
	Bike Racks								
	Landscaping - Materials								
	Landscaping - Labor								
	Hydro Mulch - Materials								
	Hydro Mulch - Labor								
	Irrigation - Materials								
	Irrigation - Labor								
	Earthwork								
	Finish Grading								
	Stabilization - Materials								
	Stabilization - Labor								
	Site Drainage - Materials								
	Site Drainage - Labor								
	Chain Link Fence-Materials								
	Chain Link Fence-Labor								
	Paving - Labor								
	Paving - Materials								
	Sidewalks								
	Close-Out Documents								
	Div. 31, 32 and 33 - Total								
	General Conditions								
	Mobilization								
	Temp. Facilities								
	Final Cleaning								
	Record Documents/Close-out/								
	O&M Manuals								
	Supervision								
	Permits								
	Bonds								
	Insurance								

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Allowances								
	Alternates (list) Change Orders A. PR# B. PR# C. PR#								

END OF SECTION SAMPLE 01 29 73

SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Pre-install meetings.

B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific Contractor.

C. Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. Requests for Information (RFI's) will not be allowed from the Contractor. The Contractor shall arrange the necessary meeting in the field with appropriate Architect's field representative(s) to obtain clarification as needed on items that may need interpretation.

1.3 SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each Contractor shall coordinate its construction operations with those of other Contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other Contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate Contractors if coordination of the Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Coordinating inspections and other jurisdictional requirements.
   10. Coordinate OFCI equipment.
   11. Action items and issue logs.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to the Specifications Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade specific information to the coordination drawings by multiple Contractors in sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures, ductwork, piping, and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   e. Floor boxes.

8. Fire Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, sprinkler heads, and inspector test locations.

9. IDF/MDF Rooms: Communications and low voltage (security, data, phone, etc.) audio

10. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

11. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
   2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
   3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
      a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
      b. Digital Data Software Program: Drawings are available in Revit.
      c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 PROJECT MEETINGS

A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Architect to prepare the meeting agenda and distribute the agenda to all invited attendees.
   3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
   4. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
   5. Issue logs: Documentation element of software project management and contains a list of ongoing and closed issues of the project.

B. Kick-off & Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that affect progress.
   4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
   5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

C. Preinstallation Conferences: Conduct a preinstallation trade conference at site before each construction activity that requires coordination with other construction trades.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Engineer of Record of scheduled meeting dates.
   2. Agenda: Contractor to review progress of other construction activities and preparations for the particular activity under consideration.
   3. Contractor to record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
   4. Reporting: Contractor to distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
6. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Substantial Completion.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each Contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
    b. Six (6) week look-ahead schedules.

5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

F. Coordination Meetings: Conduct coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each Contractor present.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
4. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 31 00

SECTION 01 31 19 - PROJECT MEETINGS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDE

A. The Architect's:
   1. Scheduling of each meeting (pre-construction meeting, periodic project meetings, and specialty called meetings throughout the progress of the Work).
   2. Preparation of agenda for meetings.
   3. Presiding at minutes, including all significant proceedings and decisions.
   4. Recording, reproducing, and distributing copies of meeting minutes within two (2) working days, excluding weekends and holidays, after each meeting to:
      a. All participants in the meeting.
      b. All parties affected by decisions made at the meeting.
   5. Providing status report of allowance funds.

B. The Contractor's:
   1. Making physical arrangement for meetings.
   2. Participation in all meetings and conferences.
   3. Scheduling attendance of Job Superintendent, Project Coordinator, and other parties affecting or affected by decisions made at meetings and conferences as their interests require.
   4. Scheduling Pre-installation conferences.
   5. Scheduling Pre-Closeout Meeting
   6. Providing updated schedules.
   7. Providing status reports/logs of CPRs, MCs, and shop drawings/submittals.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

A. Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction meeting with Contractor, Architect, and Owner. This meeting must occur prior to commencement of any construction.

B. Architect will:
   1. Administer pre-construction conference for the establishment of communication methods, procedures and Owner requirements.
   2. Administer site mobilization conference for clarification of Owner and Contractor.

C. Location: At Project site as designated by the Architect.

D. Attendance:
   1. Contractor or Contractor's Representatives
   2. Job Superintendent
   3. Project Coordinator (Manager)
   4. Owner or Owner's Representative
   5. Major subcontractors

6. Major suppliers
7. Architect's Representative
8. Others as appropriate

E. Meeting Agenda, may include, but is not limited to:
1. Discussion on major subcontracts and suppliers and projected construction schedules.
2. Critical work sequencing.
3. Major equipment deliveries and priorities. Discussion of long lead time items.
4. Project coordination and designation of responsible personnel.
5. Procedures and processing of field decisions, proposal requests, submittals, minor changes, change orders and applications for payment.
6. Method of distribution of Contract Documents.
7. Procedures for maintaining Record Documents.
8. Use of premises, office work and storage areas, on-site parking, and Owner's requirements.
9. Construction facilities and temporary utilities.
10. Housekeeping procedures.

3.2 PROGRESS MEETINGS

A. Architect will:
1. Schedule project meetings throughout progress of the work at weekly intervals, and specially called meetings.
2. Set agenda and administer said meetings.
3. Preside at meetings.
4. Record meeting minutes, including all significant proceedings and decisions.
5. Reproduce and distribute copies of meeting minutes within two (2) working days, excluding weekends and holidays, after each meeting to:
   a. All participants in the meeting.
   b. All parties affected by decisions made at the meeting.

B. Architect shall:
1. Make physical arrangements for meetings.

C. Attendance:
1. Contractor or Contractor's Representative
2. Job Superintendent
3. Project Coordinator (Manager)
4. Owner or Owner's Representative
5. Major subcontractors
6. Major suppliers
7. Architect's Field Representative
8. Consultants as needed
9. Others as appropriate

D. Meeting Agenda, may include, but is not limited to:
1. Review and approval of minutes of previous meeting.
2. Review of Work progress since previous meeting.
3. Field observations, problems, and conflicts.
4. Review of off-site fabrication and delivery schedules.
5. Corrective measures and procedures to regain projected schedule.
6. Revisions to Construction Schedule.
7. Plan progress and schedule during succeeding work period.
8. Coordination of schedules.
9. Review submittal schedules and expedite as required.
10. Maintenance of quality standards.

11. Allowance balances.
12. Review of proposed changes and substitutions for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other contracts of the Project.
13. Status of Allowance Expenditure Authorizations (AEAs).
14. Status of Change Proposal Requests (CPRs).
15. Status of Minor Changes (MCs).
16. Status of submittals, review of submittal log.
17. Other items and critical issues affecting Work.

3.3 PRE-INSTALLATION CONFERENCES

A. In accordance with the requirements of Section 01 11 00, Notification of Architect Requirements, the Contractor will convene pre-installation conferences when required by individual specification Sections or as required by the Architect, prior to the Contractor commencing Work of the Section.

B. Attendance, optional:
1. General Contractor or Contractor's Representative
2. Project Coordinator (Manager)
3. Owner or Owner's Representative
4. Architect's Project Manager (Project Executive)

C. Attendance, required:
1. Project Superintendent
2. Architect's Field Representative
3. Sub-contractor's Project Manager
4. Sub-contractor's Foreman
5. Engineer's Representative, as needed.
6. Manufacturer's Representative, as needed.
7. Governing Agency Official, as required
8. Inspection Agency Representative, as required.
9. Others affecting or affected by Work.

D. Meeting Agenda, may include, but is not limited to:
1. Review of conditions of installation.
2. Preparation and installation procedures.
3. Coordination with related work
4. Review of the contract document requirements.
5. Review of code enforcement or testing requirements.
6. Questions related to work required.

3.4 PRE-CLOSEOUT MEETING

A. In accordance with the requirements of Section 01 77 00, Closeout Procedures, the Contractor will convene a pre-closeout meeting when he considers the Work or designated portion of the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the work for its intended use.

B. Attendance, required:
1. Owner or Owner's Representative
2. Project Coordinator (Manager)
3. General Contractor or Contractor's Representative
4. Project Superintendent
5. Architect's Project Manager (Project Executive)
6. Architect's Field Representative
7. Engineer's Representative, as needed.

C. Meeting Agenda, may include, but is not limited to:
   1. Review of the contract document requirements for Substantial Completion and Project Closeout
   2. Review of Work which remains to be completed or corrected.
   3. Closeout Document review schedule and log
   4. Review of closeout procedures including, but not limited to Record Drawings, Warrantees, Operation and Maintenance Manuals, and Owner Demonstrations and Start-up.
   5. Review of code enforcement or testing requirements.
   6. Questions related to work required.

END OF SECTION 01 31 19

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Contractor's construction schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Special reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Resource Loading: The allocation of manpower and equipment necessary for completion of an activity as scheduled.

G. Recovery Schedule: Submittal of a revised critical path method (CPM) schedule and a written plan.

H. Look-ahead Schedule: Prepare schedule indicating activities scheduled to occur or commence prior to submittal of next schedule update.

I. Milestones: Measurable and observable and serve as progress markers (flags) but, by definition, are independent of time (have zero durations) therefore no Work or consumption of resources is associated with them.

1.4 SUBMITTALS

A. Submittal Format: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file.

B. Startup Diagram: Of size necessary to display entire network for entire construction period. Show logic relationship ties for all activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
   3. Total Float Report: List of all activities sorted in ascending order of total float.
   4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at monthly intervals.

G. Material Location Reports: Submit at monthly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at site. Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
   1. Review software limitations and content and format for reports.
   2. Verify availability of qualified personnel needed to develop and update schedule.
   3. Discuss constraints, including phasing, Work stages, area separations, interim milestones, and partial Owner occupancy.
   4. Review delivery dates for Owner furnished products.
   5. Review schedule for Work of Owner's separate contracts, if any.
   6. Review submittal requirements and procedures.
   7. Review time required for review of submittals and resubmittals.
   8. Review requirements for tests and inspections by independent testing and inspecting agencies.
   9. Review time required for Project closeout and Owner startup procedures.
   10. Review and finalize list of construction activities to be included in schedule.
   11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Time is of the essence to the Owner. Commence Work immediately upon issuance of the Notice to Proceed. There is a critical need for the Work to be substantially complete within the time frame identified in the Agreement.

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion and date of final completion.
   1. Contract completion date shall not be changed by submission of schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each separate area or story as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities in terms of number of days anticipated.
   2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
   4. Startup and Testing Time: Include number of days anticipated for startup and testing.
   5. Substantial Completion: Indicate completion of all conditions as in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
   6. Punch List and Final Completion: Include a maximum of 30 days for completion of punch list items and final completion.
   7. Inspections required by Authorities Having Jurisdiction (AHJ).

D. Constraints: Include constraints and Work restrictions indicated in the Contract Documents and show how the sequence of the Work is affected.
   1. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with existing construction.
      b. Limitations of continued occupancies.
      c. Uninterruptible services.
      d. Partial occupancy before Substantial Completion.
      e. Use of premises restrictions.
      f. Provisions for future construction.
      g. Seasonal variations.
      h. Environmental control.
      i. Rain days as indicated in Specification Section 01 10 00 Summary.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
   a. Submittals.
   b. Mockups.
   c. Fabrication.
   d. Installation.
   e. Tests and inspections.
   f. Adjusting.
   g. Curing.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

F. Six (6) week, lookahead schedule: Prepare schedule indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered Requests for Information.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and Contract Time.
   6. Inspections by Authorities Having Jurisdiction (AHJ).
   7. Trade pre-installation conference.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

I. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

J. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
   1. Identification of activities that have changed.
   2. Changes in early and late start dates.
   3. Changes in early and late finish dates.
   4. Changes in activity durations in workdays.
   5. Changes in the critical path.
   6. Changes in total float or slack time.
   7. Changes in the Contract Time.

2.2 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording information concerning events at the site and submit each month to Architect:
   1. List of subcontractors at Project site.
   2. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Rental equipment at Project site.
   5. Material deliveries.
   6. High and low temperatures and general weather conditions, including presence of rain or snow.
   7. Accidents.
   8. Meetings and significant decisions.
   9. Unusual events (see special reports).

10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of Authorities Having Jurisdiction (AHJ).
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report and contact Architect Field Representative. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents to Architect Field Representative.

D. Special Reports: Submit special reports directly to Owner within 24 hours of an occurrence. Distribute copies of report to parties affected by the occurrence.
1. Reporting Unusual Events: When an event of an unusual and significant nature occurs at site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner & Architect in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule with a pencil copy of pay application.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and interested parties identified by Contractor with a need to know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final completion construction photographs.

1.3 SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph or video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.
   1. Digital Camera: Minimum sensor resolution of 8 megapixels.
   2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
   3. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
      g. Unique sequential identifier keyed to accompanying key plan.

C. Construction Photographs: Submit two prints of each photographic view within seven days of taking photographs.
   1. Format: 8 inch by 10 inch (203 mm by 254 mm) smooth surface matte prints on single weight, commercial grade photographic paper; mounted on card stock to allow a 1 inch (25 mm) wide margin punched for standard three-ring binder.
   2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date photograph was taken if not date stamped by camera.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
      g. Unique sequential identifier keyed to accompanying key plan.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image editing software.
   1. Date and Time: Include date and time in file name for each image.
   2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Flag construction limits before taking construction photographs.
   2. Take minimum of 20 photographs to show existing conditions adjacent to property before starting the Work.
   3. Take minimum of 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
   4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take minimum of 20 photographs monthly, coinciding with cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
   1. Take photographs as evidence of existing project conditions as follows:
      a. Site: Take four (4) site aerial photographs at project corners.
      b. Interior views: Take four (4) minimum interior photographs of each space under construction from differing directions or as required.
      c. Exterior views: Take two (2) photographs of each elevation.
      d. Details: Take as required to document concealed conditions, including, but not limited to, underground construction, utility penetrations and installation, steel erection, concrete and masonry reinforcing, waterproofing and flashing, and roofing installation.

E. Architect Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

F. Time Lapse Sequence Construction Photographs: Take minimum of 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
   1. Frequency: Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment.
   2. Vantage Points: Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time lapse sequence.
      a. Commencement of the Work, through completion of subgrade construction.
      b. Above grade structural framing.
      c. Exterior building enclosure.
      d. Interior Work, through date of Substantial Completion.

G. Final Completion Construction Photographs: Take minimum of 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
   1. Do not include date stamp.

H. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
      a. Special events planned at Project site.
      b. Immediate follow up when on site events result in construction damage or losses.
      c. Take photographs at fabrication locations away from site.
      d. Substantial Completion of a major phase or component of the Work.
      e. Extra record photographs at time of final acceptance.
      f. Owner's request for special publicity photographs.

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Submittals: Written and graphic information and physical samples that require Architect's responsive action or are for information and do not require the architect’s action.

B. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

C. Portable Document Format (PDF): An open standard file format used for representing documents in a device independent and display resolution independent fixed layout document format.

1.4 SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
   1. Upon request, Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
      a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
      b. Digital Drawing Software Program: The Contract Drawings are available in Revit.
      c. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
      d. The following digital data files will by furnished for each appropriate discipline:

1) Floor plans.
2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow ten (10) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process in same manner as initial submittal.
3. Resubmittal Review: Allow ten (10) days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow ten (10) days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
3. Transmittal Form for Electronic Submittals: Use software generated form from electronic project management software acceptable to Owner**,** containing the following information:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Names of subcontractor, manufacturer, and supplier.
   h. Category and type of submittal.
   i. Submittal purpose and description.
   j. Specification Section number and title.
   k. Specification paragraph number or drawing designation and generic name for each of multiple items.
   l. Drawing number and detail references, as appropriate.
   m. Location(s) where product is to be installed, as appropriate.

n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

4. Metadata: Include the following information as keywords in the electronic submittal file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Submit electronic submittals via email as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

      OR
   2. Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.

   3. Certificates and Certifications Submittals: Provide statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.

   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

   5. Submit Product Data before or concurrent with Samples.
   6. Submit Product Data in PDF electronic file.

C. Shop Drawings: Prepare Project specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.

   2. Sheet Size: Except for templates, patterns, and similar full size drawings, submit Shop Drawings on sheet size indicated in specification section.

   3. Submit Shop Drawings in PDF electronic file.
   4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
      a. Prepare Shop Drawings in same digital data software program, version, and operating system as the original Drawings.
      b. Refer to Section 01 31 00 for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.

d. Number and title of applicable Specification Section.
e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples: Submit full size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Key Items Review Time: Submit samples to the Architect at least 30 days prior to the date the Contractor needs the reviewed submittals returned. The Contractor shall be prepared to submit color samples on any key items in Division 09 finishes within 30 days of the award of Contract. Once samples of all key items are received, the Architect will finalize color selections.
   b. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Division 01.

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01.

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00.

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00.

J. Closeout Submittals required for Substantial Completion: Comply with requirements specified in Section 01 77 00.

K. Maintenance Data: Comply with requirements specified in Section 01 78 23.

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Incorporate delegated design drawing and data files into Building Information Model established for Project.
   1. Prepare delegated design drawings in the same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

C. Incomplete submittals are not permitted, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Submittals not required by the Contract Documents will be returned by the Architect without action.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
   4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Laboratory Mockups: Full size physical assemblies constructed at testing facility to verify performance characteristics.
   2. Integrated Exterior Mockups: Mockups of exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
   3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality Control Testing: Tests and inspections performed on site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations.
   1. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, *experienced* means having successfully completed a minimum of five years documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Shop Drawings: Submit plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting Work on the following systems:
   1. Seismic force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by Architect.
   2. Main wind force resisting system or wind resisting component listed in the wind force resisting system quality assurance plan prepared by Architect.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.

4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

E. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

1.7 QUALITY ASSURANCE

A. Qualifications establish the minimum qualification levels required; refer to individual Specification Sections for additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated and sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated and with record of successful in service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling Work similar in material, design, and extent to that indicated for this Project, whose Work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Texas, experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products.

I. Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit certified written report of each test, inspection, and similar quality assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect a minimum of seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting Work, fabrication, or construction. Allow **seven** days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Mockup of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies shall be constructed. Mockup, if not specifically shown on the drawings, shall be minimum 8’x8’. Mockup shall include all major façade elements and at least one window minimum 2’x2’ in size. Prior to constructing mockup verify requirements with architect. Pre-installation conferences for trades involved in Integrated Exterior Mockup shall be held after mock up is completed.

M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

N. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300.

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner:

B. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections.
   1. Verifying that manufacturer maintains detailed fabrication and quality control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00.

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 40 00

SECTION 01 41 00 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality Assurance.

B. References Standards.

C. Definitions.

D. Abbreviations.

E. Format and Specification Context Explanations.

F. Drawing Symbols.

G. General Requirements.

1.2 QUALITY ASSURANCE

A. General:
   1. For products or workmanship specified by a standard of an association, trade, or Federal standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable code authorities having jurisdiction.
   2. The contractual relationship of the parties to the Purchase Order should not be altered from the Purchase Order Documents by mention or inference otherwise in any reference standard.
   3. Obtain copies of standards when required by Purchase Order Documents.
   4. Maintain copy of standards at jobsite during submittals, planning, and progress of the specific work for which the standards pertain, until the date of Substantial Completion.
   5. In the absence of specific instructions in the specifications, materials, products, equipment and their installation shall conform to the applicable codes, regulations and standards specified therein. When a conflict exists between the applicable code, regulation and standard and that specified, the more stringent code regulation or standard shall prevail, except as authorized by applicable authorities having jurisdiction.

B. Specifications and Drawings: The Drawings and Specifications are correlative and have equal authority and priority. Base disagreements in themselves or in each other on the most expensive combination of quantity and quality of work indicated. In the event of such disagreement bring it to the attention of the Owner (or Owner's Representative), who will determine the appropriate method to perform the work.

C. Industry Standards: Where compliance with two (2) or more industry standards or sets of requirements are specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement is intended and will be enforced, unless specifically detailed language written into Purchase Order Documents clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently equal-but-different requirements, and uncertainties as to which level of quality is more stringent, to the Owner for a decision before proceeding.

D. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended to be the minimum for the work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with the minimum (within specified

tolerances), or may exceed that minimum within reasonable limits. In complying with requirements, indicated numeric values are either minimums or maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to Owner for decision before proceeding.

E. Specialists' Assignments: In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists, who are engaged for performance of work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements should not be interpreted so as to conflict with applicable regulations, union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of requirements remains with the Contractor.

1.3 REFERENCE STANDARDS

A. Dates of codes, regulations and standards specified shall be the latest date of issue of that code, regulation or standard prior to the date of issue of this Project Manual or Document, except as modified or otherwise directed by the applicable codes and their supplements and amendments adopted by the code authorities having jurisdiction.
   1. Date of Issue - The "date of issue" as it appears in the statement above, means the date which appears on the cover of the Project Manual or Document corresponding to the date of issue of the Purchase Order Documents.
   2. Code Authorities: The "code authorities" as it appears in the statement above, means the authorities responsible for code enforcement.

1.4 DEFINITIONS

A. General Explanation: Drawings must be recognized as being diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in the Purchase Order Documents are defined in the General Conditions, Supplementary Conditions, and in this Section. Definitions and explanations contained in this Section are not necessarily either complete or exclusive, but are general for this Work to the extent that they are not stated more explicitly in another element of the Purchase Order Documents. In the event of a conflict in definitions or explanations within the Purchase Order Documents or whenever there is need of clarification or interpretation of definitions within or between the Purchase Order Documents, notify the Owner immediately and proceed as directed. Except in cases where definitions are determined by code authorities having jurisdiction, the Owner's interpretation of all definitions will take precedence.

B. General Requirements: The provisions or requirements of Division 1 - Sections apply to entire Scope of Work and, where indicated, to other elements which are included in the Project.

C. Owner (or Owner's Representative): Wherever the term "Owner (or Owner's Representative)" or any derivative thereof appears in the Purchase Order Documents, it means PBK, 11 Greenway Plaza, 22nd Floor, Houston, Texas 77046, (713) 965-0608, or their authorized representative(s).

D. Bid, Competitive Sealed Proposal (CSP), Response, Offer, etc.: Wherever the term "Bid", "Competitive Sealed Proposal (CSP)", "Response", "Offer", "Proposal", or any derivative thereof, or similar term appears in the Purchase Order Documents, they mean one and the same, and shall mean Competitive Sealed Proposal, which by definition allows the Owner to accept the "best value" for the school district based on factors other than cost in selecting the Contractor.

E. Contractor, General Contractor, Construction Manager, etc: Wherever the term "Contractor", "General Contractor", "Construction Manager" or any derivative thereof, or similar term appear in the Purchase Order Documents, they mean one and the same.

F. Subcontractor, Sub-subcontractor, Bidder, etc.: Wherever the term "Subcontractor", Sub-subcontractor", "Bidder", "Bidder/Vendor", "Vendor", "Installer", "Integrator", "Respondent", "Offeror", or any derivative thereof, or similar term appears in the Purchase Order Documents, they mean one and the same, and shall refer to the entity (person or firm) licensed and meeting all applicable regulations of the State of Michigan and Department of Labor to perform the Work, or their authorized representative(s).
   1. Responsibilities: To avoid any misunderstanding or lack of interpretation, the responsibility for performing the Work is totally that of the entity defined above, and the resolutions proposed in his shop drawings and related documentation shall be demonstrated throughout the Work and specified warranty period.
   2. In the event of a controversy involving the Purchase Order Documents or interpretation of Project requirements, the decision of the Owner will take precedence.

G. Lamar Consolidated Independent School District, Owner.

H. Consultants: Wherever the term "Consultant", or any derivative thereof appears in the Purchase Order Documents, it means the following to whom that portion of the work applies.
   1. Owner's Consultants:
      a. Geotechnical Consultant: Raba Kistner
      b. Surveyors: Jakubik & Associates

J. Indicated: Wherever the term "indicated", or any derivative thereof appears in the Purchase Order Documents, it means a cross-reference to graphic representations, notes, or schedules on Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in the Purchase Order Documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for the purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

K. Directed, Requested, Etc: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted" or any derivative thereof appears in the Purchase Order Documents, it means as "directed by the Owner", "requested by the Owner", and similar phrases with actions taken by the Owner. However, no meaning or otherwise shall be interpreted to extend the Owner's responsibility into Contractor's area of construction supervision.

L. Approve: Wherever the term "Approve", or any derivative thereof appears in the Purchase Order Documents, it means only the Owner, or an individual designated by him as his representative, can approve or disapprove Purchase Order actions. Even if the specifications indicate that an individual other than the Owner, such as the "Engineer" or "Consultant" will approve or disapprove an action, it is understood that only the Owner has this authority unless the individual is so designated by him in writing. Even when an individual is so designated, the Contractor may appeal the action to the Owner and the Owner's decision will be final. In no case will "approval" by the Owner be interpreted as a release of the Contractor from responsibility to fulfill requirements of the Purchase Order Documents.

M. Furnish: Wherever the term "Furnish", or any derivative thereof appears in the Purchase Order Documents, it means supply or deliver to Project site, ready for unloading, unpacking, assembly, erection, placing, installing, anchoring, applying, curing, finishing, protecting, cleaning and similar operations, as applicable in each instance.

N. Install: Wherever the term "Install", or any derivative thereof appears in the Purchase Order Documents, it means performing the operations at the Project site, of unloading, unpacking, assembly, erection, placing, installing, anchoring, applying, curing, finishing, protecting, cleaning and similar operations, as applicable in each instance.

O. Provide: Wherever the term “Provide”, or any derivative thereof appears in the Purchase Order Documents, it means furnish and install at the Project site, complete and ready for intended use, as applicable in each instance.

P. Project, Site: Wherever the term “Project”, “Site”, or similar such term appears in the Purchase Order Documents, it means the space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing work as part of the Project. The extent of project or site is shown on the Drawings, and may or may not be identical with description of land upon which Project is to be built.

Q. Installer: Wherever the term “Installer”, or any derivative thereof appears in the Purchase Order Documents, it means the entity (person or firm) engaged by the Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of work at the Project, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.

R. Specialist: Wherever the term “Specialist”, or any derivative thereof appears in the Purchase Order Documents, it means an individual or firm of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workmen skilled in either (as applicable) manufacturing or fabricating items required by the Purchase Order, installing items required by the Purchase Order, or otherwise performing work required by the Purchase Order. Where the Purchase Order Specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item or firm who will perform the work under the manufacturer’s direct supervision.

S. Testing Laboratory: Wherever the term “Testing Laboratory”, or any derivative thereof appears in the Purchase Order Documents, it means an independent entity engaged to perform specific inspections or tests of the work, either at the Project site or elsewhere; and to report and (if required) interpret results of those inspections or tests.

1.5 FORMAT AND SPECIFICATION CONTEXT EXPLANATIONS

A. Underscoring: Is used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where underscoring is used.

B. Capitalization: Except for manufacturer, product, or trademark names, capitalization is used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where capitalization is used.

C. Imperative language: Is used generally in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by the Contractor, or when so noted, by others.

D. Section Numbering: Is used to facilitate cross-reference in Purchase Order Documents. Sections are placed in Project Manual in numeric sequence; however, numbering sequence is not complete, and listing of sections at beginning of Project Manual must be consulted to determine numbers and names of specification sections in Purchase Order Documents.

E. Page Numbering: Pages are numbered independently for each section. The section number is shown preceded by the project number and followed by the page number at the bottom of each page, to facilitate the location of text. The project number is given to identify the project, for which specification was written, should the section become separated from the Project Manual.

F. Specifying Methods: The techniques or methods of specifying to record requirements varies throughout text, and may include “prescriptive, “open-generic descriptive”, “compliance with standards”, “performance”, or a combination of these. The method used for specifying one unit of work has no bearing on requirements for another unit of work.

G. Abbreviations: The language of Specifications and other Purchase Order Documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual work abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of specification requirements with notations on drawings and in schedules. These are frequently defined in section at first instance of use. Trade association names and titles of general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the Purchase Order Documents so indicates. A list of typical abbreviations, includes, but is not limited to the following trade associations and organizations. Refer to Drawings and other Purchase Order Documents for other abbreviations.

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Assn.
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
AGA	American Gas Association
AGC	Associated General Contractors of America
AHA	American Hardboard Association
AHGA	American Hotdip Galvanizers Association
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron & Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	Air Conditioning & Refrigeration Institute
ASA	Acoustical Society of America
ASA	American Subcontractors Association
ASAHC	American Society of Architectural Hardware Consultants
ASC	Adhesive & Sealant Council, Inc.
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Professional Engineers
ASPI	American Wood Preserver's Institute
ASTM	ASTM International
AWI	Architectural Woodwork Institute
AWS	American Welding Society
BIA	Brick Institute of America
BRI	Building Research Institute
CRA	California Redwood Association
CLFMI	Chain Link Fence Manufacturers Institute
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DHI	Door and Hardware Institute
EPA	Environmental Protection Agency
FTI	Facing Tile Institute
FGMA	Flat Glass Marketing Association

GA	Gypsum Association
HPMA	Hardwood Plywood Manufacturers Association
IBC	International Building Code
ICBO	International Conference of Building Officials
ICC	International Code Council
IEEE	Institute of Electrical and Electronic Engineers
JSMA	Joint Sealer Manufacturers Association
MFMA	Maple Flooring Manufacturers Association
ML/SFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal Manufacturers
NAMM	National Association of Mirror Manufacturers
NBLP	National Bureau of Lathing & Plastering
NCPI	National Clay Pipe Institute
NCMA	National Concrete Masonry Association
NEMA	National Electrical Manufacturers Assn.
NESC	National Environmental Systems Contractors
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NHLA	National Hardwood Lumber Association
NOMMA	National Ornamental Metal Manufacturers Assn
NPVLA	National Paint, Varnish and Lacquer Assn.
NRMCA	National Ready Mixed Concrete Assn.
NRCA	National Roofing Contractors Association
NSPE	National Society of Professional Engineers
NWMA	National Woodwork Manufacturers Assn., Inc.
OSHA	Occupational Safety and Health Administration
PDCA	Painting and Decorating Contractors of America
PI	Perlite Institute, Inc.
PCA	Portland Cement Association
RFCI	Resilient Floor Covering Institute
RVFC	Rubber and Vinyl Floor Council
SBCCI	Southern Building Code Congress International, Inc.
SFPA	Southern Forest Products Association
SHLMA	Southern Hardwood Lumber Manufacturing Assn.
SDI	Steel Deck Institute
SDI	Steel Door Institute
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
TCA	Tile Council of America, Inc.
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
VBI	Venetian Blind Institute
VFI	Vinyl Fabrics Institute
WCLIB	West Coast Lumber Inspection Bureau
WRCLA	Western Red Cedar Lumber Association
WWPA	Western Wood Products Association

1.6 DRAWING SYMBOLS

A. General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols defined by “Architectural Graphic Standards”, published by the American Institute of Architects (AIA) and John Wiley & Sons, Inc., latest edition. Refer instances of uncertainty to Owner (or Owner’s Representative) for clarification before proceeding.

B. Mechanical/Electrical Drawings: Graphic symbols used in Mechanical/Electrical Drawings are generally aligned with symbols recommended by American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). Where appropriate, those symbols are supplemented by more specific symbols as recommended by other recognized technical organizations, including, but not limited to American Society of Mechanical Engineers (ASME), American Society of Professional Engineers (ASPE), Institute of Electrical and Electronic Engineers (IEEE) and similar organizations. Refer instances of uncertainty to Owner (or Owner's Representative) for clarification before proceeding.

1.7 GENERAL REQUIREMENTS

A. Color, Texture, or Pattern Requirements:
1. When color, texture, or pattern is specified, the item, product, or material shall be furnished in the specified color, texture, or pattern, as applicable.
2. When more than one (1) approved manufacturer is named in the Specifications, Contractor may select any of the approved manufacturers and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Owner's review and selection.
3. When the term "match existing", or any derivative thereof appears in the Purchase Order Documents, it means that the sample must match the Owner's existing work in every respect as to color, texture, and pattern, as applicable.
4. When the term "match Owner's approved sample", or any derivative thereof appears in the Purchase Order Documents, it means that the Owner (or Owner's Representative) has selected a sample which must be matched in every respect as to color, texture, and pattern, as applicable.
5. When an item or product is specified of a manufacturer for which only one (1) color, texture, or pattern is available, and a color, texture, or pattern other than that one is specified, Contractor shall bring it to the attention of the Owner (or Owner's Representative) for a decision prior to proceeding with the work. Do not proceed with the work until Owner has approved the color, texture, and pattern, as applicable.
6. When an item or product is specified of a manufacturer for which no color, texture, or pattern is specified, and colors, textures, and patterns are available, Contractor shall bring it to the attention of the Owner and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Owner's review and selection. Do not proceed with the work until Owner has selected and approved the color, texture, and pattern, as applicable.
7. When due to the nature of the item, product, or material, i.e. face brick, tile pavers, natural stone, etc, Contractor shall submit sample or samples which exhibits the full range of characteristics (colors, i.e. lights and darks, as well as textures, and patterns) for which the item, product, or material is available. The Owner will select the color, texture, and pattern, as applicable, from those available and request a sample panel exhibiting the approved characteristics. The approved color range, texture, and pattern, as applicable will then become the standard for which all work on the project will be judged. Owner will be final judge as to having performed work in conformance with approved characteristics.
8. Under no circumstances are colors, textures, patterns, or any other characteristics for which an item, product, or material are available to be selected by anyone other than the Owner or his authorized representative.
9. Non-conforming work shall be removed from the site and replaced with new conforming work at no additional expense to Owner.

B. Continuity of Building Envelope, Full Height Partitions, and Fire Rated Construction:
1. Continuity of Building Envelope:
   a. All materials such as exterior sheathing, membrane flashings, vapor barriers, insulations, dampproofing, waterproofing, roofing, flashings, etc. and all penetrations, holes, gaps, joints, and openings through such materials shall be sealed to ensure continuity of building envelope, whether indicated or not.

b. Refer instances of uncertainty to Owner for clarification before proceeding with work.

2. Full Height Partitions:
   a. All full height partitions shall be from floor to bottom of deck structure and shall be made to fit around steel joists, beams, etc., whether indicated or not.
   b. Seal joints at top of partitions, in flutes of steel deck, and around structural elements with a compressible filler and/or sealant to accommodate movement due to expansion, contraction, and deflection, whether indicated or not. Treat seals in joints of fire rated partitions as specified below for fire rated construction, whether indicated or not.
   c. Refer instances of uncertainty to Owner for clarification before proceeding with work.

3. Fire Rated Construction:
   a. All seals in fire rated construction, whether at top, bottom, or penetrations through fire rated construction, shall be made with firestopping and fire safing materials to maintain fire rating integrity of construction and satisfy authorities having jurisdiction, whether indicated or not.
   b. Refer instances of uncertainty to Owner for clarification before proceeding with work.

C. Plumbing Line Protection:
   1. Placing or washing materials, including, but not limited to the following, down any plumbing line or fixture is strictly forbidden.
      a. Concrete, cement, sludge, mortar, grout, plaster, or any other cementitious material
      b. Paint, paint thinner, turpentine, kerosene, gasoline, oil, or any other petroleum or hazardous products.
   2. Cleaning painting equipment, including brushes in new or existing plumbing fixtures is strictly prohibited.
   3. If requested, Contractor shall certify that all affected plumbing lines and fixtures are clean , free flowing and running. Plumbing lines and fixtures damaged as a result of any of the above shall be repaired or replaced at no expense to Owner. Contractor shall bear responsibility and all costs of fines, penalties, and legal fees attributed to violations as levied by authorities having jurisdiction.

D. Hanging Items from Deck and Structure: Ducts, pipes, conduits, equipment, and other items indicated to be supported from the structure shall be accomplished using approved hangwires, hangers, or devices of type, size and material recommended to suit the application and installed in accordance with recommendations of the hanger or device manufacturer, Owner (or Owner's Representative) and/or Structural Engineer, or code authorities having jurisdiction, whichever is the more stringent requirement. Nothing shall be hung from the deck and structure unless directed to do so by the Owner (or Owner's Representative) and/or Structural Engineer. Powder activated devices in metal deck are not permitted.

E. Ducts, Pipes, Conduits, and Wires: Shall be concealed in walls, chases, and enclosed areas out of view, unless specifically indicated as exposed or where exposure is required for proper function of item, such as air registers, air returns, louvers, grilles, vents, thermostats, electrical receptacles, telephone/data terminals and jacks, light switches, etc. Refer instances of uncertainty to Owner (or Owner's Representative) for clarification before proceeding.

F. Fasteners:
   1. Unless specifically indicated or directed otherwise, all fasteners in work exposed to view, shall be concealed in the finished work.
   2. No fasteners shall show through or telegraph through exposed face of finished work and all finished surfaces shall be free of all evidence of the existence of fasteners.
   3. Fasteners shall be spaced to accurately and rigidly secure work in place.

4. If not shown or otherwise required or recommended by manufacturer, standard, or code authorities having jurisdiction, fastener spacing shall not exceed 12 inches on center.
5. Non-conforming work shall be removed from the site and replaced with new conforming work at no additional expense to Owner.

G. Exposed Metal Work:
1. Unless specifically indicated or directed otherwise, all exposed metal work shall be flat with all surfaces free of distortions, oil canning, waves, dents, scratches, weld marks, and other surface defects detrimental to good appearance or function.
2. All steel exposed to exterior weather or moisture, either exposed or concealed in work, shall be hot-dip galvanized, phosphate treated for paint retention and shop prime painted.
3. Non-conforming work shall be removed from the site and replaced with new conforming work at no additional expense to Owner.

H. Continuous Date and Time Code Operated Devices:
1. Devices used in the construction of this Project which use continuous date and time codes in their operation, whether software or hardware, and whether upgradable or not, including, but not limited to air handling, lighting, alarm, communication, security, and instrumentation systems, elevators, escalators and other conveying systems. In addition, such devices shall remain compliant for 100 years or the life of the device, whichever comes first.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 41 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK REQUIREMENTS

A. General: This Section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include the obtaining of permits, licenses, inspections, releases, and similar statements, as well as payments, associated with regulations, codes, and standards.

B. “Regulations” is defined to include laws, statutes, ordinances, and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the Work regardless of whether they are lawfully imposed by governing authority or not.

C. Governing Regulations: Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations.

1.3 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized", "selected", "required", and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown", "noted", "scheduled", and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

J. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference. Individual Specification Sections indicate which codes and standards the Contractor must keep available at the project site for reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

D. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified is intended to be the minimum for the Work to be provided or performed. Unless otherwise indicated, the actual Work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to the Architect/Engineer for decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction or other entity applicable to the context of the text provision.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the Agency.

C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.

1.6 SUBMITTALS

A. Permits, Licenses and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 42 00

SECTION 01 45 00 - QUALITY CONTROL

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Quality Assurance: Requirements for material and product quality and control of installation.

B. Tolerances

C. References and Standards

D. Testing Laboratory Services

E. Inspection Services

F. Manufacturers' field services

1.2 RELATED SECTIONS

A. Section 01 45 23 – Testing and Inspecting Services

B. Section 01 33 00 - Submittal Procedures

C. The Work of this Section shall be included as a part of all Sections of Work, whether referenced therein or not.

1.3 DESCRIPTION OF REQUIREMENTS

A. Unless specifically noted otherwise, perform all Work shown, mentioned, or reasonably inferred and comply with all work restrictions.

B. Many of the requirements specified elsewhere are included herein for reference and convenience. Where a conflict occurs between the Contract Documents, either within themselves or each other, the more stringent requirement or the most expensive combination of materials and workmanship shall prevail.

C. Contractor shall:
1. perform Work in accordance with the General Conditions, as specified herein, and with the quality control requirements of each Specification Section;
2. perform Work in the highest quality workmanship, unless specified otherwise;
3. join materials with a uniform and accurate fit so they meet with neat straight lines, free of smears, overlaps or irregularities, as applicable to the work;
4. install all exposed materials appropriately level, plumb, and at accurate angles as shown and flush with adjoining materials;
5. attach materials with sufficient strength, and with number and spacing of fasteners and attachments that will not fail until materials joined are broken or permanently deformed;
6. use concealed fasteners, unless shown or directed otherwise.

1.4 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturer’s instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.5 TOLERANCES

A. Monitor fabrication and installation tolerance control of Products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.6 REFERENCES AND STANDARDS

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Owner-Contractor Agreement except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

E. Neither contractual relationships, duties, responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

F. Refer to Section 01 41 00, Codes, Regulations and Standards, for additional information concerning applicable reference and standards requirements.

1.7 TESTING SERVICES

A. Owner will appoint, employ, and pay for specified services of an independent firm to perform testing.

B. The independent firm will perform tests and other services specified in individual specification sections and as required by the Architect/Engineer, Owner, or authority having jurisdiction.

C. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Architect/Engineer or the Owner.

D. Reports will be submitted by the independent firm to the Owner, Architect/Engineer, and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.
   2. Make arrangements with independent firm and pay for additional samples and tests required.

F. Testing does not relieve Contractor to perform Work to contract requirements.

G. Re-testing required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.

H. Refer to Section 01 45 23, Inspection and Testing Laboratory Services, for additional information concerning testing, and submittal procedures and requirements for Testing Reports.

1.8 INSPECTION SERVICES

A. Owner will appoint, employ, and pay for specified services of an independent firm to perform inspection.

B. The independent firm will perform inspections and other services specified in individual specification sections and as required by the Architect/Engineer, Owner, or authority having jurisdiction.

C. Inspecting may occur on or off the project site. Perform off-site inspecting as required by the Architect/Engineer or the Owner.

D. Reports will be submitted by the independent firm to the Owner, Architect/Engineer, and Contractor, indicating inspection observations and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish safe access and assistance by incidental labor as requested.
   1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.

F. Inspecting does not relieve Contractor to perform Work to contract requirements.

G. Refer to Section 01 45 23, Inspection and Testing Laboratory Services, for additional information concerning inspections, and submittal procedures and requirements for Inspection Reports.

1.9 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as required, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect/Engineer within ten (10) days after receipt of Notice to Proceed, in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Refer to Section 01 33 00, Submittal Procedures, for additional information concerning submittal procedures and requirements for Manufacturers Field Reports.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION 01 45 00

SECTION 01 45 23 - TESTING AND INSPECTING SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements and qualifications including but not limited to:
   1. Professional testing and laboratory services.
   2. Accessories necessary for the completion of testing and laboratory services.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
   4. Specific test and inspection requirements are not specified in this Section.

C. A qualified independent testing laboratory and/or geotechnical engineering service selected and paid by Owner.
   1. The Owner will pay for the initial laboratory services of materials that comply with the requirements of the Contract Documents. The Contractor shall pay for testing and retesting of materials that do not comply with the requirements of the Contract Documents.

D. Inspecting agency shall perform inspections and tests in accordance with the rules and regulations of the building code, local authorities, Specifications of ASTM, and the Contract Documents.

E. Materials and workmanship found not in compliance with required standards or performance obligations shall be removed and replaced. Replacement and subsequent testing shall be at Contractor’s expense.

F. Where terms “Inspector” and “Laboratory” are used, it is meant and in reference to an officially designated and accredited inspector of the testing laboratory or geotechnical service engaged by Owner.

G. Laboratory inspections shall not relieve the Contractor or Fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.

H. Contractor or Fabricator shall cooperate with the testing laboratory in matters pertaining to the Work.

I. Contractor to address deficiency and failed reports.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E 329 and ASTM E534; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
   3. Testing agencies shall be insured against errors and omissions by a professional liability insurance policy having a minimum limit of liability of $500,000.00.

B. Inspection and testing services the of testing agency shall be under the direction of a Registered Engineer licensed in the State of Texas, charged with engineering managerial responsibility, and having a minimum of five (5) years engineering experience in inspection and testing of construction materials.

C. Concrete Inspectors: Inspecting personnel monitoring concrete Work shall be ACI certified inspectors.

D. Structural Steel: Primary inspectors performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, *Standard and Guide for Qualification and Certification of Welding Inspectors*.
   1. Inspector may be supported by assistant inspectors who perform specific inspection functions under the direct supervision of the Primary Inspector. Assistant inspectors shall be currently certified AWS Certified Associate Welding Inspectors (CAWI). Work of assistant inspectors shall be monitored daily by the inspector.

E. Testing Equipment: Equipment shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards.

F. Referenced Standards: Latest adopted edition of standards referenced apply to the Work. In the event of conflict between the Contract Documents and referenced standards, the Contract Documents shall govern. In case of conflict between Contract Documents and the Building Code, the more stringent shall govern.

1.4 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Refer to the individual specification sections for specific requirements.
   2. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
   3. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

4. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
5. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
6. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
7. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
8. Associated Responsibilities and Services: Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
    a. Provide access to the Work.
    b. Deliver of samples to testing laboratory, without cost to Owner, in adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
    c. Advise laboratory and Architect sufficiently in advance of construction operations to allow laboratory to complete required inspections or tests and to assign personnel for field inspection and testing as specified.
    d. Provide facilities for storage and curing of concrete test samples on site for the first 24 hours and for subsequent field curing required by ASTM C31.
    e. Incidental labor, facilities, and equipment necessary to assist laboratory personnel in obtaining and handling samples at the site.
    f. Preliminary design mix proposed for use for material mixes that require control by testing agency.
    g. Provide concrete mix designs in accordance with ACI 301 Section 3.9 made by an independent testing laboratory or qualified concrete supplier. Where mix designs by an independent testing laboratory are required, select and pay for laboratory.
    h. Obtain required inspections or approvals of the building official. Inspection requests and notifications required by building code are responsibility of the Contractor.
    i. Provide current welder certificates for each welder employed.
    j. Provide fabrication and erection inspection and testing of welds in accordance with AWS D1.1, Chapter 6.
        1) Use prequalification of welding procedures in executing the Work.

    k. Security and protection for samples and for testing and inspecting equipment at Project site.

9. Retesting/Reinspecting: Regardless of payment responsibility of the original tests or inspections, provide quality control services, including retesting and reinspecting, for construction that replaced Work failing to comply with the Contract Documents or Code requirements.

C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

D. Coordination: Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.5 AUTHORITY AND DUTIES OF LABORATORY PERSONNEL

A. A representative of the testing laboratory, who has reviewed and is familiar with the project and specifications, shall participate in preconstruction conferences. The representative shall coordinate material testing and inspection requirements with the Contractor and its subcontractors consistent with the planned construction schedule. The laboratory representative shall attend conferences required or requested to address quality control issues.

B. Laboratory personnel shall inspect and test materials, assemblies, specimens, and Work performed, including design mixes, methods and techniques and report the progress to the Architect.

C. If material or Work fails to meet requirements of Contract Documents, laboratory inspector shall notify the Construction Manager, Architect, Engineers, supplier or subcontractor providing or preparing the materials or Work being tested of such failure.

D. Laboratory personnel shall not perform the Work of the Contractor or act as foremen or superintendents. Work will be inspected as it progresses, but failure to detect defective Work or materials shall not prevent later rejection when a defect is discovered.

E. Laboratory personnel are not authorized to revoke, alter, relax, enlarge, or release the requirements of the Contract Documents or approve or accept portions of Work, except where approval is specifically specified in the Specifications.

F. Comply with building code requirements for Special Inspections.

1.6 SUBMITTALS

A. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality control service.

C. Test and Inspection Reports: Prepare and submit certified written reports specified. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Submit copies of reports of each inspection and test:
   1. Owner, Program or Project Manager, Architect, and each Engineer or outside consultants regarding their particular phase of the project: One copy each.
   2. Construction Manager and Contractor: Two copies each.

E. In addition to furnishing a written report, notify Construction Manager and Contractor verbally of uncorrected conditions or failures to comply with requirements of the Contract Documents, and immediately fax and email corresponding report to the Architect and Engineer.

F. At completion of each trade or branch of Work requiring inspecting and testing, submit a final certificate attesting to satisfactory completion of Work and full compliance with requirements of Contract Documents.

G. Submit copies of test results sealed by a Registered Engineer to municipal authorities having jurisdiction, as required.

1.7 TESTING LABORATORY GUIDELINES AND PROCEDURES

A. Technicians scheduled to perform specific testing services must be qualified to review and perform other services that overlap, i.e. earthwork, foundation inspections, rebar inspection, and concrete when scheduled concurrently at the site.

B. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for hours over eight hours spent at the site on a single day, field testing services performed on a Saturday or Sunday, and field services performed on a recognized holiday.

C. There shall be a three hour minimum for each scheduled testing service. Vehicle charges will be included on a $25.00 per trip basis.

D. Cylinder pick up will be controlled by the technician performing test on a scheduled pick up day. If there are no testing services scheduled, the cylinder pick up fee is $40.00 on week days and $50.00 on weekends and holidays with no technician or vehicle charge.

E. The Contractor shall bear the responsibility of scheduling the testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the testing services. Cancellations or failed test shall be reimbursable to the Owner by the responsible party for the cancellations or failure of a test or service.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.
   5. Deficiency log.

B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 TESTING AND INSPECTION SERVICES

A. Testing services shall include, but not be limited to those specified below or which are necessary or required during course of construction to ascertain specification compliance and which may be deemed necessary by Architect, Engineer, or Owner to ensure the quality of the Work.

B. The Owner reserves the right to add to or delete any or all inspection and testing specified, excluding testing required by the applicable building codes.

C. If conflicts arise between Drawings and Specifications, notify Architect immediately. The most stringent requirements shall dictate procedure.

3.3 TESTING OF EARTHWORK

A. Testing Services (As specified or required):
   1. References (As applicable for tests required):
      a. American Society for Testing and Materials (ASTM):
         1) D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3).
         2) D2922, Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth).
         3) D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

      b. American Association of State Highway and Transportation Officials (AASHTO)
         1) T89, Determining the Liquid Limit of Soils.
         2) T90, Determining the Plastic Limit and Plasticity Index of Soils.
         3) T99, Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305-mm (12-in) Drop.
         4) T238, Density of Soil and Soil Aggregates In Place By Nuclear Methods (Shallow Depth).

   2. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slab on grade, and backfills.
   3. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.
   4. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
   5. Determine Liquid Limit in accordance with ASTM D4318 or AASHTO T89, Plastic Limit in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material,

6. Perform one in place density test for each 4,000 square feet (445 square yards) of existing subgrade material.
7. Perform Moisture-Density curve in accordance with ASTM D698 or AASHTO T99 for one type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
8. Perform in place density tests of each lift of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. Conduct one test for each 4,000 square feet (445 square yards) of each lift of compacted fill.
9. Perform testing at a frequency of one in-place density and moisture test for each 75 lineal feet or less of utility trench, with a minimum of three tests per lift.

B. Reports: Submit reports with the following information:
1. Type and condition of soil at footing bottoms.
2. Level of water table in the excavated areas.
3. Grain size distribution of fill materials (average of three tests).
4. Moisture density test results.
5. In place density test results with moisture content and relative density of each layer of compacted fill. Include with in place density test results, a plan showing location of each test.
6. Notify Architect by telephone within one hour of the discovery of the following conditions and follow up telephone notification with written report.
   a. Materials used, or degree of soil compaction not meeting specified requirements.
   b. Frost and freeze protection requirements for excavation bottoms not being complied with.
   c. Water in excavations which is not being removed prior to Work being performed in excavation.

3.4 INSPECTION OF PIPED SITE UTILITIES

A. Laboratory representative shall observe and report on the following:
1. Proper alignment and grade of trenches.
2. Pipe bedding and supports.
3. Pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
4. Installation of pipe and joints.
5. Testing of piped utilities performed by Contractor.

3.5 PAVING

A. Testing Services: Perform field tests for moisture density properties:
1. Provide field testing of the subgrade as specified.
2. Paving Subbase: Provide one field test for every 7,500 square feet of area of crushed limestone or caliche subbase.
3. Lime Treated Subgrade: Provide one field test for every 7,500 square feet of area of lime treated subgrade for content of lime and subgrade compaction.
4. Cement Soil Stabilization: Provide one field test for every 7,500 square feet of area of cement stabilized subgrade for content of cement and subgrade compaction.

3.6 PIER DRILLING OPERATION

A. A representative of a qualified geotechnical laboratory shall provide services specified.

B. Laboratory representative shall make continuous inspections to determine that proper bearing stratum is obtained and utilized for bearing and that shafts are properly clean and dry before placing concrete.

C. Laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, casing required or not required, actual penetration into bearing stratum, elevation of top of bearing stratum, volume of concrete used, and deviations from specified tolerances.

D. Laboratory representative shall make continuous inspections of drilled pier construction to check the following:
1. Verify soundness of bearing stratum and desired penetration.
2. Verify pier dimensions and reinforcing used.
3. Monitor condition of hole and removal of water and loose material from bottom.
4. Monitor placement of concrete and use of tremie or pumps.
5. Monitor the extraction of casing, if used.

E. Request probe holes when deemed necessary to confirm safe bearing capacity.

3.7 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

A. Inspect concrete reinforcing steel prior to placing concrete for compliance with Contract Documents and approved shop drawings. Noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of the Contractor for correction and, if left uncorrected, reported to the Architect.

B. Laboratory representative shall observe and report on the following:
1. Number and size of bars.
2. Bending and lengths of bars.
3. Splicing.
4. Clearance to forms, including chair heights.
5. Clearance to sides and bottom of trench if soil formed.
6. Clearance between bars or spacing.
7. Rust, form oil, and other contamination.
8. Grade of steel.
9. Securing, tying, and chairing of bars.
10. Excessive congestion of reinforcing steel.
11. Installation of anchor bolts and placement of concrete around such bolts.
12. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
13. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.

C. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three years' experience inspecting reinforcing steel in projects of similar size.

3.8 CONCRETE INSPECTION AND TESTING

A. Receive and evaluate proposed concrete mix designs submitted by Contractor. If mix designs comply with Drawings and Specifications, the laboratory shall submit a letter to the Architect certifying compliance. Mix designs not complying with Drawings and Specifications shall be returned by the laboratory as being unacceptable. Check the proposed mixes for proportions, water cement ratio and slump in accordance with ACI 613 and 318.

B. Comply with ACI 311 *Guide For Concrete Inspection* and ACI *Manual of Concrete Inspection* (SP-2).

C. Sample and test concrete placed at the site in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis.

D. Test concrete:
   1. Mold and cure five specimens from each sample.
      a. For each 50 cubic yards or fraction thereof of structural building concrete; and
      b. For each 100 cubic yards or fraction thereof of nonstructural concrete and site Work paving and sidewalks.
      c. Laboratory cure two cylinders in accordance with ASTM C192.
      d. Field cure remaining cylinders in accordance with ASTM C31.

   2. Two specimens shall be tested at seven days for information, two shall be tested at 28 days for acceptance.

E. Deviations from the requirements of ASTM Specifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C39.

F. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.

G. Supervise curing and protection provided for test specimens in field, and transportation from the field to laboratory. Test cylinders shall be stored in the field 24 hours and then carefully transported to laboratory and cured in accordance with ASTM C31.

H. Make one strength test (four cylinders) of each mix design of concrete placed in any one day.

I. Make one slump test for each set of cylinders following procedural requirements of ASTM C143 and ASTM C172. Make additional slump tests whenever consistency of concrete appears to vary. Slump tests corresponding to samples from which strength tests are made shall be reported with strength test results. Other slump tests need not be reported.

J. Determine total air content of air entrained normal weight concrete sample for each strength test in accordance with ASTM C231.

K. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 and ASTM C567.

L. Determine temperature of concrete sample for each strength test.

M. Inspect each batch of concrete, monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing form mixers before mix begins to set and within time limits set forth in ASTM C94.
   1. Monitor addition of water and high range water reducer to concrete at job site and length of time concrete is allowed to remain in truck during placement.

N. Testing agency shall furnish and maintain a competent inspector at the mixing plant at the start of each day's mixing. Inspector shall examine concrete materials for compliance with Specifications and approved mix design, weighing and measuring devices, proportioning and mixing of materials, water and cement content of each batch, general operation of the plant, and transportation of concrete to jobsite. Inspector shall verify that amount of free surface moisture contained in fine and course aggregate has been properly accounted for in the concrete mixing to achieve required consistency and water cement ratio.

O. Testing laboratory shall monitor addition of water to concrete at the jobsite and the length of time concrete is allowed to remain in the truck before placement. Inspector shall compare mixture with criteria on the approved mix design and report any significant deviation to the Architect, Contractor and concrete supplier. Do not permit addition of water which will exceed maximum water/cement ratio for the mix as given on the approved mix design.

P. Observe placing of concrete, except nonstructural slabs on grade and site Work. Observe and report on placing method, consolidation, cold joints, length of drop, and displacement of reinforcement. Report deficiencies to Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.

Q. Test reports shall include but no be limited to the following information: date of concrete placement, concrete mix identification number or proportion of ingredients, truck ticket number, time test was made, time of batching, location of each placement, slump, unit weight, water content (microwave test) and air content of concrete sampled and date and results of strength test.

R. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.

S. Testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and time at which cement and aggregate were dispensed into the truck, and time at which concrete was discharged from the truck.

T. Evaluation and Acceptance:
   1. If measured slump, or air content of air entrained concrete, falls outside specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, concrete shall be considered to have failed to meet the requirements of the specifications, and shall not be used in the structure.
   2. Strength level of concrete will be considered satisfactory if the averages of sets of three consecutive strength tests results are equal to, or exceed, specified strength and no individual test result (average of two cylinders) is below specified strength by more than 500 psi.
   3. Completed concrete Work will be accepted when requirements of ACI 301 Chapter 18 *Specifications for Structural Concrete for Buildings* have been met.

U. Concrete Test Reports: Reports shall be made and distributed immediately after respective tests or inspections are made.
   1. Where reports indicate deviations from Contract Documents, they shall also include a determination of the probable cause of deviation and where applicable, a recommendation for corrective action.

V. Furnish a statistical analysis for each class of concrete placed on the project in accordance with ACI 214 and ACI 318. Information shall be updated and distributed once a month as directed by the Architect. Information shall include, but not be limited to, the following:
   1. Strength tests at 7 days of one cylinder.
   2. Strength tests at 28 days of two cylinder averages.
   3. 28 day moving average strength tests of last three test groups.
   4. Standard deviation and coefficient of variation based on 28 day strength tests.
   5. Average strength and number of 28 days tests for most recent month.

W. Test Footings (Shafts) (Piers) (Caissons): Same diameter and type specified for footings, placed in same manner. Accepted test footings may be used in the Work.

X. Noncompliant Test Reports: Fax test reports indicating noncompliance immediately to each party on the test report distribution list. Copies shall be on different colored paper.

Y. Inspect application of curing compound and monitor curing conditions to assure compliance with specification requirements. Report curing deficiencies to the Contractor immediately and submit a written report to the Architect.

3.9 TESTING OF NONSHRINK GROUT

A. Make one strength test for all plates grouted and for all grout used in joints between members.

B. Each test shall consist of four cubes, two tested at 7 days and two at 28 days, made and tested in accordance with ASTM C109, with the exception that grout shall be restrained from expansion by a top plate.

3.10 STRUCTURAL STEEL

A. Inspect structural steel during and after erection for compliance with Contract Documents and shop drawings. Review and report on fabricator's quality control procedures and capabilities.

B. Field Inspection:
1. Proper erection of pieces.
2. Proper touch up painting of shop primed structural steel exposed to view or in crawl space.
3. Proper installation of bolts.
4. Plumbness of structure and proper bracing.
5. Proper field painting.
6. Initial inspection of welding process and periodically thereafter as necessary.
7. Visual examination of completed welds.
8. Ultrasonic testing of penetration field welds.
9. Installation of field welded shear studs.
10. Inspect shop fabricated members, upon arrival at the site, for defects incurred during transit and handling.
11. Measure and record camber of beams upon arrival and before erection for compliance with specified camber. Measure lying flat with web horizontal. Return members outside specified camber tolerance to shop for correction.

C. Qualifications of Welders: Fabricator and erector shall provide the testing laboratory with names of welders employed on Work, along with certification that each welder has passed qualification tests within the past 12 months, using procedures covered in AWS D1.1 *Structural Welding Code - Steel*. Verify welder qualifications.

D. Inspection of field welding shall include:
1. Visually inspect fillet welds for size, soundness, and proper return around ends. Inspect seams, folds, and delaminations.
2. Visually inspect welds for proper repair of painting.
3. Ultrasonically test penetration welds in accordance with ASTM E164.
4. Inspect surfaces to be welded. Note surface preparations, fit up, and cleanliness of surface. Verify electrodes for size, type, and condition.
5. Welding inspector shall be present during alignment and fit up of members being welded, and shall verify for correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, inspector shall order the joint to be chipped down to sound metal, or gouged out, and rewelded. Thoroughly inspect root passes for cracks. Gouge out cracks and rewelded to 2 inches beyond each end of crack.
6. Inspector shall verify that welds have been marked with welder's symbol and shall mark welds requiring repairs and reinspection. Inspector shall maintain a written record of welds. Work completed and inspected shall receive an identification mark by the inspector. Identify unacceptable material and Work identified by word *reject* or *repair* marked directly on the material.
7. Testing agency shall advise the Owner and Architect of any shop and/or field conditions which may require further tests and examination by means other than those specified. Additional tests and examinations shall be performed as authorized by the Owner and Architect.

8. Owner reserves the right to use ultrasonic or radiographic inspection to verify adequacy of welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.
9. Weld quality to comply with the American Institute of Steel Construction (AISC) Manual of Steel Construction.
10. Determine percentage of weld tested by the number of welds that fail the initial testing.
11. Reweld and retest welds that fail until the welds pass. Test two additional welds for every weld failure.

E. Inspect bolted construction in accordance with AISC *Specification for Structural Steel Buildings*:
1. Visually inspect bolts ensuring that plies have been brought into snug contact.
2. Inspect high strength bolt in accordance with Section 9 of the *Specifications for Structural Joints Using ASTM A325 or A490 Bolts*.

F. Inspect stud welding in accordance with Section 7.8, of AWS D1.1 *Structural Welding Code*:
1. Weld at least two shear studs at the start of each production period to determine correct generator, control unit, and stud welder setting. The studs shall be capable of being bent 45 degrees from vertical without weld failure.
2. When the temperature is below 32 degrees F (0 degrees C), test one stud in each 100 after cooling. Do not weld studs at temperatures below 0 degrees F or when surface is wet with rain or snow. If stud fails in the weld, two new studs shall pass the test before resumption of welding.
3. Visually inspect studs for compliance with the requirements of the Contract Documents. Verify number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, that stud shall be struck with a hammer and bent 15 degrees off perpendicular in the direction away from the missing weld. Studs failing test shall be replaced.

3.11 REINFORCING STEEL MECHANICAL SPLICES

A. Inspection and Observation Services:
1. Visually inspect and report on completed condition of each mechanical splice of reinforcing steel.
2. Visually inspect each mechanical splice to ensure compliance with the ICC-ES Reports and the manufacturer's published criteria for acceptable completed splices.
3. Place special emphasis on the inspection of the end preparation of each bar to be spliced required by the ICC-ES Report.

B. Reports: Submit reports to Architect:
1. Submit copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
2. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Indicate reasons for rejection on each report.

3.12 OPEN WEB JOISTS AND JOIST GIRDERS

A. Inspect joists at jobsite for compliance with specified fabrication requirements. Verify welded connections between web and chord, splices, and straightness of members.

B. Inspect installation of joists at jobsite. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for compliance with Contract Documents and referenced standards.

C. Verify welder qualification certificates for both shop and field welding operators.

3.13 METAL FLOOR DECK

A. Field inspection shall consist of:
   1. Verifying types, gauges and finishes for compliance with Contract Documents and shop drawings.
   2. Examine composite floor deck exposed to crawl space for damage to galvanizing due to welding or construction activities. Repair galvanized composite floor deck in accordance with the specifications.
   3. Examine the erection of metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting or other coating.
   4. Certification of welders.
   5. Inspect and test field welded shear studs used to fasten metal floor decking to supporting steel as specified for structural steel.

3.14 METAL ROOF DECK

A. Field inspection shall consist of:
   1. Verify types, gauges and finishes for compliance with Contract Documents and shop drawings.
   2. Examine the erection of the metal deck, including fastenings at supports and side laps, reinforcing of holes, and miscellaneous deck supports.
   3. Certification of welders.
   4. Visual inspection of at least 25 percent of welds.

3.15 SPRAYED FIREPROOFING

A. Verify applied thickness, density, and bond strength of sprayed fireproofing meets fire rating requirements of approved design.

B. Verify installation complies with fire rating requirements of approved design.

C. Inspect and test for thickness:
   1. Test 25 percent of structural frame columns and beams in each building level.
   2. Test 10 percent of beams other than structural frame in each building level.
   3. Test one slab per 5,000 square feet of building area.

D. Inspect and test in accordance procedures of ASTM E605 and ASTM E736.

3.16 EXPANSION BOLT INSTALLATION

A. Inspect drilling of each hole and installation of each expansion bolt for compliance with Contract Documents and shop drawings.

B. Verify installation torque for each expansion bolt for compliance with manufacturer’s installation instructions.

3.17 LIGHTWEIGHT INSULATING CONCRETE FILL

A. Inspection and Observation Services (As required):
   1. Inspection of roof deck prior to start of Work.
   2. Inspection during installation of insulation and lightweight insulating concrete fill Work to ascertain compliance with Contract Documents.
   3. Observation of base ply fastener pull tests performed by Contractor to ascertain minimum withdrawal resistance of 40 pounds per fastener.

B. Testing Services (As required):

1. References (As applicable for tests required):
    a. American Society for Testing and Materials (ASTM)
        1) C177 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties By Means of the Guarded Hot Plate Apparatus.
        2) C495 - Test Method for Compressive Strength of Lightweight Insulating Concrete.
        3) C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

2. Test EPS insulation board for thermal insulation value in accordance with ASTM C177.
3. Test lightweight insulating concrete fill in accordance with ASTM C495 for:
    a. Mix design compressive strength.
    b. Mix design wet and dry density range.
    c. Number of Tests:
        1) One per 5,000 square feet.
        2) Not less than one for each day's Work.

4. Test EPS insulation board for density in accordance with ASTM C578.

3.18 TESTING OF ROOFING

A. Inspection and Observation Services (As required):
1. Inspection of roof deck prior to start of Work.
2. Inspect on site condition of stored roofing materials.
3. Inspection during roofing, roof insulation, and sheet metal Work to ascertain compliance with Contract Documents.
4. Observation of roof test cuts performed by Contractor to ascertain that they are properly made.
5. Observation of patching of roof test cuts to ascertain that they are properly made.

B. Testing Services (As required):
1. Perform dissection and analysis on cuts provided by Contractor to confirm number of plies, bonding of plies, weight of bitumen and softening temperature to ascertain compliance with specifications.

3.19 MASONRY

A. Inspection and Observation Services:
1. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
2. Review mortar design mixes.
3. Inspection of laying, mortaring, and grouting of concrete masonry units and elements.

B. Testing Services:

1. References (As applicable for tests required):
    a. ASTM International (ASTM)
        1) C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.
        2) C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
        3) C1019 - Standard Test Method for Sampling and Testing Grout.

2. Testing of Concrete Masonry Units (CMU):
    a. Preconstruction: Perform the following tests in accordance with ASTM C140.
        1) Compressive Strength

2) Absorption
3) Weight
4) Moisture Content
5) Dimensions.

3. Mortar Tests:
   a. Preconstruction: Perform the following tests in accordance with ASTM C780 on each type of mortar mix used on the Project.
   b. 28 Day Compressive Strength
   c. Water Retention
   d. Construction: Perform 28 day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one test per 2,000 square feet of masonry.

4. Refer to and include Work for reinforcing steel specified.
5. Grout Tests:
   a. Preconstruction: Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project.
      1) 28 Day Compressive Strength
      2) Construction: Perform 28 day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
      3) Prism Test: Perform preconstruction 28 day compressive strength test on concrete masonry walls in accordance with ASTM E447-97, Method B.

3.20 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 29.

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 45 23

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 SUMMARY

A. Section Includes: Requirements for temporary utilities, support facilities, and security and protection facilities, including but not limited to:
1. Water service and distribution.
2. Sanitary facilities, including toilets, wash facilities, and drinking water facilities.
3. Heating and cooling facilities.
4. Ventilation.
5. Electric power service.
6. Lighting.
7. Telephone service.
8. Waste disposal facilities.
9. Field office.
10. Storage and fabrication sheds.
11. Lifts and hoists.
12. Construction aids and miscellaneous services and facilities.
13. Environmental protection.
14. Pest control.
15. Enclosure fence.
16. Security enclosure and lockup.
17. Barricades, warning signs, and lights.
18. Temporary partitions.
19. Fire protection.
20. Accessories necessary for a complete installation.

1.3 USE CHARGES

A. Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service: Pay sewer service use charges for water used and sewer usage by all entities for construction operations.

C. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.4 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Moisture Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged work.
3. Indicate sequencing of Work that requires water, such as sprayed fire resistive materials, plastering, and tile grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. Dust and HVAC Control Plan: Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
1. HVAC system isolation schematic drawing.
2. Location of proposed air-filtration system discharge.
3. Waste handling procedures.
4. Other dust control measures.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines (ADAAG), ICC/ANSI A117.1, and Texas Accessibility Standards (TAS) 2012.

B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized steel, chain link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils (0.25 mm) minimum thickness, with flame spread rating of 15 or less per ASTM E 84.

D. Dust Control Adhesive Surface Walk off Mats: Provide mats minimum 36 inches by 60 inches (914 mm by 1624 mm).

E. Insulation: Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame spread and smoke developed indexes of 25 and 50, respectively.

F. Lumber and Plywood: Comply with requirements in Section 06 10 53.

G. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; Type X or Type C panels with tapered edges. Comply with Section 09 29 00.

H. Paint: Comply with requirements in Section 09 90 00.

I. Tarpaulins: Fire resistive labeled with flame-spread rating of 15 or less.

J. Water: Potable.

2.2 TEMPORARY FACILITIES

A. Contractor's Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Provide elevated, stabilized concrete walkway from parking area to field offices.

B. Architect's Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Provide elevated, stabilized concrete walkway from parking area to field offices.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Air Filtration Units: HEPA primary and secondary filter equipped portable units with four stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

C. Drinking Water: Containerized, tap dispenser, bottled water drinking water units, including paper cup supply. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 degrees F to 55 degrees F (7.2 degrees C to 12.7 degrees C).

D. Electrical Outlets: Properly configured, NEMA polarized outlets to prevent insertion of 110V to 120V plugs into higher voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

F. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control.
   1. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   2. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of **8** at each return air grille in system and remove at end of construction. Clean HVAC system as required in Section 01 77 00 and install new filter with MERV 11 or greater.

G. Air Filtration Units: Primary and secondary HEPA filter equipped portable units with four stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate facilities where they will serve project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
   1. Locate facilities to limit site disturbance as specified in Section 01 10 00.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. Install temporary service. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
   2. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing Work, isolate the HVAC system in area where Work is to be performed according to coordination drawings.
      a. Disconnect supply and return ductwork in Work area from HVAC systems servicing occupied areas.
      b. Maintain negative air pressure within Work area using HEPA equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust producing equipment. Isolate limited Work within occupied areas using portable dust containment devices.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA filter equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Install electric power service underground unless otherwise indicated.
   1. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
      a. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length voltage ratio.
      b. Provide warning signs at power outlets other than 110 to 120 V.
      c. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or traffic areas.
      d. Provide metal conduit enclosures or boxes for wiring devices.
      e. Provide 4 gang outlets, spaced so 100 foot (30 m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Install lighting for Project identification sign.

J. Telephone Service: Provide temporary telephone service in common use facilities for use by construction personnel. Install one telephone line(s) for each field office.

   1. Provide dedicated telephone line for each facsimile machine in each field office.
   2. At each telephone, post a list of important telephone numbers.
      a. Police and fire departments.
      b. Ambulance service.
      c. Contractor's home office.
      d. Contractor's emergency after-hours telephone number.
      e. Architect's office.
      f. Engineers' offices.
      g. Owner's office.
      h. Principal subcontractors' field and home offices.

   3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

K. Electronic Communication Service: Provide a desktop computer and printer/scanner in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.
   1. Provide high speed wireless internet access (provide access to the Owner and Architect); DSL or broadband. Dial-up connection is not acceptable.
   2. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall.
   3. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
   4. Backup: External hard drive, minimum 1 terabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.

1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 20 00.
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent pavement until immediately before Substantial Completion.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300.

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: Use of elevators is not permitted.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities to the satisfaction of Owner and Architect.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree or plant protection zones.
   2. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin. Provide site enclosure fence to prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each Work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor to ceiling dustproof partitions to limit dust and dirt migration and to separate occupied areas occupied from fumes and noise.
   1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire retardant treated plywood on construction operations side.
   2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire retardant treated plywood. Do not apply tape to finish floor surfaces.
      a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water dampened foot mats in vestibule.
   3. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
   4. Insulate partitions to control noise transmission to occupied areas.
   5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
   6. Protect air handling equipment.
   7. Provide walk off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Avoid trapping water in finished Work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard, replace, or clean stored or installed material that begins to grow mold.

7. Perform Work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Condition Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use permanent HVAC system to control humidity.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits and moisture control.
      a. Hygroscopic materials that may support mold growth, including wood and gypsum based products, which become wet during the course of construction and remain wet for 48 hours are considered defective and are to be removed and replaced.
      b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24 hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion unless otherwise required and approved by Owner and Architect.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00"

END OF SECTION 01 50 00

SECTION 01 57 13 - GENERAL SOURCE CONTROLS

PART 1 - GENERAL

1.1 SCOPE

A. This Section describes erosion and sedimentation control and other control related practices, which shall be utilized during construction activities.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Special Conditions, and Division 1 Specification Sections, apply to this Section.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 GENERAL

A. No clearing and grubbing or rough cutting shall be permitted until erosion and sedimentation control systems are in place.

B. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated construction area. Damages caused by construction traffic or others to erosion and sedimentation control systems shall be repaired immediately by the Contractor.

C. The Contractor shall be responsible for collecting, storing, hauling, and disposing of spoils, silt, and waste materials as specified on the Drawings and in this or other Technical Specifications and in compliance with applicable federal, state, and local rules and regulations.

D. Contractor shall conduct all construction operation under this Contract in conformance with the erosion control practices described on the Drawings, the Storm Water Pollution Prevention Plan and this Section.

E. The Contractor shall install, maintain, and inspect erosion and sediment control measures and practices as specified on the Drawings and in this and other Technical Specifications.

F. Contractor shall employ protective measures to avoid damage to existing trees to be retained on the project site.

3.2 TOPSOIL PLACEMENT FOR EROSION AND SEDIMENTATION CONTROL SYSTEMS

A. When topsoil is called for as a component of another Section, the Contractor shall conduct erosion control practices described in this Section during topsoil placement operation.

B. When placing topsoil, maintain erosion and sedimentation control systems.

C. Maintain grades, which have been previously established on areas to receive topsoil.

D. After the areas to receive topsoil have been brought to grade, and immediately prior to dumping and spreading the topsoil, the subgrade shall be loosened by discing or by scarifying to a depth of at least two (2) inches to permit bonding of the topsoil to the subsoil.

E. No sod or seed shall be placed on soil, which has been treated with soil sterilants until sufficient time has elapsed to permit dissipation of toxic materials.

3.3 DUST CONTROL

A. Dust control methods shall be implemented to control dust creation and movement on construction sites and roads and to prevent airborne sediment from reaching receiving stream or storm water conveyance system, to reduce on and offsite damage, to prevent health hazards, and to improve traffic safety.

B. Contractor shall control dust blowing by utilizing one or more of the following methods:
1. Mulches bound with chemical binders.
2. Temporary vegetative cover.
3. Spray-on adhesives on mineral soils when not used by traffic.
4. Tillage to roughen surface and bring clods to the surface.
5. Irrigation by water sprinkling.
6. Barriers using solid board fences, snow fences, burlap fences, crate walls, bales of hay, or similar materials.

C. Dust control methods shall be implemented immediately whenever dust can be observed blowing on the project site.

3.4 KEEPING STREETS CLEAN

A. Contractor shall keep the streets clean of construction debris, dirt, and mud generated by construction vehicles and equipment. If necessary to keep the streets clean, Contractor shall provide stabilized construction exits at construction, staging, storage, and disposal areas. A vehicle/equipment wash area (stabilized with coarse aggregate) may be installed adjacent to the location of stabilized construction exit, as needed. Wash water shall be released into a drainage swale or inlet protected by erosion and sediment control measures.

B. In lieu of or in addition to stabilized construction exits, Contractor shall shovel and/or sweep the pavement to the extent necessary to keep the street clean. Water hosing or sweeping of debris and mud off of the street into adjacent areas is not allowed.

3.5 EQUIPMENT MAINTENANCE AND REPAIR

A. Maintenance and repair of construction machinery and equipment shall be confined to areas specifically designated for that purpose. Such designated areas shall be located and designed so that oils, gasoline, grease, solvents, and other potential pollutants cannot be washed into receiving streams or storm water conveyance systems. These areas shall be provided with adequate waste disposal receptacles for liquid as well as solid waste. Maintenance areas shall be inspected and cleaned daily.

B. On the construction site where designated equipment maintenance areas are not feasible, care shall be taken during each individual repair or maintenance operation to prevent potential pollutants from becoming available to be washed into streams or conveyance systems. Temporary waste disposal receptacles shall be provided.

3.6 WASTE COLLECTION AND DISPOSAL

A. Contractor shall formulate and implement a plan for the collection and disposal of waste materials on the construction site. The plan must designate locations for trash and waste receptacles and establish a collection schedule. Methods for ultimate disposal of waste shall be specified and carried out in accordance with applicable local, state and federal health and safety regulations. Special provisions shall be made for the collection and disposal of liquid wastes and toxic or hazardous materials.

B. Receptacles and other waste collection areas shall be kept neat and orderly to the extent possible. Waste shall not be allowed to overflow its container or accumulate for excessively long periods of time. Trash collection points shall be located where they will least likely be affected by concentrated storm water runoff.

3.7 WASHING AREAS

A. Vehicles such as concrete or dump trucks and other construction equipment shall not be washed at locations where the runoff will flow into a watercourse or storm water conveyance system. Special areas shall be designated for washing vehicles. These areas should be located where the wash water will spread out and evaporate or infiltrate directly into the ground, or where the runoff can be collected in a temporary holding or seepage basin. Wash areas shall have gravel or rock bases to minimize mud generation. These areas shall be completely cleaned up, have waste remains hauled off, and be stabilized and seeded after the area is no longer required.

3.8 STORAGE OF CONSTRUCTION MATERIALS, CHEMICALS, ETC.

A. Sites where chemicals, cements, solvents, paints, or other potential water pollutants are to be stored, shall be isolated in areas where they will not cause runoff pollution.

B. Toxic chemicals and materials, such as pesticides, paints, and acids shall be stored in accordance with manufacturers' guidelines. Groundwater resources shall be protected from leaching by placing a plastic mat, packed clay or other impervious materials on any areas where toxic liquids are to be opened and stored.

3.9 DEMOLITION AREAS

A. Demolition work, which generates large amounts of dust, shall be provided with dust control techniques to limit the transport of the airborne pollutants. However, water or slurry used to control dust shall not be allowed to run directly into watercourses or storm water conveyance systems. Methods of ultimate disposal of these materials shall be carried out in accordance with applicable local, state and federal health and safety regulations.

3.10 SANITARY FACILITIES

A. The construction site must be provided with adequate sanitary facilities for workers in accordance with Division 1 and applicable health regulations.

3.11 PESTICIDES

A. The use of pesticides shall be approved by the Owner prior to application. A one-week notice will be required of the Contractor.

B. Pesticides used during construction shall be stored and used in accordance with manufacturers' guidelines and with local, state and federal regulations. Overuse of pesticides, which could generate contaminated runoff, shall be avoided and great care shall be taken to prevent accidental spillage. Pesticide containers shall never be washed in or near flowing streams or storm water conveyance systems.

3.12 PROTECTION OF TREES IN CONSTRUCTION AREAS

A. Heavy equipment, vehicular traffic, and stockpiles of construction materials, including topsoil, are not permitted within the dripline of any tree to be retained. Contractor shall avoid all contact with trees to be retained unless otherwise directed by the Owner or required by the work under this Contract.

B. Specimen trees shown on the Drawings shall be boxed or fenced. When called for in the Drawings, tunnel under the root system for the installation of utility lines.

C. Tree trunks, exposed roots, and limbs of the trees designated to be retained, which are damaged during construction operations, will be cared for as prescribed by a forester or licensed tree expert at the expense of the Contractor.

3.13 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

END OF SECTION 01 57 13

SECTION 01 57 13.13 - FILTER FABRIC FENCE

PART 1 - GENERAL

1.1 SCOPE

A. This Section describes the installation of erosion and sedimentation control filter fabric fences (FFF) utilized during construction. The filter fabric fences are to be used to contain pollutants from overland flow. This practice shall not be used in channelized flow areas.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Special Conditions, and Division 1 Specification Sections, apply to this Section.

1.3 REFERENCE STANDARDS

A. The publications listed below forms a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. American Society for Testing and Materials (ASTM).

C. ASTM D-3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.

D. ASTM D-4632 - Standard Test Method for Breaking Load and Elongation of Geotextile (Grab Method).

1.4 SUBMITTALS

A. Manufacturer's catalogue sheets and other pertinent information on geotextile fabric.

PART 2 - PRODUCTS

2.1 FILTER FABRIC

A. Provide woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material. Geotextile fabric shall have a grab strength of 100 psi in any principal direction (ASTM D-4632), Mullen burst strength exceeding 200 psi (ASTM D-3786), and the equivalent opening size between 50 and 140, with the appropriate opening size to be selected based on the grain size characteristics of the disturbed soil. Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature range of 0 degrees F to 120 degrees F. Representative Manufacturers: Mirafi Inc. or preapproved equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide erosion and sedimentation control systems at the locations shown on the Drawings. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements shown on the Drawings and set out in this Section.

B. No clearing and grubbing or rough cutting shall be permitted until erosion and sedimentation control systems are in place.

C. Regularly inspect and repair or replace components of all erosion and sedimentation control systems as specified for each type of system. Unless otherwise directed, maintain the erosion and sedimentation control systems until the project area stabilization is accepted by the Owner. Remove erosion and sedimentation control systems promptly when directed by the Owner. Discard removed materials as required by these Specifications.

D. Remove and dispose sediment deposits at the project designated spoil site. Sediment shall not be allowed to flush into stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state and local regulations.

E. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of construction limits. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.

F. Contractor shall employ protective measures described in Section 01 57 19 - General Source Controls to avoid damage to existing trees to be retained on the project site. Conduct all construction operations under this Contract in conformance with the erosion control practices described in that Section.

3.2 CONSTRUCTION METHODS

A. Provide filter fabric fence systems at locations shown on the Drawings in accordance with the Detail at the end of this Section or on the Drawings, entitled "Filter Fabric Fence". Filter fabric fence systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the filter fabric to 1 inch by 2 inch wooden stakes spaced a maximum of 3 feet apart and embedded in the ground a minimum of 1 foot. If factory preassembled fence with support netting is used, spacing of the post may be increased to 8 feet maximum. The wooden stakes shall be installed at a slight angle toward the source of anticipated runoff.

C. Trench in the toe of the filter fabric fence with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow or for V-trench configuration as shown on the Detail. Lay filter fabric along the edges of the trench. Backfill and compact trench.

D. Filter fabric shall have a minimum height of 18 inches and a maximum height of 36 inches above the natural ground.

E. The filter fabric should be provided in continuous rolls and cut to the length of the Silt Fence to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6 inch overlap, and sealed securely.

F. Inspect sediment filter fabric fence systems after each rainfall, daily during periods of prolonged rainfall, and at a minimum once a week. Repair or replace damaged section immediately to restore the requirements of this Section. Remove sediment deposits when silt reaches one-third of the height of the fence in depth or 6 inches, whichever is less.

3.3 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

END SECTION 01 57 13.13

SECTION 01 57 13.14 - REINFORCED FILTER FABRIC BARRIER

PART 1 - GENERAL

1.1 SCOPE

A. This Section describes the installation of erosion and sedimentation control of reinforced filter fabric barriers (RFB) which must be utilized during construction. Reinforced filter fabric barrier is to be utilized to retain pollutants from passing downstream in channelized flow areas.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Special Conditions, and Division 1 Specification Sections, apply to this Section.

1.3 REFERENCE STANDARDS

A. The publications listed below forms a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM).

C. ASTM D-3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.

D. ASTM D-4632 - Standard Test Method for Breaking Load and Elongation of Geotextile (Grab Method).

1.4 SUBMITTALS

A. Manufacturer's catalogue sheets and other pertinent information on geotextile fabrics.

PART 2 - PRODUCTS

2.1 FILTER FABRIC

A. Provide woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material. Geotextile fabric shall have a minimum grab strength of 100 psi in any principal direction (ASTM D-4632), Mullen burst strength exceeding 200 psi (ASTM D-3786), and the equivalent opening size between 50 and 140, with the appropriate opening size to be selected based on the grain size characteristics of upstream disturbed soils. Filter fabric material shall contain ultraviolet inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature range of 0 degrees F to 120 degrees F. Representative Manufacturers: Mirafi, Inc. or preapproved equivalent.

B. Provide woven galvanized steel wire fence with minimum thickness of 14 gauge and a maximum mesh spacing of 6 inches.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide erosion and sedimentation control systems at the locations shown on the Drawings. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements shown on the Drawings and specified in this Section. No clearing and grubbing or rough cutting shall be permitted until erosion and sedimentation control systems are in place.

B. Regularly inspect and repair or replace components of all erosion and sedimentation control systems as specified for each type of system. Unless otherwise directed, maintain the erosion and sedimentation control systems until the project area stabilization is accepted by the Owner. Remove erosion and sedimentation control systems promptly when directed by the Owner. Discard removed materials as required by these Specifications.

C. Remove and dispose sediment deposits at the project designated spoil site. Sediment shall not be allowed to flush into stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state and local regulations.

D. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of construction limits. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately. Contractor shall employ protective measures described in Section 01560 - General Source Controls to avoid damage to existing trees to be retained on the project site. Conduct all construction operations under this Contract in conformance with the erosion control practices described in that Section.

3.2 CONSTRUCTION METHODS

A. Provide reinforced filter fabric barrier systems at locations specified on the Drawings in accordance with the Detail, found at the end of this Section or on the Drawings, entitled "Reinforced Filter Fabric Barrier". Filter fabric barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the woven wire support to steel fence posts (min. of 1.25 lbs. per linear foot & Brinell Hardness greater the 140) or 1-inch by 2-inch wooden stakes spaced a maximum of 6 feet apart and embedded a minimum of 8 inches. Steel post shall be made of hot rolled steel, at least 4 feet long with Tee or Y-bar sections with the surface painted or galvanized. Provide safety caps on top of metal posts. The posts shall be installed at a slight angle toward the source of the anticipated runoff.

C. Trench in the toe of the reinforced filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow as shown on the Detai. Lay filter fabric along the edges of the trench. Backfill and compact trench.

D. Reinforced filter fabric shall have a minimum height of 18 inches and a maximum height of 36 inches above the natural ground.

E. The filter fabric should be provided in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6 inch overlap, and sealed securely.

F. Inspect sediment filter barrier systems after each rainfall, daily during periods of prolonged rainfall, and at a minimum once a week. Repair or replace damaged section immediately to restore the requirements of this Section. Remove sediment deposits when silt reaches one-third of the height of the barrier in depth or 6 inches, whichever is less.

3.3 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

END OF SECTION 01 57 13.14

SECTION 01 57 13.15 - STABILIZED CONSTRUCTION EXIT

PART 1 - GENERAL

1.1 SCOPE

A. This Section describes the installation of erosion and sedimentation control for stabilized construction exits utilized during construction and prior to the final development of the site.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Special Conditions, and Division 1 Specification Sections, apply to this Section.

1.3 REFERENCE STANDARDS

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

B. American Society for Testing and Materials (ASTM).

C. ASTM D 4632 - Standard Test Method for Breaking Load and Elongation of Geotextile (Grab Method).

1.4 SUBMITTALS

A. Manufacturer's catalog sheets and other pertinent information on geotextile fabric.

B. Sieve analysis of aggregates conforming to requirements of this Section.

PART 2 - PRODUCTS

2.1 SEPARATION GEOTEXTILE

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material. Geotextile fabric shall have a minimum grab strength of 270 psi in any principal direction (ASTM D-4632) and the equivalent opening size between 50 and 140, with the appropriate opening size to be approved in the review process based on the characteristics of the disturbed material. Both the geotextile and threads shall be resistant to chemical attack, mildew and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 degrees F to 120 degrees F. Representative Manufacturers: Mirafi Inc. or preapproved equivalent.

2.2 COARSE AGGREGATES

A. Coarse aggregates shall consist of crushed stone, gravel, crushed blast furnace slag, or combinations thereof. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall conform to the following gradation requirements.

Sieve Size (Square Mesh)	Percent Retained (By Weight)
2-1/2"	0
2"	0 - 20
1-1/2"	15 - 50
3/4"	60 - 80
No. 4	95 - 100

PART 3 - EXECUTION

3.1 GENERAL

A. To keep the street clean of mud generated by construction vehicles and equipment, Contractor shall provide stabilized construction exits at the construction site, staging, parking, storage, and/or disposal areas. Such erosion and sediment control system shall be constructed in accordance with the Detail - Stabilized Construction Exit attached hereto or shown on the Drawings, and any additional requirements shown on the Drawings and set out in this Section.

B. No clearing and grubbing or rough cutting, other than as specifically directed by the Owner to allow soil testing and surveying, shall be permitted until erosion and sedimentation control systems are in place.

C. Maintain existing erosion and sedimentation control systems located within the project site until acceptance of the project or until directed by the Owner to remove and discard the existing system.

D. Regularly inspect and repair or replace components of stabilized construction exists. Unless otherwise directed, maintain the erosion and sedimentation control systems until the project is accepted by the Owner. Remove erosion and sedimentation control systems promptly when directed by the Owner. Discard removed materials offsite.

E. Remove and dispose sediment deposits at the project designated spoil site. If a project spoil site is not designated on the Drawings, dispose of sediment offsite at location not in or adjacent to stream or floodplain. Off-site disposal will be the responsibility of the Contractor. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state and local rules and regulations.

F. Equipment and vehicles of the Contractor, or on-site for his use, shall be prohibited from maneuvering on areas outside of the construction limits. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.

G. Conduct all construction operations under this Contract in conformance with the erosion control practices described in the Section 01 57 13 - General Source Controls.

3.2 CONSTRUCTION METHODS

A. Provide stabilized exits, entrances, access roads, parking areas, and other on-site vehicle transportation routes where shown on the Drawings.

B. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto area roadways. When washing is needed to remove sediment, Contractor shall construct a truck washing area. Truck washing shall be done on stabilized areas, which drain into a drainage system protected by erosion and sediment control measures.

C. Details for stabilized construction exit are shown on the Detail herein or as shown on the Drawings. Construction of other stabilized areas shall be to the same requirements. Roadway width shall be at least 30 feet and shall be sufficient for all ingress and egress to the site. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlaying soil. Exposure of geotextile fabric to the elements between laydown and cover shall be a maximum of fourteen days to minimize damage potential.

D. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sand bags, gravel, boards, or similar methods to prevent sediment from entering area roadways, receiving stream or storm water conveyance system.

E. The stabilized areas shall be inspected and maintained daily. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out damaged measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto area roadways shall be remove immediately.

F. The length of the stabilized area shall be as shown on the Detail or as shown on the Drawings, but not less than 50 feet in length. The thickness shall not be less than 8 inches. The width shall not be less than full width of all points of ingress or egress.

G. Stabilization for other areas shall have the same thickness, and width requirements as the stabilized construction exit, except where specified otherwise on the Drawings. The aggregate shall be a compacted limestone base material, 8 inches in thickness, with an application of emulsified asphalt. The emulsified asphalt material shall be reapplied periodically following any regrading of the limestone surface.

H. Stabilized area may be widened or lengthened to accommodate truck-washing area as required by the Contractor and approved by the Owner.

I. Alternative methods of construction, when preapproved by the Owner, may include the following.
   1. Cement Stabilized Soil - Compacted cement stabilized soil or other fill material in an application thickness of at least 8 inches.
   2. Wood Mats/Mud Mats - Oak or other hardwood timbers placed edge to edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches.
   3. Steel Mats - Perforated mats placed across perpendicular support members.

3.3 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this Section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

END OF SECTION 01 57 13.15

SECTION 01 57 26 - TEXAS POLLUTION DISCHARGE ELIMINATION SYSTEM (TPDES)

PART 1 - GENERAL

1.1 SCOPE

A. This project is subject to the Texas Commission on Environmental Quality (TCEQ) Texas Pollution Discharge Elimination System (TPDES) Construction Storm Water Discharge Regulations and Requirements. The Contractor will be required to execute a Notice of Intent and implement the Pollution Prevention Plan included in the Contract Documents and comply with all reporting and inspection requirements set forth in the TPDES regulations.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions, and relevant Division 2 Specification Sections, apply to this Section.

1.3 SUMMARY

A. The Contractor shall be responsible for the preparation, implementation, maintenance, and inspection of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking and other practices described in the Storm Water Pollution Prevention Plan (SWPPP) Drawing, and as specified elsewhere in this or other Technical Specifications.

B. Contractor shall present his plan for implementation of the SWPPP in a meeting with the Owner/Architect/Engineer prior to start of construction.

1.4 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. The components shall consist of the control measures necessary to comply with the NPDES and Cleanwater Act. Example erosion and sediment control measure components are found on the Storm Water Pollution Prevention Plan Drawing, and this or other Technical Specifications.

PART 3 - EXECUTION

3.1 NOTICE OF INTENT / CERTIFICATION REQUIREMENTS

A. The Contractor shall execute, along with the Contract Documents, a Contractor/Subcontractor Certification, which shall identify the responsibilities for construction activity during the contract. Each Subcontractor’s responsibility with regard to the SWPPP shall be identified.

B. The Contractor shall be responsible for signing the certification statement of the NOI. A copy of the NOI form is included as part of this section.

C. A copy of the NOI shall be posted in a prominent place for public viewing at the project site. The Contractor shall be responsible for execution of all documents and providing all inspections and

certifications outlined in the SWPPP as necessary for compliance with federal, state and local guidelines.

D. The executed Notice of Intent shall be sent to:

BY REGULAR U.S. MAIL

Texas Commission on Environmental Quality
Storm Water & General Permits Team; MC-228
P.O. Box 13087
Austin, Texas 78711-3087

3.2 RETENTION OF RECORDS

A. The Contractor shall retain a copy of the SWPPP from the date that it became effective to the date of project completion.

B. Contractor shall retain copies of all inspection and maintenance reports, as well as copies of all modifications and adjustments to the SWPPP until the date of project completion.

C. Contractor shall return to the Owner, all records stated above at the completion of the project. Owner will retain all SWPPP records and data for a period of three (3) years from the date project completion.

3.3 REQUIREMENTS

A. The following notices are to be posted from the date that the SWPPP goes into effect until the date of final stabilization:
   1. Copies of the Notice of Intent, submitted by the Owner and General Contractor, along with the Project Description Form of the SWPPP, are to be posted at the construction site or at the Contractor's office in a prominent place for public viewing.
   2. Notice to drivers of equipment/vehicles to stop, check, and clean tires for debris and mud before equipment/vehicles are allowed to enter traffic lanes are to be posted at every stabilized construction exit area.
   3. Notice of waste disposal procedures are to be posted at a location onsite.
   4. Notice of hazardous material handling and emergency procedures are to be posted with the NOI on site. Copies of Material Safety Data sheets are to be kept at a location onsite that is clearly made known to all personnel.
   5. A copy of the signed Certification forms included in this Section shall be kept at the construction site or at the Contractor's office.

B. Construction may not begin until 60 days after the NOI is filed.

C. Construction sites that will disturb 10 acres or more shall meet current numeric discharge limit requirements.

D. If earth disturbance will be stopped for 14 days or more, the contractor must immediately stabilize the area using straw or hydraulic mulch, soil binders, erosion control blankets, or hydroseeding.

3.4 NOTICE OF TERMINATION

A. A Notice of Termination (NOT) of Coverage under the TPDES General Permit for Storm Water Discharges Associated with Industrial Activity and storm water run-off from the construction activities does not cause sediment transport or erosion from the site. The A/E and inspector will make final determination of the final stabilization. Final stabilization is when all soil-disturbing activities at the site have been completed and when a uniform perennial vegetative cover with a density of 85% of the cover for unpaved areas has been established. The Contractor will be required to maintain structural

controls until this vegetative cover meets the above requirement.

3.5 ATTACHMENTS

A. PROJECT DESCRIPTION OF STORM WATER POLLUTION PREVENTION PLAN
B. CONTRACTOR / SUBCONTRACTOR CERTIFICATION
C. OWNER CERTIFICATION
D. INSPECTION & MAINTENANCE CERTIFICATION
E. INSPECTION & MAINTENANCE REPORT
F. NOTICE OF INTENT

END OF SECTION 01 57 13.15

(TPDES FORMS TO FOLLOW)

PROJECT DESCRIPTION
STORM WATER POLLUTION PREVENTION PLAN

Project:
Location:
Owner:

Description:

The project includes the construction of a new natural turf soccer field, and track and field complex.

Contractor:

General Contractor:

_____
Name, Title

_____
Company

_____
Address 1

_____
Address 2

Subcontractors:

_____ Name, Title	_____ Name, Title
_____ Company	_____ Company
_____ Address 1	_____ Address 1
_____ Address 2	_____ Address 2
_____ Name, Title	_____ Name, Title
_____ Company	_____ Company
_____ Address 1	_____ Address 1
_____ Address 2	_____ Address 2

CONTRACTOR / SUBCONTRACTOR CERTIFICATION

(To be completed by the Contractor)

I certify under penalty of law that I understand the terms and conditions of the general Texas Pollutant Discharge Elimination System (TPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

Signatures: Company Information: Responsibilities:
General Contractor

Signature Company Name

Name

Title Address

Date Telephone

Signatures: Company Information: Responsibilities:
General Contractor

Signature Company Name

Name

Title Address

Date Telephone

Signatures: Company Information: Responsibilities:
General Contractor

Signature Company Name

Name

Title Address

Date Telephone

OWNER CERTIFICATION

(To be completed by the Owner)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner:

Signature: _____

Printed Name: _____

Title: _____

Date: _____

INSPECTION & MAINTENANCE CERTIFICATION

(To be filed with Inspection Reports)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: _____

Printed Name: _____

Title: _____

Company: _____

Date: _____

INSPECTION & MAINTENANCE REPORT
STORM WATER POLLUTION PREVENTION PLAN

INSPECTOR: DATE:

DAYS SINCE LAST RAINFALL AMOUNT OF LAST RAINFALL INCHES

STABILIZATION MEASURES

AREA	DATE SINCE LAST DISTURBED	DATE OF NEXT DISTURBANCE	STABILIZED?	STABILIZED	CONDITION

STABILIZATION REQUIRED:

TO BE PERFORMED BY: ON OR BEFORE:

STRUCTURAL CONTROLS

DIVERSION DIKES AND SWALES:

FROM	TO	STABILIZED?	EVIDENCE OF WASHOUT OR OVER-TOPPING?

MAINTENANCE REQUIRED FOR DIVERSION DIKES AND SWALES:

TO BE PERFORMED BY: ON OR BEFORE:

TEMPORARY DIVERSION SWALE:

FROM	TO	STABILIZED?	EVIDENCE OF WASHOUT OR OVER-TOPPING?

MAINTENANCE REQUIRED FOR TEMPORARY DIVERSION SWALE:

TO BE PERFORMED BY: ON OR BEFORE:

FILTER FABRIC FENCE:

TCEQ

Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under TPDES General Permit (TXR150000)

TCEQ Office Use Only
Permit No.: TXR15
RN:
CN:
Ref No:

Sign up now for ePermits NOI at www6.tceq.state.tx.us/steers
Get Instant Permit Coverage and only pay a $225 application fee.

If filing a paper NOI you can pay the application fee on line? Go to www.tceq.state.tx.us/epay
Select Fee Type: GENERAL PERMIT CONSTRUCTION STORM WATER DISCHARGE NOI APPLICATION
If submitting a paper NOI, coverage under the general permit starts seven (7) days after the date postmarked for delivery to TCEQ.

IMPORTANT:
- Use the **INSTRUCTIONS** to fill out each question in this form.
- Use the attached **CUSTOMER CHECKLIST** to make certain all you filled out all required information.
- Incomplete applications **WILL** delay approval or result in **automatic Denial**.

Renewal of General Permit
Is this NOI to renew an ACTIVE permit?
☐ Yes - What is your permit number? **Permit No. TXR15**_____
☐ No - a permit number will be issued.

Application Fee if mailing a paper NOI:
You must pay the **$325** Application Fee to TCEQ for the application to be considered complete.
Payment and NOI must be mailed to separate addresses. See instructions for correct mailing addresses.

Provide your payment information below, for us to verify payment of the application fee:

☐ Mailed:	Check/Money Order No.:	Company Name on checking account:
☐ EPAY:	Voucher No.:	Is the Payment Voucher copy attached? ☐ Yes

A. OPERATOR (applicant)

1. If the applicant is currently a customer with TCEQ, what is the Customer Number (CN) issued to this entity?
CN (Search Central Registry)

2. What is the Legal Name of the entity (applicant) applying for this permit?

(The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal document forming the entity.)

3. What is the name and title of the person signing the application?
(The person must be an official meeting signatory requirements in TAC 305.43(a).)

Name:	Job Title:

4. What is the Operator's (applicant) mailing address as recognized by the **US Postal Service**? (verify at USPS.com)

Address:	Suite No./Bldg. No./Mail Code:	
City:	State:	ZIP Code:
Country Mailing Information (if outside USA).	Country Code:	Postal Code:

5. Phone No.: ( )	Extension:
6. Fax No.: ( )	E-mail Address:

7. Indicate the type of Customer:

☐ Individual ☐ Sole Proprietorship-D.B.A. ☐ Limited Partnership
☐ Corporation ☐ Federal Government ☐ General Partnership
☐ State Government ☐ County Government ☐ City Government
☐ Other Government ☐ Other (describe):

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8. Independent Operator: ☐Yes ☐No (If governmental entity, subsidiary, or part of a larger corporation, check "No".)			
9. Number of Employees: ☐0-20; ☐21-100; ☐101-250; ☐251-500; or ☐501 or higher			
10. Customer Business Tax and Filing Numbers *(This item is not applicable to Individuals, Government, GP or Sole Proprietor.)* **REQUIRED** for Corporations and Limited Partnerships **(Verify the entity's status and filing no. with TX SOS at 512/463-5555)**			
State Franchise Tax ID Number:		Federal Tax ID:	
TX SOS Charter (filing) Number:		DUNS Number (if known):	
B. APPLICATION CONTACT			
If TCEQ needs additional information regarding this application, who should be contacted?			
1. Name:	Title:	Company:	
2. Phone No.: ( )		Extension:	
3. Fax No.:		E-mail Address:	
C. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE			
1. TCEQ Issued RE Reference Number (RN): **RN** (Search Central Registry)			
2. Name of Project or Site (the name as known by the community where this facility/project is located): (example: phase and name of subdivision or name of project that's unique to the site)			
3. Does the site have a physical address? **If Yes**, complete **Section A** for a physical address. **If No**, complete **Section B** for site location information.			
Section A: Enter the physical address for the site. **(verify it with USPS.com or other delivery source)**			
Street Number:		Street Name:	
City:		ZIP Code:	
Section B: Enter the site location information.			
If no physical address (Street Number & Street Name), provide a written location access description to the site: (Ex.: phase 1 of Woodland subdivision located 2 miles west from intersection of Hwy 290 & IH35 accessible on Hwy 290 South)			
City where the site is located or nearest city to site:		ZIP Code where site is located:	
4. Identify the county where the site is located:			
5. Latitude:		Longitude:	
6. What is the primary business of this entity? In your own words, briefly describe the primary business of the Regulated Entity: (Do not repeat the SIC and NAICS code)			
7. What is the mailing address for the regulated entity?			
Is the RE mailing address the same as the Operator? ☐Yes, address is the same as Operator ☐No, provide the address			
Street Number:		Street Name:	
City:	State:		ZIP Code:
D. GENERAL CHARACTERISTICS			
1. Is the site located on Indian Country Lands? ☐No ☐Yes – If Yes, do not submit this NOI. Contact EPA, Region VI If the site is on Indian country lands, you must obtain authorization through EPA, Region VI.			
2. What is the Standard Industrial Classification (SIC) code (see instructions for common codes): (Search Osha.gov) Primary: _____ Secondary: _____			

3(a) What is the total number of acres disturbed? _____

3(b) Is the project site part of a larger common plan of development or sale? ☐ Yes ☐ No

If **Yes**, the total number of acres disturbed can be less than 5 acres.

If **No**, the total number of acres disturbed must be 5 or more. If the total number of acres disturbed is less than 5 then the project site does not qualify for coverage through this Notice of Intent. Coverage will be denied. See the requirements in the general permit for small construction sites.

4. Discharge Information (all information MUST be provided or the permit will be denied)

4(a) What is the name of the water body(s) to receive the storm water runoff or potential runoff from the site?

4(b) What is the segment number(s) of the classified water body(s) that the discharge or potential discharge will eventually reach?

4(c) Are any of the surface water bodies receiving discharges from the construction site on the latest EPA-approved CWA 303(d) list of impaired waters?

☐ Yes ☐ No

If Yes, provide the name of the impaired water body(s). _____

4(d) Is the discharge into an MS4? ☐ Yes ☐ No

If Yes, what is the name of the MS4 Operator? _____

Note: The general permit requires you to send a copy of the NOI to the MS4 Operator.

4(e) Is the discharge or potential discharge within the Recharge Zone, Contributing Zone, or Contributing Zone within the Transition Zone of the Edwards Aquifer?

☐ Yes ☐ No

If the answer is Yes, please note that a copy of the agency approved Plan required by the Edwards Aquifer Rule (30 TAC Chapter 213) must be included or referenced in the Storm Water Pollution Prevention Plan.

E. CERTIFICATION

Check "Yes" to the certifications below. **Failure to certify to all items will result in denial.**

☐ Yes	I certify that I have obtained a copy and understand the terms and conditions of the general permit (TXR150000).
☐ Yes	I certify that the full legal name of the entity (Operator) applying for this permit has been provided and is legally authorized to do business in Texas.
☐ Yes	I understand that a Notice of Termination (NOT) must be submitted when this authorization is no longer needed.
☐ Yes	I certify that a storm water pollution prevention plan has been developed and implemented prior to construction, and that is compliant with any applicable local sediment and erosion control plans and prepared and implemented as required in the general permit TXR150000.

Operator Certification:

I, _____ _____
Typed or printed name *(Required & must be legible)* Title *(Required & legible)*

certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code §305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signature: _____ Date: _____
(Use blue ink)

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Did you complete everything? Use this checklist to be sure!

Are you ready to mail your form to TCEQ? Go to the General Information Section of the Instructions for mailing addresses.

	Customer GP Notice of Intent Checklist **TXR150000**
√	This checklist is for use by the operator to ensure a complete application. Missing information may result in denial of coverage under the permit. (See NOI Process description in the Instructions)
☐	**Application Fee of $325.00** was mailed separately to TCEQ's Cashiers's Office (separate from the NOI) or the EPAY payment voucher is attached.
	OPERATOR INFORMATION - Confirm each item is complete:
☐	√
☐	Customer Number (CN) issued by TCEQ Central Registry
☐	Legal Name as filed to do business in Texas (Call TX SOS 512/463-5555)
☐	Name and Title of person signing the application. This person must meet signatory requirements in 30 TAC Section 305.43
☐	Operator Mailing Address is complete & verifiable with USPS. www.usps.com
☐	Phone Numbers/E-mail Address
☐	Type of Operator (Entity Type)
☐	Independent Operator
☐	Number of Employees
☐	For Corporations or Limited Partnerships – Tax ID and SOS Filing numbers are REQUIRED
	Application Contact person we can call for questions about this application.
	REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE - Confirm each item is complete:
☐	√
☐	Regulated Entity Reference Number (RN) (if site is already regulated by TCEQ)
☐	Site/Project Name/Regulated Entity
☐	Site/Project (RE) Physical Address Please do not use a rural route or post office box for a site location
☐	**Or** if no physical address, the location information that includes description, zip code and city is listed.
☐	Latitude and Longitude TCEQ USGS Topographic Map Viewer or TerraServer-USA
☐	Business description
☐	Site Mailing Address (checked same as operator or complete & verifiable with USPS. www.usps.com)
	GENERAL CHARACTERISTICS - Confirm each item is complete:
☐	√
☐	Indian Country Lands –the facility is not on Indian Country Lands
☐	Standard Industrial Classification (SIC) code www.osha.gov/oshstats/sicser.html
☐	Acres Disturbed is provided and qualifies for coverage through a NOI.
☐	Common plan of development or for sale?
☐	Discharge Information:
☐	receiving water body
☐	segment number(s) is REQUIRED
☐	water body on the latest EPA-Approved Clean Water Act 303(d) list of impaired waters
☐	MS4 Operator
☐	Edwards Aquifer Rule
☐	**CERTIFICATION** Certification statements have been checked indicating "Yes" Signature meets 30 Texas Administrative Code (TAC) §305.44 and is original and has been provided for the Operator.

Texas Commission on Environmental Quality
General Permit Payment Submittal Form
$325 for a paper Construction NOI Application Fee

Use this form to submit your Application Fee only if you are mailing your payment.

- Complete items 1 through 5 below:
- Staple your check in the space provided at the bottom of this document.
- Do not mail this form with your NOI form.
- Do not mail this form to the same address as your NOI.

Mail this form and your check to:

BY REGULAR U.S. MAIL	BY OVERNIGHT/EXPRESS MAIL
Texas Commission on Environmental Quality Financial Administration Division Cashier's Office, MC-214 P.O. Box 13088 Austin, TX 78711-3088	Texas Commission on Environmental Quality Financial Administration Division Cashier's Office, MC-214 12100 Park 35 Circle Austin, TX 78753

Fee Code: **GPA** General Permit: TXR150000

1. Check / Money Order No:
2. Amount of Check/Money Order:
3. Date of Check or Money Order:
4. Name on Check or Money Order:

5. NOI INFORMATION

If the check is for more than one NOI, list each Project/Site (RE) Name and Physical Address exactly as provided on the NOI. DO NOT SUBMIT A COPY OF THE NOI WITH THIS FORM AS IT COULD CAUSE DUPLICATE PERMIT ENTRIES.

See Attached List of Sites (If more space is needed, you may attach a list.)

Project/Site (RE) Name:

Project/Site (RE) Physical Address:

Staple Check In This Space

TCEQ-20134 (3/05/2008)

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for selection of products, including but not limited to:
   1. Product delivery, storage, and handling.
   2. Manufacturers' written warranties on products.
   3. Special warranties.
   4. Comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term *product* includes the terms *material*, *equipment*, *system*, *assembly*, and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis of Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words *basis of design product*, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the specified requirements.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 01 33 00.

b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal: Comply with requirements in Section 01 33 00. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
1. Schedule delivery to minimize long term storage at site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   2. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and items needed for complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term “as selected”, Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and characteristics based on the product named. Comply with requirements for consideration of an unnamed product by one of the named manufacturers.

C. Visual Matching Specification: Where Specifications require “*match Architect's sample”*, provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with specified requirements, comply with requirements of Section 01 25 00 for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase “*selected by Architect”* or similar phrase, select a product that complies with requirements. Architect will select color,

gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION

NOT USED

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Coordination of Owner-installed products.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair Work required to restore construction to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

C. Certified Surveys: Submit two copies signed by land surveyor.

D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor legally qualified to practice in the State of Texas, who is experienced in providing land surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not warranted. Before beginning site Work, investigate and verify existence and location of underground utilities, mechanical and electrical systems, and construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping; underground electrical services, and other utilities.
2. Furnish location data for Work related to the Work that must be performed by public utilities serving the site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation after correcting unsatisfactory conditions. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as necessary to locate each element of Project.
   2. Establish limits on use of site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
   7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical Work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control Work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other Work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical Work plumb and make horizontal Work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions ensuring the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous. Materials containing asbestos and BCPs are prohibited.

3.6 OWNER INSTALLED PRODUCTS

A. Site Access: Provide access to site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with Work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's Work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. Clean site and Work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degrees F (27 degrees C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with mechanical, plumbing, and electrical requirements.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 73 29 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Procedural requirements for cutting and patching.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair Work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   2. Changes to In Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   3. Products: List products used for patching and firms or entities that will perform patching Work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
      a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

B. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

C. Operational Elements: Do not cut and patch operating elements and related components that results in reducing the capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   1. Primary operational systems and equipment.
   2. Fire separation assemblies.
   3. Air or smoke barriers.
   4. Fire suppression systems.
   5. Mechanical systems piping and ducts.

6. Control systems.
7. Communication systems.
8. Fire-detection and -alarm systems.
9. Conveying systems.
10. Electrical wiring systems.
11. Operating systems of special construction.

D. Miscellaneous Elements: Do not cut and patch the following elements or related components that change the load bearing capacity, resulting in a reduction of capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise and vibration control elements and systems.
7. Sprayed fire resistive material.

E. Visual Requirements: Do not cut and patch construction resulting in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
1. If possible, retain original Installer or fabricator to cut and patch exposed Work. If possible, engage original Installer or fabricator. If original installer is not available, engage recognized, experienced, and specialized firm for the Work.
a. Processed concrete finishes.
b. Ornamental metal.
c. Matched veneer woodwork.
d. Preformed metal panels.
e. Roofing.
f. Firestopping.
g. Window system.
h. Fluid applied flooring.
i. Wall covering.
j. HVAC enclosures, cabinets, or covers.

F. Cutting and Patching Conference: Before proceeding, meet at site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with specified requirements.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where removal, relocation, or abandonment is necessary, bypass existing services before cutting to avoid interruption of services to occupied areas.

3.3 CUTTING AND PATCHING

A. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time, and complete without delay.
   1. Cut existing construction to provide for installation of components or performance of construction, and subsequently patch as necessary to restore surfaces to an original condition.

   2. Cut in place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of Work to be cut.

C. Protection: Protect in place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00.

E. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. Use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable earthwork specifications by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction to eliminate evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions are removed, extend one finished area into another, patch and repair surfaces in new space. Provide even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
4. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
5. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
6. Exterior Building Enclosure: Patch components and restore enclosure to a weathertight condition.

END OF SECTION 01 73 29

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Sections include the following:
   1. Division 01 Section “Temporary Facilities and Controls” for environmental-protection measures during construction.
   2. Division 02 Section “Structure Demolition” for disposition of waste resulting from demolition of buildings, structures, and site improvements.
   3. Division 02 Section “Selective Structure Demolition” for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
   4. Division 04 Section “Unit Masonry” for disposal requirements for masonry waste.
      Division 04 Section “Unit Masonry” for disposal requirements for excess stone and stone waste.
   5. Division 31 Section “Site Clearing” for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. Salvage/Recycle Requirements: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
   1. Demolition Waste:
      a. Asphaltic concrete paving.

b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:
   a. Site-clearing waste.
   b. Masonry and CMU.
   c. Lumber.
   d. Wood sheet materials.
   e. Wood trim.
   f. Metals.
   g. Roofing.
   h. Insulation.
   i. Carpet and pad.
   j. Gypsum board.
   k. Piping.
   l. Electrical conduit.
3. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
   a. Paper.

b. Cardboard.
c. Boxes.
d. Plastic sheet and film.
e. Polystyrene packaging.
f. Wood crates.
g. Plastic pails.

1.4 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 7 days of date established for commencement of the Work.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts and invoices.

H. Qualification Data: For Waste Management Coordinator.

I. 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.

1.5 QUALITY ASSURANCE

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

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities

having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section “Project management and Coordination.” Review methods and procedures related to waste management including but not limited to the following:

1. Delete subparagraphs below if not required. If retaining, insert additional requirements to suit Project.
2. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
3. Review requirements for documenting quantities of each type of waste and its disposition.
4. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
5. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
6. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.

2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

E. Forms: Prepare waste management plan on forms included at end of Part 3.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with Division 01 Section “Temporary Facilities and Controls” for operation, termination, and removal requirements.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Division 01 Section “Temporary Facilities and Controls” for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE

A. Packaging:
1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.

C. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PRE-CLOSEOUT MEETING

A. Pre-Closeout Meeting: Schedule and convene Pre-Closeout Meeting with Owner and Architect in accordance with Section 01 31 00, Project Coordination and Management.

1.3 SUBSTANTIAL COMPLETION

A. The items listed in the Supplementary Conditions, Paragraph 9.8 and the following items shall be completed before Substantial Completion will be granted:
   1. Contractor's Completion List (Punch List): Submit a thorough list of items to be completed or corrected, along with a written request for Substantial Completion and for review of the Work or portion of the Work. The Architect/Engineer's Project Representative, at their discretion, may attend and assist in the preparation of the Contractor's Punch List.
   2. Architect's Supplemental Punch List: The Architect/Engineer, along with the Owner at the Owner's discretion, will inspect the Work utilizing the Contractor's prepared Punch List, noting completed items and incomplete items, and will prepare a supplemental list of items that have been omitted or incomplete items that were not previously noted.
   3. Operations and Maintenance Manuals: Submit as described in paragraph 1.3.
   4. Final Cleaning: Provide final cleaning and adequate protection of installed construction as described in paragraph 1.6 and 1.7.
   5. Starting of systems: Start up equipment and systems as described in paragraph 1.8.
   6. Testing and balancing: Testing and balancing of systems must be performed and completed by Owner's forces, and the report submitted and accepted by Architect/Engineer and Owner, as described in the Contract Documents. Make adjustments to equipment as required to achieve acceptance.
   7. Demonstrations: If required by individual specification sections or by Owner, provide demonstrations and instructions for use of equipment as described in paragraph 1.9.

B. Date of Substantial Completion: Complete or correct items identified on Punch List and confirm that all items have been corrected prior to Architects re-inspection. Architect/Engineer, along with the Owner, will re-inspect the corrected work to establish the Date of Substantial Completion. Incomplete items remaining will be appended to the Certificate of Substantial Completion (AIA G704). The Date of Substantial Completion represents day one (1) of the closeout period, and represents the date of commencement of the Contractors correctional period and all warranty periods as described and required by the Contract Documents, except as amended in the Certificate of Substantial Completion and elsewhere in the Contract Documents.

C. Certificate of Substantial Completion: When the Work or designated portion thereof is substantially complete, Architect will prepare the Certificate of Substantial Completion to be executed by the Owner and Contractor. Items on the appended Punch List shall be completed or corrected within the time limits established in the Certificate.

1.4 PUNCH LIST

A. A comprehensive list prepared by the Contractor prior to Substantial Completion, and attached thereto, to establish all items to be corrected, or limited items of work to be completed, if any. This list is intended to represent a limited number of items needing attention.

B. Punch lists shall be furnished to the Architect in Microsoft Excel and PDF formats. The punch list shall be in matrix form and shall include the following information for each punch list item:
   1. Room number or other suitable location identifier
   2. Description of the work
   3. Sub-contractor/trade sign-off that the work has been verified to be 100% complete and in accordance with the Contract Documents
   4. Sub-contractor/trade sign-off date
   5. General contractor sign-off that the work has been verified to be I 00% complete and in accordance with the Contract Documents
   6. General contractor/trade sign-off date
   7. A/E consultant sign-off
   8. A/E consultant sign-off date
   9. If requested by the Owner, provide two additional similar columns for their sign-off.
   10. In the case of excessive repetition of the same item at various locations, the punch list may contain "general notes/items" that shall be applied to the entire project; and it shall be the responsibility of the contractor/sub-contractor to thoroughly examine the entire project and make corrective measures at all applicable locations.

C. Should the Architect determine that the Contractor's punch list lacks sufficient detail or requires extensive supplementation, the punch list will be returned to the Contractor for re-inspection and revision. The date of Substantial Completion will be delayed until the punch list submitted is a reasonable representation of the work to be done.

D. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items. It is anticipated that the detailed list of items of work to be completed or corrected at the Date of Substantial Completion will be no longer than five (5) typed pages.

E. The Contractor's superintendent shall participate in the preparation of the Contractor's punch list that is submitted to the Architect and Owner for supplementation. Upon receipt, the Architect and Consultants shall perform a spot review to determine the adequacy and completeness of the Contractor's punch list.

F. Upon receipt of an acceptable Contractor's punch list, the Contractor's Superintendent shall accompany the Architect, his Consultants and the Owner (at his discretion) during their observation and the preparation of their supplements to the Contractor's punch list.
   1. The Superintendent shall record or otherwise take note of all supplementary items.
   2. The Architect will endeavor to furnish to the Contractor typed, hand written or recorded supplements to the punch list in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect will not be cause for a claim for additional cost or extension of time as the Contractor's Superintendent shall have been in attendance during the inspections of the Architect and his Consultants and will have been expected to take his own notes.

1.5 OPERATIONS AND MAINTENANCE MANUAL

A. As a requirement for Substantial Completion, the final Operation and Maintenance Manual shall be submitted to, and reviewed and accepted by the Architect prior to issuance of the Certificate.

B. Prepare 3-ring D-slant binder cover and spline with printed title "OPERATIONS AND MAINTENANCE MANUAL", title of project, and subject matter of binder when multiple binders are required.

C. Submit one (1) copy of preliminary Operations and Maintenance Manuals to respective consultants (Civil, MEP, Structural, *etc*.) for review of conformance with contract requirements prior to submitting final to Architect. Allow time for proper review.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

F. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and Maintenance, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Equipment start-up instructions
      e. Operating instructions.
      f. Maintenance instructions for equipment and systems.
      g. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

   3. Part 3: Project documents and certificates, including the following:
      a. Product data.
      b. Air and water balance reports.
      c. Photocopies of warranties, certificates and bonds. Submit originals with Closeout Documents as specified below.

G. Submit one (1) final original and two (2) copies to Architect.

H. Contractor shall provide a DVD, in PDF Format, the following documents after approval by the Architect, Consultants and Owner: closeout manual, MSDS binder, O&M Manuals, specifications and approved submittals. Documents shall be hyper-linked to the Table of Contents.

1.4 PROJECT CLOSEOUT

A. Final Payment will not be authorized by the Architect until the Architect finds the Work acceptable under the Contract Documents, subject to the completion and acceptance of the following requirements and other applicable Contract requirements:
   1. Close-out Documents: Provide bound closeout documents as described in paragraph 1.5. Refer to the Supplementary Conditions, Paragraph 9.10 for additional information.
   2. Record Documents: Submit as described in paragraph 1.10.

3. Extra materials: Provide extra stock, materials, and products as described in paragraph 1.11 when required by individual specification sections.
4. Locks: Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
5. Temporary Facilities: Discontinue and remove temporary facilities from the site, along with mockups, construction aids, and similar elements.
6. Warranties, Certificates and Bonds: Execute and assemble transferable warranty documents, certificates, and bonds from subcontractors, suppliers, and manufacturers as described in paragraph 1.12.
7. Final Inspection and Acceptance by Architect is achieved as described in paragraph 1.13.

1.5 CLOSEOUT DOCUMENTS

A. Coordinate the following items with the requirements of Document CB, Supplementary Conditions of the Contract.

B. Prepare 3-ring D-slant binder cover and spline with printed title "CLOSEOUT DOCUMENTS", title of project, and subject matter of binder when multiple binders are required. Submit one (1) original and two (2) copies.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. The close-out documents shall be neatly organized and easily useable as determined by the Architect and Owner. Separate Close-out Documents binders from Operations and Maintenance Manuals. Documents identified as "affidavit" shall be notarized.

E. Contents: Prepare Table of Contents for each volume, with each item description identified, typed on white paper, in five (5) parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers. All General Contractor's vendors/suppliers and subcontractors that provided materials or performed any work related to this project must be listed on this form. Submit Final List of Subcontractors on Document AD.
   2. Part 2: Closeout Documents and Affidavits, include the following:
      a. AIA G707 - Consent of Surety to Final Payment;
      b. AIA G706 - Contractor's Affidavit of Payment of Debts and Claims;
      c. AIA G706A - Contractor's Affidavit of Release of Liens;

   3. Part 3: Project documents and certificates, including the following:
      a. Copy of Certificate of Substantial Completion (AIA G704);
      b. Copy of All Permits;
      c. Copy of Final Utility Bill or letter of transfer;
      d. Copy of Certificate of Occupancy;
      e. Copy of Certification of Project Compliance: Submit on attached **Close-out Form "B"**. Owner and Architect will initiate form and forward to Contractor for signature once Substantial Completion is established. (Owner to be provided original separately);

   4. Part 4: Warranties, Release of Liens, compile sequentially based on specification sections:
      a. General Contractor's Warranty: Submit on company letterhead as described below. This Warranty shall state all sections of Work performed by General Contractor's own forces, and warranty period for each section of Work;

b. Subcontractor's Release of Lien: Include contractor's, subcontractor's and direct material and equipment supplier's separate final releases. Submit on attached **Close-out Form "A"** – Subcontractor's Affidavit of Release of Lien.
c. Hazardous Material Certificate: Submit on attached **Close-out Form "C"**. Affidavits from Contractor, Subcontractors and General Contractor's vendors or suppliers stating that no hazardous materials/products have been used or installed in this project.
d. Subcontractor's Warranty: notarized, and submitted on attached **Close-out Form "D"**. This Warranty shall state all sections of Work performed by the subcontractor and warranty period.
e. Special / Extended Warranties; List and provide, notarized warranties requested by Owner, or required by or incorporated in the Contract Documents.
f. Spreadsheet depicting all items and materials that carry a warranty longer than one (1) year. Include information consisting of material/ supplier/ installer/ specification section/ length of warranty and contact information.

5. Part 5: Receipts:
a. Extra Stock: Provide original receipts for delivery of "Extra Stock" items as described below. Receipts must be signed by an authorized Owner's representative;
b. Keys: Provide original receipts for delivery of "Keys". Receipts must be signed by an authorized Owner's representative.
c. Sign in sheets: provide signatures of attendees from all demonstrations.

F. In addition to the three (3) required close-out binders listed above, provide Architect with one (1) separate binder for their records containing the following:
1. Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers;
2. All MSDS sheets for the project;
3. All warranties from Contractor, subcontractors, direct suppliers, and manufacturers.

G. Failure to complete and close-out project after substantial completion may result in liquidated damages being assessed to the Contractor. Refer to Conditions of the Contract for additional requirements and liquidated damages.

1.6 FINAL CLEANING

A. Execute final cleaning prior to final project inspection and acceptance.

B. Clean interior and exterior glass, and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces, mop hard floor surfaces.

C. Remove smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces

D. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

E. Clean and replace filters of operating equipment as required by Contract Documents

F. Clean debris from roofs, gutters, downspouts, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste and surplus materials, rubbish, and temporary construction facilities from site.

1.7 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections until Work is accepted by Architect and Owner.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.8 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and Owner 48 hours prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of Contractors' personnel, and installer in accordance with manufacturers' instructions.

G. When specified in individual specification sections or required by manufacturer, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. When specified in individual specification sections or required by Owner or Architect/Engineer, submit a written report in accordance with Section 01 33 00, Submittal Procedures, that equipment or system has been properly installed and is functioning correctly.

1.9 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel a minimum of 48 hours prior to date of Final Completion in accordance with Owner’s requirements.

B. Demonstrate Project equipment instructed by qualified manufacturer's representative who is knowledgeable about the Project and equipment.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.

D. Utilize maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment.

F. Prepare and insert additional data in maintenance manuals when need for additional data becomes apparent during instruction.

G. Review and verify proper star-up and operation of equipment prior to scheduling demonstrations with Owner.

H. All demonstrations are to be documented by video and submitted to the Owner in DVD format along with the close out documents. General contractor is responsible for all video and compilation onto DVD with linked menus.

1.10 PROJECT RECORD DOCUMENTS

A. Project Record Documents, as described in Section 01 78 39, shall be submitted at Project Closeout. Final Payment will not be authorized by the Architect until final review and acceptance by Architect and Engineers is achieved in accordance with the Owners requirements.

B. At the Contractors request, and with associated fee, Architect may provide electronic versions of the construction drawing and specification files for Contractors use, subject to the terms and conditions of Architects standard electronic document transfer agreement.

C. Submit reproducible to respective consultants (Civil, Structural, MEP, *etc*.) for review. Consultant will mark-up corrections and return to Contractor for final revisions. Make final revisions prior to submitting to Architect.
   1. Format: One (1) set of film positive reproducibles and two (2) sets bluelines of approved reproducibles.
   2. Provide the Owner with one (1) set of Record Drawings on a non-rewritable CD in AutoCAD® latest release.
   3. Provide the Owner with one (1) set of Record Drawings on a on a non-rewritable CD in PDF format.
   4. Label electronic CAD files and PDF files in the same manner as the sheets (example, A2.02 First Floor Area ‘A’, etc.)

1.11 EXTRA STOCK, MATERIALS AND MAINTENANCE PRODUCTS

A. Furnish extra stock, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site or to District Maintenance Department as directed by Owner; obtain signed receipt from Owner’s authorized representative prior to final application for payment. Delivery of materials to, or obtaining receipt from anyone other than Owner’s authorized representative may constitute breach of this requirement and may require delivery of additional materials at no cost to the Owner if original materials are misplaced.

C. Include signed receipts for delivery of extra stock and materials, including keys, with Closeout Documents.

1.12 WARRANTIES, CERTIFICATES AND BONDS

A. Definitions:

1. Standard Product Warranties: preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
2. Special Warranties: written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide coverage of specific defects, or both.

B. In accordance with the general warranty obligations under Paragraph 3.5 of the General Conditions as amended by the Supplementary Conditions, the General Contractor's warranty shall be for a period of one (1) year following the date of Substantial Completion, hereinafter called the one-year warranty period. The Contractors one-year general warranty shall include all labor, material and delivery costs required to correct defective material and installation. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

C. The Contractor's one-year warranty shall run concurrently with the one (1) year period for correction of Work required under Paragraph 12.2 of the General Conditions.

D. No service charges or call out charges are allowed to investigate warranty claims.

E. In addition to the Contractors one-year warranty, Special Warranties as described in individual specifications sections, shall extend the warranty period for the period specified without limitation in respect to other obligations which the Contractor has under the Contract Documents.

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

G. Warranty Requirements:
1. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
2. When Work covered by a warranty has failed and been corrected by replacement or reconstruction, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
3. Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
4. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
5. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or designated portion of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

H. Compile copies of each required warranty properly executed by the Contractor and the subcontractor, supplier, or manufacturer. Verify documents are in proper form, contain full information, and are notarized. Co-execute warranties, certificates and bonds when required and include signed warrantees with Closeout Documents submitted to the Architect.

1.13 FINAL COMPLETION AND FINAL PAYMENT

A. Final Notice and Inspection:

1. When all items on the Punch List have been corrected, final cleaning has been completed, and installed work has been protected, submit written notice to the Architect that the Work is ready for final inspection and acceptance.
2. Upon receipt of written notice that the Work is ready for final inspection and acceptance, the Architect and Engineer will make final inspection.

B. Final Change Order: When the Project Closeout items described above are successfully completed and the Work is found acceptable to Architect/Engineer and Owner, a Final Change Order will be executed. This Change Order will include any Allowance adjustments as required by the Contract Documents.

C. Final Application for Payment: When all of the above items are successfully complete, submit to the Architect a final Application for Payment and request for release of retainage.

D. Release of Retainage: Release of retainage will not be authorized by the Architect until Contractor completes all requirements for close-out to the satisfaction of the Owner and Architect as described herein.

1.14 TERMINAL INSPECTION

A. Immediately prior to expiration of the one (1) year period for correction of the Work, the Contractor shall make an inspection of the work in the company of the Architect and the Owner. The Architect and the Owner shall be given not less than ten (10) days notice prior to the anticipated date of terminal inspection.

B. Where any portion of the work has proven to be defective and requires replacement, repair or adjustment, the Contractor shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of the Architect and the Owner, even if the date of completion of the corrective work may extend beyond the expiration date of the correction period.

C. The Contractor shall not be responsible for correction of work which has been damaged because of neglect or abuse by the Owner nor the replacement of parts necessitated by normal wear in use.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 77 00

SECTION 01 77 00 CLOSEOUT FORMS

CLOSE-OUT FORM "A"

SUBCONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the _____ of _____, the subcontractor who supplied, installed, and /or erected the work described below, and that, he /she is duly authorized to make this Affidavit and Subcontractor Release:

   Project: PSJA ISD New Swimming Facilities
   Owner: Pharr-San Juan- Alamo ISD Architect: PBK
   Work Performed: _____ Specification Section(s): _____

2. That all work required under the subject subcontractor of the subject construction project has been performed in accordance with the terms thereof, that all material men, sub-subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said subcontractor which have not been paid and satisfied in full.

3. That to the best of his / her knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said subcontract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.

4. That he / she has received full payment of all sums due him / her for materials furnished and services rendered by the undersigned in connection with the performance of said subcontract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said subcontract.

ATTEST (If Corporation)

_____
Name of Subcontractor

_____ _____
Secretary (By) (Title)

JURAT

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____.

_____
(Seal) (Notary Public Signature)

CLOSE OUT FORM "B"

CERTIFICATION OF PROJECT COMPLIANCE

Completion of this form is required under the provisions of §61.1036(c)(3)(F) TAC for all public school district construction projects. Instructions for completion of this form can be found on page 2.

1. PROJECT INFORMATION

DISTRICT:

Facility:

ARCHITECT/ENGINEER:

Address:

CONTRACTOR/CM:

City:

CONTRACT DATE:

DATE DISTRICT AUTHORIZED PROJECT:

BRIEF DESCRIPTION OF PROJECT:

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the educational program and the educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT: **BY:** **DATE:**

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, June 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER: **BY:** **DATE:**

5. The Contractor/CM certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM: **BY:** **DATE:**

6. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT: **BY:** **DATE:**

INSTRUCTIONS FOR COMPLETION OF "CERTIFICATION OF PROJECT COMPLIANCE" FORM

Section 1. Identify the following:
- – name and address of the school facility
- – name of the school district
- – the Architect/Engineer and Contractor
- – the date of execution of the construction contract
- – the date that the school district authorized the superintendent to hire an architect/engineer
- – scope of the project.

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.1033 or §61.1036, School Facilities Standards) and returned to the school district's files.

Section 5. This section is to be executed by the contractor upon substantial completion of the project and retained in the school district's files.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project.

NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. The school district will retain this document in their files indefinitely until review and/or submittal is required by representatives of the Texas Education Agency.

CLOSE-OUT FORM "C"

SUBCONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

THE STATE OF _____

COUNTY OF _____

PROJECT: PSJA ISD New Swimming Facilites

OWNER: Pharr-San Juan-Alamo Independent School District

ARCHITECT: PBK

SPECIFICATION SECTION(S):

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says that he / she is the _____ of _____,the subcontractor / supplier who constructed or provided the section(s) of work referenced above, and that he / she is duly authorized to certify to the best of his / her information, knowledge, and belief no asbestos, lead or PCB containing products have been incorporated into the project.

ATTEST (If Corporation)

_____
Name of Subcontractor / Supplier

_____ _____

Secretary (By)

_____
(Title)

JURAT

THE STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____.

(Seal)

_____
(Notary Public Signature)

CLOSE-OUT FORM "D"

SUBCONTRACTOR WARRANTY

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the Subcontractor (or the _____of_____ the subcontractor) who supplied, installed, and / or erected the work described below, and that, he / she is duly authorized to make this Subcontractor Warranty:

   Project: PSJA ISD New Swimming Facilites
   Owner: Pharr-San Juan-Alamo Architect: PBK
   Work Performed: _____Specification Section(s): _____

2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Subcontractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Architect.

4. The Subcontractor warrants the work performed for a period of _____ months from the date of Substantial Completion, except as follows:_____
   _____

ATTEST (If Corporation)

_____
Name of Subcontractor

_____

Secretary (By) (Title)

JURAT

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20____.

_____

(Seal) (Notary Public Signature)

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for project record documents, including but not limited to:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings:
   1. Number of Copies: Submit one set of marked up record prints.
   2. Number of Copies: Submit copies of record Drawings:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and one of file prints.
         2) Submit record digital data files and one sets of plots.
         3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit PDF electronic files of scanned record prints and three sets of prints.
         2) Submit record digital data files and three sets of record digital data file plots.
         3) Plot each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and one annotated PDF electronic file of the Project Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and one annotated PDF electronic file and directory of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked up Product Data as a component of manual.

D. Miscellaneous Record Submittals: Refer to the individual Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 PROJECT RECORD DOCUMENT PROCEDURES

A. Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference.
   1. Do not use As Built Drawings and Specifications for Record Drawings and Specifications.

B. Recording Procedures: Update drawings and specifications on daily bases to record actual conditions. Record information concurrently with construction progress. Do not conceal Work until required information is accurately recorded.

C. Store Record Documents and samples apart from as built documents used for construction.
   1. Label and file Record Documents and samples in accordance with section number listings in Table of Contents. Label each document *PROJECT RECORD* in neat, large, printed letters.
   2. Maintain Record Documents in clean, dry and legible condition.
   3. Make Record Documents and samples available for inspection upon request of Architect.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked up paper copies of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked up record prints. Show actual installation conditions where installation varies from that shown originally.
      a. Give attention to information on concealed elements difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross reference record prints to corresponding shop drawings or archive photographic documentation.

   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Construction Change Directive.
      k. Changes made following Architect's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.

   3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked up record prints.
   4. Mark record sets with erasable, red colored pencil. Use colors to distinguish between changes for different categories of the Work at same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked up record prints with Architect. When authorized, prepare full set of corrected digital data files of the Contract Drawings:
   1. Format: Same digital data software program, version, and operating system as the original Contract Drawings and annotated PDF electronic file with comment function enabled.
   2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
   3. Refer instances of uncertainty to Architect for resolution.
   4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
      a. Refer to Section 01 33 00 for requirements related to use of Architect's digital data files.
      b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
   1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or modification.

   2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation *PROJECT RECORD DRAWING* in a prominent location.
   1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Format: Annotated PDF electronic file with comment function enabled.
   3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
   4. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation PROJECT RECORD DRAWINGS.
      d. Name of Architect.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Indicate actual product installation where installation varies from that indicated in Specifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.

5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and marked up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 RECORD SAMPLES

A. Record Samples: Determine with Architect and Owner which submitted Samples are to be maintained as Record Samples. Maintain and mark one set to indicate date of review and approval by Architect; note any deviations or variations between reviewed sample and installed product or material.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by the individual Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Include the following:
1. Reviewed shop drawings, product data, and samples.
2. Field test reports.
3. Inspection certificates and manufacturer's certificates.
4. Inspections by authorities having jurisdiction (AHJ).
5. Documentation of foundation depths.
6. Special measurements or adjustments.
7. Tests and inspections.
8. Surveys.
9. Design mixes.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked up miscellaneous record submittals. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.
4. O&M Manuals should be uploaded into Owner’s designated software (Prolog)

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:
   a. Name of Project.
   b. Name and address of videographer.
   c. Name of Architect.
   d. Name of Contractor.
   e. Date of video recording.

2. At completion of training, submit complete training manual(s) for Owner's use.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.

e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish an instructor to describe Owner's operational philosophy.
   2. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

   1. Schedule training with Owner through Program Manager with at least 10 days' advance

notice.

C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

END OF SECTION 01 79 00

SECTION 02 41 13.23 - ABANDONMENT OF EXISTING UTILITIES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. Abandon water lines, storm and sanitary sewers, manholes, and associated appurtenances as indicated on the Plans in accordance with the methods outlined herein.

1.2 PAYMENT

A. Payment will be made if an item is provided for such on the bid form; otherwise, include cost of work in the lump sum price.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Specific products are not required. Reference other applicable sections of the specifications for material required.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate all work so that existing utilities are operable until new utilities are complete and in place. Keep any service interruptions to a minimum.

3.2 WATER LINE ABANDONMENT

A. Remove at least one joint of existing pipe where crossing or tying-in with new water lines. Plug both ends of abandoned line with an appropriate manufactured fitting (cap or plug) or fill end of line with 3000 psi concrete. Backfill as per SECTION 31 23 00 - CONSTRUCTION OF UNDERGROUND UTILITIES.

3.3 SEWER ABANDONMENT

A. Unless noted on drawings to be removed, abandon sewers 12 inches in diameter and smaller by filling with a liquid concrete slurry composed of a 3 sack per cubic yard mix using pea gravel (1-1/2 inch and smaller aggregate) or drilling mud. Limit length of application to individual sections between manholes. Construct a temporary dam in downstream manholes above top of pipe. Pour slurry or mud in upstream manhole or in riser pipe attached to upstream end of sewer. Fill line till slurry or mud rises above top of pipe on both ends.

B. Sewers between 12” – 36” in diameter shall be abandoned in accordance with either 3.3.A or 3.3.C.

C. Unless noted on drawings to be removed, abandon sewers 36 inches in diameter and larger by breaking in top of pipe and backfilling. Excavate and expose top half of existing sewer. Using appropriate equipment, cave-in the top half of pipe; as a minimum, the upper 120 degree section of pipe must be broken in. Fill open pipe with backfill material and compact to top of existing pipe. Backfill to grade in accordance with SECTION 31 23 00 - CONSTRUCTION OF UNDERGROUND UTILITIES.

3.4 MANHOLE ABANDONMENT

A. After abandoning sewer lines in the appropriate manner, fill manholes to be abandoned with bank sand. Excavate around top of manhole and remove manway (reducer) section of manhole. Fill manhole with bank sand in 12 inch compacted lifts to top of manhole barrel. Backfill to finished grade in accordance with SECTION 31 23 00 - CONSTRUCTION OF UNDERGROUND UTILITIES.

END OF SECTION 02 41 13.23

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete formwork, for the following:
   1. Footings and/or piers.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.

B. Related Sections:
   1. Section 01 45 23 “Testing and Inspection Services”.
   2. Section 03 33 00 "Architectural Concrete".
   3. Section 03 30 00 “Cast In Place Concrete”.
   4. Section 03 20 00 “Concrete Reinforcing”.
   5. Section 03 47 13 “Tilt Up Concrete”.
   6. Section 03 38 16 “Unbonded Post Tensioned Concrete”.
   7. Section 03 53 00 "Concrete Topping".

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
   1. American Concrete Institute (ACI):
      a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
      b. ACI 301 – Specifications for Structural Concrete for Buildings
      c. ACI 318 – Building Code Requirements for Structural Concrete
      d. ACI 347 – Guide to Formwork for Concrete
      e. ACI SP-4 – Formwork for Concrete.

1.4 PERFORMANCE REQUIREMENTS

A. Design and engineering of formwork, including shores, reshores, false work, bracing, and other temporary supports as well as determining when temporary supports and bracing can safely be removed after the specified curing time is the Contractor’s responsibility.

B. All components of the formwork shall be designed to support all loads imposed during construction including weight of construction equipment, live loads, and lateral loads due to wind and imbalance or discontinuity of building components.

C. If any post tensioned members exist on the project, the formwork supporting those elements shall:
   1. It is essential to take into account the stressing sequence of post-tensioned concrete in the design of the formwork. Any concrete element which is stressed can transfer its weight off the form work to the supporting concrete element in which case the forms for the supporting concrete element must be designed to support the entire load tributary of that element.
   2. Forms shall be designed and constructed to permit movement during stressing, both lifting and shortening of the concrete elements.
   3. Formwork supporting beams and girders shall be designed to support the weight of the beam or girder's entire tributary area.
   4. Formwork supporting post tensioned concrete elements shall not be removed until all concrete supported by the formwork has been fully stressed, but in no case shall the curing time before form removal be less than specified herein.
   5. Design, engineering and production of shop drawings for the form work shall be performed under the supervision of a professional engineer.

1.5 ACTION SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Shop drawings for layout of pan type forms, if they exist on the project. Layout only - information and details about the support of these forms is not required, as it is the responsibility of the Contractor and his registered engineer
   1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

D. Manufacturer's product data and installation instruction for propriety materials used in exposed concrete work including form liners, release agents, form systems, ties, and accessories.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver form materials in manufacturer's packaging with installation instructions.

B. Store off ground in ventilated and protected area to prevent deterioration from moisture or damage.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. An experienced installer who has completed work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

B. Testing Agency Qualifications: Refer Section 01 45 23.

C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor employed by the contractor.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

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

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

D. Permanent Metal Forms for Slabs: Deck material, gauge and rib pattern shall be as noted on Drawings.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
   1. Pans shall be free of dents, irregularities, sag, rust or other deterioration.
   2. In areas permanently exposed to view, provide one piece units, manufactured to length between beams or ribs, or segmented units with reinforced butt-joint splices.

F. Load-bearing Rigid Board Insulating Fill Under Slabs:
   1. Extruded Polystyrene Board Insulation: Comply with ASTM C 578, Type X, 15 psi minimum compressive strength, 1.30 lb./cu. ft. (21 kg/cu. m) .
      a. Owens Corning Insulating Systems, LLC, Toledo, OH 43659; www.owenscorning.com.
      b. Thermal Resistance: (180-day real-time aging as mandated by ASTM C578, measured per ASTM C 518 at mean temperature of 75F): R-5.0 per inch of thickness, with 90% lifetime limited warranty on thermal resistance.
      c. Blowing Agent Formulation: Zero ozone depleting.
      d. Install according to manufacturer's recommended instructions.
   2. Expanded Polystyrene Board Insulation: Un-faced Flat Board Stock: Rigid, closed cell, expanded polystyrene (EPS) boards, UL certified, complying with ASTM C 578 Type VIII, 15 psi minimum compressive strength .
      a. Insulfoam, a Carlisle Company, which is located at: 6004 N. Westgate Blvd. Suite 120 ; Tacoma, WA 98406; Toll Free Tel: 800-248-5995; Tel: 253-572-5111; Email: request info (info@insulfoam.com); Web: www.insulfoam.com
      b. Blowing Agent Formulation: Zero ozone depleting.
      c. Install according to manufacturer's recommended instructions.

G. Formwork Accessories
   1. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
   2. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
   3. Expansion-Contraction Joint Filler Material: Bonded fabric of thickness indicated on Drawings composed of cellular fibers securely bonded together and uniformly saturated with asphalt complying with ASTM D 1751.
   4. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
      a. Formulate form-release agent with rust inhibitor for steel form-facing materials.
   5. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
      a. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
      b. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
      c. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

PART 3 - EXECUTION

3.1 FORMWORK

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

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

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch
3. Class C, 1/2 inch
4. Class D, 1 inch for rough-formed finished surfaces.

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

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

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

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

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

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

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

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

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

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts that are attached to the formwork.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.
   4. Install accessories in accordance with manufacturer’s instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
   3. Determine compressive strength of in place concrete by testing representative field-cured test specimens according to ACI 301.

B. Obtaining concrete compressive strength tests for the purposes of form removal shall be the responsibility of the Contractor.

C. In the absence of cylinder tests, formwork shall remain in place until the concrete has cured at a temperature of at least 50 degrees Fahrenheit (10 degrees Celsius) for the minimum cumulative time periods given in ACI 347, Section 3.7.2.3. When the surrounding air temperature is below 50 degrees Fahrenheit (10 degrees Celsius), that time period shall be added to the minimum listed time period.

D. Formwork for two-way conventionally reinforced slabs shall remain in place for at least the minimum cumulative time periods specified for one-way slabs of the same maximum span. Two-way conventionally reinforced slabs shall then be reshored until they attain the specified 28 day strength.

E. Minimum cumulative curing times may be reduced by the use of high-early strength cement or forming systems that allow form removal without displacing shores. However, the Contractor must demonstrate, to the satisfaction of the Architect, that the early removal of forms will not result in excessive sag, distortion or damage to the concrete elements.

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

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

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. The Contractor shall be solely responsible for proper shoring and reshoring. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

C. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement. Reshores shall be located in the same position on each floor. No construction loads shall be placed on the new construction until all supporting reshores have been installed.
   1. Extend shores or reshores from ground to top level in structure three stories or less in height, unless noted otherwise.
   2. In structures over three stories in height, extend shores or reshores at least three levels under the level being placed. Extend shores beyond the minimum number of levels if required to ensure proper distribution of loads throughout the structure.
   3. In crawl spaces or basement, shores or reshores shall extend to mud pads seated firmly on the soil or to on grade construction.

D. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

E. Bottom tier of reshores shall remain in place until the supported concrete has attained at least 85 percent of the specified 28-day compressive strength and construction loads in excess of 20 psf have been removed but not less than 14 days.

3.5 REUSE OF FORMS

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

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

3.6 JOINTS

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

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Otherwise, locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are to be installed.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 FINISHING FORMED SURFACES

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

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

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

3.8 FINISHING FLOORS AND SLABS

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

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
   1. Apply scratch finish to surfaces indicated or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated or to receive trowel finish or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment

END OF SECTION 03 10 00

SECTION 03 15 13 - WATERSTOPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provision of waterstops embedded in concrete and spanning control, expansion, and/or construction joints to create a continuous diaphragm to prevent fluid migration.

B. Non-metallic waterstops for use in concrete joints subjected to chlorinated water, sea water, and many waterborne chemicals.

C. Non-metallic waterstops for use in concrete joints subjected to acids, bases, alcohols, oils, solvents or other chemicals.

1.2 REFERENCES

A. PVC WATERSTOP
1. Corps of Engineers: CRD-C 572-74
2. American Society for Testing Materials (ASTM)
3. Bureau of Reclamation: C-902
4. Canadian General Standards Board: 41-GP-35M Types 1 & 3
5. ACI 350.2: Concrete Structures for Containment of Hazardous Materials

B. HYDROPHILIC WATERSTOP
1. American Society for Testing Materials (ASTM)

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store waterstops under tarps to protect from oil, dirt, sunlight, and premature exposure to water.

1.4 SUBMITTALS

A. Submit shop drawings and fabrication drawings indicating placement of waterstops and shop fabrications.

B. Submit manufacturer’s test data for chemical resistance.

PART 2 - PRODUCTS

2.1 PVC WATERSTOPS FOR EXPANSION JOINTS

A. Provide flexible PVC (polyvinyl chloride) waterstop as manufactured by Greenstreak, or approved equal.

B. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.

C. Profile: Ribbed with center bulb.

D. Dimensions: 6 inch by 3/8 inch thick.

E. Performance Requirements as follows:

Property	**Test Method**	**Required Limits**
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lb/in (35 kN/m) min.
Ultimate Elongation	ASTM D 638	350% min.
Tensile Strength	ASTM D 638	2000 psi min.
Low Temperature Brittleness	ASTM D 746	No Failure @ -35o F
Stiffness in Flexure	ASTM D 747	600 psi min.
Specific Gravity	ASTM D 792	1.45 max.
Hardness, Shore A	ASTM D 2240	79 +3
Tensile Strength after accelerated extraction	CRD-C 572	1850 psi min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalies after 7 days: Weight Change Hardness Change	CRD-C 572	 between -0.10% / +0.25% +/- 5 points

2.2 CHEMICALLY RESISTANT FLEXIBLE WATERSTOP

A. Thermoplastic elastomeric rubber waterstops resistant to oil, solvents, and chemicals as manufactured by Westec or approved equal.

B. Chemical resistance testing to be performed by independent ASTM certified laboratory.

C. Profile: Ribbed with center bulb

D. Dimensions: 6 inches by 3/8 inch thick.

E. Performance requirements as follows:

Property	**Test Method**	**Unexposed Value**
Tensile Strength	ASTM D638	2000 psi
Ultimate Elongation	ASTM D638	450%
100% Modulus	ASTM D638	1000 psi
Shore A Hardness	ASTM D2240	85 units

Low Temp Brittleness	ASTM D746	No Failure @ -70 F

F. Waterstop material should show less than +/- 30% change in material properties, including weight gain after 7-day exposure to selected chemicals, per ASTM D 471 testing.

2.3 HYDROPHILIC WATERSTOP FOR NON-MOVING CONTRACTION AND CONSTRUCTION JOINTS

A. Provide hydrophilic rubber waterstop as supplied by Greenstreak, HYDROTITE profile style number (fill in profile style number).

B. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.

C. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.

D. Performance Requirements as follows:

Chloroprene Rubber

Property	Test Method	Required Limits
Tensile Strength	ASTM D 412	1300 PSI min.
Ultimate Elongation	ASTM D 412	400% min.
Hardness (Shore A)	ASTM D 2240	50 +/- 5
Tear Resistance	ASTM D 624	100 lb/inch min.

Modified Chloroprene (Hydrophilic) Rubber

Property	Test Method	Required Limits
Tensile Strength	ASTM D 412	350 PSI min.
Ultimate Elongation	ASTM D 412	600% min.
Hardness (Shore A)	ASTM D 2240	52 +/- 5
Tear Resistance	ASTM D 624	50 lb/inch
Expansion Ratio	Volumetric Change - Distilled Water @ 70o F	3 to 1 min.

2.4 ACCESSORIES

A. PVC and Chemically Resistant Waterstops
1. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.
2. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
3. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.
4. Splices to be free from defects.

B. Hydrophilic Waterstops
1. Provide Greenstreak 7300 two component epoxy gel to secure HYDROTITE to rough, wet (or dry) concrete.
2. Provide LEAKMASTER single component hydrophilic sealant to secure HYDROTITE to rough, dry concrete.
3. Provide cyanacrylate adhesive (super glue) for all splices.
4. Provide LEAKMASTER as addition to cyanacrylate adhesive at all splices for added insurance (Optional).

PART 3 - EXECUTION

3.1 INSTALLATION

A. PVC and Chemically Resistant Waterstops
1. Field butt splices shall be heat fused welded using a teflon covered thermostatically controlled waterstop splicing iron at approximately 380 degrees F. Follow approved manufacturer recommendations.
2. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
3. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12” on centers along the length of the waterstop and wire tie to adjacent reinforcing steel.
4. Install in longest lengths practicable.
5. Ensure steel reinforcing bars do not interfere with proper position of waterstop.
6. Clean concrete joints of dirt and construction debris prior to second pour of concrete.
7. Cut waterstop ends with miter guide and circular saw to ensure good, full contact at joints.
8. At expansion joints, keep center bulb unembedded at joint centerline.

B. Hydrophilic Waterstop
1. Cut coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.
2. Splices shall be sealed using cyanacrylate adhesive (super glue) and LEAKMASTER (LEAKMASTER is optional).
3. Seal watertight any exposed cells of HYDROTITE using LEAKMASTER.
4. Follow approved manufacturer written recommendations.
5. Install in longest length practicable.

C. Hydrophilic and PVC Intersections
1. Maintain continuity of waterstops at all intersections and transitions.
2. Joinery between PVC and HYDROTITE shall be sealed using LEAKMASTER.
3. Follow approved manufacturer written recommendations.

D. Retrofit Waterstop
1. Prepare existing concrete by grinding away irregularities. Clean concrete to ensure good epoxy bond.
2. Apply continuous bed of epoxy to concrete 1/8 inch thick.
3. Embed retrofit waterstop in uncured epoxy.
4. Mechanically fasten waterstop to concrete using stainless steel batten bars and anchor bolts staggered 6 inches OC max. Use batten bars on top and bottom.

5. Tool continuous layer of epoxy over batten bars and bolts to protect from corrosion.
6. Use expansion joint filler at moving joints to minimize shear stresses.

E. Concrete Placement at Waterstop
1. Carefully place concrete without displacing waterstop from proper position.
2. Thoroughly and systematically vibrate concrete around waterstop to obtain impervious, void free concrete in vicinity of joint and to maximize intimate contact between concrete and waterstop.
3. After first pour, clean un-embedded waterstop leg to ensure full contact of second pour concrete.

END OF SECTION 03 15 13

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete reinforcement, for the following:
   1. Footings and/or piers.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.

B. Related Sections:
   1. Section 01 45 23 “Testing and Inspection Services”.
   2. Section 03 10 00 “Concrete Forming and Accessories”.
   3. Section 03 30 00 “Cast In Place Concrete”.
   4. Section 03 47 13 “Tilt Up Concrete”.
   5. Section 03 38 16 “Unbonded Post Tensioned Concrete”.
   6. Section 04 22 00 “Concrete Unit Masonry”.
   7. Section 31 20 00 "Earth Moving".
   8. Section 31 63 29 "Drilled Concrete Piers".

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
   1. American Concrete Institute (ACI)
      a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
      b. ACI 301 – Specifications for Structural Concrete for Buildings
      c. ACI 315 – Details and Detailing of Concrete Reinforcement
      d. SP-66 ACI Detailing Manual
   2. American Welding Society (AWS)
      a. AWS D1.1 – Structural Welding Code
   3. Concrete Reinforcing Steel Institute (CRSI)
      a. CRSI – Manual of Standard Practice
      b. CRSI 63 – Recommended Practice for Placing Reinforcing Bars

c. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

B. American Society of Testing Materials (ASTM)
   a. ASTM-A185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.
   b. ASTM-A663: Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
   c. ASTM-A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   d. ASTM-A675: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
   e. ASTM-A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   f. ASTM-A775: Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
   g. ASTM-A884: Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.

C. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement, according to ACI 315 “Details and Detailing of Concrete Reinforcement.”
   1. Do not reproduce the structural drawings for use as shop drawings.

D. Bar Supports: Submit manufacturer’s product information for bolsters, chairs, spaces, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency, installer, and fabricator as indicated herein.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
   1. Steel reinforcement and accessories.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Installer Qualifications: An experienced installer who has completed reinforcing installation work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

C. Fabricator Qualifications: An experienced fabricator who has completed reinforcing fabrication work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4, "Structural Welding Code - Reinforcing Steel."

E. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

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

B. Reinforcing Bars: ASTM A 615, Grade 60 ~~for #6 and smaller bars~~or~~,~~ Grade 75 ~~for #7 and larger bars~~as indicated on Drawings, deformed.

C. Low-Alloy-Steel Reinforcing Bars for bars to be welded: ASTM A 706, Grade 60 for #6 and smaller bars, Grade 75 for #7 and larger bars, deformed.

D. Add the following paragraph below for stainless-steel reinforcement. Retain one of two options for reinforcement type.

E. Stainless-Steel Reinforcing Bars: ASTM A 955, Grade 60, [Type 304] [Type 316L], deformed.

F. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60 or ASTM A 706, deformed bars, assembled with clips.

G. Plain-Steel Wire: ASTM A 82, as drawn .

H. Deformed-Steel Wire: ASTM A 496.

I. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

J. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

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

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, or other unacceptable materials.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." Combined tolerances for formwork, reinforcing fabrication, and reinforcing placement shall not permit a reduction in specified concrete cover of reinforcing steel. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken material. Bars used for concrete reinforcement shall meet following requirements for fabricating tolerances:
1. Sheared length: Plus or minus 1 inch.
2. Depth of truss bars: Plus 0, minus ½ inch.
3. Overall dimensions of stirrups, ties, and spirals: Plus or minus ½ inch.
4. Other bends: Plus or minus 1 inch.

B. For bars with end bearing splice couplers, bar ends shall terminate in flat surfaces, within 1.5 degrees of a right angle to axis of bars and shall be fitted within 3 degrees of full bearing after assembly.

2.4 DOWEL BAR ANCHORS/SPLICERS

A. A.Provide dowel bar anchors and threaded dowels designed to develop, both in tension and compression, 125% of the minimum ASTM specified yield strength of the dowel bars, as evidenced by published I.C.B.O. test reports. Unless otherwise indicated, anchors shall be furnished with ACI standard 90 degree hooks. Dowels shall be furnished by anchor supplier. The following dowel splicing systems are acceptable.
1. Richmond Screw Anchor “Dowel Bar Splicer”
2. Erico “Lenton Form Saver”
3. Dayton Barsplice “Grip-Twist”

2.5 MECHANICAL SPLICES

A. A.Provide mechanical splices designed to develop, both in tension and compression, 125% of minimum ASTM yield strength of the smaller bar being coupled, as evidenced by published I.C.B.O test reports. The following bar splicing systems are acceptable.
1. Erico “Cadweld C-Series”
2. Erico “Lenton”
3. Dayton Barsplice “Bar Grip”
4. Dayton Barsplice “Grip Twist”

2.6 METAL ANCHORAGE AND EMBEDDED METAL ASSEMBLIES

A. Steel Shapes and Plates: Conform to ASTM A36, “Specification for Structural Steel”.

B. Headed Stud Anchors: Headed studs welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

C. Welding Electrodes: AWS 5.5, Series E70.

D. Welded Deformed Bar Anchors: Welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

E. All metal assemblies exposed to earth, weather or moisture, including exposure to a crawl space environment, shall be hot dip galvanized.

2.7 FABRICATION OF METAL ACCESSORIES AND EMBEDDED METAL ASSEMBLIES

A. Fabricate and assemble structural steel items in the shop. Shearing, flame cutting, and chipping shall be done carefully and accurately. Holes shall be cut, drilled, or punched at right angles to the surface of metal and shall not be made or enlarged by burning. Holes shall be clean-cut without torn or ragged edges. Welded construction shall conform to AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings,” and AWS D1.1. Welding shall be done by AWS certified welders.

B. Welding of deformed bar anchors and headed stud anchors shall be done by full fusion process equal to that of TRW Nelson Stud Welding Division of KSM Welding Services Division, Omark, Ind. A minimum of two headed studs shall be tested at start of each

production period for proper quality control. Studs shall be capable of being bent 45 degrees without weld failure.

C. Welding of reinforcement shall be done in strict accordance with AWS requirements, using recommended preheat temperature and electrode for type of reinforcement being welded. Bars larger than No. 9 shall not be welded. Welding shall be performed subject to the observance and testing laboratory. Under no circumstances is ordinary reinforcing (ASTM A615) to be welded.

D. Coatings, where required, shall be applied after fabrication and prior to casting concrete.

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.2 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
1. Weld reinforcing bars according to AWS D1.4, where indicated.

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

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

F. Provide minimum concrete covering for reinforcement as shown in the Structural General Notes.

G. Place bars to following tolerances:
   1. Clear distance to formed surfaces: Plus or minus 1/4 inch.
   2. Minimum spacing between bars: Minus 1/4 inch.
   3. Top bars in slabs and beams:
      a. Members 8 inches deep or less: Plus or minus 1/4 inch.
      b. Members between 8 and 24 inches deep: Plus or minus 1/2 inch.
      c. Members more than 24 inches deep: Plus or minus 1 inch.
   4. Crosswise of members: Spaced evenly within 2 inches.
   5. Length of members: Plus or minus 2 inches.

H. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.

I. Support reinforcement and fasten together to prevent displacement by construction loads or placing concrete beyond tolerances indicated.

J. Unless permitted by Engineer, do not bend reinforcement after embedding in hardened concrete.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting: See Section 01 45 23.

B. Inspections:
   1. Steel reinforcement placement.
   2. Steel reinforcement welding.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.

B. Related Sections:
   1. Section 01 45 23 “Structural Testing and Inspection Services”.
   2. Section 03 20 00 "Concrete Forming and Accessories".
   3. Section 03 10 00 "Concrete Reinforcing".
   4. Section 03 11 31 “Void Forms”.
   5. Section 03 15 13 “Waterstops”.
   6. Section 03 05 80 “Under-slab Vapor Barrier – Retarder”.
   7. Section 03 47 13 “Tilt Up Concrete”.
   8. Section 31 63 29 “Drilled Concrete Piers and Shafts”.

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
   1. ACI 301 – Specification for Structural Concrete.
   2. ACI 302 – Guide for Concrete Floor Slab Construction.
   3. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
   4. ACI 305 – Hot Weather Concreting.
   5. ACI 306 – Cold Weather Concreting.
   6. ACI 308 – Guide to Curing Concrete.
   7. ACI 309 – Guide for Consolidating Concrete.
   8. ACI 311 – ACI Manual for Concrete Inspection.
   9. ACI 318 – Building Code Requirements for Reinforced Concrete.
   10. ACI 347 – Guide to Concrete Formwork.

11. ACI 207 – Mass Concrete.
12. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
13. ACI 211.2 – Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
14. ACI 212.3 – Chemical Admixture for Concrete.
15. ACI 212.4 – Guide for the use of High Range Water Reducing Admixtures in Concrete.
16. ACI 214 – Evaluation of Strength Test Results of Concrete.
17. ACI 303 – Guide to Cast in Place Architectural Concrete Practice.
18. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”.

B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 DEFINITIONS

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

1.5 ACTION SUBMITTALS

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

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data for Credit IEQ 4.3: For liquid floor treatments and curing and sealing compounds, documentation including printed statement of VOC content.
3. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for Portland cement or other Portland cement replacements, and for equivalent concrete mixtures that do not contain Portland cement replacements.

C. Design Mixtures: For each concrete mixture include the following information. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Each proposed mix design shall be accompanied by a complete standard deviation analysis based on at least 30 consecutive strength tests, or by three laboratory trial mixtures with confirmation tests.
2. Proportions of cement, fine, and coarse aggregate, and water.
3. Design strength.
4. Maximum slump.
5. Air Content.

6. Maximum water / cement ratio.
7. Maximum and minimum concrete temperature that is acceptable at time of placement for which the manufacturer can guarantee the strength of the concrete.
8. Type cement and aggregates.
9. Type and quantities of all admixtures.
10. Air dry density and splitting tensile strength for lightweight concrete determined in accordance with ASTM 330.
11. Type, color, and quantities of integral coloring compounds, where applicable.
12. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Refer Section 03 20 00.

E. Formwork Shop Drawings: Refer Section 03 10 00.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Semi rigid joint filler.
9. Joint-filler strips.
10. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

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

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: See Section 01 45 23.
   1. Contractor’s responsibility to testing laboratory.
      a. Furnish all labor and materials as required to assist testing agency in obtaining, making and handling samples at the jobsite.
      b. Advise the Owner’s Testing Laboratory sufficiently in advance of operations to allow adequate time for the assignment of testing personnel.
      c. Furnish and maintain adequate facilities for proper curing of concrete test specimens on the project site in accordance with ASTM C31.

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

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

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
   1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.

H. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

1.8 DELIVERY, STORAGE, AND HANDLING

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

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. See Section 03 10 00.

2.2 STEEL REINFORCEMENT

A. See Section 03 20 00.

2.3 REINFORCEMENT ACCESSORIES

A. See Section 03 20 00.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I or Type I/II, gray. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C. Carbon content shall not exceed 3 percent by volume.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years of satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1-1/2 inches, 1 inch, or 3/4 inch nominal as indicated on Drawings for specific uses.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that contain not more than 0.05 percent water soluble chloride ions. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ChemMasters.
      b. Davis Colors.
      c. Dayton Superior Corporation.
      d. Hoover Color Corporation.
      e. Lambert Corporation.
      f. QC Construction Products.
      g. Rockwood Pigments NA, Inc.
      h. Scofield, L. M. Company.
      i. Solomon Colors, Inc.
   2. Color: As selected by Architect from manufacturer's full range.

2.6 FIBER REINFORCEMENT

A. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1 to 2-1/4 inches long.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. 3M; Scotchcast Polyolefin Fibers 2".
      b. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF.
      c. FORTA Corporation; FORTA FERRO.
      d. Grace Construction Products, W. R. Grace & Co.; Strux 90/40.
      e. Nycon, Inc.; XL.
      f. Propex Concrete Systems Corp.; Fibermesh 650.
      g. Sika Corporation; Sika Fiber MS or MS10.

2.7 CONCRETE MIX DESIGNS

A. Selection of Proportions: Proportions of ingredients for concrete mixes shall be determined by a qualified concrete supplier in accordance with the requirements of ACI 301.

B. Required average strength above specified strength: Determination of required average strength above specified strength shall be based on the standard deviation record of the production facility in accordance with ACI 301. Calculation of standard deviation of compressive strength results shall be made in accordance with ACI 214. If a suitable record of strength tests is not available, proportions shall be selected on the basis of laboratory trial batches to produce an average strength greater than the strength f'c by the amount defined in ACI 301.

2.8 VAPOR RETARDERS

A. See Section 03 05 80.

2.9 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 8 sieve.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Anti-Hydro International, Inc.; Emery.
      b. Dayton Superior Corporation; Emery Tuff Non-Slip.
      c. Lambert Corporation; EMAG-20.
      d. L&M Construction Chemicals, Inc.; Grip It.
      e. Metalcrete Industries; Metco Anti-Skid Aggregate.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Anti-Hydro International, Inc.; A-H Alox.
      b. BASF Construction Chemicals - Building Systems; Frictex NS.
      c. L&M Construction Chemicals, Inc.; Grip It AO.

2.10 LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ChemMasters; Chemisil Plus.
      b. ChemTec Int'l; ChemTec One.
      c. Conspec by Dayton Superior; Intraseal.
      d. Curecrete Distribution Inc.; Ashford Formula.
      e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
      f. Edoco by Dayton Superior; Titan Hard.

g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
h. Kaufman Products, Inc.; SureHard.
i. L&M Construction Chemicals, Inc.; Seal Hard.
j. Meadows, W. R., Inc.; LIQUI-HARD.
k. Metalcrete Industries; Floorsaver.
l. Nox-Crete Products Group; Duro-Nox.
m. Symons by Dayton Superior; Buff Hard.
n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Advanced Floor Products; Retro-Plate 99.
b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
c. QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

2.11 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
b. BASF Construction Chemicals - Building Systems; Confilm.
c. ChemMasters; SprayFilm.
d. Conspec by Dayton Superior; Aquafilm.
e. Dayton Superior Corporation; Sure Film (J-74).
f. Edoco by Dayton Superior; BurkeFilm.
g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; Vapor-Aid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
      b. BASF Construction Chemicals - Building Systems; Kure 200.
      c. ChemMasters; Safe-Cure Clear.
      d. Conspec by Dayton Superior; W.B. Resin Cure.
      e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
      f. Edoco by Dayton Superior; Res X Cure WB.
      g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
      h. Kaufman Products, Inc.; Thinfilm 420.
      i. Lambert Corporation; AQUA KURE - CLEAR.
      j. L&M Construction Chemicals, Inc.; L&M Cure R.
      k. Meadows, W. R., Inc.; 1100-CLEAR.
      l. Nox-Crete Products Group; Resin Cure E.
      m. Right Pointe; Clear Water Resin.
      n. SpecChem, LLC; Spec Rez Clear.
      o. Symons by Dayton Superior; Resi-Chem Clear.
      p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
      q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Kure 1315.
      b. ChemMasters; Polyseal WB.
      c. Conspec by Dayton Superior; Sealcure 1315 WB.
      d. Edoco by Dayton Superior; Cureseal 1315 WB.
      e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
      f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
      g. Lambert Corporation; UV Safe Seal.
      h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
      i. Meadows, W. R., Inc.; Vocomp-30.
      j. Metalcrete Industries; Metcure 30.
      k. Right Pointe; Right Sheen WB30.
      l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
      m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
   2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.12 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.13 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.14 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, as indicated in Structural General Notes.

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

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.15 NON-SHRINK GROUT

A. Grout shall be prepackaged, non metallic, and non gaseous. It shall be non-shrink when tested in accordance with ASTM-C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees to 90 degrees Fahrenheit. Grout shall be bleed free and attain 7,500 psi compressive strength in 28 days at fluid consistency. Certified independent test data required. Approved products include the following:
   1. “Euco NS” by Euclid Chemical Company
   2. “Masterflow 713” by Master Builders.

2.16 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as indicated in Structural General Notes:

2.17 FABRICATING REINFORCEMENT

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

2.18 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

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

PART 3 - EXECUTION

3.1 FORMWORK

A. See Section 03 10 00.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. See Section 03 10 00.

3.4 SHORES AND RESHORES

A. See Section 03 10 00.

3.5 VAPOR RETARDERS/BARRIERS

A. See Section 03 05 80.

3.6 STEEL REINFORCEMENT

A. See Section 03 20 00

3.7 JOINTS

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

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

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are specified or otherwise indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

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

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

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Do not permit concrete to drop freely any distance greater than 10’-0” for concrete containing a high range water reducing admixture or 5’-0” for other concrete. Provide chute or tremie to place concrete where longer drops are necessary. Do not place concrete into excavations with standing water. If place of deposit cannot be pumped dry, pour concrete through a tremie with its outlet near the bottom of the place of deposit.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

H. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. See Section 03 10 00.

3.10 FINISHING FLOORS AND SLABS

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

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces indicated and/or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated and/or to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated and/or exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces according to ASTM E 1155, for a randomly trafficked floor surface.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistivegranules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive granules.

3.11 Concrete Floor Finish Tolerances

A. Interior Finish Floor surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System." The following values apply before removal of shores. Levelness values F(L) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.
1. Exposed, vinyl tiled, or thin-set tiled floors: Specified overall values of flatness, Ff =35; and levelness, Fl =25; with minimum local values of flatness, Ff =24; and levelness, Fl =17.
2. Carpeted floors, floors under concrete toppings, thickset tile and terrazzo: Specified overall values of flatness, Ff =25; and levelness, Fl = 20; with minimum local values of flatness, Ff =17; and levelness, Fl =15.

B. Floor Elevation Tolerance Envelope:
1. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:
a. Slab-on-Grade, or Slab-on-Void Construction: +/- 3/4"
b. Top surfaces of formed slabs measured prior to removal of supporting shores: +/- 3/4"
c. Top surfaces of all other slabs: +/- 3/4"
d. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10'-0" at any point, up to 3/4" from theoretical elevation at any point.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

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

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

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

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

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturers written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 28 days' old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
   1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
   2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
   3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
   4. Control and dispose of waste products produced by grinding and polishing operations.
   5. Neutralize and clean polished floor surfaces.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six month(s). Do not fill joints until construction traffic has permanently ceased.

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

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

3.16 CONCRETE SURFACE REPAIRS

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

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

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

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

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

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: See Section 01 45 23.
1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
2. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Face brick, including solids.

B. Mortar, grout, reinforcement, anchorages, flashing, and accessories shown, specified, or required to complete Work.

C. Calcium silicate masonry units (Synthetic Stone Veneer).

1.3 REFERENCES

A. ASTM International (ASTM)
1. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron & Steel Hardware.
2. A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
3. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. A706, Standard Specification for Low-Alloy Steel Deformed Bars for Concrete.
5. A951, Standard Specification for Masonry Joint Reinforcement.
6. C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
7. C90, Standard Specification for Loadbearing Concrete Masonry Units.
8. C140, Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units
9. C144, Standard Specification for Aggregate for Masonry Mortar
10. C150, Standard Specification for Portland Cement
11. C207, Standard Specification for Hydrated Lime for Masonry Purposes
12. C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
13. C270, Standard Specification for Mortar for Unit Masonry
14. C331, Standard Specification for Lightweight Aggregates for Concrete Masonry Units
15. C332, Standard Specification for Lightweight Aggregates for Insulating Concrete
16. C404, Standard Specification for Aggregates for Masonry Grout
17. C476, Standard Specification for Grout for Masonry
18. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
19. C652, Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
20. C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
21. C979, Standard Specification for Pigments for Integrally Colored Concrete
22. D226, Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
23. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
24. E119, Standard Test Methods for Fire Tests of Building Construction and Materials

B. Underwriters' Laboratories, Inc. (UL)

1.4 QUALITY ASSURANCE

A. Where requirements of this Section are in conflict with requirements noted on the Structural Drawings, the Structural Drawings shall take precedence. Refer to Structural Drawings for information on load-bearing CMU walls.

B. Fire Performance Characteristics: Where indicated or required, provide materials and construction which are identical to assemblies whose fire endurance has been determined by testing in compliance with ASTM E119 by U.L. or other recognized testing and inspection organization or by other means, acceptable to authority having jurisdiction.

C. Masonry Cleaning: Workers shall have minimum 5 years of masonry cleaning experience, and shall be approved by cleaner manufacturer prior to application of cleaning material, and shall meet with cleaner manufacturer for demonstration and instruction s for use of product prior to application.

D. Single Source Responsibility:
   1. For Masonry Units: Obtain masonry units of uniform texture and color, or a uniform blend within the accepted ranges for those characteristics, from one (1) manufacturer for each different product required for each continuous surface or visually related surfaces.
   2. For Mortar and Grout Materials: Brands of cementitious materials and admixtures, and the source of supply of sand and aggregates shall remain the same throughout the Work where exposed to view and where not scheduled to receive a subsequently applied finish, i.e. parging, painting, etc., unless directed otherwise in writing by the Architect.
   3. Contractor's Responsibility: Contractor performing Work of this Section shall be responsible for coordinating with others performing Work which is built-in or adjacent to unit masonry Work.

1.5 SUBMITTALS

A. Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

B. Samples: Two (2) sets of color chips representing manufacturer's full range of available colors and textures of each face brick for Architect's selection and approval.

C. Sample Panel(s):
   1. Do not start masonry until Architect has approved samples.
   2. Sample panel shall be 10 feet long by 8 feet high showing selected color range and texture, bonding, joint shape, and quality of workmanship. Include a brick and expansion joint, and any specialty details, such as reveals, soldier courses, etc. Include mock-up of installation of thru-wall flashing at foundation sill and lintel above openings.
   3. Brace and support as required to withstand structural windloads.
   4. A separate panel for each type of masonry and back up wall used is required.
   5. Sample panel(s) shall remain at the jobsite until the approval of the Architect, Owner and commissioning consultant agree it can be removed.
   6. Installed materials shall be visible and integrated into adjacent materials including exterior wall penetrations, pipe penetrations, exterior cameras, hose bibs, etc.

D. Certification: Submit manufacturer's affidavit that materials used in Project contain no asbestos.

E. Mortar and Grout Mix Designs: Submit two (2) copies of proposed mortar and grout mix designs to Owner's testing laboratory.

1.6 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 – Project Management and Coordination.

1.7 TESTS AND INSPECTIONS

A. Materials and installation of masonry shall be subject to testing and inspection by an independent testing laboratory. Such tests and inspections shall not relieve Contractor of responsibilities for providing materials and procedures which comply with Contract Documents. Promptly remove and replace materials which do not comply.

B. Owner will select Inspection and Testing Laboratory and will pay for all Work required by Inspection and Testing Laboratory.

1.8 DELIVERY, STORAGE AND PROTECTION

A. Deliver and store materials in dry protected areas off ground. Keep free of stain or other damage before, during and after installation. Replace any damaged material at no cost to Owner.

B. During freezing weather, protect masonry units with tarpaulins or other suitable material. Keep free of stain or other damage before, during and after installation. Replace damaged material at no cost to Owner.

C. Protect reinforcement and accessories from elements.

1.9 SITE CONDITIONS

A. Cold Weather Protection:
   1. No masonry shall be laid when the temperature of the outside air is below 40 degrees F, unless protection measures are employed and pre-approved by the Architect.
   2. Protection measures for cold weather erection include maintaining space and masonry unit temperatures of at least 40 degrees F for 48 hours prior to and after erection.

B. Hot Weather Protection:
   1. When the mean daily temperature exceeds 100 degrees F or exceeds 90 degrees F with a wind velocity greater than 8 mph, fog spray all newly constructed masonry until damp, at least three (3) times a day until the masonry is three (3) days old. Each fog spray application shall be at least 3 hours after the previous spray.

1.10 BRACING OF MASONRY DURING ERECTION

A. All masonry shall be adequately braced at all times during erection.

1.11 COORDINATION

A. Openings and chases for heating, plumbing, electrical ducts, pipes, and conduits shall be built into masonry walls as required. Provide for installation of bolts, toggles, flashings, beams, anchors, hangers, nailing strips, wall plugs, and frames as required. Consult other trades in advance and make provisions for installation of their Work to avoid cutting and patching. Coordinate installation of steel reinforcement for reinforced masonry. Coordinate placement of concrete in masonry beams, lintels, soffits, and pilasters.

1.12 WARRANTY

A. Warrant the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Noticeable deterioration of unit or mortar finish.
   2. Chalking or dusting excessively.
   3. Changing color in irregular fashion.
   4. Cracking or spalling.
   5. Releasing from substrate.
   6. Staining or discoloring, including efflorescence.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Specifications are based on products of manufacturers named within the specifications. Other manufacturers must have a minimum of five (5) years experience manufacturing products equal to those specified and comply with requirements of Division 1 regarding substitutions to be considered.

2.2 MATERIALS

A. Concrete Masonry Units (CMU/Block):
   1. Basis of Design: Headwaters Construction Materials. Other approved manufacturers are subject to compliance with requirements:
      a. Builders Concrete Products
      b. Eagle-Cordell Concrete Products
      c. Featherlite Building Products
      d. Innovative Precast Concrete Products (IPC)
      e. Palestine Concrete Tile Co.
      f. Revels Block & Brick Co., Inc.
      g. Southwest Concrete Products
      h. Texas Building Products, Inc.
      i. Texas Industries, Inc.
      j. Trenwyth Industries, Inc.

   2. Exterior exposed block: Split face units with 8 inch by 16 inch face dimensions as shown on drawings or required, 12 inch depths as indicated on drawings.
      a. Color:
         1. CMU-1 (12x8x16): Gray Integral Color

   4. Specification: Comply with ASTM C90 (Class D-2 (2 hour) and Class B-4 (4 hour)) block at rated walls)
      a. Grade: Type N, highest standard for typical cavity block and interior use. Type S, for exterior exposed masonry walls.
      b. Aggregate: Lightweight in accordance with ASTM C331.

   5. Curing: Rotary kiln process.
   6. Provide bullnose units at all outside corners.
   7. Provide bond beams, control joints, jambs, lintels, soaps, cap blocks, and fillers to match and compliment block units as shown or required.

C. Flashing and Accessories:
1. Copper Laminated Flashing: See 3.3 (I) (2), application guidelines for locations.
a. Flashing: A full sheet of copper weighing five (5) ounces per square foot coated or bonded on both sides with one (1) of the following:
1) Modified asphalt compound coated.
2) Asphalt saturated, waterproof glass fiber laminated fabric.

b. Approved Manufacturers:
1) Advanced Building Products, Inc.
2) Hohmann & Barnard, Inc.
3) Sandell Manufacturing Company, Inc.
4) York Manufacturing, Inc.

c. Mastic: manufacturer recommended asphalt troweled mastic for sealing copper laminated flashings.

2. Asphalt-free Copper Fabric Flashing (Contractors Option):
a. Glass fabric scrim bonded to a full sheet of copper for general thru-wall flashing as an alternative to asphalt coated copper specified above and where sealant compatibility is required. Provide manufacturers approved seam tape.
b. Approved Product/Manufacturer: Multi-flash 500 as manufactured by York Manufacturing, Inc,; or Copper-Tuff as manufactured by Hohmann & Barnard, Inc. (No other substitutions).

3. Membrane Flashing: See 3.3 (I) (2), application guidelines for locations.
a. Self-Adhered Flexible Flashing: 40-mil, rubberized asphalt adhesive reinforced flashing with a high density cross laminated polyethylene film. Provide compatible substrate primer as instructed by manufacturer.
b. Approved Products/Manufacturers:
1) “TW-Thru Wall Flashing” manufactured by Tamko Waterproofing.
3) “Perm-A-Barrier” manufactured by W. R. Grace & Co.
4) “Blueskin TWF” manufactured by Henry Company
5) “Bitu-Rap” manufactured by Nervastral, Inc.
6) “Air-Shield” manufactured by W.R. Meadows, Inc.
7) “AquaFlash 500” manufactured by Fiberweb.

4. Substrate Primer: as instructed by membrane manufacturer
5. Termination Bar: 1/8 inch thick by 1 inch minimum wide stainless steel, w/ pre-punched holes, and self-tapping screws.

D. Mortar:
1. Materials: (Unless stated otherwise on Structural Drawings)
a. Portland Cement: ASTM C150, Type 1.
b. Hydrated Lime: ASTM C207, TYPE “N”, typical. Use TYPE “S” for load-bearing masonry.
c. Aggregate: Sand conforming to ASTM C144
d. Water: Clean and potable
e. Admixtures For Mortar:
1) General: Do not use calcium chloride
2) Concrete Masonry Units: Shall be standard color.
3) Face Brick: Standard un-colored.

2. Mix Design: (Proportions by volume) (Unless stated otherwise on Structural Drawings)
a. Typical, Non-load bearing masonry
1) Type: ASTM C270, Type “N”

2) Proportions: 1 part cement, 1 part hydrated lime and 6 parts sand to provide a compressive strength of 750 psi in 28 days. Do not use calcium chloride.

b. Load bearing structural masonry
1) Type: ASTM C270, Type “S”
2) Proportions: 1 part cement, 1/2 part hydrated lime and 4-1/2 parts sand to provide a compressive strength of 1800 psi in 28 days. Do not use calcium chloride.

E. Grout:
1. Materials: (Unless stated otherwise on Structural Drawings)
a. Hydrated Lime: ASTM C207, TYPE “S”
b. Portland Cement: ASTM C150, Type 1.
c. Water: Clean and potable
d. Aggregates:
1) Course aggregate shall conform to ASTM C404.
2) Fine aggregate shall conform to ASTM C144.

2. Mix Design: (Unless stated otherwise on Structural Drawings)
a. Comply with ASTM C476 to provide a compressive strength of 2,500 psi in 28 days, unless noted otherwise. Do not use calcium chloride.
1) Fine Grout: Fine grout conforming to ASTM C476 and consisting of 1 part Portland cement, 0 to 1/10 part lime and 2-1/4 to 3 parts sand by volume.
2) Course Grout Mix: Course grout conforming to ASTM C476 and consisting of 1 part Portland cement, 0 to 1/10 part lime and 2-1/4 to 3 parts sand, and 1 to 2 parts course aggregate.

F. Reinforcement, Anchors and Tie Systems:
1. General: Reinforcement used in all wythes shall be galvanized after fabrication in accordance with ASTM A153, Class B-2.
2. Approved Manufacturers include the following:
a. Heckmann Building Products
b. Hohmann & Barnard, Inc
c. Wire-Bond.

3. At solid multiple wythe masonry walls and single wythe masonry walls, (Interior partitions) use #9 gauge truss type reinforcing. Pre-fab corners and tees shall be used at all wall corners and intersections; width shall be two (2) inches less than nominal thickness of walls. Wire-Bond or Hohmann & Barnard "Truss" at single wythe; "Trirod" at multiple, or Architect approved equal.
4. Control Joint Anchor: Equal to Heckmann Building Products, Inc. No. 351 Anchor.

G. Precast Concrete U-Lintels:
1. Concrete Materials:
a. Portland Cement: ASTM C150 Type I or III, gray color
b. Aggregates: ASTM C33
c. Water: potable
d. Admixtures: Shall not contain calcium chloride or chloride ions.

2. Reinforcing:
a. Deformed Reinforcement: ASTM A615 Grade 40 or 60
b. Prestressing Strand: ASTM A416 270 ksi LL.

3. Fabrication:

a. Unless specified otherwise, conform to PCI MNL-116
b. U-lintel units 14 feet in overall length and shorter shall be made of concrete with a minimum strength of 3500 psi at 28 days.
c. U-lintel units exceeding 14 feet in overall length shall be made of concrete with a minimum strength of 6000 psi at 28 days and shall be prestressed concrete.
d. Units shall be sand block finish except prestressed, 6 inch wide, and 12 inch wide U-lintels shall be smooth form finished.
e. Tolerances shall be per PCI MNL-116
f. Minor patching in plant is acceptable provided structural adequacy of units is not impaired.

4. Acceptable Product/Manufacturer: Cast-Crete High Strength Precast Concrete U-lintels as manufactured by Cast-Crete, Tampa, FL (800) 999-4641, and locally distributed by Headwaters, (713) 365-9077.

H. Miscellaneous Materials: (As shown or required)
1. Reinforcing Steel: ASTM A615, Grade 60.
2. Forms: Form grade plywood with wood studs and wales as required.
3. Shores: Patented shores of design and manufacture sufficient to safely support imposed loads.
4. Premolded Filler: Fibrous mastic strips containing 35 percent to 50 percent asphaltic impregnation, ASTM D1751.
5. Flashing Cement: "Nervaplast" cold setting mastic manufactured by Nervastral, Inc., or Architect approved equal.
6. Building Felt: No. 15 asphalt saturated felt, ASTM D226.
7. Dovetail Anchors: 16 gauge galvanized dovetail corrugated masonry anchor, 1 inch x 3-1/2 inch manufactured by AA Wire Products Co., Heckman Building Products, Inc., Dur-O-Wal, Inc., Hohmann & Barnard, Inc., Masonry Reinforcing Corporation of America, or Architect approved equal.
8. Steel Shapes and Plates: As shown on drawings and specified in Section 05 50 00, Miscellaneous Metals.
9. Headed Stud Anchor: Welded by full-fusion process as furnished by TRW Nelson Stud Welding Division, or Architect approved equal.
10. Bolts: ASTM A307. Furnish with carbon steel washers.
11. Deformed Bar Anchors: Welded by full-fusion process as furnished by TRW Nelson Stud Welding Division, or Architect approved equal.
12. Reinforcing Bars to be Welded: ASTM A706.
13. Cavity Drainage Protection: 2 inch thick by 10 inch high by 5 feet long recycled polyester/ polyethylene mesh, trapezoidal-shaped, continuous at foundation, at heads above openings, and shelf angles as indicated on drawings. Provide Mortar Net™ manufactured by Mortar Net USA, Ltd., Gary, IN; (800) 664-6638, or Architect approved equal.
14. Masonry Color: Iron oxide pigment conforming to ASTM C979 in color(s) selected by Architect, shall be inert, stable to atmospheric conditions, sunfast, weather resistant, alkali resistant, water insoluble, and free of fillers and extenders, as manufactured by ChemSystems, Inc., Davis Colors, Solomon Grind-Chem Service, Inc., or Architect approved equal.
15. Weep Hole Vents: Brick Vent as manufactured by Williams Products, Inc. consisting of Injection molded PVC designed to fit in head joint in an offset "T" shape, allowing air to pass in and water to weep out. Weep hole vents shall be sized to match masonry (may require custom sizing).

2.3 MASONRY STRENGTH

A. Ultimate compressive strength of masonry as required by design and determined by prism tests shall not be less than 1,800 psi, unless stated otherwise in Structural Drawings.

2.4 MASONRY CLEANING MATERIALS

A. Water: Clean, potable, and free of oils, acids, alkalis, salts, and organic matter. Use to rinse masonry surfaces and dilute concentrated cleaners.

B. Cleaner: "Deox" chemical cleaner manufactured by National Chemsearch, or "Sure Klean" manufactured by ProSoCo, Inc., or Tex Clean Plus" manufactured by AHI Supply, L.P.; or Architect approved equal. Verify product use based on masonry color being cleaned as instructed by manufacturer.

C. Muriatic acid is not permitted.

D. The following products based on Prosoco Sure Klean® products are intended as a guide only and does not preclude the contractors use of equal products by listed manufacturers. Consult manufacturer prior to application for any questions or inconsistencies.

Substrate	Color/Type	Cleaning Solution
Brick	Red	Tex Clean Masonry Cleaner
	Light	Tex Tral Masonry Cleaner
	Dark	Tex Tral Masonry Cleaner
	Pavers	Tex Clean Masonry Cleaner
	Glazed	Tex Tral Masonry Cleaner
CMU	Split Face	Tex Tral Masonry Cleaner
	Burnished/Ground Face	Tex Tral Masonry Cleaner
Architectural Concrete	Natural Color/Smooth	Tex Tral Masonry Cleaner
	Textured	Tex Clean Masonry Cleaner
Stone Construction	Cast Stone	Tex Tral Masonry Cleaner
	Arriscraft	Tex Tral Masonry Cleaner
	Limestone (Unpolished)	Tex Tral Masonry Cleaner

PART 3 - EXECUTION

3.1 FORMS AND SHORES

A. Provide forms and shores sufficiently strong and rigid as required to support soffits, beams, and lintels during construction.

B. Build forms to conform to shape, line, and dimension of masonry members as detailed, substantial and sufficiently tight to prevent leakage of mortar, grout or concrete. Properly brace or tie together so as to maintain position and shape.

3.2 PREPARATION OF MATERIALS

A. Concrete Masonry Units:
   1. Where cutting is required, masonry shall be cut with a sharp masonry saw.
   2. Ensure concrete masonry units to receive sand fill are ready for filling and cutouts are protected from material spillage.

B. Brickwork: Dampen brick before laying in a manner consistent with the nature of the brick, the mortar, and the weather conditions.

C. Mortar and Grout:
   1. Use suitable containers for material measurement. Measuring sand by the shovel is not acceptable.
   2. Thoroughly machine mix a minimum of five (5) minutes after all materials are in mixer.
   3. Consistency will completely fill all spaces intended to receive grout.
   4. Use within 2-1/2 hours of initial mixing.
   5. Mortar or grout shall not be used if curing has progressed to yield a stiff consistency.

D. Reinforcement:
   1. Reinforcement shall be free from loose rust and other coatings that would reduce the bond.
   2. Cut accurately to length and bend by such methods as will prevent injury to the material.
   3. Straighten out kinks or bends.

E. Flashing:
   1. Locations: Install in exterior walls to divert moisture within walls to exterior surfaces.
   2. Bed Joints: Coordinate Work with Division 4, Masonry. Install flashings between two (2) thin layers of masonry mortar without increasing thickness of mortar joint. Keep outer edge of flashing material ½ inch from exterior face of masonry.
   3. Adjacent Work: Protect Work by masking, covering, or other precautionary methods. Remove protection when no longer necessary.
   4. Separate copper flashing from dissimilar materials.
   5. Protect membrane flashing from overexposure to direct sunlight.

3.3 INSTALLATION

A. General:
   1. Do not use chipped or cracked concrete masonry units (CMU) and face brick, where exposed to view.
   2. Use masonry saws to cut and fit exposed units.
   3. Exposed masonry at exterior corners shall be solid units.
   4. Clean surface of masonry smooth and free from projections which might puncture or otherwise damage flashing material.
   5. Place through-wall flashing as follows:
      a. Place on bed of mortar and cover with mortar.
      b. Provide at steel columns and beams in exterior masonry walls and elsewhere as indicated on the drawings or required.
      c. Install asphalt laminated copper membrane as base flashing at all exterior cavity walls below weep holes.
      d. Install at material transitions inside exterior cavity walls, roof edge/exterior wall transitions, masonry joints (control/expansion) inside exterior cavity walls,

exterior wall sill/weep conditions, exterior door and window frame perimeters, roof deck/exterior wall transitions, exterior wall penetrations (i.e. pipe, conduit, ducts, etc.). Provide membrane at all joints, holes, gaps or openings to ensure a continuously sealed building envelope.

6. Lay masonry units plumb, true to line, and with level courses accurately spaced within allowable tolerances.
7. Do not furrow bed joints.
8. Stop off horizontal run by racking back in each course; toothing is not permitted.
9. Adjust units to final position while mortar is soft and plastic.
10. If units are displaced after mortar has stiffened, remove, clean joints and units and re-lay with fresh motor.
11. When joining fresh masonry to set or partially set masonry:
    a. Remove loose masonry units and mortar
    b. Clean and lightly wet exposed surface of set masonry prior to laying fresh mortar.

B. Metal Door Frames:
1. Fill jamb frames solid with mortar. Build in anchors.
2. Provide suitable backer material inside of door frame so the silencers can be securely installed in door frames after grouting.

C. Lintels and Bond Beams: Provide reinforced unit type, except where steel lintels are shown. Use reinforcing bars as shown on the drawings. Completely fill in lintel block and bond beams with grout. Provide a minimum of 8 inch bearing at end of lintels.

D. Corners: Connect corners with No. 9 galvanized wire or corrugated tie using one tie for each 4 inches of nominal wall thickness.

E. Partition Tops: Allow space at top of horizontal spanning walls for compressible joint back-up and sealant as specified in Sealant section. Anchor top of walls to deck or structure. Reference Structural details for any additional bracing requirements.

F. Mortar Beds:
1. Place mortar in a manner which will result in the development of adequate bond between the masonry and the reinforcement.
2. Lay units with full mortar coverage on horizontal and vertical joints in all courses.
3. Provide sufficient mortar on ends of masonry unit to fill head joints.
4. Rock closures into place with head joints thrown against two adjacent masonry units in place.
5. Do not pound corners or jambs to fit stretcher units after setting in place.
6. Where adjustment to corners or jambs must be made after mortar has started to set, remove mortar and replace with fresh mortar.

G. Mortar Joints and Patterns:
1. Lay CMU in running one-half (1/2) bond pattern, unless noted otherwise.
2. Lay brick in running one-third (1/3) bond pattern, unless noted otherwise on drawings. Refer to drawings for accent coursing.
3. Provide flush joints where concealed from view and where dampproofing is scheduled.
4. Provide standard concave tooled joint where masonry is exposed to view for brick and CMU, typically.
5. All mortar joints to be of consistent size.
6. Provide soldier courses where indicated, refer to the elevations.
7. All horizontal joints shall be concave tooled joint at face of units, unless noted otherwise.

H. Reinforcement, Anchor and Tie Systems:
1. General:

a. Completely embedded in mortar or grout.
b. All reinforcement consisting of bars or wire 1/4 inch or less in diameter embedded in the horizontal mortar joints shall have no less than 5/8 inch mortar coverage from the exposed face.
c. Where modular brick is used with brick coursing at 16 inches on center, provide ladder reinforcing within each wythe at 16 inches o.c. vertically for exterior wythe and back-up wythe, whether detailed or not. For other than modular brick, refer to Paragraph h. below.
d. Veneer anchors at exterior sheathed covered metal stud exterior walls shall be attached on outside face of sheathing using cadmium plated sheet metal screws. Spacing shall be same as stud spacing o.c. horizontally and 16 inches o.c. vertically.
e. Veneer anchors at Interior brick walls with metal stud back-up shall be the same as Paragraph “d” above, except anchors shall be attached directly to metal stud with recommended corrosion resistant fasteners in accordance with manufacturer’s recommendations.
f. At intersection of all perpendicular masonry walls provide two (2) vertical rows of ladder type reinforcing at 16 inches o.c. vertically.
g. Weld veneer anchors to structural steel in accordance with manufacturer’s recommendations. Touch-up steel shop paint and galvanized coating on anchor with proper touch-up paint to match damaged coating in accordance with manufacturer’s recommendations.
h. In cavity walls with CMU back-up, embed truss type horizontal reinforcement with integral adjustable pintle wall ties every 16 inches o.c. vertically.
i. Splices in reinforcement: Splices may be made only at such points and in such manner that the structural strength of the member will not be reduced. Lapped splices shall be eight (8) inches. Welded or mechanical connection shall develop the strength of the reinforcement.
j. Corrugated strap ties shall not be used as veneer anchors at exterior or where subject to moisture. Their use in interior, dry conditions are acceptable.
k. Place joint reinforcement in the first two (2) bed joints above and the first two (2) bed joints below masonry openings. Extend extra reinforcing two (2) feet beyond jambs.
l. Provide masonry ties at floor and roof decks as indicated.

I. Flashing:
1. Follow manufacturer’s instructions for mechanically fastened installation with a termination bar.
2. Application Guidelines - Install flashing at the following locations:
a. Membrane Flashing: material transitions inside exterior cavity walls, roof edge/exterior wall transitions, masonry joints (control/expansion) inside exterior cavity walls, exterior door and window frame perimeters, roof deck/exterior wall transitions, exterior wall penetrations (i.e. pipe, conduit, ducts, etc.). Provide membrane at all joints, holes, gaps, or openings to ensure a continuously sealed building envelope. Utilize primer on substrates as instructed by manufacturer.
b. Membrane Flashing: At all horizontal wall flashing, including (but not limited to) exterior wall sill/weep conditions, exterior door and window head/weep conditions, masonry wall cap flashing and masonry wall base flashing.

3. Apply substrate primer as instructed by membrane manufacturer to suit condition.
4. Provide drip edge flashing at weep conditions with membrane flashing. Cut membrane flush with outside edge of brick over top of drip edge flashing to alleviate exposure to UV degradation and deterioration of asphalt membrane.
5. On Horizontal Surfaces: The flashing shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. The flashing shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried

through the wall, turned up where possible to facilitate drainage through the weepholes, then carried upward across the cavity a minimum of six (6) inches. Flashing will then be secured in back wall with termination bar.

6. On Vertical Surfaces: Surfaces receiving the flashing shall be sufficiently spotted with asphalt mastic to hold in place until masonry is set. Secure in back wall with termination bar.
7. Foundation Sill Dampproofing: The flashing for foundation sills shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. The flashing shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be sloped across the cavity and turned up the wall a minimum of ten (10) inches and secured to back wall with termination bar. Where sill and column meet, flashing shall be brought up a minimum of ten (10) inches up the column.
8. Thru-Wall Flashing: Shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Carry flashing through the wall, turned up where possible to facilitate drainage through the weepholes, then carried upward across the cavity a minimum of six (6) inches, unless noted otherwise, and secure in back wall with termination bar.
9. Cavity Wall: Flashing shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. Flashing shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall and upward across the cavity a minimum of six (6) inches, unless noted otherwise, and secured in the back wall with termination bar. Vertical membrane joints shall be secured with termination bar as instructed by membrane manufacturer.
10. Heads and Sills: Flashing for heads and sills shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall and upward across the cavity a minimum of six (6) inches, unless noted otherwise. Head flashing shall be carried six (6) inches beyond both end of the steel lintel. Both head and sill flashing shall be turned up at the sides to form a pan. All corners shall be folded, NOT CUT. Install weepholes.
11. Spandrels: Spandrel flashing shall start from the outside toe of the shelf angle, go up the face of the beam and then through the wall, turned up on the inside not less than two (2) inches. Install weepholes.
12. Parapet or Coping: Flashing for parapets or coping sills shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. Flashing shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Weepholes shall be installed immediately on top of the flashing.
13. Lengths: Install flashings without longitudinal joints within walls, if possible. If required materials are not available in a single width, join by lapping material minimum two (2) inches and seal joint throughout its length with adhesive.
14. End Joints: Avoid end joints in flashing. When end joints are necessary, lap flashing minimum six (6) inches and seal joint continuously with adhesive.
15. Penetrations: Where anchors, pipes, and inserts penetrate flashing, make opening in flashing snug and seal with adhesive.
16. Reglet Termination: Insert wedge into place and seal carefully with adhesive
17. Termination Bar: Install flashing with termination bars in accordance with manufacturer's instructions. Provide 3 coursing at all termination bars, typical.
18. Top Coat: After flashing material is in place (except in masonry joints where bond and mortar is required) trowel full 1/8 inch protective coating or mastic on all flashing faces.

J. Laying Masonry: Lay units plumb, level, and true to line with full head and bed joints. Butter ends of masonry with sufficient mortar to fill head joints. Do not furrow bed joints. Slope top of bed joint toward center of wall to minimize amount of mortar forced into grout space. Remove mortar, protruding from joints into grout space, before pouring grout.

K. Reinforcing Bars:

1. Hold vertical bars in position at top and bottom and at intervals not exceeding eight 8 feet-0 inches with a minimum clearance of 1/4 inch from masonry and not less than one (1) bar diameter between bars.
2. When a foundation dowel is not in alignment with a vertical block cell or pilaster, slope it not more than one (1) horizontal in six (6) vertical to bring it into proper alignment before grouting.
3. Place horizontal reinforcing bars in continuous masonry courses, consisting of bond-beam or trough block units, and solidly grout in place.
4. Use straight reinforcing bars except for bends around corners and where bends or hooks are detailed on plans.
5. Lap reinforcing steel 40 bar diameters minimum where spliced and wire together.

L. Grouting: Where detailed place grout in reinforced masonry beams, walls, columns, and pilasters. All cells and spaces containing reinforcing bars shall be filled with grout. Wherever possible grouting shall be done from inside face of masonry. Exercise extreme care to prevent grout from staining face of masonry. Immediately remove any spilled grout from face and top of masonry.
1. Prior to grouting clean space so that all spaces to be filled with grout do not contain mortar projections greater than 1/2 inch, mortar droppings or other foreign material. Grout shall be placed so all spaces designated to be grouted shall be filled with grout and grout shall be confined to those specific spaces.
2. Grout materials and water content shall be controlled to provide adequate fluidity for placement, without segregation of constituents and shall be mixed thoroughly.
3. Between grout pours a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with grout stopping a minimum of 1-1/2 inches below a mortar joint, except at top of wall. Where bond beams occur, stop grout pour a minimum of 1/2 inch below top of masonry.
4. Reinforcement shall be placed prior to grouting. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent movement.
5. Segregation of grout materials and damage to masonry shall be avoided during the grouting process. Adequately brace masonry to prevent displacement or cracking during grouting operations.
6. Grout shall be consolidated by mechanical vibrator during placing, before loss of plasticity, in a manner to fill grout space. Grout pours greater than 12 inches shall be reconsolidated by mechanical vibration to minimize voids due to water loss. Grout pours 12 inches or less in height shall be mechanically vibrated, or puddled.
7. Grout shall not be handled nor pumped utilizing aluminum equipment.
8. Size and height limitations of grout space or cell shall be as follows:

GROUT TYPE	GROUT POUR MAX. HEIGHT (FEET)	LEAST CLEAR DIMENSIONS		CLEANOUTS REQUIRED
		Width of Grout Space (In.)	CMU Cell Dim. Dims. (In. x In.)	
Fine	1	3/4	1-1/2 x 2	No
Fine	5	1-1/2	1-1/2 x 2	No
Fine	8	1-1/2	1-1/2 x 3	Yes
Coarse	1	1-1/2	1-1/2 x 3	No
Coarse	5	2	2-1/2 x 3	No
Coarse	8	2	3 x 3	Yes

a. Clear dimension is the cell or grout space width less mortar projections.
b. Grout space width shall be increased by the horizontal projection of the diameters of horizontal bars within the cross section of the grout space.

9. Place grout in lifts not exceeding 8 feet-0 inches.

M. Concreting: Supervise placing of concrete in cores of masonry beams and lintels and over masonry soffits where structural concrete is detailed. Report discrepancies or procedures which may adversely affect performance of masonry Work.

N. Brick Weepholes:
1. Provide weepholes above all thru-wall flashings where weepholes occur at the base of the wall. The mason shall coordinate the location of the thru-wall flashings with the elevation of the sidewalks and planting beds on the civil engineering drawings. Both weepholes and thru-wall flashings shall be above the first course of brick above the sidewalks and planting beds. Pay particular attention to areas near exterior doors.
2. Ensure cavity drainage protection is properly installed.
3. Leave head joint free and clean of mortar.
4. Spacing: 24 inches on center maximum for modular brick and block, unless shown otherwise.
5. Keep weepholes and area above flashing free of mortar droppings.
6. Coordinate weep holes to be located above sidewalks and paving.

O. Sealant Joints:
1. Allow for sealant joints around outside perimeters of exterior doors, window frames and other wall openings.
2. Uniform depth: 3/4 inch.
3. Uniform width: As shown on the drawings but not less than 1/4 inch.
4. Provide sample for Architect's approval.
5. Refers to drawing for locations and details of accent joints.

P. Movement Joints (Expansion Joints and Control Joints):
1. Locate expansion and control joints as shown on drawings, or if not shown, comply with the following:
    a. General:
        1) Vertical expansion joints shall be placed in the brick wythe and control joints shall be placed in the concrete masonry wythe, although they do not necessarily have to be aligned.
        2) Mortar and joint reinforcement shall not bridge brick movement joints.
        3) Mortar joints which stop at the expansion joint cavity shall be struck flush with the masonry unit, producing a continuous flat surface for the sealant to adhere to.

    b. Vertical Expansion Joints:
        1) Locate expansion joints on long straight walls without openings maximum 25 feet-0 inches.
        2) Locate expansion joints at the corner of walls perpendicular to one another. In instances, where the joint is not desired at the corner, the expansion joint shall be located within 10 feet-0 inches of the corner in either wall, but not necessarily both. The spacing of expansion joints around a corner shall not exceed the spacing of expansion joints in a straight wall. For example, if the spacing between expansion joints on a straight wall is 25 feet-0 inches, then the spacing of expansion joints around a corner could be 10 feet-0 inches on one side of the corner and 15 feet-0 inches on the other side. Joint reinforcement may be added around wall corners to provide added tensile strength to the corner, but joint reinforcement shall not bridge the expansion joint.

    c. Offsets and Setbacks:

1) Locate expansion joints at 10 feet-0 inches maximum on one side of the offset or setback. The spacing of expansion joints around an offset or setback shall not exceed the spacing of expansion joints in a straight wall. See expansion joints at corners of perpendicular walls to one another above for example of spacing.

d. Openings (Doors and Windows):
1) Locate vertical expansion joints along the edge or jamb of the opening of windows and doors. Single opening windows and doors under 6 feet-0 inches in width shall have expansion joint on one (1) side of the edge or jamb of the opening as determined by the Architect, unless shown otherwise on drawings. Windows and doors 6 feet-0 inches and over in width shall have expansion joints on both sides of the edge or jamb of the opening.
2) Where masonry above an opening is supported by shelf angles attached to the structure, a vertical expansion joint shall be located alongside the opening, continuing through the horizontal support.
3) Where masonry above the opening is supported by loose lintels (unattached to the structure), special detailing and construction is required. If the expansion joint runs along side the opening, the loose steel lintel shall be allowed to expand independently of the masonry. To accomplish this, form a slip plane with flashing located above and below the angle. A backer rod and sealant shall be installed in front of the toe of the angle, and space shall be left at the end of the angle. Thus, a pocket will be formed which will allow movement of the steel angle within the brickwork. If the joint cannot be built in this manner, then the vertical expansion joint shall not be located alongside the opening, but rather, with Architect's prior approval, the joint shall be located halfway between the openings.

e. Intersections and Junctions:
1) Locate expansion joints at intersections of masonry walls and walls which serve different functions. If the masonry is not required to be bonded at the intersection, an expansion joint shall be incorporated. Walls which intersect at other than right angles are also vulnerable to cracking at the intersection.
2) Locate expansion joint to separate adjacent walls of different heights to avoid differential movement, especially if the difference is very large. ‘

f. Parapets:
1) All vertical expansion joints shall be carried through the parapets.
2) Additional expansion joints shall be halfway between those running full height, unless the parapet is reinforced. These additional expansion joints shall continue down to a horizontal expansion joint, or continue to the base of the wall.

g. Horizontal Expansion Joints:
1) Locate horizontal expansion joints at shelf angles supporting brick masonry.

h. Control Joints:
1) Locate CMU control joints directly over concrete slab control joints.
2) Whenever possible, lay out CMU so that control joint will coincide with CMU module (25 feet-0 inch maximum spacing between control joints), unless noted otherwise on drawings.

3) Locate control joints at structural columns to isolate movement from continuing or intersecting walls and columns.
4) Install backer rod and sealant in accordance with manufacturer's instructions.

Q. Block Insulation: (As shown or required)
1. Foamed-In Place Block Insulation: Make sure concrete masonry units to receive foamed in place block insulation are ready for drilling and filling. Drill holes and fill concrete masonry unit cells completely with insulation in accordance with manufacturer's instructions. Plug holes with cement mortar and leave surface smooth in accordance with manufacturer's instructions.

3.4 ALLOWABLE TOLERANCES

A. Maximum Variation from Plumb:
1. In lines and surfaces of columns, walls and at rises:
a. 1/4 inch in 10 feet (1:480).
b. 3/8 inch in 20 feet (maximum).
c. 1/2 inch in 40 feet (1:960).

2. For external corners, expansion joints and other conspicuous lines:
a. 1/4 inch in 20 feet (maximum).
b. 1/2 inch in 40 feet (1:960).

B. Maximum variation from level:
1. 1/4 inch in any bay or 20 feet.
2. 1/2 inch in 40 feet (1:960).

3.5 REMOVAL OF FORMS AND SHORES

A. Do not remove shores and forms under reinforced masonry beams, lintels, and soffits until members have hardened sufficiently to carry their own weight and other super imposed loads. Providing that sufficient curing has taken place, leave forms and shores in place as follows:
1. Beam and lintels: Minimum ten (10) days.

B. Allow 16 hours to elapse after completion of masonry columns and walls before placing floor or roof construction loads on them. Allow an additional 48 hours before applying concentrated loads such as trusses, girders, and beams.

3.6 REPAIRING, POINTING AND CLEANING

A. All holes in exposed masonry shall be pointed, and defective joints shall be cut out and re-pointed with mortar.

3.7 REPAIR OR REPLACEMENT OF DAMAGED WORK

A. Imperfect or damaged Work, or any material damaged or determined to be defective before final completion and acceptance of the entire job, shall be replaced at Contractor's expense and in conformity with all requirements of drawings and specifications to the satisfaction of the Owner and Architect. Removal and replacement of masonry Work shall be performed in such a manner as not to impair the appearance or strength of the structure in any way.

B. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 20 square feet, in a location approved by Architect. No further cleaning Work may proceed until the sample area has been approved by Architect, after which, the same cleaning

materials and method shall be used on remaining wall area. Sash, metal lintels and other corrodible parts shall be thoroughly protected.

1. Clean all exposed surfaces of new masonry of excess mortar, efflorescence, stains, and job dirt, using materials specified.
2. Clean from bottom up; prevent cleaning materials and rinse water from contacting non-cementitious materials.
3. Clean in accordance with manufacturer's instructions and recommendations, product data, and container label instructions.
4. Mix materials in strict accordance with manufacturers instructions; do not dilute unless permitted by manufacturer.
5. Prevent overspray, wind drift, and splash onto surfaces not to be treated.
6. No high pressure washers are permitted.
7. Low pressure spray for wetting and rinsing is permitted. Pressure should be in the range of 400-1000 psi. Equipment should produce 6-8 gallons of water per minute using a 15-40 degree fan tip (no fan tip less than a 15 degree is allowed).
8. No metal tools or wire brushes are allowed for cleaning of masonry. Use a waste piece of same masonry material for scraping of installed material.

3.4 REPAIR OR REPLACEMENT OF DAMAGED WORK

A. Imperfect or damaged Work, or any material damaged or determined to be defective before final completion and acceptance of the entire job, shall be satisfactorily replaced at Contractor's expense and in conformity with all requirements of drawings and specifications. Removal and replacement of masonry Work shall be performed in such a manner as not to impair the appearance or strength of the structure in any way.

3.8 CLEAN-UP AND PROTECTION

A. Clean up all debris caused by Work of this Section, keeping the area clean and neat at all times.

B. Cover all unfinished Work at night against the elements with plastic sheeting, building paper, heavy canvas or other material approved by Architect to prevent water from entering cavities.

C. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.9 FIELD QUALITY CONTROL AND TESTING

A. Inspection and Testing Laboratory services shall be in accordance with Section 01 45 23, Testing and Inspecting Services.

END OF SECTION 04 20 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Mortar and grout.
   3. Steel reinforcing bars.
   4. Masonry joint reinforcement.
   5. Ties and anchors.
   6. Embedded flashing.
   7. Miscellaneous masonry accessories.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).
B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
   1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
   2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.6 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Documentation for products with Environmental Product Declarations conforming with LEED disclosure criteria.
2. Documentation for products that comply with LEED requirements for Multi-Attribute Optimization.
    a. Include documentation for products sourced (extracted manufactured, purchased) within 100 miles of project site, indicating location and distance from Project of material manufacturer and point of extraction, manufacture, harvest, or recovery for each raw material and costs of materials.
3. Sustainability reports for products that comply with LEED requirements for Raw Material Source and Extraction Reporting.
4. Documentation for products that comply with LEED requirements for Leadership Extraction Practices. Include the following:
    a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
    b. Product data and certification for bio-based materials, indicating that they comply with Sustainable Agriculture Network's Sustainable Agriculture Standard; tested using ASTM Test Method D6866 requirements. Include statement of costs.
    c. Product data and chain-of-custody certificates for wood products certified by the Forest Stewardship Council. Include statement of costs.
    d. Receipts for reused materials including salvaged, refurbished or reused products for Project, indicating sources and costs.
    e. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer recycled content and preconsumer recycled content for products with recycled content on project. Include statement of costs.
    f. Documentation for locally sourced materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of materials.
5. Documentation for products that comply with LEED requirements for Material Ingredient Reporting.
    a. Inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN).
    b. Health product declaration.
    c. Cradle to cradle.
6. Documentation for products that comply with LEED requirements for Material Ingredient Optimization.
    a. Greenscreen v1.2 Benchmark product data and certification letter.
    b. Cradle to Cradle Certified product data and certification letter.

c. International Alternative Compliance Path- REACH Optimization product data.

7. Documentation for products that comply with LEED requirements for Product Manufacturer Supply Chain Optimization.
   a. Include documentation for locally sourced materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of materials.

C. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
   3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples for Initial Selection:
   1. Decorative CMUs, in the form of small-scale units.
   2. Pre-faced CMUs.
   3. Colored mortar.
   4. Weep holes/vents.

E. Samples for Verification: For each type and color of the following:
   1. CMUs.
   2. Accessories embedded in masonry.

1.7 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.

3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Build sample panels for each type of unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors;

tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.

F. Mortar Cement: ASTM C 1329.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

H. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints, less than 1/4-inch-thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C 404.

J. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.

L. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Mill- galvanized, carbon steel.

2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter or as indicated on Drawings.
4. Wire Size for Cross Rods: 0.148-inch diameter or as indicated on Drawings.
5. Wire Size for Veneer Ties: 0.148-inch diameter or as indicated on Drawings.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units].

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch diameter, hot-dip galvanized steel.

C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick, steel sheet, galvanized after fabrication.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch-diameter, hot-dip galvanized steel.
3. Corrugated Metal Ties: Metal strips not less than 7/8-inch-wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.075-inch-thick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.

D. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4-inch-thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
   1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153] [Epoxy coating 0.020 inch thick.

2.7 MISCELLANEOUS ANCHORS
A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.
B. Post-installed Anchors: Torque-controlled expansion anchors or chemical/adhesive anchors unless otherwise indicated on Drawings.
   1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.

2.8 EMBEDDED FLASHING MATERIALS
A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as indicated on Drawings. Include accessories, adhesives, primers, and seam tapes as applicable.

2.9 MISCELLANEOUS MASONRY ACCESSORIES
A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. For reinforced masonry, use Portland cement-lime mortar.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type M.
   2. For reinforced masonry, use Type S.
   3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
   4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C 476, Table 1 or] paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi except where indicated on Drawings.
   3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation do not vary by more than plus 1/2-inch or minus 1/4-inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2-inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4-inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch.

2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8-inch or minus 1/4-inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond, unless otherwise indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches or less on center unless otherwise indicated.
   3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
   1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
   2. Allow cleaned surfaces to dry before setting.
   3. Wet joint surfaces thoroughly before applying mortar.
D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8-inch on exterior side of walls, 1/2-inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
C. Provide continuity at wall intersections by using prefabricated T-shaped units.
D. Provide continuity at corners by using prefabricated L-shaped units.
E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
B. Form control joints in concrete masonry as follows:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING

A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

G. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 04 72 00 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Cast stone trim**.**
   2. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. Cast Stone: Refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
   1. Dry Cast Concrete Products: manufactured from zero slump concrete.
      a. Vibrant Dry Tamp (VDT) Casting Method: Vibratory ramming of earth moist, zero slump concrete against a rigid mold until densely compacted.

   2. Wet Cast Concrete Products: Manufactured from measurable slump concrete.
      a. Wet Casting Method: Manufactured from measurable slump concrete and vibrated into a mold until densely consolidated.

1.4 SUBMITTALS

A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
   1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples:
   1. For each color and texture of cast stone required, 10 inches (250 mm) square in size.
   2. For each trim shape required, 10 inches (250 mm) in length.

D. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.
   1. Provide test reports based on testing within previous two years.

E. Engineering calculations: Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of Texas.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Standards: Comply with applicable requirements of the Cast Stone Institute Technical Manual.

B. Manufacturer Qualifications: Manufacturer having minimum 5 years documented experience in the manufacture of cast stone units with has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.

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

D. Source Limitations:
1. Cast Stone: Obtain cast stone units from single source from single manufacturer.
2. Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Mockups: Provide full size unit(s) for use in construction of sample wall. The accepted mock-up shall become the standard for appearance and workmanship for the project. The accepted mock-up may be incorporated into the finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the work.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.
1. Lift with wide belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

A. Cold Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.
1. Cold Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F (4 degrees C) and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
1. Advance Architectural Stone; (817) 572-0018.
2. AHI Supply, LP; (281) 388-4500.
3. Dallas Cast Stone; (214) 428-6269.
4. SiteWorks, Inc.; (281) 931-1000.

B. Cast Stone Physical Properties:
1. Compressive Strength: ASTM C1194, 6,500 psi minimum for products at 28 days.
2. Absorption: ASTM C1195, 6 percent maximum by the cold water method or 10 percent maximum by the boiling method for products at 28 days.

3. Air Content: ASTM C173 or C231, for wet cast product shall be 4 percent to 8 percent for units exposed to freeze-thaw environments. Air entrainment is not required for VDT products.

C. Comply with ASTM C 1364.

D. Portland Cement: ASTM C 150/C 150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast-stone color indicated.

E. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33/C 33M; gradation and colors as needed to produce required cast-stone textures and colors.

F. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33/C 33M, gradation and colors as needed to produce required cast-stone textures and colors.

G. Color Pigment: ASTM C 979/C 979M, synthetic mineral oxide pigments or colored water reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

H. Admixtures: Use admixtures specified or approved in writing by Architect.
1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air Entraining Admixture: ASTM C 260/C 260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

I. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60 (Grade 420). Use galvanized or epoxy coated reinforcement when covered with less than 1-1/2 inches (38 mm) of cast stone material.
1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

J. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.2 CAST STONE UNITS

A. Cast Stone Units: Comply with ASTM C 1364.
1. Units shall be manufactured using the vibrant dry tamp or wet cast method.

2. Units shall be resistant to freezing and thawing determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.
4. Provide reveals for flashing reglets.
5. Profiles and dimensions shall be in accordance with details shown on the drawings.

C. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.

D. Cure Units:
1. Cure units in enclosed, moist curing room at 95 percent to 100 percent relative humidity and temperature of 100 degrees F (38 degrees C) for 12 hours or 70 degrees F (21 degrees C) for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:
   a. No fewer than five days at mean daily temperature of 70 degrees F (21 degrees C) or above.
   b. No fewer than six days at mean daily temperature of 60 degrees F (16 degrees C) or above.
   c. No fewer than seven days at mean daily temperature of 50 degrees F (10 degrees C) or above.
   d. No fewer than eight days at mean daily temperature of 45 degrees F (7 degrees C) or above.

E. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Colors and Textures: Selected by Architect.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Davis Colors; (800) 356-4848.
   b. Lanxess Corporation; (800) 536-9377.
   c. Solomon Colors, Inc.; (800) 624-0261.

E. Colored Cement Product: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Holcim (US) Inc.; (713) 672-4316.
      2) Lafarge North America Inc.; (800) 707-0001.
      3) Lehigh Hanson; Heidelberg Cement Group; (800) 437-7762.

4) AHI Supply Co.; (281) 331-0088.

2. Colored Masonry Cement:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cemex S.A.B. de C.V.
      2) Holcim (US) Inc.; (713) 672-4316.
      3) Lafarge North America Inc.; (800) 707-0001.
      4) Lehigh Hanson; Heidelberg Cement Group; (800) 437-7762.
      5) AHI Supply Co.; (281) 331-0088.
3. Formulate blend as required to produce color indicated or selected from manufacturer's standard colors.
4. Pigments shall not exceed 10 percent of portland cement by weight.
5. Pigments shall not exceed 5 percent of masonry cement by weight.

F. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Water: Potable.

2.4 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

B. Dowels: 1/2 inch (12 mm) diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

C. Proprietary Acidic Cleaner: Standard strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions; (800) 283-3888.
   b. EaCo Chem, Inc.; (724) 656-1055.
   c. PROSOCO, Inc.; (800) 255-4255.
   d. AHI Supply Co.; (281) 331-0088.

2.5 MORTAR MIXES

A. Comply with requirements in Section 04 20 00.

B. Do not use admixtures including pigments, air entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

C. Comply with ASTM C 270, Proportion Specification.
   1. For setting mortar, use Type N unless otherwise recommended by manufacturer.
   2. For pointing mortar, use Type N unless otherwise recommended by manufacturer.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
   3. Application: Use pigmented mortar for exposed mortar joints.

E. Colored Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
   1. Application: Use colored-aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 SETTING CAST STONE IN MORTAR

A. Unless otherwise indicated, install cast stone units with mortar joints to comply with requirements in Division 4 Section “Unit Masonry.”

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
   1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
   2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.
   1. Set units with joints 3/8 to 1/2 inch (10 to 13 mm) wide unless otherwise indicated.
   2. Build anchors and ties into mortar joints as units are set.
   3. Fill dowel holes and anchor slots with mortar.
   4. Build concealed flashing into mortar joints as units are set.
   5. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
   6. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

H. Rake out joints for pointing with sealant to depths of not less than 3/4 inch (19 mm). Scrub faces of units to remove excess mortar as joints are raked.

I. Point joints with sealant to comply with applicable requirements in Section 079200.
   1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

J. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure relieving joints; and at locations indicated.
   1. Keep joints free of mortar and other rigid materials.
   2. Build in compressible foam plastic joint fillers where indicated.
   3. Form joint of width indicated, but not less than 3/8 inch (10 mm).
   4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
   5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00.

3.3 SETTING ANCHORED CAST STONE WITH SEALANT FILLED JOINTS

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
   1. Install anchors, supports, fasteners, and other attachments necessary to secure units in place.
   2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

B. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.

C. Fill anchor holes with sealant. Where dowel holes occur at pressure relieving joints, provide compressible material at ends of dowels.

D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast-stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
   1. Form open joint of width indicated, but not less than 3/8 inch (10 mm).

F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00.

3.4 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch (1.5 mm), except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In Progress Cleaning: Clean cast stone as work progresses.
   1. Remove mortar fins and smears before tooling joints.
   2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
   3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
   5. Clean cast stone by bucket and brush hand cleaning method described in BIA Technical Notes 20.
   6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 72 00

SECTION 11 68 53 - OUTDOOR BASEBALL & SOFTBALL EQUIPMENT

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Bases
B. Pitching Rubber
C. Home Plate
D. Foul Poles
E. Padding

1.2 RELATED WORK

A. Section 03 30 00 - Cast-In-Place Concrete

B. Section 04 20 00 - Unit Masonry: Wall Support

1.3 SUBMITTALS

A. Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

B. Shop Drawings: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in protective wrapping, store inside building protected from weather, moisture and soiling.

1.5 COORDINATION

A. Coordination by all contractors and equipment manufacturers/suppliers for the work of this section shall be performed without delays or damage to parts of any work.

1.6 WARRANTY

A. Unless otherwise noted, warrant the work specified for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Foul Poles, Wall Padding: Warrant the work specified for three (3) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

C. Defects shall include, but not be limited to, the following: Rough or difficult operation, noisy operation, loose or missing parts, noticeable deterioration of finish, etc.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be approved and installed in accordance with University Interscholastic League (UIL), the National Federation of State High School Association (NFHS), and/or NCAA rules/regulations (latest edition).

2.2 APPROVED MANUFACTURERS

A. Specifications are based on named manufacturers. Except where stated as “No Substitutions”, manufacturers listed who produce equivalent products to those specified are approved for use on the Project. Other manufacturer’s must have a minimum of five (5) years experience manufacturing products equivalent to those specified and comply with Division 1 requirements regarding substitutions to be considered.
   1. Baseballracks.com, Evergreen Park, IL (708) 636-1047
   2. Aalco Mfg. Co., St. Louis, MO; (800) 537-1259
   3. Performance Sports Systems, Noblesville, IN; (800) 848-8034
   4. Porter Athletic Equipment Co., Broadview, IL; (800) 947-6783
   5. Promats Athletics, Salisbury, NC (800) 617-7125
   6. Sportsfield Specialties Inc., Delhi, NY; (888) 975-3343
   7. Pasadena Sporting Goods, Pasadena, TX; (713) 477-7151
   8. Tomark Sports, Dallas, TX; (951) 371-1844

2.3 BASEBALL/SOFTBALL EQUIPMENT

A. Bases: Provide one (1) set of three (3) "Pro-Style Jack Corbett Hollywood Bases" complete with anchors and plugs by Schutt.

B. Pitching Rubber: Provide one (1) 4-sided Pitching Rubber with interior aluminum tube by Schutt.

C. Home Plate: Provide one (1) in-ground, “Hollywood Bury All” all-rubber home plate by Schutt.

D. Foul Poles: Provide two (2) yellow powder coated aluminum Foul Poles with Wings, 30 feet in height at baseball and 20 feet in height at softball, manufactured by Sportsfield Specialties Inc. or approved equivalent.

E. Padding:
   1. Wall Padding:
      a) Description: Panels shall be constructed of a 3 inch thick high density polyurethane padding attached to a 5/8 inch moisture resistant composite wood backer board and covered with an 18 ounce high UV extruded vinyl covering. For seasonal removal or repair, panels can be installed to walls with optional, extruded aluminum “Z” type clips. The “Z” clip attachment system provides a smooth and neat appearance and allows worn or vandalized pads to be removed for repair or replacement by simply lifting the panel upward.
      b) Size: The size of the individual pads shall be approved by the owner prior to manufacturing.
      c) Cover material shall have a tear strength of 100 P.S.I minimum, shall be mildew and rot resistant, and fortified with an infection combating fungicide. Cover material shall be in color selected by Architect from manufacturer’s standard colors and shall have a Class A flame resistance according to ASTM E-84.
      d) All cutouts for electrical, etc., if any, shall be made in the field to fit job conditions.
      e) Contractor shall be responsible for proper inspection and installation of panels.
      f) Approved Manufacturer: Buck Terrell Athletics, BaseZone by Promats Athletics, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instructions, and in locations shown on drawings or as directed by Owner/Consultant.

B. Bases: Install bases in locations shown on drawings or directed as recommended by the manufacturer.

C. Pitching Rubber: Install pitching rubber in location shown on drawings or as directed and recommended by the manufacturer.

D. Home Plate: Install home plate in location shown on drawings or as directed and recommended by the manufacturer.

E. Foul Poles: Install foul poles in location shown on drawings or as directed and recommended by the manufacturer.

F. Wall Padding: Verify walls to which wall padding panels are attached are perfectly plumb or slightly convex (bowed out) over the area to be covered. If found to be not perfectly plumb or concave (bowed in), install sufficient shims at midsection of panels to provide plumb or convex wall profile. Panels must be inspected before installed. Install products under manufacturer's supervision and/or in accordance with manufacturer's instructions. Attach backstops securely to structure in locations shown on drawings. Locate hoists as shown or required. Install wall padding panels in locations shown on drawings with minimum amount of wrinkles in fabric in accordance with ASTM F2440-04. Make final adjustment after installation and clean all backstop support piping of dirt and other substances which may affect final finish. Lubricate all moving parts. Touch-up primer paint where damaged. Clean wall padding panels of dirt, grease and other substances detrimental to good appearance.

END OF SECTION 11 68 53

SECTION 31 11 00 - CLEARING AND GRUBBING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Protecting and preserving trees and vegetation designated to remain.

B. Clearing of site, including, but not limited to the removal of trees, shrubs, and vegetation which is not designated to remain, and brush, branches, logs, rock, debris, rubbish and other objectionable material from the entire project area.

C. Grubbing of site, including, but not limited to uprooting and removal of all stumps, roots, other organics, etc. to their full depth from the project area and disking to a depth of nine (9) inches.

D. Removal and legal, satisfactory disposal of all material cleared and grubbed from the site.

1.2 PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 CONDITIONS AT SITE

A. Execute all work in an orderly and careful manner with due consideration for any and all surrounding areas, planting or structures which are to remain. Periodically, water as required to allay dust and dirt. Protect any adjacent property and improvements from damage and replace any portions damaged through this operation.

B. Coordinate and comply with the following:
   1. Geotechnical Report.
   2. Local ordinances and requirements of authorities having jurisdiction.

C. The Contractor shall take proper precautions to protect adjacent or adjoining property from damage caused by clearing and grubbing activities. All damage shall be repaired or replaced at Contractor's expense.

D. The Contractor shall be responsible for obtaining all permits required by State and local governing agencies.

3.2 DISPOSAL OF MATERIAL

A. All cleared and grubbed material becomes the property of the Contractor and shall legally and satisfactorily be removed and disposed of off-site. **On-site burning will not be permitted**.

3.3 FINAL SITE PREPARATION

A. Remove all rubbish, debris, etc., resulting from Work of this Section from the site.

B. After clearing, grubbing and discing the project site, rake and pick the entire site to remove all debris material.

END OF SECTION 31 11 00

SECTION 31 13 13.13 - WASTE MATERIAL DISPOSAL

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE

A. Waste material disposal consists of disposal of trees, brush, vegetation, rubbish and other objectionable matter from operations such as clearing and grubbing, demolition, excavation, concrete placement and grading. Unless otherwise specified, the Contractor is responsible for removal and disposal of waste material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Specific products are not required. Use equipment and materials necessary to properly complete disposal of waste materials.

PART 3 - EXECUTION

3.1 DISPOSAL AREA

A. Items noted on plans to be "removed" or “disposed” will be taken completely off the site.

B. Concrete wash-out will become property of Contractor to be disposed of with other waste materials.

3.2 COMPACTION AND GRADING

A. Level off waste material to an elevation 12 inches below final grade. Place excess topsoil on waste material in a layer not less than 12 inches thick and compact to the density of the surrounding area.

END OF SECTION 31 13 13.13

SECTION 31 20 00 – EARTHWORK (UNDER PAVING AND SITE APPURTENANCES)

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE

A. This section includes the furnishing of all plant, labor, equipment, materials and the performance of all operations required to complete the Earthwork indicated on the Drawings and specified herein, including the following: Clearing and Grubbing, Stripping, Excavation, Embankment, Borrow, Subgrade Preparation, Compaction and Finish Grading.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 CLEARING & GRUBBING

A. This item shall consist of clearing the ground of all trees, brush, rubbish, and of grubbing the roadway, pavement areas, roadside ditches and/or outfall ditch right-of-way or other easements as designated within the limits of the project. The designated areas shall be cleared of stumps, brush, logs, rubbish, trees and shrubs, except such trees and shrubs and certain areas designated by the Engineer for preservation shall be carefully protected from abuse, marring or damage during construction operations. Continual parking and/or servicing of equipment under the branches of trees designated for preservation will not be permitted. Trees and shrubs designated for preservation, that must be pruned, shall be trimmed as directed by the Engineer and all exposed cuts over two (2) inches in diameter shall be treated with an approved material.

B. On areas required for paving, channel, or structural excavation, all stumps, roots, etc., shall be removed to a depth of approximately 2-feet below the lower elevation of the excavation. On areas required for embankment construction, all stumps, roots, etc., shall be removed to a depth of approximately 2-feet below the existing ground surface. All holes remaining after clearing and grubbing shall be backfilled and compacted to ninety percent of Standard Proctor Density (ASTM Method D698) at a moisture content of between optimum and plus 3 percent of optimum as directed by the Engineer and the entire area bladed to prevent ponding of water and to provide drainage; except in areas to be immediately excavated, the Engineer may direct that the holes not be backfilled. On areas required for borrow sites and material sources, stumps, roots, etc., shall be removed to the complete extent necessary to prevent such objectionable matter becoming mixed with the material to be used in construction.

C. All cleared and grubbed materials shall be disposed of off site. Contractor shall be responsible for obtaining any necessary disposal permits. The Contractor shall not bury any refuse on site. No burning shall be permitted unless specifically noted and permitted by local jurisdictions.

D. No separate measurement or payment will be made for furnishing all labor, materials, permits, supervision, equipment and supplies required to complete all items of work specified for clearing and grubbing.

3.2 STRIPPING

A. Within the limits indicated, or in areas where existing grade is to be altered either by excavation or embankment, the Contractor shall strip existing topsoil to approximately 3-inches in depth, except that areas beneath foundations or structures shall be stripped to a minimum depth of 6-

inches, and may be stockpiled for future use or disposed of at the Contractor's expense. Stripping shall include the removal and disposal of scrap iron, rubbish, logs, abandoned utilities, signs, and any and all other debris, if within the project site or right-of-way, whether above or below existing grade. Stripping and excavation can take place in the same operation, provided the topmost material is suitable for use in future construction and provided it is not to be set aside for backfill or topsoil. The upper topsoil and debris to be stripped as noted above, shall be removed regardless of whether the site is to be excavated or receive embankment. Surface soil, not suitable for use in the future construction and any other unsatisfactory material shall be excavated, removed off the site and placed in designated spoil banks or shall otherwise be disposed of as directed by the Engineer in such a manner as not to create an unsightly or objectionable condition.

B. Stripping will not be paid for directly. Payment for stripping shall be subsidiary to excavation, borrow or embankment.

3.3 EXCAVATION

A. Excavation shall consist of the required excavation within the project limits, the removal and proper utilization or disposal of all excavated materials; and the constructing, shaping and finishing of all earthwork on the entire project site, in conformity with the required lines, grades and typical cross sections, and in accordance with the specification requirements herein outlined. All suitable excavated materials shall be utilized, insofar as practicable, in grading the site, uniformly widening embankment, flattening slopes, etc., or as directed by the Engineer. The Engineer will define suitable materials. Unsuitable excavation in excess of that needed for construction shall be known as waste and shall become the property of the Contractor to be disposed of by the Contractor outside the limits of the site. Unsuitable material encountered below subgrade elevation, shall be replaced with material from the excavation, or with other suitable material.

B. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price, including preparing ditches, trimming of slopes, disposal of surplus materials (wastage), preparation and completion of subgrade, shoulders, roadway, any necessary hauling and the furnishing of all labor, tools, equipment and incidentals necessary to complete the work.

3.4 EMBANKMENT

A. This item shall govern for the placement and compaction of all materials obtained from the site, borrow, channels, structural and sewer excavation, including all underground utility excavation, used in the construction of project fill and/or embankment. Prior to placing any embankment, all stripping and/or clearing and grubbing operations shall 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 compacted by approved methods before commencing embankment construction.

B. Unless otherwise indicated on the plans, the surface of the ground of all unpaved areas, which are to receive embankment, shall be loosened by scarifying or plowing to a depth of not less than 4-inches. The loosened material shall be recompacted with the new embankment as hereinafter specified, and shall not exceed 8-inches in total depth. Where indicated on the plans or as directed by the Engineer, the surface of a hillside to receive embankment shall be loosened by scarifying or plowing to a depth of not less than 4 inches, or cut into steps, benched or notched before embankment materials are placed. The embankment shall then be placed in layers, not to exceed 8-inches, as hereinafter specified, beginning at the low side in part width layers and increasing the widths as the embankment is raised. The material, which has been loosened, shall be recompacted simultaneously with the embankment material placed at the same elevation. Where embankments are to be placed adjacent to or over existing roadbeds, the roadbed slopes

shall be plowed or scarified to a depth of not less than 4-inches and the embankment built up in successive layers, as hereinafter specified to the level of the old roadbed before its height is increased. The top of the old roadbed shall be scarified and recompacted with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible depth of layer.

C. Trees, stumps, roots, vegetation or other unsuitable materials shall not be placed in the embankment.

D. Except as otherwise required by the plans, all embankment shall be constructed in layers approximately parallel to the finished grade of the site or paving. Embankments shall be constructed to the grade established by the Engineer, and completed embankments shall 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 Engineer. After completion, the site shall be continuously maintained to its finished section and grade until the project is completed.

E. No material placed in the embankment by dumping in a pile or windrow shall be incorporated in a layer in that position, but all such piles or windrows shall be moved by blading or similar methods. Clods or lumps of material shall be broken and the embankment material mixed by blading, harrowing, discing, or similar methods to the end that a uniform material is secured in each layer. Water required for sprinkling to bring the material to the moisture content necessary for maximum compaction shall be evenly applied and it shall be the responsibility of the Contractor to secure uniform moisture content throughout the layer by such methods as may be necessary.

F. After each layer of embankment or select material is complete, the Engineer will make tests as necessary. If the material fails to meet the density specified, the course shall be reworked, as necessary, to obtain the specified compaction. Should the subgrade, due to any reason or cause, lose the required stability, density or finish before the pavement is placed, it shall be recompacted and refinished at the sole expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling, sealing or covering with a subsequent layer of asphaltic or other approved material. Embankment shall not be paid for directly, but shall be incidental to site excavation, channel excavation, construction of underground utilities, including all sewers, or borrow.

3.5 BORROW

A. Borrow shall consist of the required excavation, removal and proper utilization of materials secured from sources obtained by the Contractor and approved by the Engineer. Borrow shall be used only when shown on the bid form or directed by the Engineer and then only from approved sources. Borrow material shall come only from sources approved by the Engineer. The Engineer shall provide samples of the fill material for testing and approval. In the event the material is not acceptable, as determined by the Engineer, the Contractor shall find other sources. All fill material shall be free from organic matter and deleterious material.

B. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price. All work performed as required herein shall be full compensation for furnishing all labor, for all materials, for all royalties and freight involved, for all hauling, delivery, spreading and compacting complete and in place and for all tools, equipment and incidentals necessary to complete the work.

3.6 SUBGRADE

A. The subgrade shall be brought to the lines, grades and typical cross section shown on the plans and in accordance with these specifications. Whenever unsuitable natural material is encountered and cannot be handled by the excavation or embankment requirements, then the

following requirements shall apply. The unsuitable material shall be excavated to a depth deemed sufficient by the Engineer and the excavated material shall be disposed of off the jobsite at the expense of the Contractor. The excavated area shall be filled to its original level with suitable material meeting the requirements of borrow. This imported material shall be compacted to 95-percent of standard proctor density, (ASTM Method D698) using a moisture content ranging from optimum to plus 3-percent above optimum. Soils shall not be compacted at less than the optimum moisture content.

B. After all holes and depressions are filled with approved material, the subgrade shall be brought up to the lines and grades required and if it is not to be stabilized, it shall be compacted to 95-percent of standard proctor density, (ASTM Method D698), using a moisture content ranging from optimum to plus 3-percent above optimum. The subgrade, without stabilization, shall be compacted to a depth of 9-inches. The subgrade shall be kept free from all ruts and weak spots. Any ruts and weak spots that develop under traffic shall be repaired with suitable material as they develop.

3.7 COMPACTION

A. All fill material shall be placed in uniform layers, dried or moistened as required to obtain approximate optimum moisture content and rolled to a density of at least 95 percent of maximum density at optimum moisture as determined by ASTM D-698. Compaction equipment shall be as hereinafter specified. The maximum thickness of uniform layers (loose measurements) shall be as follows:
   1. If the Contractor elects to use a pneumatic tired roller, the thickness of each uniform layer shall not exceed six (6) inches.
   2. If the Contractor elects to use sheepsfoot rollers, the thickness of each uniform layer shall not exceed eight (8) inches.
   3. In locations where it is impractical to use the roller equipment, mechanical hand tampers will be used and the thickness of each uniform layer shall not exceed four (4) inches. The method used to secure the optimum moisture content will be the Contractor's responsibility. The compacting equipment and the method of compaction shall be such that a uniform density will be obtained over the entire area and depth of material being compacted. All fill material deposited in place by means of scrapers, dump trucks, draglines or other similar equipment shall be thoroughly broken up before being spread into the uniform layers. Rolling shall start longitudinally at the sides and proceed toward the center of the crowned sections or start longitudinally at the low side and proceed toward the high side of sloped areas, overlapping on successive trips by at least one-half (1/2) the width of the roller unit. Alternate trips of the roller shall be slightly different in length.

B. Excess loss of moisture shall be construed to exist when the soil moisture content is three (3) percent less than optimum moisture.

C. An independent qualified Testing Laboratory either selected by or approved by the Owner or Engineer, for every 500 square yards of the compacted subgrade shall take density tests. The Testing Laboratory will furnish written reports covering results of all tests and inspections made. Reports will be made promptly to the Engineer, Contractor and Owner.

3.8 FINISH GRADING

A. Uniformly smooth grade all areas indicated on the drawings to be graded. The finish surface shall be not more than 0.05 feet above or below the established grade or approved cross section. All ditches and swales shall be properly graded so as to drain readily. Where existing grade is disturbed by the Contractor in areas not marked to be graded, the Contractor will regrade the disturbed area to its original grade at no additional expense to the Owner.

END OF SECTION 31 20 00

SECTION 31 23 00 - CONSTRUCTION OF UNDERGROUND UTILITIES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SUMMARY

A. This Section shall govern for all excavation required for the construction of sewers, sewer structures, pipe culverts, appurtenances and connections and for the backfilling around completed sewers to the level of the original ground, all in conformity with the locations, lines and grades shown on the plans or as given by the Engineer and in accordance with these specifications. This Section shall also govern for any necessary pumping or bailing and drainage and all sheathing and bracing of trench walls. Also governed by this Section are the cutting and restoration of pavement and base courses, the furnishing and placing of cement stabilized backfill, the hauling and disposing of surplus materials and the bridging of trenches and other provisions for maintenance of traffic or access as provided herein.

1.2 QUALITY ASSURANCE

A. The Testing Laboratory's representative will determine the moisture density relationship in accordance with ASTM D698 on material secured from the trench excavation. Samples secured from the cement stabilized sand supplier shall be blended with Portland cement in accordance with Section 31 23 23.16 - Cement Stabilized Sand Bedding and Backfill, and the moisture density relationship will be determined in accordance with ASTM D558.

B. The Testing Laboratory's representative will determine the in place density in accordance with ASTM Methods D2922 or D1556. The minimum level of testing will consist of at least one test for each 200 linear feet of trench per lift of backfill.

C. At the completion of the project, all on site storm and sanitary sewer lines shall be cleaned out using a hydraulic jet machine in the presence of the owner and engineer. After hydro-jetting storm and sanitary sewer lines, all segments shall be video tape recorded and tapes shall be furnished to the owner.

1.3 REQUIRED INSPECTIONS

A. The contractor is solely responsible for meeting with all inspecting authorities having jurisdiction over the project (to include, but not limited to: MUD District, City, County, State and Federal) prior to construction. All required inspections shall be coordinated by the contractor prior to installation of the WORK. All WORK found to be deficient by the inspector(s) and WORK installed prior to notification of inspector(s) shall be removed and replaced at the contractor's sole expense.

PART 2 – PRODUCTS

2.1 CONNECTIONS TO BUILDING GRAVITY SEWERS

A. Connections to building gravity sewers, to include roof drains and sanitary sewer connections shall be made with SCH 40 X SDR adapter couplings.

B. Fernco couplers are not allowed.

PART 3 – EXECUTION

3.1 EXCAVATION & TRENCH PREPARATION

A. Excavate trench to the alignment and depth required. Brace the trench and drain, as required, so that the work may be accomplished safely and efficiently. If necessary, install a dewatering system to provide a dry trench bottom. Pumps shall discharge into natural drainage channels or to drains. Shoring for excavations and trenches shall meet the requirements of the latest edition of OSHA Regulation 1926, Subpart P.

B. For pipes less than 30 inches in diameter, the minimum width of the trench shall be the width of the outside barrel of the pipe plus 24 inches, the maximum width of the trench shall be the width of the outside barrel of the pipe plus 36 inches. For pipe 30 inches and larger, the minimum trench width shall be the width of the outside barrel of the pipe plus 32 inches, and the maximum width of the trench shall be the width of the outside barrel of the pipe plus 36 inches.

C. Side sloping or benching of the trench, where permitted, will begin at one foot above the top of the pipe and will not encroach upon private property or endanger existing or future structures or underground utilities. Depth of trench, without sheathing or bracing shall comply with OSHA Regulation 1926.650.

D. The full width of the trench shall be excavated to a depth below the invert elevation of the pipe so as to permit placing the bedding material specified on the attached drawings below the outside bottom of the pipe. Any additional depth excavated by the Contractor shall be replaced with an equal depth of cement-stabilized sand. The cost of this additional material, in place shall be at the expense of the Contractor.

E. Where necessary, excavations shall have sheathing and bracing to prevent caving. At these locations, increase the trench width as required and leave the sheathing in place until the pipe has been laid and the backfill compacted to a depth of 2 feet over the pipe. All sheathing and bracing shall be designed to the requirements of OSHA Standard 1926, Subpart P (latest edition).

F. Sewers shall not be constructed or sewer pipe laid in the presence of water. All water shall be removed from the excavation sufficiently prior to the sewer placing operation to ensure a dry, firm bed on which to place the sewer and shall be maintained in such unwatered condition until all concrete and mortar is set. Removal of water may be accomplished by bailing, pumping or by a well-point system as conditions warrant. There will be no separate pay for well pointing without the prior approval of the Engineer. Contractor shall include in base proposal all costs associated with de-watering, well pointing, stabilizing, etc. necessary to install all underground utilities.

G. In the event that the excavation cannot be dewatered to the point where the pipe subgrade is free of mud, excessive wet soil, sand silt or clay with water, a seal slab shall be used in the bottom of the excavation. Such seal slab shall consist of a lean concrete mixture. The seal slab shall be a Class “D”, 5 sacks of cement per cubic yard with a minimum compressive strength of 1,750 P.S.I. at 7 days and 2,500 P.S.I. at 28 days. A precast seal slab may be used, provided that the joints of the seal slab do not occur at the joint of the pipe. Contractor shall have an option of using a three-day cylinder break test at no expense to the Owner.

H. For unstable conditions requiring outside forms, seals, sheathing, and bracing, or where groundwater is encountered, any additional excavation in width and backfill required shall be done at the Contractor’s expense. Portable trench boxes may be used in lieu of sheathing upon approval in writing by the Engineer. The trench box must be in accordance with OSHA Regulation 1926.650 (latest edition).

I. Use of the trench box does not relieve the Contractor of any liability for damages to person or property. When a trench box is moved, the jointed pipe or in-place backfill shall not be disturbed.

J. All materials from excavation operations not required for backfilling, if considered suitable shall be placed in embankments or wasted, in accordance with Section 31 20 00 - Earthwork. All material not suitable for use in embankments will be declared surplus by the Engineer and shall become the responsibility of the Contractor to dispose of as he wishes. Such surplus material shall be promptly removed from the work following the completion of the portion of the sewer involved. No separate payment shall be made for disposal of this surplus material.

K. Unless otherwise specifically approved, Contractor shall use ladder or wheel-type trench-digging machinery, except where hand methods must be employed to avoid damage to existing structures above or below ground, or where hand excavation is indicated.

L. Engineer may limit the amount of trench opened or partially opened at any time in advance of the completed pipe laying operation and the amount of trench left unfilled. Open no more than 500 feet of trench at any one time.

3.2 PIPE LAYING

A. No pipe shall be laid in water or when the trench conditions or weather is unsuitable for such work, unless specifically approved by the Engineer.

B. Non-pressure concrete pipe shall be laid with the ends abutting and true to line and grade. Fit and lay the pipe to form a smooth and uniform invert. Laying of pipe shall commence at the lowest point, so that the spigot ends point in the direction of flow. Lay cast iron pipe on firm earthen foundation with bell ends facing the direction of laying.

C. All other types of pipe shall be laid in accordance with the applicable provisions of this specification, in accordance with the Special Provisions preceding this Subsection, or with the manufacturer’s recommendations.

D. Cut cast iron pipe with wheel-type cutters or cold chisel. Flame cutting of cast iron pipe is not allowed. Make cuts in a neat and workmanlike manner without damage to pipe and so as to leave a smooth end at right angles to axis of pipe. Field cutting of Polyvinyl Chloride shall be in accordance with the pipe manufacturer's recommendations.

E. Minor deflections may be obtained in pipe joints. Contractor must obtain approval when the degree of deflection is necessary to deflect from a straight line. Where necessary to make major deflections in concrete pipe, use sections of pipe with beveled ends for deflections not greater than five degrees. For deflections greater than five degrees, use fabricated fittings for concrete pressure pipe and use cast iron fittings for cast iron pipe.

F. When the pipe laying operation is halted, seal the open end of the pipe with a temporary plug. Plug is to remain in place until the pipe laying operation re-commences. Standard plugs shall be inserted into bells of all dead end pipe.

G. All underground pipe shall have a 12 gauge metallic tracer wire running the full length of the pipe. Tracer wire shall be taped to the pipe at intervals not to exceed 15-feet using duct tape and terminate at each end above ground in a 2” PVC riser.

H. Pipe shall be installed with the labels facing upward.

I. At the completion of the project, all on site storm and sanitary sewer lines shall be cleaned out using a hydraulic jet machine in the presence of the owner and engineer. After hydro-jetting storm and sanitary sewer lines, contractor shall run video-camera through pipes and video-record each line segment in order to document proper installation.

3.3 BACKFILLING

A. As soon as practicable after completion of laying and jointing of pipe, backfill the trench. Not more than 200 feet of the trench shall be left open after laying the pipe.

B. Trenches shall be backfilled in accordance with drawing details and notes. Backfill material selected from sewer trench excavation, or obtained from other sources, shall be free from stones, which will interfere with compaction and free of large lumps, which will not break down readily under compaction. Do not use material excavated in large lumps which will not break down or which cannot be spread in loose layers. Material excavated by trenching machine will generally be suitable for use as backfill. Cement stabilized sand shall be in accordance with Section 31 23 23.16 - Cement Stabilized Sand Bedding and Backfill.

C. When placing backfill in the trench simultaneously on both sides of the pipe for the full width of the trench, moisten if necessary and tamp in approximately 6-inch layers, thoroughly compacting under and on each side of the pipe to provide solid backing against the external surface of the pipe. Walking or working on the completed pipeline, except as necessary in tamping or backfilling shall not be permitted until the trench has been backfilled to at least 12-inches over the top of the pipe.

3.4 RESTORATION OF SURFACES

A. Replace or repair sidewalks, driveway culverts, inlets, curbing, gutters, shrubbery, trees, fences, sod and other like obstructions removed or disturbed, to the condition equivalent to that existing prior to commencement of this work. Use concrete having a compressive strength of not less than 3,000 psi in 28 days for the replacement of curbing, gutters, inlets and sidewalks.

B. Use reasonable care in the removal and replacement of shrubbery and trees designated to be replaced at original locations. Where at all possible, ditch alignment will be such as to minimize this work. The restoration of asphalt-topped flexible base and concrete streets shall be as specified under other items of the specifications.

3.5 CLEAN-UP

A. The Contractor shall remove from the site of the work and from public and private property temporary structures, rubbish, and waste materials, including excess excavated materials. The Contractor is responsible for disposing of all surplus earth. The pipe laying operation shall be temporarily suspended if the clean-up is falling behind as determined by the Engineer or Owner.

3.6 MEASUREMENT & PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

END OF SECTION 31 23 00

SECTION 31 23 23.16 - CEMENT STABILIZED SAND BEDDING AND BACKFILL

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SUMMARY

A. This Section specifies cement stabilized sand to be used for backfill and bedding as called for on the drawings, in other parts of the specifications, or as directed by the Engineer.

1.2 PERFORMANCE

A. The sand cement mixtures shall produce a minimum unconfined compressive strength of one hundred pounds per square inch (100 psi) in forty eight hours, when compacted to ninety five percent (95%) of Standard Proctor density (ASTM Method D558), without additional moisture control and when cured in plastic bags at a temperature of 73.4º F at plus or minus 3º F and tested in accordance with ASTM D1633.

B. Random samples of the delivered product will be taken in the field at the direction of the Engineer and tested at the Owners expense.

1.3 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Cement shall be Type I Portland cement conforming to ASTM C150. Sand shall be clean durable sand containing not more than the following:
   1. Deleterious Materials:
      a. Clay lumps, when tested in accordance with ASTM C142 shall be less than 0.5 percent. Lightweight pieces, when tested in accordance with ASTM C123 shall be less than 5.0 percent. Organic impurities when tested in accordance with ASTM C40 shall not show a color darker than the standard color.
   2. The plasticity index shall be six (6) or less when tested in accordance with ASTM D4318.
   3. Sand shall be free of organic matter and deleterious substances and shall meet the following gradation requirement.

Square Sieve Size	% Passing, By Weight
3/8"	100%
No. 200	5 - 30%

   4. Water shall be clean and clear, free of oils, acids, alkalis, organic matter or other deleterious substances and shall conform to the requirements of ASTM C94.

2.2 SAND-CEMENT MIXTURE PRODUCT

A. The mixture shall consist of not less than 1.5 sacks of Portland cement per cubic yard (1.1 sacks per ton) of material mixture as placed. The mixture shall contain sufficient water to hydrate the cement.

B. The cement, sand and water shall be mixed in a pug mill type mixer, which meets the approval of the Engineer. It shall be mixed for a minimum period of two minutes per batch.

PART 3 – EXECUTION

3.1 APPLICATION

A. The sand cement mixture shall be placed in maximum eight (8) inch thick lifts, loose measure, and thoroughly rodded and tamped around the pipe, boxes, structures, and paving sections. Placement and compaction shall be performed in a manner that will thoroughly fill all voids without placing undue strain on or displacement of the structure.

B. Cement stabilized sand backfill below the top of sewers, manholes, inlets or other structures shall be placed equally along all sides of the structure. Cement stabilized sand backfill/bedding shall be placed in a manner that will completely fill all voids in the trench. Should compaction be required to fill all voids in the areas described, hand operated tampers may be used.

C. Materials not placed and compacted within four (4) hours after mixing shall be rejected. Do not place or compact sand-cement mixtures in standing or free water.

D. Cement stabilized sand backfill/bedding that is placed in trench bottoms or all other locations between the tops of sewer lines to the bottom of the subgrade, shall be compacted to a minimum of ninety five percent (95%) of Standard Proctor Density (ASTM Method D558), and shall apply to all areas of construction within the limits of the project.

E. In-place density tests shall be taken at each location, each day, to test the placement of bedding/backfill material as directed by the Engineer. In-place densities shall be determined in accordance with ASTM D2922 or ASTM D1556.

END OF SECTION 31 23 23.16

SECTION 31 32 13.17 - CEMENT STABILIZED SUBGRADE

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SUMMARY

A. This item shall consist of treating the subgrade by the pulverizing, the addition of Portland cement, mixing, wetting and compacting the mixed material to the required density. This item applies to natural ground, embankment or existing pavement structure and shall be constructed as specified herein and in conformity to the typical sections, lines and grades as shown, on the plans or as established by the Engineer.

B. Cement treatment shall not be mixed or placed when the air temperature is below 40° F and falling, but may be mixed or placed when the air temperature is above 35° F and is rising, the temperature being taken in the shade and away from artificial heat and with the further provision that cement treatment shall be mixed or placed only when weather conditions, in the opinion of the Engineer, are suitable.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Soil shall consist of approved material free from vegetation or other objectionable matter encountered in the existing roadbed and other acceptable material used in the preparation of the roadbed in accordance with this specification.

B. Portland cement shall be Type I of a standard brand of cement and shall conform to the requirements of ASTM Designation C150.

One sack, containing 1 cubic foot of cement, shall be considered as weighing 94 pounds net. One barrel of cement shall be considered as weighing 376 pounds net and containing 4 cubic feet.

The Contractor, at his option, may use bulk cement, provided the apparatus for handling, weighing and spreading the cement is approved by the Engineer. Cement weighing equipment shall meet the requirements of the Item, "Weighing and Measuring Equipment".

C. Water shall be free from substances deleterious to the hardening of the cement treatment and shall meet the requirements of the Item, Concrete Pavement.

The ratio of cement to soil will be based on dry material weight and shall be established by the Engineer in the field to provide the desired stability. The normal range is 6-percent to 10-percent by weight. The percentage of moisture in the soil, at the time of the cement application shall not exceed the quantity that will permit the uniform and intimate mixture of soil and cement during the dry mixing operations and shall not exceed the specified optimum moisture content for the soil cement mixture, as determined by ASTM Method D558.

2.2 EQUIPMENT

A. Equipment necessary for proper construction of the work shall be on the project, in first-class working condition and be approved by the Engineer, both as to type and condition, prior to the start of construction operations. The Contractor shall at all times provide sufficient equipment to enable continuous prosecution of the work.

B. Portland cement treatment for materials in-place may be constructed with any machine or combination of machines and auxiliary equipment that will produce the results as outlined in this specification.

C. Mixing may be accomplished by a multiple-pass traveling mixing plant or a single-pass traveling mixing plant.

D. The equipment provided by the Contractor shall be operated by experienced and capable workmen and shall be that necessary to provide a cement treatment meeting the requirements herein specified.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. It is the primary requirement of this specification to secure a completed course of treated material containing a uniform Portland cement mixture free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his work, to process a sufficient quantity of material to provide full depth as shown on the plans, to use the proper amount of Portland cement, maintain the work and rework the courses as necessary to meet the above requirements.

B. The Portland cement shall be mixed to the full depth shown on the plans and in no case, shall it be less than six (6) inches.

C. The subgrade shall be firm and able to support, without displacement, the construction equipment at the density hereinafter specified. Soft or yielding subgrade shall be corrected and made stable by scarifying and aeration or adding cement and compacting until it is of uniform stability.

D. Before other construction operations are begun, the subgrade shall be graded, shaped and compacted, as required, to construct the Portland cement treatment for materials in-place in conformance with the lines, grades, thickness and typical cross section shown on the plans. Unsuitable soil or material shall be removed and replaced with acceptable material.

E. The soil shall be so pulverized that, at the completion of moist-mixing 100-percent by dry weight passes a 1-inch sieve, and a minimum of 80-percent passes a No. 4 sieve, exclusive of gravel or stone retained on these sieves. Old bituminous wearing surfaces shall be pulverized so that 100 percent will pass a 2-inch sieve.

F. Portland cement shall be spread uniformly on the soil at the rate specified or as approved by the Engineer. If a bulk cement spread is used, it shall be positioned by string lines or other approved methods during spreading to insure a uniform distribution of cement.

G. Cement shall be applied only to such an area that all operations can be continuous and completed in daylight and within 5 hours of such application.

H. The percentage of moisture in the soil at the time of cement application, shall not exceed the quantity that will permit uniform and intimate mixture of the soil and cement during dry mixing operations, and it shall not exceed the specified optimum moisture content for the soil cement mixture.

I. No equipment, except that used in spreading and mixing, will be allowed to pass over the freshly spread cement, until it is mixed with the soil.

J. After the cement has been applied, it shall be dry mixed with the soil. Mixing shall continue until the cement has been sufficiently blended with the soil to prevent the formation of cement balls when water is applied. Any mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

K. Immediately after dry mixing of soil and cement is complete, water as necessary shall be uniformly applied and incorporated into the mixture. Pressurized equipment shall provide an adequate supply to insure continuous application of the required amount of water to the sections being processed within 3-hours of the application of the cement. Proper care shall be exercised to insure proper moisture distribution at all times. After the last increment of water has been added, mixing shall continue until a thorough and uniform mix has been obtained.

L. The material shall be compacted to not less than 95-percent of standard proctor density (ASTM Method D698). At the start of compaction, the percentage of moisture in the mixture and in the un-pulverized soil lumps, based on dry weights, shall not be below or more than two percentage points above the specified optimum moisture content and shall be less than that quantity which will cause the soil cement mixture to become unstable during compaction and finishing. When the uncompacted soil cement mixture is wetted by rain so that the average moisture content exceeds the tolerance given at the time of final compaction, the entire section shall be reconstructed in accordance with this specification at the sole expense of the Contractor.

M. The specified optimum moisture content and field density shall be determined from representative samples of the soil, taken in the fields and blended cement in a materials laboratory setting in accordance with ASTM Method D698.

N. Prior to the beginning of compaction, the mixture shall be in a loose condition for its full depth. The loose mixture shall then be uniformly compacted to the specified density lines and grades.

O. After the soil and cement mixture is compacted, water shall be uniformly applied, as needed, and thoroughly mixed. The surface shall then be reshaped to the required lines, grades and cross section and then lightly scarified to loosen any imprint left by compacting or shaping equipment.

P. The resulting surface shall be thoroughly rolled with a pneumatic tire roller and "skinned" by a power grader to achieve final grade, removing all loosened soil and cement from the section. The surface shall then be thoroughly compacted with the pneumatic roller, adding small increments of moisture as needed during rolling. If aggregate larger than a No. 4 screen is present in the mixture, one complete coverage of the section with the flat wheel roller shall be made immediately after the skinning operation. When directed by the Engineer, surface finishing methods may be varied from this procedure, provided a dense uniform surface, free of surface compaction planes, is produced. The moisture content of the surface material must be maintained at its specified optimum during all finishing operations. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than 2-hours, a smooth, closely knit surface, free of cracks, ridges or loose material conforming to the crown, grade and line shown on the plans.

3.2 CURING

A. After the cement treated course has been finished as specified herein, the surface shall be protected against rapid drying by either of the following curing methods for a minimum period of 3-days, or as directed by the Engineer. These methods of curing are:
   1. Maintain in a thorough and continuously moist condition by sprinkling.
   2. Apply an asphalt membrane to the treated course, immediately after its completion. The material for the asphalt membrane shall be MC-30. The asphaltic material shall meet the requirements of Item 300, "Asphalt Oils and Emulsions" contained in the Texas Highway Department; "Standard Specifications for Construction of Highways, Streets and

Bridges," Latest Edition. The quantity and type of asphalt approved for use by the Engineer shall be sufficient to completely cover and seal the total surface of the base and fill all voids. If the Contractor elects to use this method, it shall be his responsibility to protect the asphalt membrane from being picked up by the traffic. The asphalt membrane may remain in-place when the proposed surface or base courses are placed. The surface or other base courses may be applied on the finished base as soon after completion as operations will permit.

3.3 CONSTRUCTION JOINTS

A. At the end of each day's construction a straight transverse construction joint shall be formed by cutting back into the total width of completed work to form a true two-inch depth vertical face free of loose and shattered material.

B. Cement treatment for large wide areas shall be built in a series of parallel lanes of convenient length and width meeting the approval of the Engineer.

3.4 TRAFFIC

A. After the 3 day curing period, or as directed by the Engineer, completed sections of cement treated material in-place, may be opened immediately to local traffic and to construction equipment and to all traffic after the curing period, provided the cement treated course has hardened sufficiently to prevent marring or distorting the surface by equipment or traffic.

3.5 MAINTENANCE

A. The Contractor shall be required, within the limits of his contract, to maintain the cement treated course in good condition until all work has been completed and accepted. Maintenance shall include immediate repairs to any defects that may occur. This work shall be done by the Contractor at his own expense and repeated as often as may be necessary to keep the area continuously intact. Faulty work shall be replaced for the full depth at treatment. It is the intent of this specification that the Contractor construct the plan depth of cement treatment in one homogenous mass. The addition of thin stabilized layers will not be permitted in order to provide the minimum specified depth.

3.6 QUALITY ASSURANCE

A. The Testing Laboratory’s representative will determine the Moisture-Density Relationships in accordance with ASTM Method D698 on material secured from the roadway. Samples will be blended with Portland cement for each type of material encountered.

B. The Testing Laboratory’ representative will determine the in-place density in accordance with ASTM Methods D2922 or D1556. The minimum level of testing will consist of at least three tests for each 1,000 feet per lane of roadway or 4,000 square feet (500 square yards) of embankment.

3.7 MEASUREMENT

A. The work performed and the material furnished as prescribed by this item will be measured as follows:
   1. Manipulation of cement during stabilization of the subgrade will be measured by the square yard of surface area of the completed and accepted work in-place.
   2. Portland cement will be measured by the ton of 2,000 pounds.

END OF SECTION 31 23 13.17

SECTION 31 32 13.19 - LIME STABILIZED SUBGRADE

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SUMMARY

A. This item shall consist of treating the subgrade, by the pulverizing, addition of lime, mixing and compacting the mixed material to the required depth and density, and in the amounts shown on the plans.

B. This item applies to natural ground, embankment, base or sub-base and shall be constructed to the sections, lines and grades shown on the plans. The subgrade shall be stabilized with lime to a depth of at least 6-inches in the amount recommended by a materials engineering laboratory. The P.I. shall be determined by ASTM Method D4318.

1.2 QUALITY ASSURANCE

A. The Testing Laboratory's representative will determine the Moisture-Density Relationships in accordance with ASTM Method D698 on material secured from the roadway after stabilization with lime, for each type of material encountered.

B. The Testing Laboratory's representative will determine the in-place density in accordance with ASTM Method D2922 or D1556. The minimum level of testing will consist of at least three tests for each 1,000 feet per lane of roadway or 4,000 square feet (500 square yards) of embankment.

1.3 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Lime for stabilization shall be classified as Type A- Hydrated Lime, or Type B- Commercial Lime Slurry, conforming to the requirements of Section 31 32 13.20 - Hydrated Lime and Lime Slurry.

2.2 EQUIPMENT

A. The machinery, tools and equipment necessary for proper execution of the work shall be on the project and approved by the Engineer prior to the beginning of construction operations. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

A. It is the primary requirement of this specification to secure a completed course of treated material containing a uniform lime soil mixture free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his

work, to use the proper amount of lime, maintain the work and rework the courses as necessary to meet the above requirements.

B. The subgrade shall be constructed and shaped to conform to the typical sections, lines and grades as shown on the plans or as established by the Engineer. The subgrade shall be firm and able to support, without displacement, the construction equipment at the density herein specified. Any wet or unstable materials below the secondary grade shall be corrected, as directed by the Engineer, by scarifying, adding lime, and compacting, or other methods until satisfactory stability is obtained. The cost of the repair of the secondary subgrade and any materials below the secondary subgrade is incidental to this Section.

C. The Contractor shall be required to proof-roll the subgrade, as directed by the Engineer, before using the pulverizing machine and correct any soft areas that this rolling may reveal.

D. Lime shall be spread only on that area where the first mixing operations can be completed during the same working day. The application and mixing of lime with the material shall be accomplished by the methods hereinafter described as "Dry Placing" or "Slurry Placing". When Type A, Hydrated Lime, is specified, the Contractor may use either method, unless otherwise noted on the plans.

E. When dry placing, the lime shall be spread by an approved spreader or by bag distribution at the rates shown on the Bid Sheet, or as directed by the Engineer.

F. The lime shall be distributed at a uniform rate and in such a manner as to reduce the scattering of lime by wind to a minimum. Lime shall not be applied when wind conditions, in the opinion of the Engineer, are such that blowing lime becomes objectionable to traffic or adjacent property owners. A motor grader shall not be used to spread the lime.

G. The material shall be sprinkled as directed by the Engineer, until the proper moisture content has been secured. Where Type A, hydrated lime is specified and slurry placement is used, the Type A hydrate shall be mixed with water to form a slurry of the solids content designated by the Engineer. A minimum of two mixing passes will be required.

H. Where Type B, commercial lime slurry is to be used, it shall be of the minimum solids and purity for the applicable grade being used. The distribution of lime shall be at the rates shown on the proposal form, or as directed by the Engineer. Proper application shall be attained by successive passes over a measured section of the roadway, until the proper moisture and lime content has been secured. The distributor truck shall be equipped with an agitator, which will keep the lime and water in a uniform mixture.

I. The material and lime shall be thoroughly mixed by approved road mixers or other approved equipment, and the mixing continued until, in the opinion of the Engineer, a homogenous friable mixture of material and lime is obtained, such that when all non-slaking aggregates retained on the 3/4-inch sieve are removed, the remainder of the material shall meet the following requirements when tested in accordance with ASTM Method C136, from samples procured from the roadway.

TABLE I

Minimum Passing 1 3/4" sieve	100 Percent
Minimum Passing 3/4" sieve	85 Percent

J. If gradation is achieved on the first mixing, no additional mixing is required.

K. The soil lime mixture shall be sprinkled during the mixing operation as directed by the Engineer to provide optimum moisture in the mixing. The subgrade shall be stabilized to a minimum depth of

6-inches and compacted to a minimum of 95-percent of standard proctor density (ASTM D698) at a moisture content of optimum to 3-percent above optimum.

L. During the interval of time between application and mixing, hydrated lime that has been exposed to the open air for a period of 6-hours, or more, or has had excessive loss due to washing or blowing will not be accepted for payment.

M. Compaction of the mixture shall begin immediately after final mixing unless approval has been obtained from the Engineer not to do so. The material shall be aerated and/or sprinkled as necessary, to provide the optimum moisture content. Compaction shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted.

N. The material and lime shall be thoroughly mixed by approved road mixers or other approved equipment and the mixing continued until, in the opinion of the Engineer, a homogenous, friable mixture of material and lime is obtained, free from all clods or lumps. Materials containing plastic clays or other materials which will not readily mix with lime shall be mixed as thoroughly as possible at the time of lime application, brought up to the proper moisture content and left to cure 48 to 96, hours as directed by the Engineer. During the curing period the material shall be kept moist as directed.

O. If a second mixing is required, the material shall be given a final mixing, using approved methods. If the soil binder-lime mixture contains clods, they shall be reduced in size by raking, blading, discing, harrowing, scarifying, or the use of other approved pulverization methods, so that all non-slaking material retained on the 3/4-inch sieve is removed and the remainder of the material shall meet the gradation requirements outlined by Table I. After the second mixing has been completed, the material shall be allowed to cure for a minimum of 3 days, unless otherwise directed by the Engineer.

P. The material shall be sprinkled and rolled, as directed by the Engineer. All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding or removing material as required and reshaping and re-compacting by sprinkling and rolling. The surface of the course shall be maintained and cured for a minimum of 3 days, prior to placing a base or surface course or until traffic is allowed to travel thereon.

Q. In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests as necessary will be made by the Engineer. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. Throughout this entire operation, the shape of the course shall be maintained by blading and the surface upon completion shall be smooth and in conformity with the typical section shown on the plans and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density and finish before the next course is placed or the work is accepted, it shall be reprocessed and refinished at the expense of the Contractor.

3.2 FINISHING

A. After the final course of the lime treated subgrade has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling as directed with a pneumatic tire or other suitable roller sufficiently light to prevent hair cracking. The completed section shall be moist or emulsion cured until covered by base material, unless otherwise directed by the Engineer. If the plans provide for the treated material to be sealed or covered by other courses of material, such seal or course shall be applied within 14 days after final mixing and compaction is completed, unless otherwise directed by the Engineer.

END OF SECTION 31 32 13.19

SECTION 31 32 13.20 - HYDRATED LIME AND LIME SLURRY

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section establishes the requirements for hydrated lime and commercial lime slurry of the type and grade considered suitable for use in the treatment of natural or processed materials or mixtures for subgrade, sub-base and base construction.

1.2 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 – PRODUCTS

2.1 MATERIALS

A. The various types and grades are defined and identified as follows:

1. Type A, Hydrated Lime: Shall consist of a dry powder obtained by treating quicklime with enough water to satisfy its chemical affinity for water under the conditions of its hydration. This material is to consist essentially of calcium hydroxide or a mixture of calcium hydroxide and a small allowable percentage of calcium oxide, magnesium oxide and magnesium hydroxide. Hydrated lime shall meet the requirements of ASTM Designation.
   a. When sampled and tested according to prescribed Texas Highway Department procedures, hydrated lime shall conform to the following requirements as to chemical composition:
      1) Hydrate alkalinity, percent by weight CA (OH)2 Min. 90.0%
      2) Unhydrated lime content, percent by weight CaO Max. 5.0%
      3) "Free Water" content, percent by weight H 2 0 Max. 4.0%

   b. The percent by weight of residue retained shall conform to the following requirements:
      1) Residue retained on a No. 6 sieve Max. 0.0%
      2) Residue retained on a No. 10 sieve Max. 1.0%
      3) Residue retained on a No. 30 sieve Max. 2.5%

   c. Specifications for Type "A" applies specifically to the normal hydrate of lime made from "high-calcium" type limestone. Hydrated Lime for stabilization purposes shall be applied, as provided in the governing specifications, as a dry powder or mixed with water to form a slurry.

2. Type B, Commercial Lime Slurry: Shall be pumpable suspension of solids in water. The water or liquid portion of the slurry shall not contain dissolved material in sufficient quantity and/or nature injurious or objectionable for the purpose intended. The solids portion of the mixture, when considered on the basis of "solids content", shall consist principally of hydrated lime of a quality and fineness sufficient to meet the following requirements as to chemical composition, residue and delivered in trucks which shall be equipped with an agitator which will keep the lime and water in a uniform mixture.
   a. Chemical Composition: The "solids content" of the lime slurry shall have a hydrate alkalinity Ca (OH)2 of not less than 90% by weight.

b. Residue: The percent by weight of residue retained in the "solids content" of lime slurry shall conform to the following requirements:
   1) Residue retained on a No. 6 sieve Max. 0.0%
   2) Residue retained on a No. 10 sieve Max. 1.0%
   3) Residue retained on a No. 30 sieve Max. 2.5%

c. Type B: Commercial Lime Slurry shall conform to one of the following grades:
   1) Grade 1: The "Dry Solids Contents", shall be at least 31 percent by weight of the slurry.
   2) Grade 2: The "Dry Solids Contents", shall be at least 35 percent by weight of the slurry.
   3) Grade 3: The "Dry Solids Contents", shall be at least 46 percent by weight.

PART 3 – EXECUTION

3.1 SAMPLING AND TESTING

A. The sampling and testing of lime slurry shall be as determined by Test Method Tex-600-J, "Lime Testing Procedure".
   1. When Type A: Hydrated Lime is used, the quantity of lime will be measured by the ton of 2000 pounds, dry weight.
   2. When Type B: Commercial Lime slurry, is used, the quantity of lime shall be calculated from the required minimum percent solids based upon the use of Grade 1, Grade 2, or Grade 3 as follows:
      a. Grade 1: The "Dry Solids Content" shall be at least 31 percent by weight of the slurry and the quantity of lime will be calculated by the ton of 2000 pounds based on the 31 percent dry weight solids.
      b. Grade 2: The "Dry Solids Content" shall be at least 35 percent by weight of the slurry and the quantity of lime will be calculated by the ton of 2000 pounds based on the 35 percent dry weight solids.
      c. Grade 3: The "Dry Solids Content" shall be at least 46 percent by weight of the slurry and the quantity of lime will be calculated by the ton of 2,000 pounds based on the 46 percent dry weight solids.

END OF SECTION 31 32 13.20

SECTION 31 32 13.21 - LIME-FLYASH STABILIZED SUBGRADE

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE

A. This item shall consist of treating the subgrade by the pulverizing, addition of lime flyash and/or flyash, mixing and compacting the mixed material to the required density. This item applies to natural ground and embankment and shall be constructed as specified herein and in conformity with the typical sections, lines and grades shown on the Plans.

1.2 QUALITY ASSURANCE

A. The Materials Engineer will determine the Moisture-Density Relationship in accordance with ASTM Method D698, on material secured from the roadway. Samples shall be blended with Lime-Flyash in the laboratory for each type of material encountered.

B. The Materials Engineer will determine the in-place density in accordance with ASTM Method D2922 or D1556. The minimum level of testing will consist of at least three tests of 4,000 square feet (500 square yards) of subgrade.

1.3 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Hydrated lime shall meet the requirements of ASTM C977 and SECTION 31 32 13.20 – HYDRATED LIME AND LIME SLURRY of these Specifications. When Type B, commercial lime slurry, is specified, the Contractor shall select, prior to construction, the grade to be used and shall notify the Engineer in writing before changing from one grade to another.

B. Flyash shall meet the requirements of ASTM C618, Class C. Flyash shall also have a minimum CaO content of 20 percent.

C. Water shall meet the requirements of ASTM Designation C94.

2.2 EQUIPMENT

A. Machinery, tools and equipment for proper performance of the work shall be on the Project and approved by the Engineer prior to the beginning of construction operations.

B. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.

C. Hydrated lime and flyash shall be stored and handled in closed, weatherproof containers until immediately before distribution on the subgrade. If storage bins are used, they shall be completely enclosed. Materials in bags shall be stored in weatherproof buildings with adequate protection from ground dampness.

D. If lime and/or flyash are furnished in trucks, each truck shall have a weight ticket from a certified

scale.

E. If lime and/or flyash are furnished in bags, each bag shall bear the manufacturer's certified weight. Bags varying more than five percent from that weight may be rejected and the average weight of the bags in any shipment, as shown by weighing 50 bags taken at random, shall not be less than the manufacturer's certified weight.

PART 3 – PRODUCTS

3.1 CONSTRUCTION METHODS

A. It is the primary requirement of this Specification to secure a complete course of treated material containing a uniform lime-flyash or flyash mixture free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth, and with a smooth surface and suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his work, to use the proper amount of lime and flyash, maintain the work and rework the courses as necessary to meet the above requirements.

B. Before other operations are begun, the subgrade shall be graded, shaped, and compacted as required to construct the lime-flyash or flyash treatment for materials in-place in conformance with the lines, grades, thickness and typical cross sections shown on the Plans. Unsuitable soil or material shall be removed and replaced with acceptable material.

C. The subgrade shall be firm and able to support, without displacement, the construction equipment at the compaction hereinafter specified. Soft or yielding subgrade shall be corrected and made stable by scarifying and aeration or adding lime and/or flyash and compacting until it is of uniform stability.

D. The Contractor shall be required to use a cutting and pulverizing machine that will remove the subgrade material accurately to the secondary subgrade; and pulverize the material at the same time. He will not be required to expose the secondary grade nor windrow the material. However, the Contractor shall be required to roll the subgrade, before using the pulverizing machine and correct any soft areas that this rolling may reveal. This method will be permitted only where a machine is provided which will insure that the material is cut uniformly to the proper depth and which has cutters that will plane the secondary grade to a smooth surface over the entire width of the cut.

E. The cost of the repair of the secondary subgrade and any materials below the secondary subgrade is incidental to this item.

F. When lime-flyash stabilization is required it shall be a two-phase operation, with the lime placed and allowed to cure, before the flyash stabilization begins.

G. Application of the lime and the subsequent curing shall be in accordance with SECTION 31 32 13.19 - LIME STABILIZED SUBGRADE. After the subgrade has cured for the time required by that Specification, then flyash stabilization may begin. Flyash stabilization shall be in accordance with this Specification. Unless otherwise noted, the thickness of stabilization shall be 6-inches.

H. The machine will be of such design that a visible indication is given at all times that the machine is cutting to the proper depth.

I. Lime shall be spread only on that area where the first mixing operation can be completed during the same working day.

J. The sequence of application of lime and flyash, with the material, shall be accomplished by the methods hereinafter described as "Dry Placing", or "Slurry Placing". When Type A, hydrated lime is specified, the Contractor may use either method.

K. The lime or flyash shall be spread by a spreader or by bag distribution at the rate directed by the Engineer.

L. For dry placing, the lime or flyash shall be distributed at a uniform rate and in such a manner as to reduce the scattering of lime or flyash by wind to a minimum. Lime or flyash shall not be applied when wind conditions are such that blowing lime or flyash becomes objectionable to traffic or adjacent property owners. A motor grader shall not be used to spread the lime or flyash.

M. The materials shall be sprinkled until the proper moisture content has been secured. However, initial mixing after the addition of lime or flyash will be accomplished dry or with a minimum of water to prevent lime and/or flyash balls.

N. For slurry placing, the lime or flyash shall be mixed with water in vehicles with approved distributors and applied as a thin water suspension or slurry.

O. Type B, commercial lime slurry, shall be applied with a lime percentage not less than that applicable for the grade used. The distribution of lime and flyash shall be attained by successive passes over a measured section of roadway until the proper moisture and lime or flyash content has been secured. The distributor vehicle shall be equipped with an agitator, which will keep the lime or flyash and water in a uniform mixture.

P. The mixing procedure shall be the same for "Dry Placing or "Slurry Placing", as hereinafter described.

Q. The material shall be uniformly mixed by approved methods. If the soil binder lime mixture contains clods, they shall be reduced in size by raking, blading, discing, harrowing, scarifying or the use of other approved pulverization methods so that when all non-slaking aggregates retained on the 3/4" sieve are removed, the remainder of the material shall meet the following requirements when tested at the field moisture condition, or dry by laboratory sieves in accordance with ASTM Method C136.

Minimum Passing 1-3/4 sieve	100 percent
Minimum Passing 3/4 sieve	85 percent

R. It is the intent of this Specification that lime and flyash shall be spread as directed by the Engineer.

S. The amount of lime and flyash used shall be as directed by the Engineer.

T. During the interval of time between application and mixing, hydrated lime or flyash that has been exposed to excessive loss due to washing or blowing will not be accepted for payment. Spreading, mixing, compaction and finishing for lime-flyash stabilized subgrade should be completed during daylight hours of the same day.

U. If flyash only is to be used without lime, the following mixing procedures shall apply.

V. The raw material shall be thoroughly mixed by approved road mixers or other approved equipment, and the mixing continued until a homogeneous, friable mixture is obtained, free from all clods or lumps.

W. The flyash shall be distributed at a uniform rate and in such manner as to reduce the scattering of flyash by the wind to a minimum. Flyash shall not be applied when wind conditions, are such that blowing flyash becomes objectionable to traffic or adjacent property owners. A motor grader shall not be used to spread flyash.

X. The material and flyash shall be thoroughly mixed by approved road mixers or other approved equipment and the mixing continued until a homogeneous, friable mixture of materials is obtained, free from all clods or lumps. If the soil binder-flyash mixture contains clods, they shall be reduced in size by raking, blading, discing, harrowing, scarifying or the use of other approved pulverization

methods so that when all nonslaking aggregates, retained on the 3/4" sieve are removed, the remainder of the material shall meet the following requirements when tested at the field moisture condition or dry by laboratory sieves using ASTM Method C136:

Minimum Passing 1-3/4 sieve	100 percent
Minimum Passing 3/4 sieve	85 percent

Y. Flyash shall be applied only to such an area that all the operations can be continuous and completed in daylight.

Z. During the interval of time between application and mixing, flyash that has been exposed to the open air for a period of 6 hours or more, or to excessive loss due to washing or blowing will not be accepted for payment. It is recommended that the mixing and compaction of flyash stabilized subgrade by completed within 2 hours in order to take advantage of rapid initial set characteristics.

AA. Mixing after the addition of flyash will be accomplished dry or with a minimum of water to prevent flyash balls.

BB. Compaction of the mixture shall begin immediately after adding and mixing of the last stabilizing agent and be completed within 6 hours. The material shall be aerated or sprinkled as necessary to provide the optimum moisture. Compaction shall begin at the bottom and shall continue until the entire depth of the mixture is uniformly compacted to 95 percent of standard proctor density (ASTM D698), to a minimum depth of 6 inches. In addition to the requirements it shall be compacted to the extent necessary to remain firm and stable under the construction equipment. Throughout the entire operation the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical section shown of the Plans and to the established lines and grades.

CC. After the final layer of the lime-flyash or flyash treated subgrade has been compacted, it shall be brought up to the required lines and grades, and in accordance with the typical sections.

DD. The resulting surface shall be thoroughly rolled with a pneumatic tire roller and skinned by a power grader to achieve final grade, removing all loosened stabilized material from the section. The surface shall be thoroughly compacted with the pneumatic roller, adding small increments of moisture as needed during rolling. If aggregate larger than a 3/4" screen is present in the mixture, one complete coverage of the section with the flat wheel roller shall be made immediately after the skinning operation. Surface finishing methods may be varied from this procedure to provide a dense, uniform surface, free of surface compaction planes. The moisture content of the surface material must be maintained at optimum during all finishing operations. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than 2 hours, a smooth, closely knit surface, free of cracks, ridges or loose material conformity to the crown, grade and line shown on the Plans.

EE. After the lime-flyash or flyash treated course has been finished as specified herein, the surface shall be protected against rapid drying by either of the following curing methods for a period of not less than 3 days or as directed by the Engineer.
1. Maintain in a thorough and continuously moist condition by sprinkling.
2. Apply an asphalt membrane to the treated course, immediately after same is completed. The asphalt material for the membrane shall be MC-30. Asphaltic material shall meet the requirements of Item 300, Oils, Asphalts and Emulsions, of the TxDOT "Standard Specifications for Construction of Highways, Streets and Bridges". The asphalt shall completely cover and seal the total surface of the base and fill all voids. If the Contractor elects to use this method, it shall be his responsibility to protect the asphalt membrane from being picked up by traffic.

FF. The asphalt membrane may remain in place when the proposed surface or other base courses are applied.

GG. Completed sections of lime-flyash or flyash treated material in-place may be opened immediately to local traffic and to construction equipment and to all traffic after the curing period, provided the lime-flyash or flyash treated course has hardened sufficiently to prevent marring or distorting the surface by equipment or traffic, and after the minimum 3 day curing period. If the Plans provide for the treated material to be sealed or covered by other courses of material such seal or course shall be applied within 14 days after compaction unless otherwise directed by the Engineer. Should the material, due to any reason or cause, lose the required stability, density and finish before the next course is placed, it shall be reprocessed and refinished at the expense of the Contractor.

END OF SECTION 31 32 13.21

SECTION 31 41 00 - TRENCH SAFETY SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SUMMARY

A. This item is for furnishing all labor and materials for installation and maintenance of a trench safety system.

B. For any trench excavation in materials other than solid rock, greater than five (5) feet in depth, or where shown on the plans, the contractor shall provide a trench safety system. This trench safety system shall be in accordance with the appropriate requirements established in the Occupational Safety and Health Administration (OSHA), Safety and Health Regulations, Part 1926, Subpart P - "Excavations, Trenching and Shoring" (latest edition).

1.2 MEASUREMENT

A. Measurement of the "Trench Safety System" for gravity pipelines and boxes and for pressure pipelines shall be made by the linear foot of trench measured along the centerline of the trench.

1.3 PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 – PRODUCTS
Not Used

PART 3 – EXECUTION
Not Used

END OF SECTION 31 41 00

SECTION 32 05 19.18 - PVC - GEOMEMBRANE LINER FOR TURF SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The GEOSYNTHETICS CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the installation of all geomembrane, complete with appurtenances, as shown, specified or required by the Drawings.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. D 618 Conditioning
   2. D 751 Hydrostatic Burst Test, Section 33, Procedure A
   3. D 792 Specific Gravity
   4. D 882 Tensile Properties
   5. D 1004 Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting
   6. D 1203 Volatile Loss
   7. D 1204 Dimensional Stability
   8. D 1239 Water Extraction
   9. D 1790 Low Temperature Impact
   10. D 4354-99 Standard Practice for Sampling of Geosynthetics for Testing
   11. D 4551 PVC Plastic Concealed Water Containment Membrane
   12. D 4873-01 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
   13. D 5199-01 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
   14. D 5321-92 (1997) Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
   15. D 5820-95 Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes
   16. D 6214 Chemical Seam Evaluation
   17. D 6243-98 Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method
   18. D 6392-99 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
   19. D 7176 Standard Specification for Non-Reinforced Polyvinyl Chloride (PVC) Geomembranes used in Buried Applications.
   20. D 7177 Standard Specification for Air Channel Evaluation of Polyvinyl Chloride (PVC) Dual Track Seamed Geomembranes

B. Environmental Protection, Inc.
   1. Quality Control Manual for Fabrication and Installation of PVC Geomembranes. January 1, 2006.

C. The most current version of the specified test method shall be followed by the MANUFACTURER, GEOSYNTHETICS CONTRACTOR or authorized testing laboratory.

1.3 DEFINITIONS

A. Minimum Value – Property value representing the lowest individual allowable value obtained when tested according to the specified test method. This applies to individual readings, such as thickness; or where only one specimen is tested for the specified parameter.

B. Minimum Average Value – Property value representing the lowest allowable value for the average of results for the specimens tested.

C. Nominal Value – Property value that is representative of a measurable property, determined under a set of prescribed test conditions, by which a product may be described.

D. Lot - For the purposes of this project, a “Lot” will be defined as a single run of geosynthetic material from the same production facility, where the tooling and raw materials of production have not changed during manufacturing.

E. Roll - A quantity geomembrane rolled up to form a single package as supplied from the manufacturer

F. Sheet - A part of the manufactures geomembrane material cut from the roll.

G. Panel - A series of geomembrane sheets fabricated together to make a larger unit, as supplied by a fabricator usually folded onto a pallet or folded then rolled on a core.

H. Manufacturer - A company that takes raw materials and calendars or extrudes them into geomembrane rolls

I. Fabricator - a company that converts geomembrane rolls into panels

J. Installer - a company that installs PVC geomembrane panels in field applications.

1.4 SUBMITTALS

A. The GEOSYNTHETICS CONTRACTOR shall submit to the ENGINEER all items included in this Article. Submittals shall be provided as follows:
   1. With the GEOSYNTHETICS CONTRACTOR’s BID:
      a. A project reference list documenting the experience of the GEOSYNTHETICS CONTRACTOR on a minimum of 5 projects consisting of at least 10 million square feet of installed PVC geomembrane.
      b. A copy of the Fabricator’s Quality Assurance/Quality Control (QA/QC) Plan for the complete geomembrane fabrication process.
      c. A schedule of operations, including means and methods of installation.
      d. The name of the fabricator of the geomembrane panels to be used for the project and the proposed method of joining adjacent geomembrane panels.

   2. At least 15 days prior to delivery of geomembrane to the site, unless otherwise noted below:
      a. Shop drawings, including proposed panel diagram and details of proposed work, pipe boots, and details of sealing around all necessary geomembrane penetrations, to be submitted at least 15 days prior to delivery of geomembrane to the site. The panel diagram must depict and/or note the planned number and orientation of panels, the panel sizes, seam orientation, placement of seams in corners, treatment of tee seams and the GEOSYNTHETICS CONTRACTOR’s preferred sequence of panel placement. The PVC panels shall be orientated in a manner that minimizes seams. The ENGINEER, prior to geomembrane installation must approve the panel diagram. The ENGINEER, in writing, prior to altering the installation, must approve proposed revisions to the panel diagram.

b. Geomembrane - Manufacturing Quality Control (MQC) data (Material Certifications) for the geomembrane to be delivered to the site. The reports shall include the quality control test results obtained during the manufacture of the material. In the event material is delivered to the site prior to the receipt of the MQC certificates, the material without certificates will be stored separately from the material with certificates. Material with unacceptable MQC data will be segregated from approved material and shall be marked for rejection. The geomembrane will be rejected if it is found to have defects, rips, holes, flaws, deterioration or other damage deemed unacceptable by the ENGINEER.
c. Geomembrane Sample - Samples of the proposed geomembrane shall be sent to the OWNER for interface shear testing within 5 days after the OWNER makes such request. The GEOSYNTHETICS CONTRACTOR shall coordinate the quantity and dimensions of the samples with the OWNER.

3. At least 15 days prior to installation:
   a. Resumes of geomembrane crew; including, Supervisor, QC Manager, and Master Seamer. The resumes shall include prior experience in installing PVC geomembrane. Individual geomembrane crew members will be subject to the approval of the ENGINEER and OWNER.
   b. A copy of the GEOSYNTHETICS CONTRACTOR's standard operating procedure (SOP) for operating an ATV on site, particularly with respect to specific uses of the ATV and the prevention of damage to materials.
   c. Field tensiometer calibration certificate showing that the equipment to be used for shear/peel testing in the field as been calibrated by a qualified individual within the previous 6 months.

4. During Installation Submitted Daily:
   a. Completed Subgrade Acceptance Form, as endorsed by the ENGINEER, prior to geomembrane deployment in any area.
   b. Construction progress reports clearly showing geomembrane placed by date.
   c. Passing and failing test results for trial seams.
   d. Documentation of passing and failing destructive and nondestructive testing of installed seams.

5. Within 5 days after completion:
   a. Summary and log of all field quality control work completed by the GEOSYNTHETICS CONTRACTOR.
   b. Certification statement signed by the Supervisor that geomembrane installation is complete and in accordance with these Specifications, with details of any changes or exceptions noted.
   c. Statement of material and installation warranties.

B. The above-noted requirements shall apply to all shop-fabricated materials and those items specified for fabrication in the field.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The GEOSYNTHETICS CONTRACTOR shall protect the work described in this Section before, during, and after installation, and shall protect the installed work specified in other Sections, as well as work completed by the OWNER.

B. Geomembrane labeling, shipment and storage shall follow ASTM D4551 as modified according to this Specification.
C. Product labels shall be placed on the top of panels such that they can be seen, clearly showing the fabricator or supplier name, product description, panel number, and panel dimensions.

D. Each panel of PVC shall include any additional information required to allow the ENGINEER to relate that panel with the manufacturing quality control and raw material quality assurance documentation. Additionally, if any special handling is required, it shall be so marked on the outside surface of the wrapping.

E. During storage, the geomembrane shall be placed on a stable, relatively flat, dry, well-drained surface. The geomembrane pallets shall not be placed on objects that may cause deformation of the geomembrane panels. Adequate space shall be left between stored panels, such that panel labels can be examined. The geomembrane shall be protected from the following:
   1. Site construction damage.
   2. Chemicals that are strong acids or bases.
   3. Flames, sparks, geomembrane temperatures in excess of 150° F.
   4. Any environmental condition that might damage the geomembrane.

F. Panel numbers on partially used panels must be maintained such that each panel number can be readily identified prior to deployment of the remaining portions of the panel.

G. If the ENGINEER determines the geomembrane is damaged, the GEOSYNTHETICS CONTRACTOR shall make all repairs and replacements in a timely manner, so as to prevent delays in the progress of the work.

PART 2 - MATERIALS

2.1 GENERAL

A. The geomembrane sheet shall consist of polyvinyl chloride (PVC) resin in amounts greater than 50% of the total polymer content suitably compounded with plasticizers, stabilizers, additives, and pigments, to satisfy the physical property requirements.

B. The ENGINEER shall conduct conformance testing on the geomembrane. The GEOSYNTHETICS CONTRACTOR shall, at no additional cost to the OWNER, provide whatever reasonable assistance the ENGINEER may require in obtaining samples for conformance testing. Geosynthetic material sampling frequency shall be in accordance with ASTM D4354, unless determined otherwise by the ENGINEER. A qualified laboratory with GAI-LAP accreditation shall conduct conformance testing.

C. Conformance testing will be at the expense of the OWNER, unless the tests show the material does not comply with the Specifications, in which case the GEOSYNTHETICS CONTRACTOR shall pay the cost of re-sampling and testing.

D. The GEOSYNTHETICS CONTRACTOR shall be solely responsible for the quality of the material provided. Should any of the tests performed on the material yield unsatisfactory results, the GEOSYNTHETICS CONTRACTOR will be responsible for replacing the material with satisfactory materials without delay to the project or cost to the OWNER.

2.2 GEOMEMBRANE

ASTM D7176 Standard Specification for Non-Reinforced Polyvinyl Chloride (PVC) Geomembranes used in Buried Applications.

Certified Properties	ASTM	PVC 10	PVC 20	PVC 30	PVC 40	PVC 50	PVC 60
Thickness	D 5199	10 ±0.5 mil 0.25±.013mm	20 ±1 mil 0.51 ± .03 mm	30 ±1.5 mil 0.76 ± .04 mm	40 ±2 mil 1.02 ± .05 mm	50 ±2.5 mil 1.27 ± .06 mm	60 ± 3 mil 1.52 ± .08 mm
Tensile Properties[2]	D 882 Min						
Strength at Break		24 lbs/in 4.2 kN/m	48 lbs/in 8.4 kN/m	73 lbs/in 12.8 kN/m	97 lbs/in 17.0 kN/m	116 lbs/in 20.3 kN/m	137 lbs/in 24.0 kN/m
Elongation		250%	360%	380%	430%	430%	450%
Modulus at 100%		10 lbs/in 1.8 kN/m	21 lbs/in 3.7 kN/m	32 lbs/in 5.6 kN/m	40 lbs/in 7.0 kN/m	50 lbs/in 8.8 kN/m	60 lbs/in 10.5 kN/m
Tear Strength	D 1004 Min	2.5 lbs 11 N	6 lbs 27 N	8 lbs 35 N	10 lbs 44 N	13 lbs 58 N	15 lbs 67 N
Dimensional Stability	D 1204 Max Chg	4%	4%	3%	3%	3%	3%
Low Temperature Impact	D 1790 Pass	-10° F -23° C	-15° F -26° C	-20° F -29° C	-20° F -29° C	-20° F -29° C	-20° F -29° C

Index Properties	ASTM	PVC 10	PVC 20	PVC 30	PVC 40	PVC 50	PVC 60
Specific Gravity	D 792 Typical	1.2 g/cc	1.2 g/cc	1.2 g/cc	1.2 g/cc	1.2 g/cc	1.2 g/cc
Water Extraction Percent Loss (max)	D 1239 Max Loss	0.15%	0.15%	0.15%	0.20%	0.20%	0.20%
Volatile Loss	D 1203 Max Loss	1.5%	0.9%	0.7%	0.5%	0.5%	0.5%
Soil Burial	G 160 Max Chg						
Break Strength		5%	5%	5%	5%	5%	5%
Elongation		20%	20%	20%	20%	20%	20%
Modulus at 100%		20%	20%	20%	20%	20%	20%
Hydrostatic Resistance	D 751 Min	42 psi 290 kPa	68 psi 470 kPa	100 psi 690 kPa	120 psi 830 kPa	150 psi 1030 kPa	180 psi 1240 kPa

Seam Strengths	ASTM	PVC 10	PVC 20	PVC 30	PVC 40	PVC 50	PVC 60
Shear Strength[2]	D-882 Min	20 lbs/in 3.47 kN/m	38.4 lbs/in 6.7 kN/m	58.4 lbs/in 10 kN/m	77.6 lbs/in 14 kN/m	96 lbs/in 17 kN/m	116 lbs/in 20kN/m
Peel Strength[2]	D-882 Min	10 lbs/in 1.8 kN/m	12.5 lbs/in 2.2 kN/m	15 lbs/in 2.6 kN/m	15 lbs/in 2.6 kN/m	15 lbs/in 2.6 kN/m	15 lbs/in 2.6 kN/m

***FTB = Film Tearing Bond *MD = Machine Direction *TD = Transverse Direction**

Notes:

1. Certified properties are tested by lot as spec ified in ASTM D-7176.
2. Metric values are converted from US values and are rounded to the available significant digits.
3. Modifications or further details of test are described in ASTM D-7176.
4. Index properties are tested once per formulation as specified in ASTM D-7176.

A. Geomembrane Conformance Testing - The ENGINEER shall take samples of the geomembrane panel for conformance testing. Unless otherwise specified, samples shall be three feet long by the roll width and shall not include the outer wrap. The ENGINEER or authorized representative shall mark the machine direction on the samples with an arrow.

1. Unless otherwise specified, conformance samples shall be taken at a rate of one per 100,000 square feet. An appropriate number of samples, as determined by the ENGINEER in accordance with ASTM D4354 will be taken. The ENGINEER will ship these samples directly to the CQA laboratory.
2. Geomembrane conformance samples selected by the ENGINEER may be tested for any properties specified in Article 2.3, but shall as a minimum be tested for the following:

GEOMEMBRANE CONFORMANCE

MINIMUM TESTING AND FREQUENCY

PROPERTY	TEST METHOD	
Thickness	ASTM D 5199	
Strength at Break	ASTM D 882	
Elongation	ASTM D 882	
Modulus at 100%	ASTM D 882	
Tear Strength	ASTM D 1004	
Low Temperature	ASTM D 1790	

3. Non-conforming material will not be used in the work. In the event nonconforming results are obtained from the laboratory, the nearest numbered rolls on each side of the non-conforming roll shall be sampled and tested for the full suite of conformance tests, until the extent of nonconformance is established, at no cost to the OWNER. The owner reserves the right to reject the lot of rolls at any stage of extended sampling and testing.

B. Interface Shear Testing - Interface shear strength testing of the geomembrane and related materials is the responsibility of the OWNER. The results must comply with the criteria determined by the OWNER, as specified in the Construction Drawings. All testing must meet the

minimum requirements, and the analysis of those results must be completed by the ENGINEER prior to installation of the materials. Testing for geosynthetic to geosynthetic, or geosynthetic to soil interface, shall be conducted according to the current version of ASTM D 5321-92 (97). Testing for interfaces involving geosynthetic clay liner (GCL) shall be conducted according to the current version of ASTM D 6243-98.

2.3 FACTORY FABRICATION

A. All completed factory seams are 100% inspected. Factory seams will be visually inspected for full seam continuity over their full length. Any areas that do not meet the specified requirements shall be removed and repaired per section.

B. Destructive tests will be performed to verify that the seam strength requirements of the specifications are met. Random samples shall be taken at a minimum of every 3,000 lineal feet of factory seam or once per factory panel fabricated, which ever is more frequent, and the following quality assurance tests will be performed on each sample:
   1. Thickness
   2. bonded seam strength (shear strength)
   3. peel adhesion

C. The sample shall be cut into ten one - inch wide specimens. Five peel and five bonded seam specimens are removed. Five specimens shall be tested for bonded seam strength (bss) and five for peel adhesion. To be acceptable, the average of five test specimens for peel and the average of five test specimens for bonded seam strength must meet the minimum peak load requirements of factory seams as follows:
   1. Bonded Seam Strength: One-inch strips cut with the weld centrally located are tested by stressing the weld in a "shear" configuration. That is, the top sheet is stressed in relation to the bottom sheet in a direction away from the weld. A pass result occurs when the specimen averages meet the minimum peak load requirements stated in the contract (usually 80% of specified sheet strength). A failure occurs when the weld separates or the material breaks at a peak load less than the minimum requirements. The test result to be reported will be the average of the peak loads recorded for each of the five specimens.
   2. Peel Adhesion: One-inch strips cut with the weld centrally located are tested by stressing the top sheet in relation to the overlapped edge of the lower sheet in an effort to peel the weld away. Each specimen will be peeled one inch along the seam length. A pass result occurs when the specimen meets the minimum peak load requirements stated in the contract. A failure occurs when the weld peels at a peak load less than the specification without film tearing bond. The test result to be reported is the average of the peak loads recorded for each of the four specimens.

D. Each test will be identified by panel serial number and the manufacturer's roll number. These tests shall be performed in the fabricators laboratory.

E. Prior to installation of the geomembrane at the site, the fabricator will provide to the ENGINEER, copies of manufacturer material certifications and a copy of quality control test results for all panels to be supplied, verifying conformance with this specification and the requirements as represented in ASTM D 7176 specification. The location of any defects and repairs and all necessary retesting results will also be documented in the report.

F. When a seam sample is removed from the panel being fabricated the resulting hole will be repaired with a patch with a minimum of a one inch bonded area around the patch, and the patch will be rounded on all corners.

G. Factory fabricated geomembrane panels are packaged accordion folded on a sturdy wooden pallet designed for fork lift truck access. Smaller panels (i.e. less than 500 lbs.) can be rolled on a fiber core, and placed on a pallet.

H. All panels will be packaged with a protective, black stretch wrap or cardboard cover to protect the panel from weather or shipping damage.

2.4 GEOMEMBRANE PENETRATION BOOTS

A. The GEOSYNTHETICS CONTRACTOR shall furnish all geomembrane penetration boots and other materials required for completion of the geomembrane installation. All geomembrane boots required for the project shall be factory prefabricated boots. The geomembrane shall be of the same thickness as the geomembrane panels.

B. Geomembrane penetrations are to be constructed only at the locations shown on the Plans. The GEOSYNTHETICS CONTRACTOR is cautioned that no deviation in the quantity or configuration of geomembrane penetrations will be accepted without the advance written approval of the ENGINEER.

C. All penetrations through the geomembrane shall be thoroughly and securely sealed. The seal between the geomembrane and the pipe shall be without any detectable leakage.

D. In attaching the geomembrane penetration boot in the field, no field seams will be allowed in locations or configurations that do not allow for Construction Quality Control testing. Visual observation is not considered a sole acceptable method for in-field quality control.

E. Where clamps, fasteners, gasket seals or sealants are used, the GEOSYNTHETICS CONTRACTOR shall use only materials that are compatible with the geomembrane.

PART 3 - EXECUTION

3.1 SITE PREPARATION

A. All required grading, grooming and construction quality assurance (CQA) testing on any low permeability soil or GCL to be covered by the geomembrane shall be complete and accepted by the ENGINEER prior to geomembrane placement.

B. The surface to be covered by the geomembrane shall be cleared of sharp objects, angular stones, sticks, or any materials that may contribute to punctures, shearing, rupturing or tearing of the geosynthetic materials. The geomembrane subgrade shall have a smooth, finished surface, free from pockets, holes, ruts, and discontinuities that, in the judgment of the ENGINEER, will cause bridging of the material. The subgrade shall be inspected for unsuitable areas or soft spots before the geomembrane is placed, and additional surface preparation will be required to eliminate any unsuitable areas as determined by the ENGINEER.

C. The GEOSYNTHETICS CONTRACTOR and ENGINEER shall carefully and completely inspect the subgrade surface immediately prior to the deployment of each geomembrane panel. No geomembrane shall be placed on unsuitable subgrade surface, or without the ENGINEER's written approval. The ENGINEER and the GEOSYNTHETIC CONTRACTOR's Quality Control (QC) inspector shall furnish their signatures on a Subgrade Acceptance Log prior to the installation of each panel or series of panels placed on a daily basis.

D. Under no condition shall the geomembrane be placed over standing water on the subgrade.

3.2 SEAMING METHODS

A. A six - inch wide overlap must be cleaned of all dust, dirt or foreign debris no more than 30 minutes prior to welding. Only clean, soft rags will be used for cleaning. If mud has adhered to the sheet surface overlap area, it will be removed with clean water and allowed to dry prior to seaming.

B. During the cleaning operation, the sheet will be inspected for defective areas which must be removed and/or repaired prior to seaming. The seaming operation requires a solid, smooth subsurface. Subsurface voids, hard nodules, rocks, soft areas or unsuitable conditions will be removed or repaired prior to seaming during subgrade preparation.

C. Seaming cannot be conducted in the presence of standing water. Wet surfaces must be allowed to dry. A slip sheet or seaming board may be used to lift the geomembrane above damp surfaces. If wind conditions contaminate the seaming area or displace the geomembrane sheets, temporary ballast and additional cleaning procedures will be required.

D. The geomembrane panels shall be joined utilizing approved seaming methods. Dual-track fusion welding shall be the required method on all seams where it is feasible. Chemical welds shall be made only where approved by the ENGINEER.

E. All geomembrane surfaces that are to become a seam interface are to be free of dust, dirt, excess moisture or any other condition that may affect the quality of the seam.

F. Seaming will not be allowed during rain or snowfall, unless proper precautions are made to allow the seam to be made on dry subgrade and geomembrane materials. If weather conditions are not satisfactory, panels will not be put into place. If panels are placed and pulled out, the installation crew will do what is necessary to finish or secure those individual panels that day.

G. The field seams shall be produced using one of the following methods:
   1. Dual-Track Thermal Fusion Weld – All field seams shall be fused using Dual-Track Thermal Fusion Welding. A seam produced by melting the two intimate surfaces by running a hot metal wedge or hot air device between the surfaces, followed immediately by pressure to form a homogeneous bond. This seam has a center air channel for non-destructive testing of the seam. Panels to be seamed shall be overlapped sufficiently to allow proper destructive testing of seams. The CONTRACTOR shall mark the liner where the Dual-Track Fusion Welding machine settings are adjusted (including speed, temperature and pressure). Measurable setting values shall be indicated on the liner.
   2. Chemical Fusion Weld – Chemical Fusion Welding shall only be used for repairs and detail work. All field seams will be a minimum of 2 inches wide. A sufficient amount of chemical fusion agent will be applied that, upon compressing the seam surfaces together, a thin excess of chemical fusion agent will be forced out. A high durometer rubber, nylon or steel roller will be used to compress the seam surfaces together until a bond is formed. Roller action will be at a parallel direction to the seam's edge so that excessive amounts of chemical fusion agent will be purged from between the sheets. Trapped chemicals should be rolled out of the seaming area. Care will be exerted in applying the chemical fusion agent. A continuous wet layer of chemical fusion agent is necessary to prevent a leak at the tie - in point between the last chemical fusion agent application and the next. If the chemical fusion agent, which is initially shiny when applied, takes on a dull filmy appearance, the interfaces may require a faster closing together or the ambient temperature is too high to continue seaming. The installer will monitor this condition at sheet temperatures over 105°F. At the completion of seaming, all rags, chemical containers, etc., will be properly removed from the geomembrane.

3.3 INSTALLATION

A. The number of panels to be deployed in any day will be limited to the number of panels which can be seamed that day. The geomembrane will be placed over the prepared surface in such a manner as to assure minimum handling.

B. Based on the approved geomembrane panel diagram and material certifications, the individual panels will be numbered and seams will be identified by using the panel numbers that create the seam. The PVC panels shall be installed in a manner that minimizes seams. Where ever possible longitudinal seams shall be oriented to be no greater than ten degrees from parallel with the direction of the slope. Cross seams (i.e. those seams which join the ends of contiguous panels) shall not be placed on any slope that exceeds a ten percent grade. All panels placed on slopes shall be cut no closer than five feet from the top of the slope or ten feet from the toe of slope. All seam overlaps shall be shingled in a downslope direction. In no case shall parallel seams be placed within five feet of the centerline of any leachate collection pipe.

B. During installation, and any other period of exposure of geomembrane, pedestrian and equipment activity over the geomembrane shall be kept to a minimum, and restricted to only that which is necessary for geomembrane construction.

C. Smoking is not permitted on the geomembrane.

D. Construction workers shall take precautions not to damage the geomembrane surface. Construction workers shall wear smooth-soled footwear, and exercise care not to drag tools across the geomembrane surface. All large tools are to have smooth base plates or shoes. Construction and landfill staff shall be informed of the restricted access to areas of geomembrane placement by use of barriers and signs posted as necessary.

E. The GEOSYNTHETICS CONTRACTOR shall perform all activities of geomembrane construction in such a way as to avoid damage to the geomembrane. Any damage caused to the geomembrane by the GEOSYNTHETICS CONTRACTOR shall be repaired or the material replaced at the expense of the GEOSYNTHETICS CONTRACTOR.

F. No tracked or wheeled vehicles, other than low ground pressure ATVs as preapproved by the ENGINEER, shall be permitted on the geomembrane prior to placement of adequate soil cover, as determined by the ENGINEER.

G. The GEOSYNTHETICS CONTRACTOR shall complete his work in a manner that will prevent water or wind from getting under the partially installed geomembrane. This could include, but is not limited to, installing sandbags along the leading edges. Should excessive moisture become trapped below the geomembrane, or should wind damage occur due to the negligence of the GEOSYNTHETICS CONTRACTOR, the GEOSYNTHETICS CONTRACTOR, at no extra cost to the OWNER, will be required to perform all work, including removing and replacing as much of the in-place geosynthetic material as the ENGINEER directs, to assure that the integrity of the geomembrane and the underlying subbase or geosynthetic clay liner (GCL) has not been compromised.

H. Seams shall be welded throughout the entire length of the panels during initial panel seaming.

I. Sandbags or other approved ballast shall be used to prevent bridging or material movement in areas such as toe of slope or near sumps. Ballast shall not be used to force the geomembrane into contact with the subgrade.

J. Special care shall be taken to prevent tensile stress in the geomembrane and geomembrane seams in all corners and grade changes.

K. The GEOSYNTHETICS CONTRACTOR shall exercise his best judgment and care to provide sufficient slack in the PVC geomembrane.

L. The geomembrane shall not be installed when ambient or sheet temperatures are below 32° F, when the sheet temperature exceeds 158° F, or when the air temperature is above 120° F unless the GEOSYNTHETICS CONTRACTOR demonstrates, to the satisfaction of the ENGINEER, that procedures can be implemented which will result in the proper installation and seaming of the geomembrane.

M. Adjacent geomembrane panels shall be allowed to reach essentially equivalent temperatures prior to seaming to avoid development of fishmouths.

N. If fishmouths are created at the seam overlaps, they shall be cut to achieve a flat overlap.

O. Geomembrane covering operations shall be performed in a manner that does not damage the geomembrane lining system. Geomembrane covering operations shall be performed only in the presence of a Construction Observer such that the condition and cleanliness of the geomembrane is observed at the time the material is covered, and any effects of the covering operation on the geomembrane lining system can be observed.

P. Any use of ATV's on the site must be pre-approved by the ENGINEER. The GEOSYNTHETICS CONTRACTOR shall submit an S.O.P. describing how ATV's are to be used, if at all, in the deployment of geomembrane at the site. As a minimum, the following shall apply:
   1. Any damage resulting from the use of ATV's, as determined by the ENGINEER, shall be repaired according to Article 3.3, at no additional cost to the OWNER. If repeated repairs are required as the result of the use of ATVs operating on geosynthetic material, further use of ATVs will be prohibited.
   2. Any and all ATV's proposed to be used in the deployment of geosynthetics will be inspected by the ENGINEER. ATV's which are found to be leaking oil or fuel, or which in any other way exhibit the potential to damage the lining system components, will not be permitted.
   3. Any oil or fuel which leaks onto geosynthetic materials shall be thoroughly removed (cleaned) by the GEOSYNTHETICS CONTRACTOR, or the geosynthetic material shall be replaced at the discretion of the ENGINEER, at no additional cost to the OWNER.
   4. Re-fueling of ATVs on geosynthetic materials is prohibited.
   5. ATVs shall have tires with low ground pressure, typically less than 5 psi, and shall have shallow treads.
   6. ATVs shall be operated by a single operator at speeds less than 5 mph.
   7. Quick starts, stops, spinning wheels and sharp turns will not be permitted above any geosynthetic material.

3.4 REPAIRS

A. All geomembrane panels and seams shall be examined by the ENGINEER for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The geomembrane surface shall be clean at the time of examination. Each suspect location shall be repaired and all repairs shall be nondestructivelytested.

B. Damaged geomembrane shall be removed and replaced with acceptable geomembrane if damage cannot be repaired to the satisfaction of the ENGINEER.

C. Any portion of the geomembrane, or any portion of a seam exhibiting a flaw or failing a destructive or non-destructive test, shall be repaired as follows:
   1. Geomembrane patches shall be used for holes over 1/8 of an inch in diameter, tears, and contamination by foreign matter. Patches shall be constructed of the same geomembrane, and will be joined to the panel using adhesive or chemical fusion welding where possible.

2. Geomembrane patches or caps shall extend at least 6 inches beyond the edge of the defect or failed seam area, and all corners of material to be patched. The corners of the patch shall be rounded.
3. Geomembrane caps shall be used to repair failed seams that are left inplace. Seams that fail destructive or non-destructive test ing may also be removed and replaced if determined necessary by the ENGINEER.

PART 4 - FIELD QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

4.1. GENERAL

A. Before installation begins, and weekly thereafter (more often if determined necessary by the ENGINEER) project coordination meetings shall be held with the designated representative of the EARTHWORKS CONTRACTOR, GEOSYNTHETICS CONTRACTOR, ENGINEER and OWNER in attendance to review the following information:
   1. Progress of the work.
   2. Adherence to the Specifications.
   3. Adherence to the Construction Quality Assurance Program described in this Section, including the timely submission of the pertinent forms.
   4. Planned work and methods for the ensuing week, including estimate of time remaining to completion of the work.
   5. Problem resolutions to be implemented during the upcoming week.

B. All of the Forms specified and required must be submitted to the ENGINEER in a timely fashion.

C. The OWNER and ENGINEER must approve any changes in the proposed method of work, subcontractors to be utilized, geomembrane resin, or manufacturing in advance.

D. The GEOSYNTHETICS CONTRACTOR assumes all responsibility relevant to providing an acceptable product.

4.2. INSTALLATION QA/QC

A. The ENGINEER and GEOSYNTHETICS CONTRACTOR shall visually inspect all material to be included in the work, and compare panel identification numbers with those on the certifications provided by the manufacturer to assure delivery of the appropriate material.

B. Damage to geomembrane during installation shall be repaired according to Article 3.4. If the ENGINEER determines that any damage cannot adequately be repaired, the damaged material will be replaced.

C. The GEOSYNTHETICS CONTRACTOR will be required to conduct both destructive and non-destructive testing on seams during the geomembrane installation, as part of the Construction Quality Control program. All trial and installed seam samples shall be tested.

D. Thermal Weld Trial Seams –
   1. Trial seams shall be produced each day, at the start of each workday, after every four hours of continuous operation, after each break in seaming of 1 hour or more, after a break that results in equipment replacement or shutdown, and if the geomembrane temperature changes by more than 45°F. Trial seams shall be required each day for each piece of seaming equipment and each welding crew combination (including welding technician, seam cleaners and/or helpers). The trial seams will be performed on strips of geomembrane from approved rolls, and shall be produced at the work location such that the conditions mimic those under which production seams will be made.
   2. A trial seam shall be a minimum of 5 feet in length for self-propelled seaming devices, and a minimum of 3 feet for hand-held seaming devices. The material for the trial seam

and the test fixture for ma king the field tests shall be provided by the GEOSYNTHETICS CONTRACTOR at no additional cost. One-inch wide cutouts of the trial seams will be subject to shear and peel testing at the site. A minimum of 3 cutouts will be tested for shear, and a minimum of 3 cutouts will be tested for peel. The ENGINEER shall document the locus of break code for each specimen as shown in Figure 3 and Figure 4 of ASTM D6392-99, included at the end of this Section.

3. All trial seam specimens must be acceptable or the trial seam will be repeated until all results from a given trial seam are found acceptable. If any trial seam fails at any time during the workday, the reason for the failure shall be resolved before any production seaming of the geomembrane by the subject equipment and crew. All trial seam welding and testing must be observed by the ENGINEER.
4. A trial seam specimen will be considered a failure if:
    a. In the shear test, the bonded thickness of the seam fails or the material breaks at a stress lower than specified.
    b. In the peel test, the two sheets comprising the seam separate at a peak stress lower than specified. Should the ENGINEER, at any time during the installation, believe the production seaming process may not be performing adequately, he may, to avoid destructive sampling of the installed geomembrane, request additional trial seams. The GEOSYNTHETICS CONTRACTOR at no additional cost shall do this.

E. The GEOSYNTHETICS CONTRACTOR shall complete non-destructive testing of all seams along their entire length, in the manner approved prior to installation, in the presence of the ENGINEER. The recommended test methods are as follows:
1. Pressurized Air Channel
    a. All field seams made by a dual-track fusion welding device will be tested by applying air pressure within the air channel to a sealed length of seam, and monitoring the pressure over time. The testing shall be conducted in accordance with ASTM D 7177.
    b. For the geomembrane, the initial inflation pressure shall be equal to or greater than the minimum according to ASTM D 7177. The minimum allowable pressure drop over a 30 second period shall be 5.0 psi.
    c. A pressure gauge shall be inserted into the end of the air channel to check for continuity in the air channel. Alternately, the far end of the seam may be cut to relieve the air pressure. An audible rush of air shall serve as an indicator that the test represents the entire length of seam.
    d. Air channels that do not hold the minimum specified air pressure shall be further inspected to identify the location and nature of any defects or unbonded sections of seam. The seam will then be repaired and retested. The ENGINEER may, at his discretion, require the entire questionable seam area to be capped or replaced.

2. Air Lance Testing
    a. The ENGINEER shall witness the testing, and the seam shall be clearly visible to the ENGINEER and GEOSYNTHETICS CONTRACTOR during the test. Unbonded areas or defects shall be marked by the ENGINEER for repair by the GEOSYNTHETICS CONTRACTOR.
    b. The air lance will be capable of supplying 50 PSI through a 3/16 inch diameter nozzle. The air stream is directed at the upper edge of the seam no more that 2 inches from the seam edge. Any voids in the seam will be marked, repaired, and re-tested with the air lance. The testing technician and the inspector will mark each seam or repair with an indelible marker as accepted immediately after completion of final air lance testing.

F. All inadequate seams or portions thereof that fail the non-destructive testing shall be repaired in accordance with this Specification and the method approved by the ENGINEER. Should

differences of opinion between the GEOSYNTHETICS CONTRACTOR and the ENGINEER develop during the installation relevant to seam integrity, the ENGINEER may, at his discretion, obtain samples of the seams in dispute for field and/or laboratory testing. The GEOSYNTHETICS CONTRACTOR will be responsible for patching the resulting void in accordance with the previously approved procedures at no additional cost to the OWNER.

G. Destructive Sample Collection - Samples of the in-place seams shall be cut from the installed geomembrane at a minimum frequency of one sample per 500 linear feet of seam, excluding repair seam length. A minimum of one seam sample shall be obtained for each seaming machine/operator combination for each day, or as directed by the ENGINEER. The cutout sections shall be 12 inches wide by 40 inches long with the seam centered lengthwise. The sample size can be reduced to 30" if the CONTRACTOR does not elect to have a cutout section for their use. A 1-inch wide specimen shall be cut from each end of the sample, and these two specimens shall be peel tested in the field in accordance with 4.2 G. The remaining sample shall be cut into 2 parts and distributed as follows:
   1. One 12-inch by 18-inch sample to the ENGINEER for independent laboratory testing; and,
   2. One 12-inch by 18-inch sample to the OWNER for archive storage.
   3. The remainder of the sample shall be available for the CONTRACTOR if requested at the time of sample collection.

H. The 12-inch by 18-inch laboratory sample will provide 5 specimens for shear testing and 5 specimens for peel testing. Specimens that will be subject to peel and shear testing shall be selected alternately from the sample. All peel tests shall be performed on the outer track of dual track fusion welds. The laboratory shall report the locus of break code for each specimen according to the definitions included in Figure 3 and Figure 4 of ASTM D 6392, included at the end of this Section. The laboratory sample will be considered acceptable only if all 10 specimens meet the minimum requirements. The specimen will be considered a failure if:
   1. In the shear test, the bond of the seam fails or the material breaks at a stress lower than specified.
   2. In the peel test, the two sheets comprising the seam separate at a peak stress lower than specified. Complete peel separation of the seam is allowable.
   3. In the shear or peel test, locus of break codes AD, AD-BRK, BRK, and SE are reported by the ENGINEER.

I. If a sample fails destructive testing, the welding path must be retraced to intermediate locations at least 10 feet in each direction from the location of the sample that failed the test, and a second sample shall be taken for an additional field test. If the tracking samples pass, the seam must be reconstructed between the location of the two tracking samples and the original sampled location. If the tracking sample fails, this process must be repeated. The seam between 2 passing test locations shall be capped, the cap seams shall be nondestructively tested, and shall include one field peel and shear test location along the reconstructed seam.

J. The ENGINEER and GEOSYNTHETICS CONTRACTOR shall visually inspect all geomembrane seams.

K. All welds shall be observed for traces of deformation to the geomembrane panels. Any seams, which in the opinion of the ENGINEER, have caused excessive deformation of the sheet, show signs of discoloration, exhibit thinning or stepping of the sheet, or show visual signs of overheating of the geomembrane panels, shall be repaired at no additional cost to the OWNER regardless of the result of any destructive testing on the seam. The deficient seam or portion thereof shall be cut out, the geomembrane panels again overlapped and seamed, or the questionable seam length shall be capped, as approved by the ENGINEER.

L. The GEOSYNTHETICS CONTRACTOR shall not place overlying materials on the installed geomembrane until the ENGINEER has reviewed and accepted the written test results for the

geomembrane to be covered. At a minimum, the predelivery testing, the daily log of trial seam results, laboratory destructive sample results, non-destructive test results, record drawings of the completed area, and approval of the seams in place will be reviewed.

M. The GEOSYNTHETICS CONTRACTOR shall provide a report to the OWNER and the ENGINEER at the conclusion of the work which shall include the following:
   1. The quality control tests used as specified and/or directed, including all requirements of the Report section of the specified test method.
   2. Complete description of field sampling procedure, number of test specimens, size of test specimens.
   3. Log of all Construction Quality Control work.

N. The GEOSYNTHETICS CONTRACTOR shall be responsible for all costs incurred by the OWNER including, but not limited to, additional field and laboratory CQA testing resulting from greater than 5 percent of the CQA testing not meeting or exceeding the Specifications.

O. All seams that cannot be subjected to the required Construction Quality Control or Construction Quality Assurance (CQA/CQC) testing shall be overcapped.

4.3. WARRANTY

A. The GEOSYNTHETICS CONTRACTOR shall issue a warranty on the installation of geomembrane for a minimum period of 1 year.

B. The GEOSYNTHETICS CONTRACTOR shall issue a warranty on the geomembrane material for a minimum period of 20 years.

END OF SECTION 32 05 19.18

SECTION 32 11 23.23 - "FREE-DRAINING STONE" BASE FOR SYNTHETIC TURF SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE

A. This specification covers the installation of a "free draining stone" base to provide a vertical drainage system beneath an infilled synthetic turf.

1.2 RELATED WORK

A. 31 20 00 – Earthwork

B. 31 23 00 - Construction of Underground Utilities

C. 32 05 19.17 HDPE- Geomembrane HDPE Liner

D. 32 05 19.18 PVC- Geomembrane PVC Liner

E. 33 41 00 - Storm Sewer and Appurtenances

1.3 QUALITY CONTROL

A. Contractor shall use an independent testing laboratory selected by the Owner to provide testing of the "free draining stone" base material.

1.4 SUBMITTALS

A. Submit the "free draining stone" base material to the Testing Laboratory for testing. The quantity of the "free draining stone" base material for testing to be determined by the Testing Laboratory.

1.5 STORAGE AND HANDLING

A. The "free draining stone" base material used for placement around the subdrain system may be temporarily stored on a clean, hard surface to prevent contamination of the stone material. Stone material used for placement on the subgrade shall be delivered and back dumped onto the subgrade such that the delivery truck is not traveling on the subgrade itself. The stone material shall be pushed onto the subgrade by working off of previously placed material. Contractor shall sequence delivery of the stone material to minimize storage of the material on site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. "Free Draining Stone" Base
   1. The "free draining stone" base material shall consist of clean washed gravel or crushed stone. Soft limestone or other soft materials are not acceptable. The "free draining stone" base material shall not lose more than 12% by weight when tested for weathering stability based on ASTM C-88 sodium sulfate soundness test. The "free draining stone" base material shall be tested by the L.A. Abrasion test, ASTM C-131, with a percentage lost by weight not exceeding 40.
   2. The "free draining stone" material shall have the following gradation as a guide for selection of material:

Sieve Size	Percent Passing	
	Base Stone	Finishing Stone
1 1/2”	100	
1”	95-100	
1/2”	25-60	100
3/8”		40-75
#4	0-10	5-25
#8	0-5	0-10

3. The “free draining stone” material shall be checked for the following:
   a. Structural stability: $\frac{D60/D10 > 5 \text{ and } 1 < D\ 2/30}{D10\ D60} > 3$
   b. Fragmentation shall be 100%.
   c. Separation of both stones: $\frac{D85 \text{ of finishing stone}}{D15 \text{ of base stone}} > 2$

      And $\frac{3 < D50 \text{ of base stone}}{D50 \text{ of finishing stone}} < 6$
   d. Drainage: Permeability of base stone > 600 in/hr. (0.42 cm/sec.)
      Permeability of finishing stone > 150 in/hr. (0.106 cm/sec.)
      Porosity of both stones > 25%
      (when stone is saturated and compacted to 95% max. density)
   e. Depending on the type of stone used, other mechanical characteristics may be necessary for approval.

PART 3 - EXECUTION

3.1 SUBDRAINS

A. The Contractor shall layout and excavate all of the trenches for the storm sewer system on the perimeter of the athletic field. The trenches shall be excavated to proper width and grade to allow for the placement of the geomembrane liner and “free draining stone” material in the trench. Trench walls shall be cut straight without sloughing of any material from the sidewalls. Bottom of the trenches shall be graded smooth and compacted to 95% maximum density ASTM D698. All excavated material for the storm sewer system shall be removed and the subgrade shall be cleaned, graded and amended as required to maintain the design elevations of the subgrade.

3.2 GEOMEMBRANE LINER

A. The geomembrane liner shall be installed the length of the playing field. A separate liner panel shall be used for each trench. End seams will not be allowed in the trench. Place liner in trench so that fabric at a higher elevation overlaps liner at a lower elevation to prevent free water from running underneath the liner in the event of a tear or hole. The geomembrane liner shall be installed in accordance with SECTION 32 05 19.17.

3.3 GRAVEL DRAINAGE - TRENCHES

A. With the geomembrane liner inplace, the Contractor shall place initial “free draining stone” in the perimeter storm sewer trench and then place the perforated storm sewer pipe to design grade and alignment, as specified and/or shown on the drawings.

B. After storm sewer pipe is inplace and has been approved by Owner’s Representative, Contractor shall place “free draining stone” around the sides of the pipe and continue to fill the trench with the “free draining stone” to the elevation of the subgrade.

C. The Contractor shall install composite drains on top of the geomembrane liner in the pattern as shown on the drawings.

3.4 “FREE DRAINING STONE” BASE AND FINISH COURSE

A. The Contractor shall inspect the surface of the geomembrane liner to assure there are no irregularities in elevation, wrinkles in the liner and that the surface is free of any debris.

B. The “free draining stone” shall be laid without damaging the subgrade, geomembrane liner or composite drains by back dumping the stone material onto the geomembrane liner so as to keep the delivery trucks off the liner. Contractor shall use the proper equipment to push the stone material over the athletic field.

C. The “free draining stone” base and finish courses shall have a combined minimum thickness of 8-inches at the centerline of the athletic field. The “free draining stone” base course shall be placed in maximum 6” lifts. The top 1 to 2-inches of the “free draining stone” base shall be a finishing stone of the gradation listed above. The “free draining stone” material shall maintain a moisture content of 90% to 110% of optimum moisture at all times. Contractor shall ensure the stone at the plant meets this requirement and shall maintain this moisture content while placing, grading and compacting the stone material. The “free draining stone” base and finish courses shall be compacted to 95% maximum density ASTM D698, and shall have a maximum deviation from design grade of +0” to -1/4” in 10’ feet when measured in any direction using a 10’ straight-edge.

D. After the “free draining stone” has been finished to grade, at the Owners option a minimum of five (5) permeability tests shall be made at random locations on the “free draining stone” base in accordance with ASTM D3385 test methods.

E. If the “free draining stone” base fails to meet any of the design specifications, it shall be the Contractor’s responsibility to restore at his expense, the materials to meet all requirements for permeability, cross-section, grade and density as outlined in the specifications. The “free draining stone” base shall be approved by the Owner’s Representative before the Contractor is allowed to install the synthetic turf.

3.5 DISPOSAL OF WASTE MATERIAL

A. All excess excavated material, debris or other objectionable material shall become the property of the Contractor and shall be removed from the project site and legally disposed of at no cost to the Owner.

END OF SECTION 32 11 23.23

SECTION 32 18 23.14 - BASEBALL MOUND CLAY

PART 1 – GENERAL

1.1 SUMMARY

A. Provide Mound Clay for Baseball Field.

1.2 RELATED WORK

A. Earthwork. Section 31 20 00

1.3 QUALIFICATIONS

A. Refer to Section 32 92 31

PART 2 – PRODUCTS

2.1 MATERIALS

A. Home Plate and Pitchers Circle. Pitchers circle shall be a screened clay loam with a rich red color. Mixture of sand, silt and clay shall be in approximate equal retained percentage proportions. Use “Diamond Pro Home Plate/Mound Clay” or approved equivalent material.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Pitchers mound
   1. Pitchers Circle. Install clay loam soil in the pitchers circle to a depth of 9” to finish grade. Clay loam soil shall be compacted to 95% maximum density ASTM-D698.

B. All finish surfaces on infield shall be to elevations shown on the drawings and smooth graded.

END OF SECTION 32 18 23.14

SECTION 32 18 23.33 - ASTROTURF BASEBALL/SOFTBALL INFILLED SYNTHETIC TURF SYSTEM

PART I – GENERAL

1.1 SUMMARY

A. The work under this section shall consist of furnishing all labor, materials, and equipment necessary to install, in place, all synthetic turf and other materials as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with these specifications, the manufacturer's instructions and in accordance with all details and shop drawings.

1.2 RELATED SECTIONS

A. Section 31 20 00 - Earthwork
B. Section 31 32 13.19 - Lime Stabilized Subgrade
C. Section 31 32 13.21 - Hydrated Lime and Lime Slurry
D. Section 32 05 19.18 – PVC Geomembrane Liner for Synthetic Turf System
E. Section 32 11 23.23 – "Free-Draining Stone" Base for Synthetic Turf System

1.3 SUBMITTAL

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

1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications, preparation and installation instructions and recommendations
2. All supplied and installed materials and products will meet or exceed the minimum specifications designated in this section. Sufficient data must be submitted to indicate compliance with the Contract Documents
3. Submit instructions for installation.

B. Test Results: The following test results, certified by a licensed independent testing laboratory, shall be submitted as outlined below

1. With the bid – Mandatory and minimum specifications as shown in Part 2. Bids not meeting the minimum specifications will be rejected.

C. Shop Drawings: Show fabrication and installation details for synthetic turf including, but not limited to

1. Proposed locations of all seams in fabric surfacing. Show installation methods and construction.
2. Field lining and marking - Submit a complete scale and dimensional drawing of inlaid or tufted-in field lines and marking boundaries.
3. All submittals shall be provided within 14 days after Notice to Proceed

D. The Manufacturer / Installer shall provide the following samples of the artificial turf selected for this project

1. A 6-inch x 6-inch minimum sample of the exact synthetic turf and infill system that is specified for this project.
2. Infill mix in accordance with product specifications

E. Manufacturer Certificates: Certified list of Twelve (12) existing Division 1, NCAA baseball specific installations within the last three years, including Owner Representative and telephone number, attesting compliance with quality assurance information. These fields must comply with the materials section of this specification. All must be located within the continental United States. Turf contractor and manufacturer must be one and the same.

F. With the bid - Proof that the Manufacturer/Installer is a member, in good standing, of the Synthetic Turf Council

G. With the bid – Sample Warranty: Provide a sample pre-paid third party insured warranty with the bid. Policy must be in force at the time of the bid.

1. The Contractor shall provide a warranty to the Owner that covers defects in materials and installation workmanship of the turf for a period of eight (8) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements and any written directives. The manufacturer's warranty shall include general wear and damage caused from UV degradation. Other items that must be addressed include the following:
    a. Acceptable uses for the field
    b. Fading
    c. Color match within specifications
    d. Excessive fiber wear
    e. Wrinkling and panel movement
    f. Seam integrity
    g. Drainage (through the turf only)
2. Exclusions shall include the following:
    a. Vandalism
    b. Acts of God beyond the control of the Owner or the Manufacturer
3. The warranty shall be fully third party insured for the entire 8-Year term and be non-prorated. Warranties that include language which pro-rates benefits shall cause the provider's bid to be rejected. Prior to final payment for the synthetic turf, the Contractor shall submit to the Owner, this policy guaranteeing the warranty to the Owner. Insurance must reflect the following values:
    a. $5,000,000.00 per each insured warranty
    b. $15Million dollar annual aggregate for all warranties issued during each 12 month period of the 8-Year warranty
    c. Policies that are backed by a Letter of Credit are not acceptable
    d. Policy must be issued by an A- rated or greater A.M. Best Rating
    e. Policies that include self-insurance or self-retention clauses shall not be considered. Policy can not include any form of deductible amount. Policy must be in force at the time of the bid.

H. Maintenance and Operations Data: At the completion of the project submit 3 complete sets, in manual form, of all the manufacturer's recommended procedures and materials for, but not limited to general maintenance, line/marking installation, small repair procedures, cleaning, etc…

I. Project Record Documents: Record actual locations of seams, drains, and other pertinent information in accordance with the General Requirements

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications

1. Shall own and operate its manufacturing plant in the United States. Plant must be capable of extruding and twisting a blended, polyethylene and nylon, monofilament fiber.
2. Shall be experienced in the manufacture and installation of the specified type of synthetic infill grass for a minimum of five (5) years.
3. Shall have its own, in-house laboratory where samples of turf are retained and analyzed. Tests shall be performed at all levels of production from the extrusion process to the tufting process and through to the final stages before the turf is loaded onto the truck for delivery.
4. Shall have a minimum of 300 full sized tall fiber infilled type field installations. Field size to be a minimum of 65,000 square feet to qualify. This list is to be provided with the bid.
5. Shall provide third party certification confirming compliance with referenced standards including 8 lbs tuft bind.

B. Installer Qualifications:

1. Installation team shall be an established, insured installation firm experienced as a premium turf installer with suitable equipment and supervisory personnel, with a minimum of five years of experience with 15 foot wide tufted materials.
2. Installation team shall be trained and certified, in writing, by the turf manufacturer, as competent in the installation of the specified material, including seaming and proper installation of the infill mixture.
3. Site superintendent shall have at least 10 installations similar to this type and shall have installed a minimum of two (2) NCAA, Division 1 baseball fields within the past 6 years.

C. Source Limitations: Obtain synthetic turf through one source from a single manufacturer.

D. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields. The materials as hereinafter specified, should be able to withstand full climatic exposure, be resistant to insect infestation, rot, fungus and mildew; to ultra-violet light and heat degradation, and shall have the basic characteristic of flow- through drainage allowing free movement of surface run-off through the turf and directly into prepared granular base and into the field drainage system.

E. The synthetic turf and components shall be of national reputation with previous use at all levels of competition, including professional and collegiate levels of baseball and softball and shall have been in use for a period of not less than three years. The turf fabric shall be produced by the manufacturer and installed by factory-authorized distributors directly employing the installation crew.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit synthetic turf work to be performed according to Contractor or Manufacturer's written instructions and warranty requirements.

B. Field Measurements: Indicate measurements on Shop Drawings.

1.6 WARRANTY – The product will be warranted for a period of eight (8) years.

1.7 MAINTENANCE SERVICE – Turf Installation Contractor shall train maintenance staff and/or contracted maintenance staff in the use of the recommended maintenance equipment and provide maintenance guidelines to the facility maintenance staff.

PART TWO – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pre-Approved manufacturers:

1. AstroTurf®, LLC
2680 Abutment Road, SE
Dalton, GA 30721
P: 706-277-8873

2.2 MATERIALS

A. Synthetic Turf System: The synthetic turf system for the infield skin (clay) areas of the field shall consist of factory extruded diamond shaped monofilament fibers of which three ends are polyethylene and three ends are nylon. Pile height shall be nominal 1 1/8".

The synthetic turf system for the warning track area of the field shall consist of factory extruded diamond shaped monofilament of which three ends are polyethylene and three ends are nylon. Pile height shall be nominal 1 1/8".

The synthetic turf system for the grass areas of the field shall consist of blended monofilament and slit-film face fibers. Pile height shall be a nominal 1 5/8".

B. All Fibers shall be tufted to a primary backing and a mechanically applied adhesive secondary backing.

1. The tufted fiber shall not weigh less than 30 ounces per square yard. The tufted rows of fiber are to be spaced no more than 3/8" apart. ASTM tests proving the fiber meets these qualifications must be provided with the bid. Turf systems that do not meet this specification will be disqualified.
2. The carpets' primary backing shall be comprised of two layers (18pic and 13pic) of woven polypropylene. The carpet shall then be coated with a secondary backing of Biocel™ Polyurethane synthetic coating material with a minimum application rate of 26 ounces per square yard and then perforated for adequate drainage. Carpets that are not perforated for adequate drainage shall not be acceptable.
3. The carpet shall be delivered in 15' wide rolls.

C. The pile surface shall provide good traction in all types of weather with the use of conventional sneaker type shoes, composition mold sole athletic shoes, baseball spikes and screw-on football spikes.

D. The pile surface shall be suitable for both temporary and permanent line markings using acrylic paint, as per the manufacturer's recommendations.

E. All adhesives used in bonding the seams shall be resistant to moisture, freeze/thaw, bacteria and fungus attacks, and resistant to ultraviolet radiation. The adhesive shall be made especially for the adhesion of synthetic turf seams.

F. The adhesive system shall have been utilized on at least 25 full installations. Provide this information with the bid. It shall consist of a factory-made adhesive bed applied to a non- woven fabric seaming tape. The adhesive bed shall be a metered amount suitable for the application. It shall be heat and pressure activated. A special heat application machine and pressure application using weighted rollers is mandatory.

G. The entire turf system shall include a factory-applied heat reduction technology.

H. Supply a field sweeper/groomer, which shall include a towing mechanism compatible with a field utility vehicle. The field sweeper/groomer shall be an “SMG TurfCare TCA1400” (or approved equivalent) Synthetic Sweeper/Groomer with 72” tow-behind magnet.

I. Perimeter edge details required for the system shall be as detailed and recommended by the manufacturer, and as approved by the manufacturer.

2.3 FABRIC SURFACE

A. The pile surface shall resemble freshly mown natural grass in appearance, texture and color.

B. The pile surface shall be nominally uniform in length.

C. The pile fiber angle shall be 90 degrees ± 15 degrees, measured from the horizontal after installation of the infill material.

D. The entire system shall be resistant to weather, insects, rot, mildew and fungus growth and will be non-allergic and non-toxic.

E. The synthetic turf system shall have a nominal fiber length of 1 1/8” for the skin/warning track areas and 1 5/8” for the grass areas.

F. Each roll shall be minimum 15’ wide

G. The entire system shall be constructed for porous standards as specified. Synthetic turf system shall be perforated at 4 – 6” on center. Systems that are not perforated for maximum drainage shall not be acceptable.

2.4 PRODUCT SPECIFICATIONS

A. Face yarns shall be a combination of:

1. A proven athletic quality, outdoor stabilized blend of factory extruded diamond shaped monofilament yarn, consisting of three ends of nylon and three ends of polyethylene;

2. A proven athletic quality, outdoor stabilized blend of monofilament and slit-film fibers. B. The fabric shall possess the following minimum physical characteristics. ASTM testing shall be provided with the bid and any products not meeting the minimum physical characteristics will be rejected:

Average Pile Yarn Weight	ASTM D 5848	30 oz/square yard
Average Total Weight	ASTM D 5848	64 oz/square yard
Secondary Backing Weight	ASTM D 5848	26 oz/square yard
Primary Backing	ASTM D 5848	8 oz/square yard
Average Tuft Length	ASTM D 5823	1 5/8”
Tufting Gauge	ASTM D 5793	3/8” maximum
Tuft Bind	ASTM D 1335	> 8 lbs
Yarn Denier (primary fiber)	ASTM D 1577	10,600
Yarn Denier (secondary fiber)	ASTM D 1577	5,000
Surface Flammability	ASTM D 2859	8 of 8 PASS
Permeability	ASTM F 1551	>30
Melt Point	ASTM D 789	130 Degrees Celsius

2.5 INFILL MATERIAL

A. Infill particles shall be recycled granulated SBR rubber, free of belting fabric and/or wire; and silica sand with a minimum fill height necessary to achieve the required shock absorbing properties and bio-mechanical properties.

B. Specifically for the warning track, lava rock or large particulate sand can be utilized at the owner's request.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for visual installation tolerances. Proceed with installation only after satisfactory conditions have been corrected.

B. Certification of prior work: The synthetic turf manufacturer and / or installation contractor shall perform a visual inspection of the field base onto which the synthetic turf system is to be installed and to examine the finished surface for required compaction, and grade tolerances(through string line testing). After any discrepancies between the required materials, application and tolerance requirements noted have been corrected, the synthetic turf installer should submit a written certification of VISUAL acceptance of the base for installation of the synthetic turf system. Any tests other than VISUAL tests (string line, water hose, etc…) shall be the responsibility of the General Contractor or Landscape Architect.

C. Installation of all materials shall be performed in full compliance with approved project shop drawings. Only factory trained technicians skilled in the installation of athletic caliber synthetic turf systems, working under the direct supervision of the manufacturer's supervisors, shall undertake the placement of the turf system. The designated Supervisory personnel on the project must be certified, in writing by the turf manufacturer as competent in the installation of these materials, including proper seaming and proper installation of the infill mixture. The manufacturer shall certify the installation and warranty compliance.

3.2 PREPARATION

A. Inspect delivered field surface fabric and components immediately prior to installation. Any damaged or defective items shall be rejected. Installed artificial system shall be inspected for, but not limited to, the following:

1. Uniformity of product and color
2. Surface bubbles
3. Field markings
4. Field Edge installation
5. Pile height of each roll shall be measured. Any material(s) that does not meet minimum height and thickness specifications shall be rejected. Pile height shall be measured in its finished positions.

B. Environmental Conditions: Weather conditions are important for the successful installation of the systems. No work under this section will proceed when:

1. Ambient temperatures are below 45 degrees F.
2. Material temperatures are below 45 degrees F.

3. Surfaces are wet or damp
4. Rain is imminent or falling.
5. Conditions exist or are imminent, which will be unsuitable to installation requirements of the systems specified herein. Humidity levels will be inside the limits recommended by the adhesive manufacturer to obtain optimum bonding characteristics of the surfaces.

3.3 INSTALLATION OF THE SYNTHETIC TURF

A. The carpet rolls are to be installed directly over the properly prepared base stone. Extreme care should be taken to avoid disturbing the base stone both in regard to compaction and planarity. A 2-5 ton static roller shall be on site and available to repair and properly compact any disturbed areas of the base stone.

B. The full width rolls shall be laid out across the field. When all of the rolls of the playing surface have been installed, the sideline areas will be installed at right angles to the playing field turf. All work shall be such that the seams shall remain as required for the duration of the warranty period at a minimum. All seam widths are to be held to a minimum and shall be traverse to the field direction. Seams shall be flat, tight and permanent with no separation or fraying.

C. The perimeter of the field shall be firmly secured to the edge anchors for the life of the warranty and in accordance to project details.

D. Resilient Infill

1. The rubber infill material shall be spot inspected and tested for conformance to sieve specifications. Any metal found in the rubber shall be cause for rejection of the rubber sack and immediate inspection of all materials.
2. Infill must be placed in such a way as to minimize fiber entrapment.
3. The infill must be uniformly applied so as to ensure uniform, predictable surface. The turf foreman must take numerous on site measurements to confirm the uniformity of the infill.

3.4 FIELD LINING MARKINGS

A. General: A complete field “Lining, Marking and Field Boundary” system will be provided with the installation of the surfacing system specified herein. All markings shall be installed in accordance with prior approved project Shop Drawings.

B. Inlays shall conform to the manufacturers’ specifications, directions and recommendations for the best results.

C. Striping layouts shall be accurately surveyed by the Contractor before installation of inlaid field markings

D. Install inlays only when the surface is completely dry. Adhere all inlays securely into place. Never loose-lay and sew an inlay into place.

3.5 FIELD QUALITY CONTROL

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

B. Testing Services: Testing and inspecting of completed applications of synthetic turf system shall take place in suggestive states, in areas of extent and using methods that are industry standard. Do not proceed with application of next stages until test results for previously completed applications show compliance.

C. Remove and replace items where test results indicate that it does not comply with specified requirements.

3.6 FINAL ACCEPTANCE

A. Prior to final acceptance, the Contractor shall submit to the Owner three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and striping.

B. The Contractor shall provide evidence that the turf can be plowed with conventional rubber bladed snow removal equipment.

C. The finished playing surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use.

3.7 CLEANING

A. Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items. All usable remnants of new material shall become the property of the Owner. The Contractor shall keep the area clean throughout the project and clear of debris. Surfaces, recesses, enclosures, etc… shall be cleaned, as necessary, to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION

SECTION 32 18 23.34 – FIELDTURF DOUBLE PLAY-INFIELD INFILLED SYNTHETIC TURF SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools and equipment necessary to install slit-film artificial grass FieldTurf as indicated on the plans and as specified herein; including components and accessories required for a complete installation. including but not limited to:
   1. Acceptance of prepared sub-base.
   2. Coordination with related trades to ensure a complete, integrated, and timely installation: Aggregate base course, sub-base material (tested for permeability), grading and compacting, piping and drain components (when required); as provided under its respective trade section.

1.2 RELATED SECTIONS

A. Section 31 20 00 - Earthwork
B. Section 31 32 13.19 - Lime Stabilized Subgrade
C. Section 31 32 13.21 - Hydrated Lime and Lime Slurry
D. Section 32 05 19.18 – PVC Geomembrane Liner for Synthetic Turf System
E. Section 32 11 23.23 – “Free-Draining Stone” Base for Synthetic Turf System

1.3 REFERENCE STANDARDS

A. FM Factory Mutual
   1. P7825 - Approval Guide; Factory Mutual Research Corporation; current edition

B. ASTM – American Society for Testing and Materials.
   1. D1577 - Standard Test Method for Linear Density of Textile Fiber
   2. D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
   3. D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Covering
   4. D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
   5. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
   6. F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
   7. D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
   8. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
   9. F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
   10. F1936 - Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
   11. D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
   12. ASTM F355 - Gmax

1.4 SUBMITTALS

A. Substitutions: Other products are acceptable if in compliance with all requirements of these specifications. Submit alternate products to Architect for approval prior to bidding.
   1. Provide substantiation that proposed system does not violate any other manufacturer's patents, patents allowed or patents pending.
   2. Provide a sample copy of insured, non-prorated warranty and insurance policy information.

B. Comply with Section 01 33 00, Submittals Procedures. Submit for approval prior to fabrication.

C. Shop Drawings:
   1. Indicate field layout; field marking plan and details for the specified sports; i.e., NCAA Baseball; roll/seaming layout; methods of attachment, field openings and perimeter conditions.
   2. Show installation methods and construction indicating field verified conditions, clearances, measurements, terminations, drainage.
   3. Provide joint submission with related trades when requested by Architect.

D. Product Data:
   1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
   2. Submit fiber manufacturer's name, type of fiber and composition of fiber.
   3. Submit data in sufficient detail to indicate compliance with the contract documents.
   4. Submit manufacturer's instructions for installation.
   5. Submit manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

E. Samples: Submit samples, 6 x 6 inches, illustrating details of finished product in amounts as required by General Requirements, or as requested by Architect.

F. Product Certification:
   1. Submit manufacturer’s certification that products and materials comply with requirements of the specifications.
   2. Submit test results indicating compliance with Reference Standards.

G. Project Record Documents: Record actual locations of seams, drains and other pertinent information in accordance with Division 1 Specifications Series, General Requirements.

H. List of existing installations: Submit list including respective Owner’s representative and telephone number.

I. Warranties: Submit warranty and ensure that forms have been completed in Owner's name and registered with approved manufacturer.

J. Testing data to the Owner to substantiate that the finished field meets the required shock attenuation, as per ASTM F1936.

K. Submit Bills of Lading/Material Delivery Receipts for synthetic turf infill materials. Bills of lading shall bear the name of the project/delivery address, quantity of materials delivered, source/location of origin of infill materials and/or manufacturer, and date of delivery.

L. Testing Certification: Submit certified copies of independent (third-party) laboratory reports on ASTM testing:
   1. Pile Height, Face Weight & Total Fabric Weight, ASTM D5848.
   2. Primary & Secondary Backing Weights, ASTM D5848.
   3. Tuft Bind, ASTM D1335.
   4. Grab Tear Strength, ASTM D1682 or D5034.
   5. Shock Attenuation, ASTM F1936.
   6. Water Permeability, ASTM D4491

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00, Quality Control.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The turf contractor and/or the turf manufacturer:
   1. Shall be experienced in the manufacture and installation of infilled slit-film synthetic grass turf for a minimum of five (5) years. This includes a slit-film fiber, backing, the backing coating, and the installation method.
   2. Shall have 300 fields in play. Fields shall be 65,000 ft² or more
   3. The manufacturer must have ISO 9001, ISO 14001 and OHSAS 18001 certifications demonstrating its manufacturing efficiency with regards to quality, environment and safety management systems.
   4. Shall have minimum twelve (12) NCAA Division 1 game and/or practice fields installed for baseball within the past five (5) years.

C. Installer: Company shall specialize in performing the work of this section. The Contractor shall provide competent workmen skilled in this specific type of synthetic grass installation.
   1. The designated Supervisory Personnel on the project shall be certified, in writing by the turf manufacturer, as competent in the installation of slit-film material, including sewing seams and proper installation of the infill mixture.
   2. Installer shall be certified by the manufacturer and licensed.
   3. The installer supervisor shall have a minimum of 5 years experience as either a construction manager or a supervisor of synthetic turf installations, have at least 10 installations similar to this type, and shall have installed a minimum of two (2) NCAA Division 1 Baseball fields within the past six (6) years.

D. Pre-Installation Conference: Conduct conference at project site at time to be determined by Architect. Review methods and procedures related to installation including, but not limited to, the following:
   1. Inspect and discuss existing conditions and preparatory work performed under other contracts.
   2. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, The Owner’s representative, and the Architect.

E. The Contractor shall verify special conditions required for the installation of the system.

F. The Contractor shall notify the Architect of any discrepancies.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prevent contact with materials that may cause dysfunction.

B. Deliver and store components with labels intact and legible.

C. Store materials/components in a safe place, under cover, and elevated above grade.

D. Protect from damage during delivery, storage, handling and installation. Protect from damage by other trades.

E. Inspect all delivered materials and products to ensure they are undamaged and in good condition.

F. Comply with manufacturer’s recommendations.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate the Work with installation of work of related trades as the Work proceeds.

B. Sequence the Work in order to prevent deterioration of installed system.

1.8 WARRANTY AND GUARANTEE

A. See Section 01 77 00 - Closeout Procedures, For Additional Warranty Requirements.

B. The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a period of eight (8) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the Owner or the manufacturer. The warranty shall be fully third party insured; pre paid for the entire term and be non-prorated. The Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to owner notification in writing that the field is officially added to the annual policy coverage, guaranteeing the warranty to the Owner. The insurance policy must be underwritten by an “AM Best” A rated carrier and must reflect the following values:

- Pre-Paid insured warranty.
- Insured Warranty Coverage must be provided in the form of 1 single policy
- Maximum per claim coverage amount of $5,000,000.
- Minimum of 15 million dollar ($15,000,000) annual aggregate
- Must cover full 100% replacement value of total square footage installed, minimum of $7.00 per sq ft. (in case of complete product failure, which will include removal and disposal of the existing surface)
- Policies that include self insurance or self retention clauses shall not be considered.
- Policy cannot include any form of deductible amount.
- Sample policy must be provided at time of bid to prove that policy is in force. A letter from an agent or a sample Certificate of Insurance will not be acceptable.

C. The artificial grass system must maintain a G-max of less than 200 for the life of the Warranty as per ASTM F1936.

1.9 MAINTENANCE SERVICE

A. Contractor shall train the Owner's facility maintenance staff in the use of the turf manufacturer's recommended maintenance equipment.

B. Manufacturer must provide maintenance guidelines and a maintenance video to the facility maintenance staff.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Approved manufacturers are as follows:

1. FieldTurf USA Inc.
   175 N. Industrial Blvd
   Calhoun, GA 30701
   P: 800-724-2969

Model: FieldTurf DoublePlay Classic - Infield

2.2 MATERIALS AND PRODUCTS

A. Artificial grass FieldTurf system materials shall consist of the following:
   1. Carpet made of slit-film polyethylene fibers tufted into a fibrous, non-perforated, porous backing.
   2. Infill: Controlled mixture of graded sand and rubber crumb that partially covers the carpet.
   3. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass slit-film FieldTurf.

B. The installed artificial grass slit-film FieldTurf shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	10,000+
ASTM D5823	Pile Height – Green Areas	1.75”
ASTM D5793	Stitch Gauge	3/4”
ASTM D5848	Pile Weight	30oz/square yard
ASTM D5848	Primary Backing	7oz/square yard
ASTM D5848	Secondary Backing	14+oz/square yard
ASTM D5848	Total Weight	51+oz/square yard
ASTM D1335	Tuft Bind (Without Infill)	8+ lbs
ASTM D5034	Grab Tear (Width)	200 lbs/force
ASTM D5034	Grab Tear (Length)	200 lbs/force
ASTM D4491	Carpet Permeability	>40 inches/hour
ASTM F355/F1936	Impact Attenuation (Gmax)	<200
	Infill Material Depth	1.25 inches
	Sand Infill Component	3.65lbs/square foot
	Cryogenic Rubber Infill Component	2.6lbs/square foot

C. Carpet shall consist of slit-film fibers tufted into a primary backing with a secondary backing.

D. Carpet Rolls shall be 15’ wide rolls.

E. Backing:
   1. Primary backing shall be a double-layered polypropylene fabric treated with UV inhibitors.
   2. Secondary backing shall consist of an application of porous, heat-activated urethane to permanently lock the fiber tufts in place.
   3. Perforated (with punched holes), backed carpet are unacceptable.

F. Fiber shall be 10,000+ denier, low friction, and UV-resistant fiber measuring not less than 2 inches high.

G. Infill materials shall be approved by the manufacturer.
   1. Infill shall consist of a resilient layered granular system, comprising selected and graded dust-free silica sand and cryogenically hammer-milled SBR rubber crumb.
   2. Artificial Grass products without cryogenically processed rubber or a finish application of

straight rubber cryogenically processed will not be acceptable.

3. The sand component of the infill must represent a minimum of 51% or more of the total infill, by weight.

H. Non-tufted or inlaid lines and markings shall be painted with paint approved by the synthetic turf manufacturer.

I. Thread for sewing seams of turf shall be as recommended by the synthetic turf manufacturer.

J. Glue and seaming fabric for inlaying lines and markings shall be as recommended by the synthetic turf manufacturer.

2.3 QUALITY CONTROL IN MANUFACTURING

A. The manufacturer shall own and operate its own manufacturing plant in North America. Both tufting of the field fibers into the backing materials and coating of the turf system must be done in-house by the turf manufacturer. Outsourcing of either is unacceptable.

B. The manufacturer shall have full-time certified in-house inspectors at their manufacturing plant that are experts with industry standards.

C. The manufacturer's full-time in-house certified inspectors shall perform pre-tufting fiber testing on tensile strength, elongation, tenacity, denier, shrinkage, and twist i.e., turns per inch, upon receipt of fiber spools from fiber manufacturer.

D. Primary backing shall be inspected by the manufacturer's full-time certified in-house inspectors before tufting begins.

E. The manufacturer's full-time in-house certified inspectors shall verify "pick count", yarn density in relation to the backing, to ensure the accurate amount of face yarn per square inch.

F. The manufacturer's full-time, in-house, certified inspectors shall perform turf inspections at all levels of production including during the tufting process and at the final stages before the turf is loaded onto the truck for delivery.

G. The manufacturer shall have its own, in-house laboratory where samples of turf are retained and analyzed, based on standard industry tests, performed by full-time, in-house, certified inspectors.

H. The manufacturer must have ISO 9001, ISO 14001 and OHSAS 18001 certifications demonstrating its manufacturing efficiency with regards to quality, environment and safety management systems.

2.4 FIELD GROOMER & SWEEPER

Supply a field sweeper/groomer, which shall include a towing mechanism compatible with a field utility vehicle. The field sweeper/groomer shall be an "SMG TurfCare TCA1400" (or approved equivalent) Synthetic Sweeper/Groomer with 72" tow-behind magnet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all sub-base leveling is complete prior to installation.

B. Installer shall examine the surface to receive the synthetic turf and accept the sub-base planarity in writing prior to the beginning of installation.

1. Acceptance is dependent upon the Owner's test results indicating compaction and planarity are in compliance with manufacturer's specifications.
2. The surface shall be accepted by Installer as "clean" as installation commences and shall be maintained in that condition throughout the process.

C. Compaction of the aggregate base shall be 95%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0- ¼" over 10 feet and 0- ¼" from design grade.

D. Correct conditions detrimental to timely and proper completion of Work.

E. Do not proceed until unsatisfactory conditions are corrected.

F. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Prior to the beginning of installation, inspect the sub-base for tolerance to grade.

B. Sub-base acceptance shall be subject to receipt of test results (by others) for compaction and planarity that sub-base is in compliance with manufacturer's specifications and recommendations.

C. Dimensions of the field and locations for markings shall be measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made.

D. When requested by Architect, installed sub-base shall be tested for porosity prior to the installation of the slit-film turf. A sub base that drains poorly is an unacceptable substrate

3.3 INSTALLATION - GENERAL

A. The installation shall be performed in full compliance with approved Shop Drawings.

B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.

C. The designated Supervisory personnel on the project must be certified, in writing by the turf manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

D. Designs, markings, layouts, and materials shall conform to all currently applicable National Collegiate Athletic Association rules, NFHS rules, and/or other rules or standards that may apply to this type of synthetic grass installation. Designs, markings and layouts shall first be approved by the Architect or Owner in the form of final shop drawings. All markings will be in full compliance with final shop drawings.

3.4 INSTALLATION

A. Install at location(s) indicated, to comply with final shop drawings, manufacturers'/installer's instructions.

B. The Contractor shall strictly adhere to specified procedures. Any variance from these requirements shall be provided in writing, by the manufacturer's on-site representative, and submitted to the Architect and/or Owner, verifying that the changes do not in any way affect the Warranty. Infill materials shall be approved by the manufacturer and installed in accordance with the manufacturer's standard procedures.

C. Carpet rolls shall be installed directly over the properly prepared aggregate base. Extreme care shall be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity.
   1. Repair and properly compact any disturbed areas of the aggregate base as recommended by manufacturer

D. Full width rolls shall be laid out across the field.
   1. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline.

2. No cross seams will be allowed in the main playing area between the sidelines.
3. Each roll shall be attached to the next roll utilizing standard state-of-the- art sewing procedures.
4. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing surface.

E. Artificial turf panel seams shall be sewn along the selvedge edging flap of the turf roll. Seams secured by other means including gluing are unacceptable. Installation shall be 99% sewn.
1. Minimum gluing will only be permitted to repair problem areas, corner completions, and to cut in any logos or inlaid lines as required by the specifications.
2. Seams shall be flat, tight, and permanent with no separation or fraying.
3. In the case of all lines and logos, turf carpet must be field fibers must be sheared to the backing (do not cut the backing) and adhered using hot melt adhesives.

F. Infill Materials:
1. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth determined by the manufacturer.
2. Three-layered infill shall be installed in a systematic order.
3. Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of a base layer of sand followed by a homogenous mixture of the sand and the cryogenically processed rubber. A final application of specifically sized cryogenically processed rubber completes the system. The Infill shall be installed to the depth of 1.25". Infill density shall consist of no more than 3.65 pounds of sand and at least 2.6 pounds of rubber per square foot. The Infill shall be placed so that there is a void of ¾" to the top of the fibers.

G. Non-tufted or inlaid lines and markings shall be painted in accordance with turf and paint manufacturers' recommendations. Number of applications will be dependent upon installation and field conditions.

H. Synthetic turf shall be attached to the perimeter edge detail in accordance with the manufacturer's standard procedures.

I. Upon completion of installation, the finished field shall be inspected by the installation crew and an installation supervisor.

3.5 FIELD MARKINGS

A. Field markings shall be installed in accordance with approved shop drawings. If football is designated as the primary sport, all five yard lines will be tufted-in.

B. Balance of sports markings will be inlaid or painted in accordance with the Drawings.

C. Center field logo shall be either painted or inlaid according to artwork indicated on Drawings and in accordance with manufacturer's standard palette of turf colors.

D. End-zone letters and logos shall be either painted or inlaid according to artwork and fonts indicated on the Drawings, and in accordance with manufacturer's standard palette of turf colors.

3.6 FIELD MAINTENANCE

A. The maintenance activities will include and not be limited to the most current FieldTurf Maintenance Guidelines at the time the maintenance is being undertaken, including the following FieldTurf Products: FieldTurf Scrub Detergent, FieldTurf Static Control, FieldTurf Gum Remover.

3.7 ADJUSTMENT AND CLEANING

A. Do not permit traffic over unprotected surface.

B. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

C. All usable remnants of new material shall become the property of the Owner.

D. The Contractor shall keep the area clean throughout the project and clear of debris.

E. Surfaces, recesses, enclosures, and related spaces shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

3.8 PROTECTION

A. Protect installation throughout construction process until date of final completion.

END OF SECTION

SECTION 32 18 23.35 – FIELDTURF DOUBLE PLAY-OUTFIELD INFILLED SYNTHETIC TURF

PART 1 - GENERAL

1.1 SUMMARY

Furnish all labor, materials, tools and equipment necessary to install slit-film artificial grass FieldTurf as indicated on the plans and as specified herein; including components and accessories required for a complete installation. including but not limited to:

1. Acceptance of prepared sub-base.
2. Coordination with related trades to ensure a complete, integrated, and timely installation: Aggregate base course, sub-base material (tested for permeability), grading and compacting, piping and drain components (when required); as provided under its respective trade section.

1.2 RELATED SECTIONS

Section 31 20 00 - Earthwork

Section 31 32 13.19 - Lime Stabilized Subgrade

Section 31 32 13.21 - Hydrated Lime and Lime Slurry

Section 32 05 19.18 – PVC Geomembrane Liner for Synthetic Turf System

Section 32 11 23.23 – “Free-Draining Stone” Base for Synthetic Turf System

1.3 REFERENCE STANDARDS

FM Factory Mutual

1. P7825 - Approval Guide; Factory Mutual Research Corporation; current edition

ASTM – American Society for Testing and Materials.

2. D1577 - Standard Test Method for Linear Density of Textile Fiber
3. D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
4. D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Covering
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6. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
7. F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
8. D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
9. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
10. F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
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1.4 SUBMITTALS

Substitutions: Other products are acceptable if in compliance with all requirements of these specifications. Submit alternate products to Architect for approval prior to bidding.

1. Provide substantiation that proposed system does not violate any other manufacturer's patents, patents allowed or patents pending.
2. Provide a sample copy of insured, non-prorated warranty and insurance policy information.

Comply with Section 01 33 00, Submittals Procedures. Submit for approval prior to fabrication.

Shop Drawings:

3. Indicate field layout; field marking plan and details for the specified sports; i.e., NCAA Baseball; roll/seaming layout; methods of attachment, field openings and perimeter conditions.
4. Show installation methods and construction indicating field verified conditions, clearances, measurements, terminations, drainage.
5. Provide joint submission with related trades when requested by Architect.

Product Data:

6. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
7. Submit fiber manufacturer's name, type of fiber and composition of fiber.
8. Submit data in sufficient detail to indicate compliance with the contract documents.
9. Submit manufacturer's instructions for installation.
10. Submit manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

Samples: Submit samples, 6 x 6 inches, illustrating details of finished product in amounts as required by General Requirements, or as requested by Architect.

Product Certification:

11. Submit manufacturer’s certification that products and materials comply with requirements of the specifications.
12. Submit test results indicating compliance with Reference Standards.

Project Record Documents: Record actual locations of seams, drains and other pertinent information in accordance with Division 1 Specifications Series, General Requirements.

List of existing installations: Submit list including respective Owner’s representative and telephone number.

Warranties: Submit warranty and ensure that forms have been completed in Owner's name and registered with approved manufacturer.

Testing data to the Owner to substantiate that the finished field meets the required shock attenuation, as per ASTM F1936.

Submit Bills of Lading/Material Delivery Receipts for synthetic turf infill materials. Bills of lading shall bear the name of the project/delivery address, quantity of materials delivered, source/location of origin of infill materials and/or manufacturer, and date of delivery.

Testing Certification: Submit certified copies of independent (third-party) laboratory reports on ASTM testing:

13. Pile Height, Face Weight & Total Fabric Weight, ASTM D5848.
14. Primary & Secondary Backing Weights, ASTM D5848.
15. Tuft Bind, ASTM D1335.
16. Grab Tear Strength, ASTM D1682 or D5034.
17. Shock Attenuation, ASTM F1936.
18. Water Permeability, ASTM D4491

1.5 QUALITY ASSURANCE

Comply with Section 01 45 00, Quality Control.

Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The turf contractor and/or the turf manufacturer:

1. Shall be experienced in the manufacture and installation of infilled slit-film synthetic grass turf for a minimum of five (5) years. This includes a slit-film fiber, backing, the backing coating, and the installation method.
2. Shall have 300 fields in play. Fields shall be 65,000 ft² or more
3. The manufacturer must have ISO 9001, ISO 14001 and OHSAS 18001 certifications demonstrating its manufacturing efficiency with regards to quality, environment and safety management systems.
4. Shall have minimum twelve (12) NCAA Division 1 game and/or practice fields installed for baseball within the past five (5) years.

Installer: Company shall specialize in performing the work of this section. The Contractor shall provide competent workmen skilled in this specific type of synthetic grass installation.

5. The designated Supervisory Personnel on the project shall be certified, in writing by the turf manufacturer, as competent in the installation of slit-film material, including sewing seams and proper installation of the infill mixture.
6. Installer shall be certified by the manufacturer and licensed.
7. The installer supervisor shall have a minimum of 5 years experience as either a construction manager or a supervisor of synthetic turf installations, have at least 10 installations similar to this type, and shall have installed a minimum of two (2) NCAA Division 1 Baseball Fields within the past six (6) years.

Pre-Installation Conference: Conduct conference at project site at time to be determined by Architect. Review methods and procedures related to installation including, but not limited to, the following:

8. Inspect and discuss existing conditions and preparatory work performed under other contracts.
9. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, The Owner's representative, and the Architect.

The Contractor shall verify special conditions required for the installation of the system.

The Contractor shall notify the Architect of any discrepancies.

1.6 DELIVERY, STORAGE, AND HANDLING

Prevent contact with materials that may cause dysfunction.

Deliver and store components with labels intact and legible.

Store materials/components in a safe place, under cover, and elevated above grade.

Protect from damage during delivery, storage, handling and installation. Protect from damage by other trades.

Inspect all delivered materials and products to ensure they are undamaged and in good condition.

Comply with manufacturer's recommendations.

1.7 SEQUENCING AND SCHEDULING

Coordinate the Work with installation of work of related trades as the Work proceeds.

Sequence the Work in order to prevent deterioration of installed system.

1.8 WARRANTY AND GUARANTEE

See Section 01 77 00 - Closeout Procedures, For Additional Warranty Requirements.

The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a period of eight (8) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the Owner or the manufacturer. The warranty shall be fully third party insured; pre paid for the entire term and be non-prorated. The Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to owner notification in writing that the field is officially added to the annual policy coverage, guaranteeing the warranty to the Owner. The insurance policy must be underwritten by an “AM Best” A rated carrier and must reflect the following values:

- Pre-Paid insured warranty.
- Insured Warranty Coverage must be provided in the form of 1 single policy
- Maximum per claim coverage amount of $5,000,000.
- Minimum of Fifteen million dollar ($15,000,000) annual aggregate
- Must cover full 100% replacement value of total square footage installed, minimum of $7.00 per sq ft. (in case of complete product failure, which will include removal and disposal of the existing surface)
- Policies that include self insurance or self retention clauses shall not be considered.
- Policy cannot include any form of deductible amount.
- Sample policy must be provided at time of bid to prove that policy is in force. A letter from an agent or a sample Certificate of Insurance will not be acceptable.

The artificial grass system must maintain a G-max of less than 200 for the life of the Warranty as per ASTM F1936.

1.9 MAINTENANCE SERVICE

Contractor shall train the Owner's facility maintenance staff in the use of the turf manufacturer's recommended maintenance equipment.

Manufacturer must provide maintenance guidelines and a maintenance video to the facility maintenance staff.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Approved manufacturers are as follows:

1. FieldTurf USA Inc.
   175 N. Industrial Blvd
   Calhoun, GA 30701
   P: 800-724-2969

Model: FieldTurf DoublePlay Classic - Outfield

2.2 MATERIALS AND PRODUCTS

Artificial grass FieldTurf system materials shall consist of the following:

1. Carpet made of slit-film polyethylene fibers tufted into a fibrous, non-perforated, porous backing.
2. Infill: Controlled mixture of graded sand and rubber crumb that partially covers the carpet.
3. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass slit-film FieldTurf.

The installed artificial grass slit-film FieldTurf shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	10,000+
ASTM D5823	Pile Height – Green Areas	1.75”
ASTM D5793	Stitch Gauge	3/4”
ASTM D5848	Pile Weight	30oz/square yard
ASTM D5848	Primary Backing	7oz/square yard
ASTM D5848	Secondary Backing	14+oz/square yard
ASTM D5848	Total Weight	51+oz/square yard
ASTM D1335	Tuft Bind (Without Infill)	8+ lbs
ASTM D5034	Grab Tear (Width)	200 lbs/force
ASTM D5034	Grab Tear (Length)	200 lbs/force
ASTM D4491	Carpet Permeability	>40 inches/hour
ASTM F355/F1936	Impact Attenuation (Gmax)	<200
	Infill Material Depth	1.25 inches
	Sand Infill Component	3.65lbs/square foot
	Cryogenic Rubber Infill Component	2.6lbs/square foot

Carpet shall consist of slit-film fibers tufted into a primary backing with a secondary backing.

Carpet Rolls shall be 15’ wide rolls.

Backing:

4. Primary backing shall be a double-layered polypropylene fabric treated with UV inhibitors.
5. Secondary backing shall consist of an application of porous, heat-activated urethane to permanently lock the fiber tufts in place.
6. Perforated (with punched holes), backed carpet are unacceptable.

Fiber shall be 10,000+ denier, low friction, and UV-resistant fiber measuring not less than 2 inches high.

Infill materials shall be approved by the manufacturer.

7. Infill shall consist of a resilient layered granular system, comprising selected and graded dust-free silica sand and cryogenically hammer-milled SBR rubber crumb.

8. Artificial Grass products without cryogenically processed rubber or a finish application of straight rubber cryogenically processed will not be acceptable.
9. The sand component of the infill must represent a minimum of 51% or more of the total infill, by weight.

Non-tufted or inlaid lines and markings shall be painted with paint approved by the synthetic turf manufacturer.

Thread for sewing seams of turf shall be as recommended by the synthetic turf manufacturer.

Glue and seaming fabric for inlaying lines and markings shall be as recommended by the synthetic turf manufacturer.

2.3 QUALITY CONTROL IN MANUFACTURING

The manufacturer shall own and operate its own manufacturing plant in North America. Both tufting of the field fibers into the backing materials and coating of the turf system must be done in-house by the turf manufacturer. Outsourcing of either is unacceptable.

The manufacturer shall have full-time certified in-house inspectors at their manufacturing plant that are experts with industry standards.

The manufacturer's full-time in-house certified inspectors shall perform pre-tufting fiber testing on tensile strength, elongation, tenacity, denier, shrinkage, and twist i.e., turns per inch, upon receipt of fiber spools from fiber manufacturer.

Primary backing shall be inspected by the manufacturer's full-time certified in-house inspectors before tufting begins.

The manufacturer's full-time in-house certified inspectors shall verify "pick count", yarn density in relation to the backing, to ensure the accurate amount of face yarn per square inch.

The manufacturer's full-time, in-house, certified inspectors shall perform turf inspections at all levels of production including during the tufting process and at the final stages before the turf is loaded onto the truck for delivery.

The manufacturer shall have its own, in-house laboratory where samples of turf are retained and analyzed, based on standard industry tests, performed by full-time, in-house, certified inspectors.

The manufacturer must have ISO 9001, ISO 14001 and OHSAS 18001 certifications demonstrating its manufacturing efficiency with regards to quality, environment and safety management systems.

2.4 FIELD GROOMER & SWEEPER

Supply a field sweeper/groomer, which shall include a towing mechanism compatible with a field utility vehicle. The field sweeper/groomer shall be an "SMG TurfCare TCA 1400" (or approved equivalent) Synthetic Sweeper/Groomer with 72" tow-behind magnet.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that all sub-base leveling is complete prior to installation.

Installer shall examine the surface to receive the synthetic turf and accept the sub-base planarity in writing prior to the beginning of installation.

1. Acceptance is dependent upon the Owner's test results indicating compaction and planarity are in compliance with manufacturer's specifications.

2. The surface shall be accepted by Installer as “clean” as installation commences and shall be maintained in that condition throughout the process.

Compaction of the aggregate base shall be 95%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0- ¼” over 10 feet and 0- ¼” from design grade.

Correct conditions detrimental to timely and proper completion of Work.

Do not proceed until unsatisfactory conditions are corrected.

Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

Prior to the beginning of installation, inspect the sub-base for tolerance to grade.

Sub-base acceptance shall be subject to receipt of test results (by others) for compaction and planarity that sub-base is in compliance with manufacturer’s specifications and recommendations.

Dimensions of the field and locations for markings shall be measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made.

When requested by Architect, installed sub-base shall be tested for porosity prior to the installation of the slit-film turf. A sub base that drains poorly is an unacceptable substrate

3.3 INSTALLATION - GENERAL

The installation shall be performed in full compliance with approved Shop Drawings.

Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.

The designated Supervisory personnel on the project must be certified, in writing by the turf manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

Designs, markings, layouts, and materials shall conform to all currently applicable National Collegiate Athletic Association rules, NFHS rules, and/or other rules or standards that may apply to this type of synthetic grass installation. Designs, markings and layouts shall first be approved by the Architect or Owner in the form of final shop drawings. All markings will be in full compliance with final shop drawings.

3.4 INSTALLATION

Install at location(s) indicated, to comply with final shop drawings, manufacturers’/installer’s instructions.

The Contractor shall strictly adhere to specified procedures. Any variance from these requirements shall be provided in writing, by the manufacturer’s on-site representative, and submitted to the Architect and/or Owner, verifying that the changes do not in any way affect the Warranty. Infill materials shall be approved by the manufacturer and installed in accordance with the manufacturer’s standard procedures.

Carpet rolls shall be installed directly over the properly prepared aggregate base. Extreme care shall be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity.

1. Repair and properly compact any disturbed areas of the aggregate base as recommended by manufacturer

Full width rolls shall be laid out across the field.

2. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline.
3. No cross seams will be allowed in the main playing area between the sidelines.
4. Each roll shall be attached to the next roll utilizing standard state-of-the- art sewing procedures.
5. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing surface.

Artificial turf panel seams shall be sewn along the selvedge edging flap of the turf roll. Seams secured by other means including gluing are unacceptable. Installation shall be 99% sewn.

6. Minimum gluing will only be permitted to repair problem areas, corner completions, and to cut in any logos or inlaid lines as required by the specifications.
7. Seams shall be flat, tight, and permanent with no separation or fraying.
8. In the case of all lines and logos, turf carpet must be field fibers must be sheared to the backing (do not cut the backing) and adhered using hot melt adhesives.

Infill Materials:

9. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth determined by the manufacturer.
10. Three-layered infill shall be installed in a systematic order.
11. Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of a base layer of sand followed by a homogenous mixture of the sand and the cryogenically processed rubber. A final application of specifically sized cryogenically processed rubber completes the system. The Infill shall be installed to the depth of 1.25". Infill density shall consist of no more than 3.65 pounds of sand and at least 2.6 pounds of rubber per square foot. The Infill shall be placed so that there is a void of ¾" to the top of the fibers.

Non-tufted or inlaid lines and markings shall be painted in accordance with turf and paint manufacturers' recommendations. Number of applications will be dependent upon installation and field conditions.

Synthetic turf shall be attached to the perimeter edge detail in accordance with the manufacturer's standard procedures.

Upon completion of installation, the finished field shall be inspected by the installation crew and an installation supervisor.

3.5 FIELD MARKINGS

Field markings shall be installed in accordance with approved shop drawings. If football is designated as the primary sport, all five yard lines will be tufted-in.

Balance of sports markings will be inlaid or painted in accordance with the Drawings.

Center field logo shall be either painted or inlaid according to artwork indicated on Drawings and in accordance with manufacturer's standard palette of turf colors.

End-zone letters and logos shall be either painted or inlaid according to artwork and fonts indicated

on the Drawings, and in accordance with manufacturer's standard palette of turf colors.

3.6 FIELD MAINTENANCE

The maintenance activities will include and not be limited to the most current FieldTurf Maintenance Guidelines at the time the maintenance is being undertaken, including the following FieldTurf Products: FieldTurf Scrub Detergent, FieldTurf Static Control, FieldTurf Gum Remover.

3.7 ADJUSTMENT AND CLEANING

Do not permit traffic over unprotected surface.

Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

All usable remnants of new material shall become the property of the Owner.

The Contractor shall keep the area clean throughout the project and clear of debris.

Surfaces, recesses, enclosures, and related spaces shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

3.8 PROTECTION

Protect installation throughout construction process until date of final completion.

END OF SECTION

SECTION 32 18 23.36 - HELLAS MATRIX BASEBALL/SOFTBALL INFILLED SYNTHETIC TURF SYSTEM

1.1 WORK INCLUDED

A. Furnish all labor, materials, tools and equipment necessary to install all synthetic turf as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.

B. Perimeter edge details required for the system shall be as detailed and recommended by the Manufacturer, and as approved by the Owner.

C. It is the intent of this Section that the Work shall:
   1. include, but not be limited to:
      a. Baseball/Softball field construction, and related materials and accessories shown on Drawings or required to complete Work.
      b. Work shall be performed and warranted by a single source supplier/contractor.

1.2 RELATED SECTIONS

A. Section 31 20 00 - Earthwork

B. Section 31 32 13.16 –Lime-Flyash Stabilized Subgrade

C. Section 32 11 23.23 - "Free-Draining Stone" Base for Synthetic Turf System

D. Section 32 05 19.18 – PVC Geomembrane Liner for Synthetic Turf System

1.3 REFERENCES

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition

B. ASTM Standard Test Methods:

D1577 - Standard Test Method for Linear Density of Textile Fiber
D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
D418 - Standard Test Method for Testing Pile Yarn Floor Covering Construction
D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics
F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
F1936 - Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

C. UIL rules/regulations, latest edition.

1.4 SUBMITTALS

A. See Section 01 33 00 - Requirements for submittal procedures.

B. Prior to the Architect approval of a specified synthetic turf system, the Manufacturer shall specify in writing that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending.

C. Submit the following with the Proposal:

1. Submit two samples, minimum of 6x6 inch in size, illustrating details of finished product.

2. A letter and specification sheet certifying that the products of this section meet or exceed specified requirements.

3. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:

   a) Pile Height, Face Width & Total Fabric Weight, ASTM D418 or D5848
   b) Primary & Secondary Backing Weights, ASTM D418 or D5848
   c) Tuft Bind, ASTM D1335
   d) Grab Tear Strength, ASTM D1682 or D5034
   e) Pill Burn Test ASTM D2859
   f) Flooring Critical Radiant Panel Test (Flame Spread) ASTM E-648

4. List of existing installations, including Owner representative and telephone number.

5. Lists providing specific contacts and telephone numbers of the following:

   a) A football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber, in play for at least 5 years. These installations must have used the same manufacturer, product and company they are proposing for this field.
   b) A list of NCAA division 1 football fields in play for at least 5 seasons.
   c) A list of 10 fields in the United States that have been in play for the past 5 years utilizing the same fiber and fiber manufacturer that is being proposed for this field.

6. Resume of Installation Supervisor who will be present on site during installation.

7. The Contractor and the turf Manufacturer (if different from the company) shall, if requested by the Owner or Owner’s representative, provide a current audited company financial statement. The Owner shall put in writing that this information shall be held in confidence and not shared with third parties.

8. The Contractor and Turf Manufacturer (if different from the company) shall provide evidence that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending.

9. The Contractor and the turf Manufacturer (if different from the company) shall provide a sample copy of insured, non-prorated warranty and third party, non-cancelable insurance policy information, as detailed in these documents. The work cannot commence until the 8-year policy documentation is submitted and approved.

D. Prior to ordering of materials:

1. The Contractor shall submit Shop Drawings indicating:

a) Field Layout
b) Field Marking Plan and details for the sport field(s) shall meet National Collegiate Athletic Association (NCAA) rules/regulations (latest edition).
c) Roll/Seaming Layout
d) Methods of attachment, field openings and perimeter conditions.

2. The turf Manufacturer must submit the fiber manufacturer's name, type of fiber and composition of fiber.

E. Prior to Final Acceptance, the Contractor shall submit to the Owner:

1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

2. Project Record Documents: Record actual locations of seams, drains or other pertinent information.

3. Warranty: Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.

4. Warranty Insurance Policy Certificate—8 year policy must be executed prior to Final Payment. Policy must be prepaid for full 8 year term.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The Turf Contractor and/or the turf Manufacturer:

1. Must be experienced in the manufacture and installation of this specific type of synthetic infill grass system for at least 5 years with the same manufacturer, product and company they are proposing for this field. This includes the same pile fiber, the backing, the backing coating, and the installation method

2. Must have a football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber, in play for at least 5 years with the same manufacturer and company they are proposing for this field.

3. Must have 10 fields in play for the past 5 years, utilizing the same fiber and fiber manufacturer that is being proposed for this field.

B. Installer Qualifications: Company specializing in performing the work of this section.

1. The Contractor must provide competent workmen skilled in this specific type of synthetic turf installation.

2. The designated Supervisory Personnel on the project must be certified, in writing by the Turf Manufacturer, as competent in the installation of this material, including sewing/gluing seams and proper installation of the infill mixture.

3. The Manufacturer shall have a representative on site to certify the installation and Warranty compliance.

C. Prior to the beginning of installation, the Installer of the synthetic turf shall inspect the sub-base. The installer will accept the sub-base in writing when the contractor provides test results for planarity and permeability that are in compliance with the synthetic turf manufacturer's guidelines. The Installer shall have the dimensions of the field and locations for markings measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made. The final tolerance-to-grade of the base shall not exceed ±¼ inch in ten feet in any direction.

D. The Contractor shall provide the necessary testing data to the owner that the finished field meets the required shock attenuation, as per ASTM F1936.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to project site in wrapped condition.

B. Store products under cover and elevated above grade.

1.7 WARRANTIES

A. See Section 01 77 00 – Closeout Procedures, for additional warranty requirements.

B. The contractor and Turf Manufacturer shall provide a Warranty to the owner that covers defects in materials and workmanship of the synthetic turf system for a period of 8 years from the date of Substantial Completion. The turf manufacturer must verify that their onsite representative has inspected the installation and that the work conforms to the manufacturer's requirements.

C. The Manufacturer's Warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the owner or the manufacturer.

D. The Turf Manufacturer's Warranty must be supported by a third party, non-cancelable insurance policy for the full eight (8) year period. The policy must be from an A Best Rated company and be paid in full for the 8 year term.

E. The Contractor shall provide a Warranty to the owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the Manufacturer's recommendations and any written directives of the Manufacturer's onsite representative.

F. The synthetic turf for the baseball/softball fields must maintain an ASTM 355 G-max of between 125-165 for the life of the Warranty. The contractor shall pay for a third party G-max testing upon completion of field installation.

1.9 MAINTENANCE SERVICE

A. The Contractor will train the Owner's facility maintenance staff in the use of the Turf Manufacturer's recommended groomer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers are as follows:
   1. Hellas

2.2 MATERIALS

A. The component materials of the synthetic turf system consist of:

1. A Carpet made of polyethylene fibers tufted into a fibrous, porous backing.

2. An Infill that is a controlled mixture of graded sand and rubber crumb that partially covers the carpet.

3. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass field turf.

B. The installed artificial grass field turf shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	8000 nominal
ASTM D1577	Fiber Thickness	100 microns
ASTM D418/D5848	Pile Height	1-3/4”-2” nominal (Baseball/Softball)
ASTM D418/D5848	Pile Weight	42-46 oz./sq. yd., min.
ASTM D1682/D5034	Grab Tear (width)	>275-287.4 lbs/force
ASTM D1682/D5034	Grab Tear (length)	>300-340.9 lbs/force
ASTM F1015	Relative Abrasiveness Index	20
ASTM D4491	Carpet Permeability	>40 inches/hour
ASTM D2859	Flammability (Pill Burn)	Pass
ASTM E648	Critical Radiant Flux	>.2 g/sq.cm. (Class B)
ASTM F355/F1936	Impact Attenuation, Gmax	=<130 at installation =<190 over warranty life

C. The Carpet shall consist of fibers tufted into a primary backing with a secondary elastomeric coating.

1. The Carpet shall be furnished in 15’ wide rolls. Rolls shall be long enough to go from sideline to sideline without splicing. The perimeter white line shall be tufted into the individual sideline rolls. Head seams, other than at sidelines, will not be acceptable

2. The Carpet’s primary backing shall be a composite fabric treated with UV inhibitors, consisting of multiple layers of woven polypropylene and non-woven polypropylene needle punched together so as to function as a single unit. The secondary back coating shall consist of an application of heat-activated urethane to permanently lock the fiber tufts in place. Drainage shall be accomplished by means of uncoated fabric “valleys” between the coated fiber stitches or perforations in the backing.

3. The fiber shall be 8,000 denier, 100 microns thick, low friction, UV-resistant fiber measuring not less than 1-3/4” inches high.

D. The Infill materials shall be approved by the Manufacturer. The Infill shall consist of a resilient layered granular system, comprised of selected and graded dust-free silica sand and cryogenically hammer-milled SBR rubber crumb.

E. Threaded and/or glued seams of turf shall be as recommended by the synthetic Turf Manufacturer. The method and adhesives used for inlaid markings shall be as recommended by the synthetic turf .

F. Acceptable shock pads (if utilized):
   1. In situ SBR rubber granule pad bound by polyurethane (elastic layer). Polyurethane shall comprise at least 7% of the mix. Thickness of elastic layer pad, which must be installed using suitable equipment designed for the application (P700), shall be a minimum 26mm. System must include a percentage of gravel in the mix to provide sufficient weight and density). Provide detailed specifications with the Bid, if applicable.
   2. Factory made rubber shock pad (Regupol or equal), comprised of recycled SBR granule bound by polyurethane under heat and pressure. Thickness shall be a minimum 10mm. Joints shall be seamed properly per the manufacturer's recommendation. Provide detailed specifications with the Bid, if applicable.

2.3 FIELD SWEEPER & FIELD GROOMER

A. Supply a field sweeper/groomer, which shall include a towing mechanism compatible with a field utility vehicle. The field sweeper/groomer shall be an "SMG TurfCare TCA1400" (or approved equivalent) Synthetic Sweeper/Groomer with 72" tow-behind magnet.

PART 3 EXECUTION

3.1 GENERAL

A. The installation shall be performed in full compliance with approved Shop Drawings.

B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.

C. The designated Supervisory personnel on the project must be certified, in writing by the turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

D. All designs, markings, layouts, and materials shall conform to all currently applicable NCAA rules and other standards that may apply to this type of synthetic grass installation.

D. Elastic layer pad system must be installed using proper paving equipment (SMG P700, modified for the application) and crew must be experienced in this application.

3.2 EXAMINATION

A. Verify that all sub-base, drainage and leveling is complete prior to installation.

B. The surface to receive the synthetic turf shall be inspected by the Installer, and prior to the beginning of installation, the Installer must accept the sub-base in writing. The acceptance will depend on the contractor providing the installer with test results indicating that planarity and permeability are in compliance with the synthetic turf manufacturer's written guidelines or recommendations. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

C. The compaction of the aggregate base shall also be accepted in writing by the Turf Installer, and the surface tolerance-to-grade shall not exceed $\pm$1/4 inch over 10 feet.

3.3 INSTALLATION

A. Install in accordance with Manufacturer's instructions. The Contractor shall strictly adhere to he installation procedures outlined under this section. Any variance from these requirements must be accepted in writing, by the Manufacturer's onsite representative, and submitted to the Architect/Owner, verifying that the changes do not in any way affect the warranty. Infill materials shall be approved by the Manufacturer and installed in accordance with the Manufacturer's standard procedures.

B. Install the shock pad, if required, per these specifications, per the manufacturer's installation procedures using only approved and suitable equipment and skilled technicians experienced in the installation of elastic layer or factory made pads. In situ pads must be allowed to cure for a minimum 24 hours.

C. The carpet rolls are to be installed directly over the properly prepared aggregate base or shock pad. Extreme care should be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity. It is suggested that a 2-5 ton static roller is on site and available to repair and properly compact any disturbed areas of the aggregate base.

D. The full width rolls shall be laid out across the field. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline. No head or cross seams will be allowed in the main playing area between the sidelines. Utilizing standard state of the art sewing or glueing procedures each roll shall be attached to the next. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing field turf.

E. All seams shall be sewn using double bagger stitches and polyester thread or adhered using seaming tape and high grade adhesive (per the manufacturer's standard procedures). Seams shall be flat, tight, and permanent with no separation or fraying.

F. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth determined by the Manufacturer.

G. The Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of a base layer of sand followed by a homogenous mixture of the sand and the cryogenically processed rubber. A final application of specifically sized cryogenically processed rubber completes the system.

H. Synthetic turf shall be attached to the perimeter edge detail in accordance with the Manufacturer's standard procedures using non-corrosive fastners.

3.4 FIELD MARKINGS

A. The field will have the following lines and markings tufted or inlaid according to NCAA standards:

1. Competition Baseball/Softball Fields: as shown on the contract drawings. Color shall be white, except where noted.
   a) Base lines
   b) Foul lines
   c) Batters box
   d) Catchers box
   e) Coach's boxes
   f) Pitcher's circle (softball only)

B. Standards

1. Standards; all lines and markings shall be to UIL, NFHS, NCAA Standards.

3.5 CLEANING

A. Protect installed turf from subsequent construction operations.

B. Do not permit traffic over unprotected turf surface.

C. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

D. All usable remnants of new material shall be come the property of the Owner.

E. The Contractor shall keep the area clean throughout the project and clear of debris.

F. Surfaces, recesses, enclosures, etc., shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION

SECTION 32 18 23.37 – SHAW SPORTS TRUEHOP 46-INFIELD SYNTHETIC TURF SYSTEM

1.1 WORK INCLUDED

A. Furnish all labor, materials, tools and equipment necessary to install all synthetic turf as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.

B. Perimeter edge details required for the system shall be as detailed and recommended by the Manufacturer, and as approved by the Owner.

C. It is the intent of this Section that the Work shall:
   1. include, but not be limited to:
      a. Baseball/Softball field construction, and related materials and accessories shown on Drawings or required to complete Work.
      b. Work shall be performed and warranted by a single source supplier/contractor.

1.2 RELATED SECTIONS

A. Section 31 20 00 - Earthwork

B. Section 31 32 13.16 –Lime-Flyash Stabilized Subgrade

C. Section 32 11 23.23 - "Free-Draining Stone" Base for Synthetic Turf System

D. Section 32 05 19.18 – PVC Geomembrane Liner for Synthetic Turf System

1.3 REFERENCES

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition

B. ASTM Standard Test Methods:

D1577 - Standard Test Method for Linear Density of Textile Fiber
D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
D418 - Standard Test Method for Testing Pile Yarn Floor Covering Construction
D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics
F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
F1936 - Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

C. UIL rules/regulations, latest edition.

1.4 SUBMITTALS

A. See Section 01 33 00 - Requirements for submittal procedures.

B. Prior to the Architect approval of a specified synthetic turf system, the Manufacturer shall specify in writing that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending.

C. Submit the following with the Proposal:

1. Submit two samples, minimum of 6x6 inch in size, illustrating details of finished product.

2. A letter and specification sheet certifying that the products of this section meet or exceed specified requirements.

3. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:

a) Pile Height, Face Width & Total Fabric Weight, ASTM D418 or D5848
b) Primary & Secondary Backing Weights, ASTM D418 or D5848
c) Tuft Bind, ASTM D1335
d) Grab Tear Strength, ASTM D1682 or D5034
e) Pill Burn Test ASTM D2859
f) Flooring Critical Radiant Panel Test (Flame Spread) ASTM E-648

4. List of existing installations, including Owner representative and telephone number.

5. Lists providing specific contacts and telephone numbers of the following:

a) A football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber, in play for at least 5 years. These installations must have used the same manufacturer, product and company they are proposing for this field.
b) A list of NCAA division 1 football fields in play for at least 5 seasons.
c) A list of 10 fields in the United States that have been in play for the past 5 years utilizing the same fiber and fiber manufacturer that is being proposed for this field.

6. Resume of Installation Supervisor who will be present on site during installation.

7. The Contractor and the turf Manufacturer (if different from the company) shall, if requested by the Owner or Owner’s representative, provide a current audited company financial statement. The Owner shall put in writing that this information shall be held in confidence and not shared with third parties.

8. The Contractor and Turf Manufacturer (if different from the company) shall provide evidence that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending.

9. The Contractor and the turf Manufacturer (if different from the company) shall provide a sample copy of insured, non-prorated warranty and third party, non-cancelable insurance policy information, as detailed in these documents. The work cannot commence until the 8-year policy documentation is submitted and approved.

D. Prior to ordering of materials:

1. The Contractor shall submit Shop Drawings indicating:

a) Field Layout
b) Field Marking Plan and details for the sport field(s) shall meet National Collegiate Athletic Association (NCAA) rules/regulations (latest edition).
c) Roll/Seaming Layout
d) Methods of attachment, field openings and perimeter conditions.

2. The turf Manufacturer must submit the fiber manufacturer's name, type of fiber and composition of fiber.

E. Prior to Final Acceptance, the Contractor shall submit to the Owner:

1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

2. Project Record Documents: Record actual locations of seams, drains or other pertinent information.

3. Warranty: Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.

4. Warranty Insurance Policy Certificate—8 year policy must be executed prior to Final Payment. Policy must be prepaid for full 8 year term.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The Turf Contractor and/or the turf Manufacturer:

1. Must be experienced in the manufacture and installation of this specific type of synthetic infill grass system for at least 5 years with the same manufacturer, product and company they are proposing for this field. This includes the same pile fiber, the backing, the backing coating, and the installation method

2. Must have a football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber, in play for at least 5 years with the same manufacturer and company they are proposing for this field.

3. Must have 10 fields in play for the past 5 years, utilizing the same fiber and fiber manufacturer that is being proposed for this field.

B. Installer Qualifications: Company specializing in performing the work of this section.

1. The Contractor must provide competent workmen skilled in this specific type of synthetic turf installation.

2. The designated Supervisory Personnel on the project must be certified, in writing by the Turf Manufacturer, as competent in the installation of this material, including sewing/gluing seams and proper installation of the infill mixture.

3. The Manufacturer shall have a representative on site to certify the installation and Warranty compliance.

C. Prior to the beginning of installation, the Installer of the synthetic turf shall inspect the sub-base. The installer will accept the sub-base in writing when the contractor provides test results for planarity and permeability that are in compliance with the synthetic turf manufacturer’s guidelines. The Installer shall have the dimensions of the field and locations for markings measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made. The final tolerance-to-grade of the base shall not exceed $\pm$¼ inch in ten feet in any direction.

D. The Contractor shall provide the necessary testing data to the owner that the finished field meets the required shock attenuation, as per ASTM F1936.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to project site in wrapped condition.

B. Store products under cover and elevated above grade.

1.7 WARRANTIES

A. See Section 01 77 00 – Closeout Procedures, for additional warranty requirements.

B. The contractor and Turf Manufacturer shall provide a Warranty to the owner that covers defects in materials and workmanship of the synthetic turf system for a period of 8 years from the date of Substantial Completion. The turf manufacturer must verify that their onsite representative has inspected the installation and that the work conforms to the manufacturer's requirements.

C. The Manufacturer's Warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the owner or the manufacturer.

D. The Turf Manufacturer's Warranty must be supported by a third party, non-cancelable insurance policy for the full eight (8) year period. The policy must be from an A Best Rated company and be paid in full for the 8 year term.

E. The Contractor shall provide a Warranty to the owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the Manufacturer's recommendations and any written directives of the Manufacturer's onsite representative.

F. The synthetic turf for the baseball/softball fields must maintain an ASTM 355 G-max of between 125-165 for the life of the Warranty. The contractor shall pay for a third party G-max testing upon completion of field installation.

1.9 MAINTENANCE SERVICE

A. The Contractor will train the Owner's facility maintenance staff in the use of the Turf Manufacturer's recommended groomer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers are as follows:
   1. Shaw Sports

2.2 MATERIALS

A. The component materials of the synthetic turf system consist of:

   1. A Carpet made of polyethylene fibers tufted into a fibrous, porous backing.

   2. An Infill that is a controlled mixture of graded sand and rubber crumb that partially covers the carpet.

3. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass field turf.

B. The installed artificial grass field turf shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	8000 nominal
ASTM D1577	Fiber Thickness	110 microns
ASTM D418/D5848	Pile Height	1.625" nominal (Baseball/Softball)
ASTM D418/D5848	Pile Weight	46 oz./sq. yd., min.
ASTM D1682/D5034	Grab Tear (width)	>200 lbs/force
ASTM D1682/D5034	Grab Tear (length)	>200 lbs/force
ASTM F1015	Relative Abrasiveness Index	20
ASTM D4491	Carpet Permeability	>30 inches/hour
ASTM D2859	Flammability (Pill Burn)	Pass
ASTM E648	Critical Radiant Flux	>.2 g/sq.cm. (Class B)
ASTM F355/F1936	Impact Attenuation, Gmax	=<130 at installation =<190 over warranty life

C. The Carpet shall consist of fibers tufted into a primary backing with a secondary elastomeric coating.

1. The Carpet shall be furnished in 15' wide rolls. Rolls shall be long enough to go from sideline to sideline without splicing. The perimeter white line shall be tufted into the individual sideline rolls. Head seams, other than at sidelines, will not be acceptable

2. The Carpet's primary backing shall be a composite fabric treated with UV inhibitors, consisting of multiple layers of woven polypropylene and non-woven polypropylene needle punched together so as to function as a single unit. The secondary back coating shall consist of an application of heat-activated urethane to permanently lock the fiber tufts in place. Drainage shall be accomplished by means of uncoated fabric "valleys" between the coated fiber stitches or perforations in the backing.

3. The fiber shall be 8,000 denier, 110 microns, low friction, UV-resistant fiber measuring not less than 1-3/4" inches high.

D. The Infill materials shall be approved by the Manufacturer. The Infill shall consist of a resilient layered granular system, comprised of selected and graded dust-free silica sand and cryogenically hammer-milled SBR rubber crumb.

E. Threaded and/or glued seams of turf shall be as recommended by the synthetic Turf Manufacturer. The method and adhesives used for inlaid markings shall be as recommended by the synthetic turf .

F. Acceptable shock pads (if utilized):
1. In situ SBR rubber granule pad bound by polyurethane (elastic layer). Polyurethane shall comprise at least 7% of the mix. Thickness of elastic layer pad, which must be installed using suitable equipment designed for the application (P700), shall be a minimum 26mm. System must include a percentage of gravel in the mix to provide sufficient weight and density). Provide detailed specifications with the Bid, if applicable.
2. Factory made rubber shock pad (Regupol or equal), comprised of recycled SBR granule bound by polyurethane under heat and pressure. Thickness shall be a minimum 10mm. Joints shall be seamed properly per the manufacturer's recommendation. Provide detailed specifications with the Bid, if applicable.

2.3 FIELD SWEEPER & FIELD GROOMER

A. Supply a field sweeper/groomer, which shall include a towing mechanism compatible with a field utility vehicle. The field sweeper/groomer shall be an “SMG TurfCare TCA1400” (or approved equivalent) Synthetic Sweeper/Groomer with 72” tow-behind magnet.

PART 3 EXECUTION

3.1 GENERAL

A. The installation shall be performed in full compliance with approved Shop Drawings.

B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.

C. The designated Supervisory personnel on the project must be certified, in writing by the turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

D. All designs, markings, layouts, and materials shall conform to all currently applicable NCAA rules and other standards that may apply to this type of synthetic grass installation.

D. Elastic layer pad system must be installed using proper paving equipment (SMG P700, modified for the application) and crew must be experienced in this application.

3.2 EXAMINATION

A. Verify that all sub-base, drainage and leveling is complete prior to installation.

B. The surface to receive the synthetic turf shall be inspected by the Installer, and prior to the beginning of installation, the Installer must accept the sub-base in writing. The acceptance will depend on the contractor providing the installer with test results indicating that planarity and permeability are in compliance with the synthetic turf manufacturer’s written guidelines or recommendations. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

C. The compaction of the aggregate base shall also be accepted in writing by the Turf Installer, and the surface tolerance-to-grade shall not exceed $\pm$1/4 inch over 10 feet.

3.3 INSTALLATION

A. Install in accordance with Manufacturer's instructions. The Contractor shall strictly adhere to he installation procedures outlined under this section. Any variance from these requirements must be accepted in writing, by the Manufacturer’s onsite representative, and submitted to the Architect/Owner, verifying that the changes do not in any way affect the warranty. Infill materials shall be approved by the Manufacturer and installed in accordance with the Manufacturer’s standard procedures.

B. Install the shock pad, if required, per these specifications, per the manufacturer’s installation procedures using only approved and suitable equipment and skilled technicians experienced in the installation of elastic layer or factory made pads. In situ pads must be allowed to cure for a minimum 24 hours.

C. The carpet rolls are to be installed directly over the properly prepared aggregate base or shock pad. Extreme care should be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity. It is suggested that a 2-5 ton static roller is on site and available to repair and properly compact any disturbed areas of the aggregate base.

D. The full width rolls shall be laid out across the field. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline. No head or cross seams will be allowed in the main playing area between the sidelines. Utilizing standard state of the art sewing or glueing procedures each roll shall be attached to the next. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing field turf.

E. All seams shall be sewn using double bagger stitches and polyester thread or adhered using seaming tape and high grade adhesive (per the manufacturer's standard procedures). Seams shall be flat, tight, and permanent with no separation or fraying.

F. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth determined by the Manufacturer.

G. The Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of a base layer of sand followed by a homogenous mixture of the sand and the cryogenically processed rubber. A final application of specifically sized cryogenically processed rubber completes the system.

H. Synthetic turf shall be attached to the perimeter edge detail in accordance with the Manufacturer's standard procedures using non-corrosive fastners.

3.4 FIELD MARKINGS

A. The field will have the following lines and markings tufted or inlaid according to UIL, NFHS, NCAA standards:

1. Competition Baseball/Softball Fields: as shown on the contract drawings. Color shall be white, except where noted.
   a) Base lines
   b) Foul lines
   c) Batters box
   d) Catchers box
   e) Coach's boxes
   f) Pitcher's circle (softball only)

3.5 CLEANING

A. Protect installed turf from subsequent construction operations.

B. Do not permit traffic over unprotected turf surface.

C. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

D. All usable remnants of new material shall be come the property of the Owner.

E. The Contractor shall keep the area clean throughout the project and clear of debris.

F. Surfaces, recesses, enclosures, etc., shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION

SECTION 32 18 23.38 – SHAW SPORTS LEGION HP 2.0-OUTFIELD INFILLED SYNTHETIC TURF SYSTEM

1.1 WORK INCLUDED

A. Furnish all labor, materials, tools and equipment necessary to install all synthetic turf as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.

B. Perimeter edge details required for the system shall be as detailed and recommended by the Manufacturer, and as approved by the Owner.

C. It is the intent of this Section that the Work shall:
   1. include, but not be limited to:
      a. Baseball/Softball field construction, and related materials and accessories shown on Drawings or required to complete Work.
      b. Work shall be performed and warranted by a single source supplier/contractor.

1.2 RELATED SECTIONS

A. Section 31 20 00 - Earthwork

B. Section 31 32 13.16 –Lime-Flyash Stabilized Subgrade

C. Section 32 11 23.23 - "Free-Draining Stone" Base for Synthetic Turf System

D. Section 32 05 19.18 – PVC Geomembrane Liner for Synthetic Turf System

1.3 REFERENCES

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition

B. ASTM Standard Test Methods:

D1577 - Standard Test Method for Linear Density of Textile Fiber
D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
D418 - Standard Test Method for Testing Pile Yarn Floor Covering Construction
D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics
F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
F1936 - Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

C. UIL rules/regulations, latest edition.

1.4 SUBMITTALS

A. See Section 01 33 00 - Requirements for submittal procedures.

B. Prior to the Architect approval of a specified synthetic turf system, the Manufacturer shall specify in writing that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending.

C. Submit the following with the Proposal:

1. Submit two samples, minimum of 6x6 inch in size, illustrating details of finished product.

2. A letter and specification sheet certifying that the products of this section meet or exceed specified requirements.

3. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:

a) Pile Height, Face Width & Total Fabric Weight, ASTM D418 or D5848
b) Primary & Secondary Backing Weights, ASTM D418 or D5848
c) Tuft Bind, ASTM D1335
d) Grab Tear Strength, ASTM D1682 or D5034
e) Pill Burn Test ASTM D2859
f) Flooring Critical Radiant Panel Test (Flame Spread) ASTM E-648

4. List of existing installations, including Owner representative and telephone number.

5. Lists providing specific contacts and telephone numbers of the following:

a) A football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber, in play for at least 5 years. These installations must have used the same manufacturer, product and company they are proposing for this field.
b) A list of NCAA division 1 football fields in play for at least 5 seasons.
c) A list of 10 fields in the United States that have been in play for the past 5 years utilizing the same fiber and fiber manufacturer that is being proposed for this field.

6. Resume of Installation Supervisor who will be present on site during installation.

7. The Contractor and the turf Manufacturer (if different from the company) shall, if requested by the Owner or Owner’s representative, provide a current audited company financial statement. The Owner shall put in writing that this information shall be held in confidence and not shared with third parties.

8. The Contractor and Turf Manufacturer (if different from the company) shall provide evidence that their turf system does not violate any other manufacturer's patents, patents allowed or patents pending.

9. The Contractor and the turf Manufacturer (if different from the company) shall provide a sample copy of insured, non-prorated warranty and third party, non-cancelable insurance policy information, as detailed in these documents. The work cannot commence until the 8-year policy documentation is submitted and approved.

D. Prior to ordering of materials:

1. The Contractor shall submit Shop Drawings indicating:

a) Field Layout
b) Field Marking Plan and details for the sport field(s) shall meet National Collegiate Athletic Association (NCAA) rules/regulations (latest edition).
c) Roll/Seaming Layout
d) Methods of attachment, field openings and perimeter conditions.

2. The turf Manufacturer must submit the fiber manufacturer's name, type of fiber and composition of fiber.

E. Prior to Final Acceptance, the Contractor shall submit to the Owner:

1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

2. Project Record Documents: Record actual locations of seams, drains or other pertinent information.

3. Warranty: Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.

4. Warranty Insurance Policy Certificate—8 year policy must be executed prior to Final Payment. Policy must be prepaid for full 8 year term.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The Turf Contractor and/or the turf Manufacturer:

1. Must be experienced in the manufacture and installation of this specific type of synthetic infill grass system for at least 5 years with the same manufacturer, product and company they are proposing for this field. This includes the same pile fiber, the backing, the backing coating, and the installation method

2. Must have a football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber, in play for at least 5 years with the same manufacturer and company they are proposing for this field.

3. Must have 10 fields in play for the past 5 years, utilizing the same fiber and fiber manufacturer that is being proposed for this field.

B. Installer Qualifications: Company specializing in performing the work of this section.

1. The Contractor must provide competent workmen skilled in this specific type of synthetic turf installation.

2. The designated Supervisory Personnel on the project must be certified, in writing by the Turf Manufacturer, as competent in the installation of this material, including sewing/gluing seams and proper installation of the infill mixture.

3. The Manufacturer shall have a representative on site to certify the installation and Warranty compliance.

C. Prior to the beginning of installation, the Installer of the synthetic turf shall inspect the sub-base. The installer will accept the sub-base in writing when the contractor provides test results for planarity and permeability that are in compliance with the synthetic turf manufacturer’s guidelines. The Installer shall have the dimensions of the field and locations for markings measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made. The final tolerance-to-grade of the base shall not exceed $\pm$¼ inch in ten feet in any direction.

D. The Contractor shall provide the necessary testing data to the owner that the finished field meets the required shock attenuation, as per ASTM F1936.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to project site in wrapped condition.

B. Store products under cover and elevated above grade.

1.7 WARRANTIES

A. See Section 01 77 00 – Closeout Procedures, for additional warranty requirements.

B. The contractor and Turf Manufacturer shall provide a Warranty to the owner that covers defects in materials and workmanship of the synthetic turf system for a period of 8 years from the date of Substantial Completion. The turf manufacturer must verify that their onsite representative has inspected the installation and that the work conforms to the manufacturer's requirements.

C. The Manufacturer's Warranty shall include general wear and damage caused from UV degradation. The warranty shall specifically exclude vandalism, and acts of God beyond the control of the owner or the manufacturer.

D. The Turf Manufacturer's Warranty must be supported by a third party, non-cancelable insurance policy for the full eight (8) year period. The policy must be from an A Best Rated company and be paid in full for the 8 year term.

E. The Contractor shall provide a Warranty to the owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the Manufacturer's recommendations and any written directives of the Manufacturer's onsite representative.

F. The synthetic turf for the baseball/softball fields must maintain an ASTM 355 G-max of between 125-165 for the life of the Warranty. The contractor shall pay for a third party G-max testing upon completion of field installation.

1.9 MAINTENANCE SERVICE

A. The Contractor will train the Owner's facility maintenance staff in the use of the Turf Manufacturer's recommended groomer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers are as follows:
   1. Shaw Sports

2.2 MATERIALS

A. The component materials of the synthetic turf system consist of:

   1. A Carpet made of polyethylene fibers tufted into a fibrous, porous backing.

   2. An Infill that is a controlled mixture of graded sand and rubber crumb that partially covers the carpet.

   3. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass field turf.

B. The installed artificial grass field turf shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	8000 nominal
ASTM D1577	Fiber Thickness	110 microns
ASTM D418/D5848	Pile Height	2" nominal (Baseball/Softball)
ASTM D418/D5848	Pile Weight	41 oz./sq. yd., min.
ASTM D1682/D5034	Grab Tear (width)	>200 lbs/force
ASTM D1682/D5034	Grab Tear (length)	>200 lbs/force
ASTM F1015	Relative Abrasiveness Index	20
ASTM D4491	Carpet Permeability	>30 inches/hour
ASTM D2859	Flammability (Pill Burn)	Pass
ASTM E648	Critical Radiant Flux	>.2 g/sq.cm. (Class B)
ASTM F355/F1936	Impact Attenuation, Gmax	=<130 at installation =<190 over warranty life

C. The Carpet shall consist of fibers tufted into a primary backing with a secondary elastomeric coating.

1. The Carpet shall be furnished in 15' wide rolls. Rolls shall be long enough to go from sideline to sideline without splicing. The perimeter white line shall be tufted into the individual sideline rolls. Head seams, other than at sidelines, will not be acceptable

2. The Carpet's primary backing shall be a composite fabric treated with UV inhibitors, consisting of multiple layers of woven polypropylene and non-woven polypropylene needle punched together so as to function as a single unit. The secondary back coating shall consist of an application of heat-activated urethane to permanently lock the fiber tufts in place. Drainage shall be accomplished by means of uncoated fabric "valleys" between the coated fiber stitches or perforations in the backing.

3. The fiber shall be 8,000 denier, 110 microns, low friction, UV-resistant fiber measuring not less than 2" inches high.

D. The Infill materials shall be approved by the Manufacturer. The Infill shall consist of a resilient layered granular system, comprised of selected and graded dust-free silica sand and cryogenically hammer-milled SBR rubber crumb.

E. Threaded and/or glued seams of turf shall be as recommended by the synthetic Turf Manufacturer. The method and adhesives used for inlaid markings shall be as recommended by the synthetic turf .

F. Acceptable shock pads (if utilized):
1. In situ SBR rubber granule pad bound by polyurethane (elastic layer). Polyurethane shall comprise at least 7% of the mix. Thickness of elastic layer pad, which must be installed using suitable equipment designed for the application (P700), shall be a minimum 26mm. System must include a percentage of gravel in the mix to provide sufficient weight and density). Provide detailed specifications with the Bid, if applicable.
2. Factory made rubber shock pad (Regupol or equal), comprised of recycled SBR granule bound by polyurethane under heat and pressure. Thickness shall be a minimum 10mm. Joints shall be seamed properly per the manufacturer's recommendation. Provide detailed specifications with the Bid, if applicable.

2.3 FIELD SWEEPER & FIELD GROOMER

A. Supply a field sweeper/groomer, which shall include a towing mechanism compatible with a field utility vehicle. The field sweeper/groomer shall be an “SMG TurfCare TCA1400” (or approved equivalent) Synthetic Sweeper/Groomer with 72” tow-behind magnet.

PART 3 EXECUTION

3.1 GENERAL

A. The installation shall be performed in full compliance with approved Shop Drawings.

B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.

C. The designated Supervisory personnel on the project must be certified, in writing by the turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

D. All designs, markings, layouts, and materials shall conform to all currently applicable NCAA rules and other standards that may apply to this type of synthetic grass installation.

D. Elastic layer pad system must be installed using proper paving equipment (SMG P700, modified for the application) and crew must be experienced in this application.

3.2 EXAMINATION

A. Verify that all sub-base, drainage and leveling is complete prior to installation.

B. The surface to receive the synthetic turf shall be inspected by the Installer, and prior to the beginning of installation, the Installer must accept the sub-base in writing. The acceptance will depend on the contractor providing the installer with test results indicating that planarity and permeability are in compliance with the synthetic turf manufacturer’s written guidelines or recommendations. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

C. The compaction of the aggregate base shall also be accepted in writing by the Turf Installer, and the surface tolerance-to-grade shall not exceed $\pm$1/4 inch over 10 feet.

3.3 INSTALLATION

A. Install in accordance with Manufacturer's instructions. The Contractor shall strictly adhere to he installation procedures outlined under this section. Any variance from these requirements must be accepted in writing, by the Manufacturer’s onsite representative, and submitted to the Architect/Owner, verifying that the changes do not in any way affect the warranty. Infill materials shall be approved by the Manufacturer and installed in accordance with the Manufacturer’s standard procedures.

B. Install the shock pad, if required, per these specifications, per the manufacturer’s installation procedures using only approved and suitable equipment and skilled technicians experienced in the installation of elastic layer or factory made pads. In situ pads must be allowed to cure for a minimum 24 hours.

C. The carpet rolls are to be installed directly over the properly prepared aggregate base or shock pad. Extreme care should be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity. It is suggested that a 2-5 ton static roller is on site and available to

repair and properly compact any disturbed areas of the aggregate base.

D. The full width rolls shall be laid out across the field. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline. No head or cross seams will be allowed in the main playing area between the sidelines. Utilizing standard state of the art sewing or glueing procedures each roll shall be attached to the next. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing field turf.

E. All seams shall be sewn using double bagger stitches and polyester thread or adhered using seaming tape and high grade adhesive (per the manufacturer's standard procedures). Seams shall be flat, tight, and permanent with no separation or fraying.

F. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth determined by the Manufacturer.

G. The Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of a base layer of sand followed by a homogenous mixture of the sand and the cryogenically processed rubber. A final application of specifically sized cryogenically processed rubber completes the system.

H. Synthetic turf shall be attached to the perimeter edge detail in accordance with the Manufacturer's standard procedures using non-corrosive fastners.

3.4 FIELD MARKINGS

A. The field will have the following lines and markings tufted or inlaid according to NCAA standards:

1. Competition Baseball/Softball Fields: as shown on the contract drawings. Color shall be white, except where noted.
   a) Base lines
   b) Foul lines
   c) Batters box
   d) Catchers box
   e) Coach's boxes
   f) Pitcher's circle (softball only)

B. Standards

1. Standards; all lines and markings shall be to NCAA Standards.

3.5 CLEANING

A. Protect installed turf from subsequent construction operations.

B. Do not permit traffic over unprotected turf surface.

C. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

D. All usable remnants of new material shall be come the property of the Owner.

E. The Contractor shall keep the area clean throughout the project and clear of debris.

F. Surfaces, recesses, enclosures, etc., shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION

SECTION 32 31 13.33 - BASEBALL AND SOFTBALL CHAIN LINK FENCE, GATES, and BACKSTOPS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Chain link fencing and gates, with accessories and concrete footings for a complete installation as shown on drawings. Windscreen at outfield perimeter fence of baseball and softball fields.

B. Chain link batting cage, with netting, accessories, and concrete footings for a complete installation; located as shown on drawings.

C. Chain link baseball backstop, with accessories and concrete footings for a complete installation; located as shown on drawings.

D. Chain link softball backstop, with netting, accessories, and concrete footings for a complete installation; located as shown on drawings.

E. Chain link fencing, gates, windscreens, practice walls (Beat Walls), and accessories at Tennis Courts.

1.2 RELATED WORK

A. Section 31 20 00 - Earthwork

B. Section 32 31 19 - Ornamental Picket Fence and Gates

1.3 REFERENCES

A. ASTM International (ASTM)
   1. A120, Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, For Ordinary Uses
   2. A501, Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
   3. A585, Aluminum-Coated Steel Barbed Wire
   4. F900, Industrial and Commercial Swing Gates

B. Chain Link Fence Manufacturers Institute (CLFMI)
   1. “Industrial Steel Specifications for Fence Posts, Gates and Accessories”

1.4 SUBMITTALS

A. Product Data: Submit schedules, charts, literature, and illustrations indicating the performance, fabrication procedures, product variations and accessories.

B. Shop Drawings:
   1. Indicate size, material, and finish, show locations and installation procedures. Include details of joints, attachments and clearances.

2. Supplementary Design: Contractor shall design the chain link fencing and netting to comply with the specified performance. Provide engineering calculations for all chain link fence and netting greater than 10 feet-0 inches high. Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of Texas.

C. Samples: Submit appropriate size samples of netting and windscreen in specified color for Architect's approval.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. As scope and performance documents, the Drawings and Specifications do not necessarily indicate or describe all the work required for the performance and completion of the Work. Contracts will be let on the basis of such documents with the understanding that the Contractor shall furnish and install the items required for proper completion of the Work without adjustment to price or schedule. Work shall be of sound, quality construction and the Contractor shall be solely responsible for the inclusions of adequate labor and materials to cover the proper and timely fabrication and installation of the chain link fencing and netting items indicated, described, or implied.

B. As a performance specification, the criteria for the solution of structurally sound chain link fencing and netting indicated on the Drawings or specified herein are the sole purpose of defining the design intent and performance requirements. The details shown are intended to emphasize the acceptable profiles and performance requirements for this Project. To avoid any misunderstanding or lack of interpretation, the Contractor is hereby advised that the responsibility for the chain link fencing and netting is totally his and that designs and resolutions proposed in the Contractor's shop drawings, structural calculations, and related documentation shall be demonstrated throughout the Work and warranty period specified herein.

C. Design proposal submissions which follow exactly the details indicated on the Drawings, will not relieve the Contractor of his responsibility for the design, fabrication, erection, or performance of the Work of this Section.

D. In the event of a controversy over the design, the decision of the Architect will take precedence.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Specifications are based on products named. Manufacturers listed who produce an equivalent product are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products equivalent to those specified and comply with Division 1 requirements regarding substitutions to be considered.

2.2 FENCE AND BATTING CAGE MATERIALS

A. Chain Link Fabric:
1. Helically woven and interwoven in 2 inch diamond mesh, except at Tennis Courts use 1-3/4 inch diamond mesh.
2. Hot dip galvanized copper bearing steel wire in 9 gauge, except at Tennis Courts use 11 gauge.
3. Twisted and barbed (Double knuckle) finished at top and bottom selvages (no exposed barbs).
4. Wire Tensile Strength: 70,000 PSI.
5. Approved Manufacturer: Master Halco / Anchor Fence; (800) 229-5615, Merchants Metals; (800) 254-0080, USX Corp., Cyclone Fence; (800) 292-5663, or Architect approved equal.

B. Netting at Baseball and Softball Backstops and Batting Cages:
   1. Backstop Netting: 1-5/8 inch square, #18 knotted multi-strand UHMW polyethylene mesh with 350 lb tensile strength made from Spectra fibers (Honeywell) or Dyneema fibers (DSM), treated for UV protection, in longest practical lengths in order to limit number of splices.
   2. Batting Cage Netting: 1-5/8 inch square mesh made from #42 knotted black nylon with 380 lb tensile strength, treated for UV protection, in longest practical lengths in order to limit number of splices.
   3. Rope and Twine: Pre-shrunk black nylon, treated for UV protection; 3/8-inch diameter rope with 2,500 lb tensile strength; #48 twine with 380 lb tensile strength.
   4. Hardware: Galvanized 3/8-inch aircraft cable with 15,000 lb tensile strength. Cable clips, shackles, eyebolts, turn-buckles, etc shall be galvanized.
   5. Support Poles: Hot dipped galvanized steel poles engineered to support net and deflection caused by tensioned cable.
   6. Approved Supplier: Nets of Texas, Houston TX, (281) 541-2766 or approved substitution.

C. Fence and Batting Cage Framing:
   1. All components hot dip galvanized.
      a. Line posts 1-7/8 inch o.d. for 4 feet and 6 feet high fence, and 2-3/8 inch o.d. for 8 feet, 3 inch o.d. for 12 feet high. Schedule 40 pipe.
      b. Terminal and pull posts 3 inch o.d. typical Schedule 40 pipe with conical tops.
      c. Baseball and Softball Backstop Posts: Galvanized 6-5/8 inch o.d. (18.97 pounds per foot) for ends and 4 inch o.d. (9.11 pounds per foot) elsewhere, unless shown otherwise on drawings. Provide five (5) 1-5/8 inch o.d. horizontal rails (top, bottom, and 3 intermediate) at 6 feet-0 inches o.c. Backstop at baseball field shall be length across the back and length along 1st base line as shown on drawings by height as shown on drawings, and length along 3rd base line as shown on drawings by height as shown on drawings. Where netting occurs at high chain link fencing, remainder of height up to 60 feet shall be accomplished with specified netting material.
      d. Softball Backstop: Same as baseball backstop. Shall be height shown on drawings with three (3) equally spaced horizontal rails. Backstop shall have a back and two (2) wings in dimensions shown on drawings.
      e. Batting Cage Framing: Galvanized steel horizontal piping shall span across the top of batting cages as required to fully support the netting on top of the batting cages.
      f. Approved Manufacturer: Master Halco / Anchor Fence; (800) 229-5615, Merchants Metals; (800) 254-0080, USX Corp., Cyclone Fence; (800) 292-5663, or Architect approved equal.

D. Top Rail:
   1. 1-5/8 inch o.d. for 4 feet, 6 feet and 8 feet high fences, Schedule 40 continuous top rail.
   2. Attach to fabric at 18 inch intervals with 9 gauge tie wire.

E. Mid Rails and Truss Braces:
   1. Provide 1-5/8 inches o.d. Schedule 40 mid rails at no greater than 6 feet-0 inches o.c. vertically and at the base of fences over 6 feet-0 inches tall. Provide 5/16 inch truss rod and turnbuckle between terminal posts and adjacent posts.

F. Tension Bars: Attach to post with clips for securing fabric to posts.

G. Windscreens (At outfield perimeter fence of baseball and softball fields): Heavy-duty open-mesh, dark green vinyl coated polyester windscreen in 8 feet-0 inch height, custom fabricated to lengths shown on drawings. Windscreen shall include center tape (extra row of grommets along the

center of the panel). Approved Manufacturer: Tomark Sports, Corona, CA; (800) 454-1844, Buck Terrell Athletics, Houston, TX; (713) 673-2577 or Architect approved equal.

H. Swing Gates: ASTM F900
   1. General: Gate frames shall be constructed of round steel tubing of the sizes listed below. Gate shall be joined at the corners by arc welding to form a rigid, one piece unit and filled with specified chain link fabric to match the fence. Fasten fabric to the frame on all four sides by means of adjustable hook bolts and tension rods. Equip all gates with galvanized steel hinges and latch.
   2. Single Leaf: (Dimensions are face to face)
      a. 3 feet through 6 feet: 2.875 inch o.d., 5.79 pounds per foot, ASTM A120, galvanized schedule 50 pipe or 2-1/2 inch square, with a 3/16 inch wall, 5.1 pounds per square feet, ASTM A501, hot dipped galvanized.
      b. 7 feet through 10 feet: 4 inch o.d. 9.11 pounds per foot, ASTM A120, galvanized Schedule 50 pipe or 3 inch square, ASTM A501, hot dipped galvanized.
   3. Double Leaf: (Dimensions are face to face)
      a. 8 feet through 12 feet: 2.875 inch o.d., 5.79 pounds per foot, ASTM A120, galvanized schedule 50 pipe or 2-1/2 inch square, with a 3/16 inch wall, 5.1 pounds per square feet, ASTM A501, hot dipped galvanized.
      b. 14 feet through 24 feet: 4 inch o.d. 9.11 pounds per foot, ASTM A120, galvanized Schedule 50 pipe or 3 inch square, ASTM A501, hot dipped galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fence Post Spacing:
   1. Space line posts at 8 feet-0 inches o.c. maximum.
   2. Space pull posts where grade changes more than 30 degree (slope).

B. Fence Post Footings:
   1. Line posts - set in 9 inch diameter concrete post a minimum of 24 inches with 3 inch concrete cover at bottom.
   2. All end, corner, and pull posts shall be set in minimum 12 inch diameter concrete piers, with a minimum of 36 inch post embedment in concrete with an additional 3 inch concrete cover at bottom (typically). Baseball post piers shall be 6 feet-0 inches deep (+3 inch bottom cover), 18 inch diameter and be reinforced with 4-#3 verticals and #3 stirrups at 24 inches o.c.
   3. All concrete shall be 3,000 PSI minimum (28 days)

C. Install fencing in accordance with CLFMI recommendations and as follows:
   1. Stretch fabric to proper tension between terminal posts and securely fasten to frame. Bottom of fabric shall be held as uniformly as practical to the finished grade.
   2. Fasten chain link fabric to fences and backstops securely to terminal posts with 3/16 inch x 3/4 inch tension bars and 11 gauge tie wires, spacing not to exceed 14 inches apart. Tie fabric to top rail with 9 gauge tie wires, spacing not to exceed 24 inches.
   3. Fasten chain link fabric to inside of fences of Baseball, Softball, Competition Track, Football Fields, and Tennis Courts.
   4. Stretch bottom tension wire taut between terminal posts. Securely anchor to each intermediate post 6 inches above grade and secure to fence fabric with hog rings at 24 inches on center.
   5. Install chain link at baseball and softball backstops up to height as shown on drawings and install netting from that point to remaining height.
   6. Install chain link and netting at batting cages with all posts to outside.

7. Install windscreens at baseball and softball outfield perimeter fencing up to height as shown on drawings.
8. Cap top of all fence, batting cage posts, and backstop posts.
9. Where shown on drawings, install extension arms and barbed wire.

D. Gates (Swing): Install plumb and level. Adjust hardware for smooth operation.

END OF SECTION 32 31 13.33

SECTION 32 31 13.34 - BACKSTOP SCREENING (SPECTRA_DYNEMA)

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SUMMARY

A. Provide netting and suspension members for protective screening of project name.

1.2 SUBMITTALS

A. Product data and installation drawings.

B. Evidence of compliance with Article 1.02 shall include a list of at least five projects of a similar nature in Texas, including name and contact information for Architect or Contractor, and Owner.

1.3 QUALITY ASSURANCE

A. Work of this section shall be performed by a firm with a minimum of five years experience in installing sports netting.

PART 2 – PRODUCTS

2.1 SUPPLIER

A. Nets of Texas, Houston TX, (281) 541-2766 or approved substitution.

2.2 COMPONENTS

A. Netting. 1-5/8 inch square, #18 knotted multi-strand UHMW polyethylene mesh with 350 lb tensile strength made from Spectra fibers (Honeywell) or Dyneema fibers (DSM), treated for UV protection, in longest practical lengths in order to limit number of splices.

B. Rope and Twine. Pre-shrunk black nylon, treated for UV protection; 3/8-inch diameter rope with 2,500 lb tensile strength; #48 twine with 380 lb tensile strength.

C. Hardware. Stainless Steel 3/8-inch aircraft cable with 15,000 lb tensile strength. Cable clips, Shackles, eyebolts, turn-buckles, etc shall be galvanized.

D. Support Poles. Hot dipped galvanized steel poles engineered to support net and deflection caused by tensioned cable.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install net tight, without sags or puckering.

B. Sharp edges and burrs on cable will not be acceptable.

C. Inspect work to ensure that balls cannot fit between edge of net and adjacent surfaces.

END OF SECTION 32 31 13.34

SECTION 32 81 00 - IRRIGATION SYSTEM FOR ATHLETIC FIELDS

PART 1 – GENERAL

1.1 QUALIFICATIONS OF IRRIGATION CONTRACTOR:

A. The irrigation contractor's primary business shall be the complete installation of automatic sprinkler systems for athletic fields.

B. The irrigation contractor must be an approved contractor with a minimum of 5 years experience installing automatic irrigation systems on athletic fields. The irrigation contractor shall submit a list of at least ten athletic fields they have installed irrigation for within the last eighteen months. The irrigation contractor shall provide digital pictures of each of the ten fields taken after completion of the irrigation systems.

C. The irrigation contractor shall provide a list of at least ten references. The references shall be High School, or College Athletic Directors or Head Coaches, and must include their name, telephone number, and description of the athletic field or fields irrigated by the contractor.

D. The irrigation contractor must have a current Irrigation License issued by the State of Texas.

E. The irrigation contractor shall be thoroughly familiar with the type of material specified for the installation and the manufacturers' recommended methods of installation and shall direct the work performed under this section.

F. Refer to Section 32 92 31 Turf Contractor Qualification.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including and Supplementary Conditions and Division 1 Specification sections, apply to the work of this Section.

1.3 WORK SUMMARY:

A. Furnish all labor, materials, equipment, instruction manuals necessary to install a complete operational automatic irrigation system in strict accordance with specifications and drawings including but not limited to the following:
   1. Furnishing and installation of complete automatic irrigation systems to irrigate the athletic fields as illustrated in the construction drawings.
   2. Trenching, backfill and compaction work.
   3. Furnishing and installation of a water meter and backflow prevention devices per local code.
   4. Installation of sleeves for irrigation piping and remote control wires where shown on drawings.
   5. Low voltage wiring as required to operate the automatic irrigation controllers including extra wires as specified on drawings.
   6. Inspection and tests.
   7. Preparation and recording of "as-built" irrigation plans for project Owner's use.
   8. Warranty and Guarantees.
   9. Maintenance procedures and follow-up adjustments to entire system.

1.4 QUALITY ASSURANCE AND REQUIREMENTS OF REGULATORY AGENCIES:

A. All work and materials shall be in full accordance with latest rules and regulations of safety orders of Division of Industrial Safety, The Uniform Plumbing Code, State Law, and other applicable laws or regulations, including the City of Houston Plumbing Codes.

B. Procure all required permits and pay all required fees for water meter taps and backflow devices. Arrange for inspections required by all local agencies and ordinances during the course of work.

C. Nothing in these drawings and specifications shall be construed to permit work not conforming to the governing codes and applicable rules and regulations. Should the contractor documents be at variance with the aforementioned rules and regulations, notify the Landscape Architect and get instructions prior to start of any irrigation related works.

D. Furnish and maintain all necessary warning signs, shoring, red lanterns, barricades, etc. as required by the Safety Orders of the Division of Industrial Safety and Local ordinances.

1.5 SUBMITTALS

A. Submit shop drawings, product data, and installation instructions.

B. Submit a complete materials list of all items proposed to be furnished and installed under this Section.

C. Submit samples of gate valves, pipe, fittings, sprinkler heads, electric irrigation valves, valve boxes, swing joints, and low voltage wire connections.

1.6 RECORD DRAWINGS

A. The contractor shall maintain one record set of blueline prints of the irrigation system in good condition at the site and mark on them the exact “Record”. The contractor shall make a daily record of all work installed during each day. Plans shall indicate the exact location of check valves, gate valves, wire locations, head layout, automatic valves, quick couplers, all irrigation piping and wire splices. Locations should be shown by triangular systems of measurements from easily identified, permanent features, such as buildings, curbs, fences, walks, etc. Drawings shall show approved substitutions, if any, of the materials including manufacturers’ name and catalog number. Upon completion, all information shall be noted on a clean, legible drawing (to scale) and shall be furnished to the engineers, architect, and owner as “as-built” drawings.

PART 2 – PRODUCTS:

2.1 ACCEPTABLE MANUFACTURERS:

A. Products specified are manufactured by Telsco, Excalibur, Sloane, Scotchlock,Carson Industries, King, Rain Bird, Hunter, Lasco, Paigespec, Spears, Matco-Norca, Inc., Cantex, IPS Corporation, Febco, and are listed as a standard of quality.

B. Products of Dixie, Placentia, California, Lasco and Spears conforming to specification requirements are acceptable.

2.2 GENERAL

A. Materials for the irrigation system shall be as indicated on the drawings. All materials shall be new and in perfect working condition.

2.3 PIPE

A. All pipe shall be continuously and permanently marked with the following information: manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73 degrees F, and National Sanitation Foundation (NSF). All irrigation pipe shall be installed with the labels oriented on the top surface so that the information can be easily read as viewed from ground level.

B. Piping on pressure side of control valves:
   1. Two inch diameter and smaller and all mains in sleeving shall be Polyvinyl Chloride (PVC) 1120-1220, Schedule 40, and shall conform to ASTM No. 1785-73
   2. Two and one half inch and larger pipes shall be Polyvinyl Chloride (PVC) 1120-1220 SDR 21.0, Class 200 with rubber gaskets, conforming to ASTM D-1784 and ASTM D-2241. Rubber gasket shall conform to ASTM D-1869 and as provided by pipe manufacturer.
   3. Main lines and lateral lines shall be virgin high impact Polyvinyl Chloride (PVC) pipe and shall have a minimum 200 PSI working pressure rating, NSF approved, and conforming to Commercial Standard 256-63, manufactured by Telsco.

C. Piping on non-pressure side of irrigation control valves.
   1. Polyvinyl Chloride (PVC) 1120-1220, SDR 21.0, Class 200 and conforming to ASTM D-2241-73.
   2. One half-inch pipe shall not be used.
   3. Flexible PVC pipe shall not be used.

2.4 PIPE FITTINGS

A. Fittings for solvent-welded pipe shall be schedule 40, Polyvinyl Chloride, standard weight, as manufactured by "Sloane", Lasco", or approved equal, to meet ASTM D-2466-73 and D-2467-73. Threaded PVC nipples shall be made of Schedule 80.

B. Fittings for swing joints shall be Schedule 80 Polyvinyl Chloride (PVC) with o-rings as manufactured by Lasco or approved equal. Absolutely no flex pipe or polyethylene-type swing joints will be accepted.

C. Solvent cement shall conform to ASTM 1564. Solvent glue shall be IPS Weld-on 700 with a compatible primer, purple in color, or approved equal.

2.5 SLEEVES FOR CONTROL WIRE AND WATER LINE:

A. All conduits and sleeves for irrigation main and laterals shall be four-inch schedule 40 PVC. Sleeves larger than 4" shall be Class 200 PVC. Use 2" Schedule 40 PVC for control wires where it passes under paved surfaces.

2.6 24 VOLT CONTROL WIRES:

A. Wires shall be solid copper, insulated, U>L approved for direct burial in ground. Minimum gauge shall be #14 UF. Common ground wire shall be white.

B. Splicing materials: Schotchlock No. 3576 Sealing Pack, King Wire Connectors, or 3M DBY or DBR connectors.

2.7 VALVE BOXES

A. Valve boxes shall be as manufactured by Carson industries or Ametek, 10" round for gate valves, quick couplers, and remote controlled valves.

B. Valve boxes shall have a black lid. Using stencils and white paint the letters “GV” shall be painted (2” tall) on the lids for gate valves, “QC” for quick couplers, and “RC” for remote controlled valves.

C. Valve boxes for gate valves on the main line shall be supported by a vertical length of 8” PVC pipe such that the valve box is flush with finished grade and the 8” pipe eliminates intrusion of dirt over the valve. Contractor shall provide not less than two valve tools with T-handles of sufficient length to allow operation of the gate valves. Gate valves must be centered inside the 8” vertical pipe to allow easy operation.

2.8 GATE VALVE (SHUT-OFF VALVE)

A. 3” valves and smaller – use 125 pound bronze construction, non-rising stem-type, sized to match the main line size.

B. 4” and larger

2.9 ELECTRIC VALVES

A. Electric valves shall be Normally Closed, 24 VAC, Rain Bird PEB Series valves.

2.10 BACKFLOW PREVENTION DEVICE

A. Shall be as specified on irrigation drawings. Refer to Irrigation Legend for Backflow Prevention Device. The Backflow Prevention Device shall be as manufactured by Febco or approved equal.

2.11 WATER METERS

A. Shall be provided and installed by the local water district in accordance with their requirements. The cost of materials and installation shall be included under this Section of Work. Refer to the drawings for the meter size and location.

2.12 IRRIGATION CONTROLLER

A. The irrigation controller(s) shall be a Rainbird ESP-LX Modular Controller or approved equivalent. Refer to the irrigation layout for the location(s) of the controller(s). Irrigation Contractor is responsible for coordination of work necessary to get electrical power to the irrigation controller(s).

2.13 QUICK COUPLING VALVE

A. Shall be 1” as manufactured by Buckner or Rain Bird, and shall be installed inside valve box below grade. Refer to the Irrigation Legend on the Irrigation Plan for proper method of installation.

2.14 IRRIGATION HEADS

A. Refer to irrigation layout plan Legend for all sprinkler heads to be used for project. Only Rain Bird or Hunter, gear-driven rotors will be approved for installation. It is the sole responsibility of the irrigation contractor to verify existing water pressures on site, and install the sprinkler heads such that they provide head-to-head coverage under the recommended guidelines of the sprinkler head manufacturer.

2.15 AIR RELIEF VALVE

A. Refer to the irrigation plan and the irrigation legend for the proper location of the air relief valves for the main line.

PART 3 – EXECUTION

3.1 INSPECTIONS:

A. Inspect site conditions, secure and verify exact locations of all underground utility lines and other structures prior to the start of work in this section.

B. Should utilities and other work not shown on the drawings be found during excavation, promptly notify the Landscape Architect. Do not proceed with work until condition is corrected and approved by Owner.

3.2 PREPARATION

A. Cooperate with other sections so that all phases of the project may be properly coordinated without delays or damage to any part of the work.

B. Products and materials shall be kept covered and protected from weather and damaging conditions at all times while in transit and after receipt at the project site.

C. Review drawings for irrigation of turf planting areas and visit the project site to familiarize with the topographical conditions and to ascertain the locations of all drives, walks, planting areas and building locations.

3.3 LAYOUT

A. No consideration will be given to any design changes until the awarding of the contract. Should changes be deemed necessary after award of the contract for proper installation and operation of the system, such changes shall be initiated by the Landscape Architect.

B. Sprinkler heads shown are diagrammatic only. Establish the location of all sprinkler heads on all grass areas in order to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the plans and/or those specified. Pipe sizes shall conform to those shown on the plans. Absolutely no substitutions of smaller pipe size will be allowed, but substitution of larger sizes may be approved.

C. Full, complete, head-to-head coverage is required. Make all necessary minor adjustments in layout to attain required coverage of areas to be irrigated.

D. All valve boxes shall be located as far away from the playing field as possible.

3.4 EXCAVATING AND TRENCHING

A. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks if necessary. Restore all surfaces, existing underground installations, etc. damaged or cut as a result of the excavations to their original conditions.

B. Exercise extreme care in excavating and working near existing utility lines. Verify locations of all existing utility lines prior to start of any excavation works.

C. Dig trenches wide enough to allow a minimum of six inches of distance between parallel pipes. Trenches shall be of a sufficient depth to provide minimum cover from finish grade to top of pipe as follows:
   1. Over PVC pipe on the pressure side of irrigation control valves, control wires, and quick coupler valve: 18 inches
   2. Over pipe non-pressure side of irrigation control valve: 12 inches
   3. All PVC pipe under paving shall be bedded with a minimum of four inches of sand backfill on all sides and have twenty-four inches of cover.

D. Should existing paving require cutting, saw cut paving a minimum of twelve inches wide, compact backfill to ninety five percent dry density, dispose of waste off site, and patch to match existing pavement immediately after work.

E. Trenches for plastic pipe shall be excavated of sufficient depth and width to permit proper handling and installation of the pipe and fittings. The backfill shall be thoroughly compacted in six-inch layers by water tamping, vibratory compactor with a packing foot narrower than the width of the trench, or other method to be approved by the Landscape Architect. The backfilling process shall be deemed complete when all of the excavated material is returned to the trench and the trench is compacted and level with the adjacent soil. All trenches that are opened during any particular working day shall be closed and backfilled the same day. No open trenches or partially backfilled trenches shall be left overnight except when required for inspection.

F. If trenching is to be executed where there is an existing root zone for new turf the backfilling process shall be executed as previously outlined whereby the top layer of the restored trench consists of the root zone material in its original thickness and depth.

3.5 WATER METER

A. Water meter shall be installed as per the requirements of the local water district and all applicable local plumbing code. The size of the water meter shall be as noted on the drawings.

3.6 BACKFLOW PREVENTION DEVICE AND MAINLINE CONNECTION:

A. Make all required connections to water meter. Backflow prevention device(s) shall be installed according to local codes and manufacturer's latest printed specifications and instructions.

B. The backflow prevention device(s) shall be installed at a required grade as per plumbing codes. All exposed main line and mainline risers above PVC main elevation shall be type "L" copper pipe. Install one brass union in the riser downstream of device.

C. Install gate valve at all connection points, size valve same as main line. Verify locations shown on plans.

3.7 LINE INSTALLATION:

A. All pipe, fittings, and valves, etc. shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipe shall be closed by approved means.

B. The first phase of the irrigation installation shall involve the installation of the water meter(s) and backflow device(s), the main lines, valves, wiring, lateral lines, swing joints, and controller(s) only. After the root zone has been installed onto the sports fields and rough graded the irrigation contractor shall return to site and excavate by hand where each head is to be installed, flush each zone, install each sprinkler head, and restore whereby the top of the sprinkler heads is one-half inch above existing rough grade, and the adjacent soil is compacted by hand as outlined in

Section 3.4. The sprinkler heads are to be clearly with minimum of 12" tall flags to allow visibility for the finish grading process.

C. Lateral lines - All trenches shall be hand-cleaned using trenching shovels after excavation and trench bottom shall remain clean until after the pipe has been installed. All piping on the non-pressure side of the irrigation valves shall be covered with at least 2 inches of soil free from rocks or clods in excess of one inch in diameter

D. Main lines – All main line trenches shall be hand-cleaned using trenching shovels after excavation. Clean masonry sand shall be installed and leveled by hand to a thickness of not less than three inches prior to installation of the main line. After the main line pipe has been installed a layer of masonry sand shall be installed over the top of the pipe to a thickness of approximately six inches, and hand-leveled, prior to restoration.

E. All lateral connections to the main line and all other connections shall be made to the side of the main line pipe. No connections to the top of the main line shall be allowed.

F. Plastic pipe shall be installed in a way so as to provide for expansion and contraction as recommended by the manufacturer.

G. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so a smooth unobstructed flow will be obtained.

H. All plastic-to-plastic joints except where threaded adaptors are used for connection to valves shall be solvent weld joints except on main lines larger than two inch. Main line piping larger than two inch shall have gasket joints and all fittings shall be ductile iron fittings with joint restraints. Female threads on plastic fittings on the pressure side of the control valves will not be accepted or approved.

I. Concrete thrust blocks shall be installed at all elbows, tees, and dead-ends of the main line. Thrust blocks shall conform to the standards and guidelines required by the City of Houston Specifications. Thrust blocks must be approved by the Landscape Architect prior to backfilling.

J. Trenching within thirty-six inches from a future fence line, warning track, backstop, dugout or similar structure will not be permitted. For irrigation zones along such barriers, the lateral line must be trenched parallel to the row of sprinkler heads and tees shall be incorporated to allow a perpendicular pipe to extend to the swing joint for the sprinkler head. Lateral lines shall not be permitted under infield skinned area and warning track unless approved by the Landscape Architect prior to installation.

3.8 SOLVENT-WELDED JOINTS FOR PVC PIPES:

A. Use solvents and methods specified by pipe manufacturer.

B. Thoroughly clean the mating pipes and fittings with a clean, dry cloth.

C. After cleaning and drying with a cloth, apply an even coat of approved primer to the outside of the male surface of the pipe, then the inside of the female surface of the fitting. Allow primer to dry for approximately thirty seconds before applying solvent.

D. After priming has been completed apply solvent as follows:
   1. Pipes 3/4" – 1-1/2": Apply one even coat of solvent around the outside of the pipe, then one even coat on the inside of the fitting, then insert pipe into fitting to the full depth of the fitting, rotate one-quarter of a turn and hold in place for one minute. Fitting must be

oriented prior to insertion of pipe such that it is oriented properly after one-quarter turn has been executed.

2. Pipes 2" and larger: Apply one even coat of solvent around the outside of the pipe, then one even coat on the inside of the fitting. Then repeat. Insert pipe into fitting to the full depth of the fitting, rotate one-quarter turn, and hold in place for at least one minute. Fitting must be oriented prior to insertion of pipe such that it is oriented properly after one-quarter turn has been executed.
3. Cure joints a minimum of one hour before applying any external stress on the piping and at least twenty-four hours before placing the joint under water pressure.

3.9 THREADED JOINTS FOR PVC PIPES

A. Use Teflon tape on the treaded PVC fittings for the control valves and gate valves. Follow the recommended procedures specified by the valve manufacturers.

B. Use strap-type friction wrench only on plastic fittings. Do not use metal-jawed wrench on plastic fittings.

C. When connection is plastic to metal, male adapters shall be used. The male adapter shall be hand tightened plus one turn with a strap wrench. Joint compound shall be Teflon tape or equal.

3.10 GATE VALVES

A. Group valves together and locate in planting areas whenever possible except inside the field of play for the athletic fields.

3.11 REMOTE CONTROL VALVES

A. Unless otherwise specified, the installation of all valves shall include the excavation and backfill, the furnishing, installing, and testing of risers, fittings and valves, and the removal and/or restoration of existing improvements and all other work in accordance with the plans and specifications and as required for the completed installation.

B. Valve installation shall include setting of the specified valve box to the proposed grade. All valves shall be teed off the main line to facilitate setting the valve at the proper depth for the lateral line to be level and not in a binding position.

C. No valves shall be located inside the fences for the baseball and softball fields except for the quick coupler valves. No valves shall be located inside the field of play for soccer or football fields.

D. Install valves and valve boxes where shown on the drawings but not within eighteen inches to curbs, sidewalks, building structures, or fences. Upon completion the top of the valve boxes shall be flush with grade.

3.12 AUTOMATIC IRRIGATION CONTROLLER(S):

A. Install per code and manufacturer's latest printed instructions.

B. Verify exact location of irrigation controller on project site. Refer to electrical drawings for location of electrical hookup, which is specifically provided for the controller(s).

C. Connect remote control valves to controller in a logical sequence such that each athletic field involves consecutive and orderly stations.

D. Refer to the drawings for implementation of rain sensor(s) and install according to manufacturer's recommendations should sensors be specified on the drawings.

3.13 QUICK COUPLER VALVES:

A. Install quick coupling valves inside 10" round valve box. A one-inch, schedule 80 swing joint with o-rings must be incorporated in the quick coupler connection. A one-inch gate valve must be used in between the swing joint and the quick coupler. Install a ½" by 24" long rebar vertically adjacent to the quick coupler/gate valve assembly and affix assembly to the rebar using two, stainless steel, heavy duty hose clamps. Gate valve must be easily accessible by hand to operate freely upon completion. Top of quick coupler valve must be set not more than one inch below the top of the valve box so that the handle of the quick coupler key does not interfere with the valve box upon rotation and insertion. Fill bottom of valve box with two inches of pea gravel.

B. Irrigation contractor must provide one quick coupler key and hose swivel adapter per field to project owner upon completion of irrigation.

3.14 SPRINKLER HEADS

A. Sprinkler heads shall be installed after swing joints have been dug up and zone lines have been flushed. This process shall occur after root zone has been installed and rough graded, and prior to finish grading. Soil and root zone around heads shall be hand tamped and compacted. Heads must be set perpendicular to grade and top of head to be set one-half inch above rough grade. Heads are to be clearly flagged to allow visibility during the finish grading process.

B. Sprinkler heads adjacent to fences, walls, warning tracks, infield skinned area, dirt baselines, etc. shall not be located within eight inches of such barriers.

C. After the finish grading is complete, the irrigation contractor must return and reset each sprinkler head, compact the surrounding area and assure that the top of each head is set three-quarters of an inch above the finish grade of the root zone. Each zone must be tested at this time and coverage must be checked in its entirety. The arcs of the heads must be checked and adjusted as well.

D. The adjusting screws for each sprinkler head must be adjusted if necessary to assure that proper coverage is achieved.

E. Irrigation contractor to provide two extra sprinkler heads of each type for this project to the project Owner.

3.15 CONTROL WIRES

A. Install control wires with irrigation mains and laterals in common trenches wherever possible. Lay to the side of the pipeline. Snake wires in trench to allow for contraction of wires. Tie wire in bundles of ten foot intervals with ¾" black, electrical tape.

B. Control wire splices at remote control valves to be connected using approved watertight wire connectors. There must be sufficient length of control wire used to allow connection to be pulled vertically at least ten inched from the valve box to access the connection. The wire grouping must be neatly coiled into one-inch diameter coils and placed neatly inside the valve box next to the remote valve with the wire connectors oriented vertically.

C. Line splices will be allowed only on runs of more than five hundred feet. Any line splices must be located inside a ten-inch valve box and labeled properly on the as-built drawings.

D. There shall be two extra wires installed from the controller(s) to the farthest valve on each field. These extra wires must be identified and neatly coiled inside the valve box. The valve boxes with the extra wires must be noted on the as-built drawings.

3.16 CLOSING AND FLUSHING OF LINES

A. Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is needed for completion of installation.

B. The end of each swing joint must be wrapped with plastic and taped during installation prior to the installation of the root zone. The swing joint must be oriented such that the opening is pointed upward and the area around the swing joint must be filled with masonry sand.

C. Operate each valve manually to permit water to enter the corresponding lateral lines for a given zone. Shut valve off and look for water to bubble up from above each swing joint. Hand - excavate at each swing joint and expose each swing joint in preparation for flushing the zone lines. After all of the swing joints for a given zone have been exposed flush the zone with water. Install the head closest to the remote valve first and flush again. Install the second closest head to the remote valve and flush again. Repeat this procedure until all heads are installed on that zone. Repeat for all zones.

D. Refer to Section 3.14 for proper restoration around sprinkler heads.

3.17 TESTING

A. Pressurizing the main line:
   1. After all of the remote control valves, the quick coupler valves, and the air vent(s) have been installed on the main line, close the ball valves at each backflow prevention device.
   2. Slowly open the water meter and allow the main line to pressurize between the meter and the backflow prevention device. Do not allow more than ten gallons of water per minute to flow while pressurizing the main line.
   3. Slowly open the backflow prevention device to allow the main line between the device and the valves to begin pressurizing. Do not allow more than ten gallons of water per minute to enter the main line during pressurization.
   4. After the main line is pressurized and no water is flowing through the meter close the flow control on each remote control valve. Manually operate each remote control valve and slightly open the flow control to allow air to escape through the valve into the lateral piping. When the air has escaped the valve and water is heard entering the valve manually shut off the valve. Repeat this process for each valve.
   5. After the system has been pressurized close the one-inch gate valve located below each quick coupler. Insert a coupler key into the quick coupler and slowly open the gate valve below to allow air to escape. Close the gate valve after the air has escaped. Repeat this procedure for each quick coupler valve.
   6. With the gate valve closed, remove the quick coupler closest to the water source and install an oil-filled water pressure gauge in place of the quick coupler. The gauge must be easily legible above grade.
   7. Choose another quick coupler location and make sure the gate valve below it is closed. Remove the quick coupler and attach the appropriate fittings using Teflon tape to allow the connection of a 100-PSI air compressor.
   8. Shut off the gate valve located after the water meter to isolate the water meter from the pressure test. Shut off the ball or gate valve on the exhaust side of the backflow device.
   9. Pressurize the main line to a minimum of 100 PSI using the air compressor. When the main has reached at least 100 PSI, close the gate valve below where the compressor is connected to the quick coupler fitting. Pressure must maintain a constant pressure of not less than 100 PSI for a period of one hour without deviation.

10. All testing shall be coordinated with the Landscape Architect and conducted in the presence of proper personnel to be specified by the Landscape Architect.

11. The hydrostatic pressure testing may be executed in sections to allow for timely restoration of the irrigation installation. A multi step plan must be submitted and approved by the Landscape Architect prior to execution.

3.18 BACKFILL AND COMPACTING:

A. Pressurized Mains:
1. Prior to hydrostatic testing the main lines may be partially backfilled with masonry sand to a level not less than four inches and not more than 8 inches above the main line pipe.
2. After testing has been completed and approved by the Landscape Architect the backfilling of the main line trench may proceed.
3. Install six inches of trenched backfill over the top of the masonry sand inside the trench. Compact thoroughly using a motorized compactor with a special foot narrow enough to fit inside the trench. Compact the entire layer prior to filling with more backfill. Repeat this process until restoration is complete. Irrigation contractor is responsible for top dressing or repairing trenches that settle using approved method(s) defined by Landscape Architect for a period of one year as stated in the Warranty.
4. If necessary use the water method of tamping and compaction to assure that the restoration of the trenched area will compact properly.

B. Lateral Piping:
1. Backfill the first three inches above the lateral pipe with materials free from rock and other unsuitable substances to prevent damage to the pipe. Backfill to a level six inches above the pipe using the excavated soil and tamp using a motorized compactor as described above. Repeat in layers of six inches until restoration is complete. If necessary use the water method of tamping and compaction to assure that the restoration of the trenched area will compact properly.
2. Irrigation contractor is responsible for top dressing or repairing trenches that settle using approved method(s) defined by the Landscape Architect for a period of one year as stated in the Warranty.

3.19 WINTERIZING THE SYSTEM

A. The irrigation piping must be winterized by first blowing the system clear of water using compressed air (80 PSI maximum) admitted into the piping at a quick coupler valve located at the highest elevation on the system piping.

B. Activate individual zones first, then proceed successively through the system towards lower elevations. Proceed through all zones twice. The air compressor used to winterize the system must have an engine separate from the compressor tanks to prevent high temperature air from being directly introduced to the PVC piping.

3.20 FOLLOW-UP AND ADJUSTMENT OF SPRINKLER HEADS:

A. Irrigation contractor shall be on site upon completion of the installation of grass or sprigs at each field to test and adjust sprinkler heads for height relative to the sod or root zone as well as the arc of each head to assure one hundred percent coverage of the new sod or sprigs.

B. Irrigation contractor shall return to check and adjust the head height for each sprinkler head not more than 2 weeks and not less than 3 weeks after the sod or sprigs have been installed for each field.

3.21 CLEAN UP:

A. Irrigation contractor shall keep the premises clean and free of excess equipment, materials, and rubbish incidental to his/her work.

B. Clean up and removal of all debris from the entire project site shall be done prior to final acceptance and approval of work by the Landscape Architect and Owner.

3.21 FINAL ACCEPTANCE

A. The irrigation contractor shall request a substantial completion review from the Landscape Architect. At this review, a "punch list" of items will be generated. Upon completion of these items, the irrigation contractor shall request for a Final Completion Review.

B. Upon final acceptance of the work, the irrigation contractor shall submit to the Owner, an "As Built" irrigation plan based on the record drawing as specified in 1.04 of this specification. The delivery of this As Built Drawing does not relieve the irrigation contractor of the responsibility of furnishing required information that may have been omitted.

C. The irrigation contractor shall also provide the Owner with two copies of the irrigation controller manual, irrigation controller keys, and any specific instruction on the operation of the irrigation system.

D. It is the Turf Contractor's responsibility to determine water application rates and timer cycling. The irrigation contractor will instruct the turf contractor on the operation and programming of the controller and will assist the Turf contractor as necessary in such operations throughout the one year maintenance period. Any adjustments, repairs, etc. other than programming are the total responsibility of the irrigation contractor.

3.22 WARRANTY

A. The entire irrigation system shall be unconditionally guaranteed by the irrigation contractor as to material and workmanship, including settling of backfilled areas below grade for a period of one year following the date of final acceptance of work and he/she hereby agrees to repair or replace any such defects to the satisfaction of the Owner occurring within that year at his or her expense.

B. It shall be the irrigation contractor's responsibility to insure complete coverage as specified herein of the areas to be irrigated. During the warranty period the irrigation contractor shall make any adjustments as necessary to maintain proper and full coverage.

C. If settlement occurs, or sprinkler heads require adjustments, valves or any other components of the irrigation system require modifications to bring the system, grade or paving (if paving has been cut and patched by irrigation contractor) to the proper level of the permanent grades, these adjustments and modifications shall be done by the irrigation contractor without cost to the Owner.

D. Should any operational difficulties in connection with the irrigation system develop within the specified guarantee period, which, in the opinion of Owner may be due to inferior material and/or workmanship, said difficulties shall be immediately corrected by the irrigation contractor to the satisfaction of the Owner at no additional cost to the Owner, including any and all other damages caused by such defects.

END OF SECTION 32 81 00

SECTION 32 92 13 - HYDRO-MULCH SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work covered by this section consists of furnishing all plant, labor, materials, equipment, supplies, supervision and tools and performing all work necessary to top soiling, smoothing, seeding, fertilizing, watering maintenance and cleanups of side slopes, all in accordance with these specifications.

B. The hydro-mulch seeding operations, together with all necessary related work, shall conform to the requirements specified in this section. The area(s) to be hydro-mulch seeded shall be noted in the construction documents.

1.2 MEASUREMENT & PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All seed must meet the requirements of the U.S. Department of Agriculture Rules & Regulations as set forth in the Federal Seed Act and the Texas Seed Law.

B. Type of seed, purity and germination requirements, rate of application and planting dates are as follows:

TABLE I

Type	Application Rate Pounds per Acre	Planting Date
Hulled Common Bermuda Grass 98/88	40	Jan. 1 to Apr. 15
Unhulled Common Bermuda Grass 98/88	40	Jan. 1 to Apr. 15
Annual Rye Grass, including Gulf	50	Jan. 1 to Apr. 15
Hulled Common Bermuda Grass 98/88	40	Apr. 15 to Oct. 1
Hulled Common Bermuda Grass 98/88	40	Oct. 1 to Jan. 1
Unhulled Common Bermuda Grass 98/88	40	Oct. 1 to Jan. 1

C. Fertilizer shall be water soluble with an analysis of 10 percent nitrogen, 20 percent phosphoric acid and 10 percent potash. Rate of application shall be 500 pounds per acre, except during the period of April 15 through September 1, when the rate shall be reduced to 400 pounds per acre. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable State Fertilizer Laws and bearing the name and warranty of the producer.

D. Mulch shall be virgin wood cellulose fiber made from whole wood chips. Within the fiber mulch material, at least 20 percent of the fibers will be 10.7mm in length and 0.27mm in diameter. Rate of application shall be 2000 pounds per acre. Soil Stabilizers such as Terra Type III (or approved equal) shall be applied at a rate of 40 pounds per acre on side slopes and Terra Tack I (or approved equal) shall be applied at a rate of 40 pounds per acre on flatter portions.

E. Wood cellulose fiber mulch, for use in the grass seed and fertilizer, shall be processed in such a manner that it will not contain germination or growth inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover, which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to the underlying soil. Weight specifications from suppliers, shall refer only to the air-dry weight of the fiber. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and must be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that it meets all of the foregoing requirements.

F. Water shall be free from oil, acid, alkali, salt and other substances harmful to the growth of grass. The water source shall be subject to approval, prior to use.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Immediately after the finished grade has been approved, begin hydro-mulching operations to reduce erosion and excessive weed growth.

B. Hydraulic equipment used for the application of fertilizer, seed and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of 70 pounds of fertilizer solids for each 100 gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles, which provide even distribution of the slurry on the area to be seeded. The slurry tank shall have a minimum capacity of 800 gallons and shall be mounted on a traveling unit, which may either be self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded, so as to provide uniform distribution without waste. The Engineer may authorize equipment with a smaller tank capacity, provided the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

C. Care shall be taken that the slurry preparation take place on the site of the work. The slurry preparation should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good re-circulation shall be established and seed shall be added. Fertilizer shall then be added, followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is

two-third to three-fourths full. Spraying shall commence immediately when the tank is full. The operator shall spray the area with a uniform visible coat, by using the green color of the wood pulp as a guide.

3.2 APPLICATION

A. The Contractor shall obtain approval of hydro-mulch area preparation from the Engineer prior to application.

B. Operators of hydro-mulching equipment shall be thoroughly experienced in this type of application. Apply the specified slurry mix in a motion to form a uniform mat at the specified rate. Operators shall keep the hydro-mulch within the areas designated and keep from contact with other plant material. Immediately after application, thoroughly wash off any plant material, planting areas or paved areas not intended to receive slurry mix.

C. Keep all paved and planting areas clean during maintenance operations. Contractor shall keep hydro-mulching within the areas designated and keep from contact with other plant material.

D. If in the opinion of the Engineer, unplanted skips and areas are noted after hydro-mulching, the Contractor shall be required to seed the unplanted areas with the grasses that were to have been planted at no additional cost to the Owner.

3.3 CONTRACTOR'S MAINTENANCE AND GUARANTEE PERIOD

A. The hydro-mulch seeding shall be adequately watered until established. Any areas damaged by erosion or areas that do not have any acceptable turfing shall be redone to the satisfaction of the Engineer. Maintenance of grass areas shall be for 60 days after the completion of the project and shall consist of watering, weeding, repair of all erosion and reseeding, as necessary to establish a uniform stand of the specified grasses. The Contractor shall guarantee growth and coverage of hydro-mulch planting under this contract to the effect that a minimum of 95% of the area planted will be covered with the specified planting after 60 days.

B. Prior to final acceptance, the Contractor shall be responsible for one (1) mowing per month between the months of April to September and shall mow every thirty (30) days plus or minus five (5) after the initial mowing. The Contractor shall also be responsible for one (1) mowing every six (6) weeks between the months of October to March. In addition, the Contractor shall water the entire sodded and hydro-mulched areas to a saturated depth of one (1) inch at least once a week between the months of April to September and at least once a month between the months of October to March.

C. The Contractor shall make a second application of specified hydro-mulch planting to those bare areas not meeting specified coverage as determined by the Engineer. Such replanting is to be performed within 60 days of initial application and upon notification by the Engineer to replant.

D. The Contractor shall apply top dress fertilizer (delayed action), at the rate of 10 pounds per 1000 square feet at 25 days after hydro-mulching of all new lawn areas.

E. Top dress fertilizer shall be 16-6-8.

END OF SECTION 32 92 13

SECTION 32 92 31 - NATURAL TURF CONTRACTOR QUALIFICATION

PART 1 – GENERAL

1.1 QUALIFICATIONS

A. The Turf Contractor's primary business shall be turnkey construction of athletic fields.

B. The Turf Contractor must be an approved contractor with a minimum of 5 years experience installing athletic fields. The contractor shall submit a list of at least ten athletic fields they have turnkey constructed within the last 18 months. The contractor shall provide digital pictures of each of the ten projects taken after completion.

C. The Turf Contractor shall provide a list of at least ten references. The references shall be High School, or College, Athletic Directors or Head Coaches, and must include their name, phone number, and description of the athletic field constructed by the Turf Contractor.

D. The Turf Contractor shall be capable of installation of all Athletic Fields on a turnkey basis, inclusive of sub-surface drainage, irrigation installation, root zone installation, turf installation, infield & warning track installation, and all maintenance requirements.

E. The Turf Contractor shall be a licensed irrigator with a minimum of 5 years experience in athletic field irrigation installation.

F. Proposed Turf Contractors Qualifications shall be submitted with proposal information.

1.2 TURF CONTRACTORS:

Athletic Field Specialist, LLC
1910 Avenue C
Katy, Texas 77493
Phone: (281) 961-2229
Contact: Matt Webb

Burnside Services, Inc.
1110 Navasota Ridge Road
Navasota, Texas 77868
Phone: (936) 825-7090
Contact: Tommy Burnside

Paragon Sports Constructors
5001 Saunders Road
Fort Worth, Texas 76119
Phone: (817) 916-5000
Contact: William Chaffe

Texas Multi-Chem, Inc.
P.O. Box 291306 / 305 Mill Run
Kerrville, Texas 78029
Phone: (830) 895-3747 or 1-800-292-1214
Fax: (830) 895-3388
Contact: Steve Caraway

1.3 RELATED WORK

A. All work listed below shall be performed by the same subcontractor:
   1. Section 32 92 31 - Turf Contractors Qualifications
   2. Section 32 71 00 - Irrigation System for Athletic Fields
   3. Section 32 92 31.14 - Natural Turf Root Zone for Athletic Fields (Sandy Loam)
   4. Section 32 92 31.15 - Natural Turf Root Zone for Athletic Fields (Sand Based)
   5. Section 32 92 31.19 - Natural Turf Installation for Athletic Fields

PART 2 – MATERIALS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 32 92 31

SECTION 32 92 31.15 - NATURAL TURF ROOT ZONE FOR ATHLETIC FIELDS - 90% SAND BASED

PART 1 - GENERAL

1.1. DESCRIPTION

A. Work under this section shall consist of locating, testing, furnishing, hauling and placing the specified sand fill root zone over the subsurface drainage system and irrigation piping. The specified sand fill root zone shall be of the thickness and at the finish grades as depicted on the Contract Drawings. Laboratory testing and final grading are also a part of this work.

1.2. RELATED SECTIONS

A. Section 32 81 00 - Irrigation System for Athletic Fields

B. Section 32 92 31.18 – Washed Natural Turf for Athletic Fields

C. Section 33 46 16.33 - Subdrainage System for Athletic Fields

1.3. MEASUREMENT & PAYMENT

A. There will be no separate measurement and payment for work performed under this section.

1.4 SUBMITTALS

A. Submit two, 1 gallon containers of root-zone material for testing. Additional material shall be submitted if so requested by the Testing Laboratory in order to complete their testing.

1.5 DELIVERY, STORAGE AND HANDLING

A. Root-zone material shall not be stored at the project site. Root-zone material must be placed directly from the truck onto the prepared subgrade. The material is to be back-dumped so as to keep delivery trucks off the subgrade. Any contaminated root-zone material shall be rejected and removed from project site.

1.6 QUALIFICATIONS

A. Refer to Section 32 92 31

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sand: A uniformly graded clean and/or washed sand meeting the "Particle Size Criteria" and "Physical Performance Criteria" as specified herein, and which will continuously provide desired parameters for permeability, moisture retention and firmness. The sand shall have a pH between 5.5 and 8.0. The particle and physical performance shall meet the criteria as shown in the table contained on the following page herein. The test shall include, but may not limited to: percent sand, silt, clay sand gradation, saturated hydraulic conductivity, porosity (including total, air-filled and capillary pore space) and bulk density.

1. The Contractor shall contact sources of the clean and/or washed sands that are available in sufficient quantity for the project. Preferred samples shall be collected and forwarded to a sand testing laboratory normally engaged in the testing of sand for particle size analysis and physical performance, and approved by the Engineer. The samples shall be tested for physical analysis, determination of pH and recommendations for the organic

amendment to meet the specified criteria for physical performance. A report of the particle size gradation and physical performance analysis shall be submitted to the Engineer for approval of the source and shall include, as a minimum, a comparison with the criteria specified herein.

2. Chemical analysis shall be performed on qualified sands in accordance with procedures published in Recommended Chemical Soil Test Procedures for the North Central Region NCR-221 (1988), Tests to be conducted include, but may not be limited to pH; SMP buffer (when pH <8.3); Bray 1 available phosphorous; ammonium acetate exchangeable potassium, calcium, magnesium and sodium; DTPA extractable iron, manganese, zinc, and copper; hot water extractable boron; and organic matter by combustion at 440 degrees C. A neutralization test shall be performed with a pH >7.2.
3. Based upon results of the test reports, the Contractor, Engineer and Owner's representative shall determine the best available source of sand to be used and any requirement for amendments to meet the specified physical performance criteria.
4. The sand shall be "quality control" tested at the Owner's expense throughout the profile construction process at an approved laboratory for every 800 tons brought to the site. Sand which does not meet specifications shall be removed and replaced at the Contractor's expense.

PARTICLE SIZE CRITERIA FOR ROOTZONE SAND – (90% SAND BASED)

USDA Particle Name	U.S. Standard Sieve Number	Diameter of Particle (mm)	Allowable Range % Retained	
Gravel	6	3.35	0	No more than 10% combined.
Fine Gravel	10	2.00 - 3.35	0-3%	
Very Coarse Sand	18	1.00 - 2.00	0-10%	
Coarse Sand	35	0.05 - 1.00	>60%	A Minimum of 70% in these combined sand fractions.
Medium Sand	60	0.25 - 0.50		
Fine Sand	100	0.10 - 0.25	<30%	
Very Fine Sand	270	0.05 - 0.25	5-10%	
Silt		0.002 - 0.05	5-10%	7-10% in these combined fractions.
Clay		< 0.002	0-5%	

PHYSICAL PERFORMANCE CRITERIA FOR ROOTZONE SAND – (90% SAND BASED)

pH: 5.5 – 7.0	Total Porosity: 30% - 55%
Organic Matter Content: 5-15%	Air Filled Porosity: 10% - 30%
Capillary Porosity: 10% - 35%	Saturated Hydraulic Conductivity: 6” – 24” / Hour (Minimum)

B. Fertilizer: Fertilizer of sand root zone shall be as recommended by final lab analysis of the root zone mixture with review and final approval by the Owner's selected soil management professional.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Root Zone: A root zone having an 10 inch thickness as shown on the Contract Drawings shall be placed over the subsurface drainage system and irrigation piping. Placement and spreading of the root zone mix shall be done with caution and in a moist condition. All root zone shall be stockpiled outside the limits of the subsurface drainage system and irrigation piping installation and spreading of the root zone shall be accomplished by small, wide-track dozers operating on a minimum sand thickness of 12 inches.

1. The root zone shall be irrigated with water in order to assure uniform settling. Uniformity and accuracy of the final grade shall be established with the use of laser grading and shall be carefully inspected by the Engineer and Contractor.

B. Final Grading: After installation of all root zone and uniform settlement, smooth and compact the finished surface to the finish elevation within plus or minus 1/2 inch of the design grade.

1. The Contractor shall inspect and check the variations and uniformity of the finish grade with a representative of the Engineer and Owner and shall correct deficiencies at areas until they meet the requirements of this specification. Prior to final acceptance of the finished surface, the Engineer shall verify that the finish grade conforms with the Contract Drawings and specifications contained herein.

C. Fertilizer: Broadcast approved specified starter fertilizer blend by truck or power operated machine. Fertilizer shall be mechanically diced, ripped or harrowed to 6 inch depth taking care to maintain proper finished grades and protecting irrigation system.

D. Rootzone Amendments: Provide an inorganic soil amendment. The amendment shall be a kiln fired porous ceramic being a calcined, non-swelling illite and non-crystalline opal CT material. The final rootzone mix shall be 15% amendment and 85% rootzone sand. Approved rootzone amendments shall be Profile Greens Grade or preapproved equivalent.

3.2 PROTECTION

A. Provide protection of root zone playing surface until such time as the sod installation can be performed.

3.3 FIELD QUALITY CONTROL

A. The Contractor shall be responsible for providing materials which meet the intent and requirements of the specifications contained herein. A Test Report or Certification shall be furnished by the manufacturer or material supplier, properly notarized, stating that all materials furnished for the project meet or exceed the specifications contained herein. Three (3) copies of this documentation shall b supplied to the Engineer.

B. The Owner will employ an independent testing laboratory qualified to provide testing of all sand and sod in accordance with United States Golf Association procedures and requirements. One representative sample of sand shall be taken from the material delivered to the field for every 800 tons of sand placed with a minimum of two samples for each day's placement. Each sample shall be tested for gradation, fineness modulus and uniformity coefficient and reported to the Engineer within 24 hours.

C. Pre-approval of the sand and Bermuda grass to be incorporated in the field is required by the Engineer and the Owner's representative, as a prerequisite to commencing work. Initial testing for sand shall include the tests specified in this Section.

D. The Contractor shall be responsible for and bear all cost for the initial material selection and testing as set forth above, and the Owner shall be responsible for all costs for subsequent testing which many be required by the Owner.

E. Inspections:
   1. General: Inspections of construction are required at the completion of certain phases of the work prior to commencing the next phase. The Contractor shall not proceed to the next phase of work until the previous phase has been approved by the Engineer and Owner. The Contractor shall remedy any deficiencies in a timely manner and request reinspection from the Owner and Engineer, This procedure shall continue until approved by the Owner and Engineer. Inspections are required at the completion of the following phases.
      a. Subgrade construction
      b. Installation of subgrade piping
      c. Installation of root zone sand
      d. Final grading
      e. Sodding

      The Owner reserves the right to withhold payment for any work or materials which are not approved prior to incorporation into the project until the material meets the specifications contained herein.

F. Layout and Construction Staking: The Contractor shall be responsible for setting and preserving all construction stakes deemed necessary to construct the work in accordance with the Contract Documents. If any of these points or stakes are destroyed or disturbed, the Contractor shall immediately reset all points which will control construction of the project.

END OF SECTION 32 92 31.15

SECTION 32 92 31.17 - NATURAL TURF FOR ATHLETIC FIELDS (TIF-419)

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 – GENERAL

1.1 SUMMARY

A. Provide Texas Certified Tif-419 Hybrid Bermuda Sod for installation on the playing field as well as open areas off the playing field.

1.2 RELATED WORK

A. Irrigation System for Athletic Fields. Section 32 81 00

B. Natural Turf Root Zone for Athletic Fields. Section 32 92 31.15

C. Natural Turf Installation for Athletic Fields. Section 32 92 31.19

1.3 QUALITY CONTROL

A. The Turf Contractor shall use an independent testing laboratory selected by and paid by the Owner prior to installation of delivered sod.

B. Approved Testing Laboratory.

Thomas Turf Services, Inc.
2151 Harvey Mitchell Prkwy. S
Suite 302
College Station, TX 77840
979.764.2050

1.4 SUBMITTALS

A. Submit certified sample of Tif-419 Sod for testing by Owner's testing agent. Sample shall be one foot square with 1" of soil below the thatch layer.

B. Submit Certificates of Inspection as required by Government agencies for the sod.

1.5 DELIVERY, STORAGE AND HANDLING

A. Sod shall be delivered in netted rolls. Sod shall be temporarily stored in clean area by Turf Contractor to prevent contamination of sod. Turf Contractor shall handle sod so as to not tear turf or displace soil from root system.

1.6 QUALIFICATIONS

A. Refer to Section 32 92 31.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Sod shall be a Nursery grown sand based Certified Tif-419 Sod. The sand based soil shall have a minimum of 90% sand and a maximum of 10% clay and silt as defined by the U.S.D.A. soil classification system.

B. Sod soil shall be tested by the Owner's testing agent for compatibility with the available root zone mixture.

C. Sod soil at the growing site shall be tested for the presence of phytopatho genic nematodes by an approved Laboratory. Evidence of such test taken not more than 3 months prior to harvest shall be furnished to the Architect/Engineer and evaluated for suitability. Sod shall be free of insects, broad leaf weeds, and objectionable grasses.

D. Turf shall be strongly-rooted sod (not sprigs), that has been in a mature condition of growth in the field no less than ten months prior to harvest. Turf grass shall be of a vigorous growth and development.

E. Turf shall be maintained at a mowed height of 1" going from the Winter Season to the Summer Season. The final mowing prior to harvest shall be at a height of ¾" prior to installation.

F. Turf grass crop must be mature by May for a harvest in June of the same year and will be subject to inspection from April through June for verification of this condition.

G. Sod shall be machine stripped at a uniform thickness of ¾" below the thatch line. The sod shall be rolled into big rolls of 42" wide and 50' long. The rolls shall be netted. The sod shall be harvested not more than 18 to 24 hours prior to installation.

H. Architect/Engineer shall have discretion to accept or reject delivered sod.

I. Any delivered sod, once accepted by Owner, that becomes damaged or unsuitable for installation, as determined by Owner, shall be replaced by Turf Contractor at no additional expense to Owner.

PART 3 – EXECUTION (see Section 32 92 31.19 for installation)

END OF SECTION 32 92 31.17

SECTION 32 92 31.19.1 - NATURAL TURF INSTALLATION FOR ATHLETIC FIELDS (TIF-419)

PART 1 – GENERAL

1.1 SUMMARY

A. Install certified and approved Sand Base Tif-419 Bermuda, in 42” rolls on approved root zone materials for playing fields.

1.2 RELATED WORK

A. Irrigation System for Athletic Fields. Section 31 81 00

B. Natural Turf Root Zone for Athletic Fields. Section 32 92 31.15

C. Natural Turf Installation for Athletic Fields. Section 32 92 31.19

1.3 QUALITY CONTROL

A. Turf Contractor to verify the root zone materials are to proper grade and thickness before proceeding with the installation of turf.

1.4 QUALIFICATIONS

A. Refer to Section 32 92 31

PART 2 – PRODUCTS

2.1 MATERIALS

A. Turf shall meet the requirements of Section 32 92 31.17.

B. Fertilizer to be added to the root zone mix shall be as recommended by the Owner’s approved testing laboratory.

C. All Fertilizer shall be of uniform composition and suitable for application by a mechanical spreader.

D. Fertilizers shall be delivered in bags labeled according to State of Texas fertilizer laws. Each bag of fertilizer shall have the following label information:
   1. Name brand.
   2. Name and address of manufacturer.
   3. Net pounds of fertilizer.
   4. Chemical composition.
   5. Guarantee of composition.

PART 3 – EXECUTION

3.1 GENERAL

A. Turf Contractor shall coordinate the turf installation with other Contractors working at the project site.

3.2 SITE PREPARATION

A. Turf Contractor shall verify the irrigation rotors have been installed and working properly. Turf Contractor shall also verify that each rotor has been adjusted to allow a minimum ½" – maximum ¾" of rotor exposed above the final root zone grade, and that each rotor is flagged for identification.

B. Turf Contractor shall verify the root zone mix for the playing field and auxiliary areas are to plan elevations, thickness and meets testing laboratory recommendations.

C. Prior to adding fertilizer and turf, submit a certificate to the Architect/Engineer stating the root mix for the playing field and auxiliary areas are to plan elevations and the root zone mix complies with the testing laboratory recommendations.

D. Architect/Engineer will review the finish grade of the root zone and will provide written approval of the work. Turf Contractor shall not proceed with the Turf installation without the written approval.

3.3 ROOT ZONE FERTILIZER

A. After the root zone has been approved as to grade and thickness Turf Contractor shall install a fertilizer in the upper 2 to 3 inches of root zone mix.

B. Fertilizer to be installed shall meet the chemical analysis as recommended by the testing laboratory conducting fertility test on the root zone mix.

C. Dry fertilizer shall be applied just prior to the installation of turf.

D. Turf Contractor shall re-grade the root zone mix to finished grade and shall keep the root zone moist until the turf is installed.

3.4 TURF INSTALLATION

A. Sod for the playing field and auxiliary areas shall be big roll sod, 42 inches in width and 50 feet long. The sod shall be placed within 24 hours from the time the sod was harvested. Sod not placed within 24 hours of harvesting will be rejected by the Architect/Engineer. Cost to replace rejected sod will be borne by the Turf Contractor.

B. Sod shall be placed on a moist root zone mix. The sod shall be laid in straight lines with the first roll being the guide for subsequent rolls. Each roll shall be placed parallel to and snug against the preceding roll. All sod netting shall be removed as the roll of sod is being installed.

C. Rolls of sod shall be laid so as to stagger the ends of each roll with that of the adjoining roll of turf. Do not stretch rolls of sod. End joints of sod shall be cut square.

D. Turf Contractor shall use equipment designed to install rolled turf. The machines shall have high flotation tires to minimize disturbance of the root zone surface. Heavy equipment will not be allowed on the root zone material. Transport equipment for the rolled sod will not be allowed on the root zone. Any area of the root zone material that is disturbed shall be hand raked back to finished grade.

E. Turf Contractor shall not allow turf-installing equipment to operate on newly installed sod. Turf Contractor shall fill all cracks between seams. Seams of sod shall be filled by hand using root zone mix material. Turf Contractor shall hand tamp or roll sod to remove air pockets and insure sod is in contact with the root zone material.

F. Architect/Engineer will inspect the installed sod and note any defects. Defects shall be repaired or replaced by the Turf Contractor. Repair patches shall be a minimum of 42 inches by 42 inches in size. All edges shall be square cut. Seams shall be filled in with root zone material. Patches shall be tamped after installation.

G. Placed sod shall be watered immediately after placement. Water sufficiently to moisten the root zone material a depth of 1 to 2 inches.

H. Architect/Engineer will inspect the installed turf at the end of each day's installation. Unacceptable turf shall be removed immediately and replaced with fresh turf from the next days installation. Architect/Engineer shall have sole judgment as to determining unacceptable sod, and repair areas of the installed sod.

3.5 ROLLING

A. After all the sod is in place, Turf Contractor shall roll the sod as early as practical using a mechanical roller weighing 2.5-4 tons. Sod shall be rolled in two directions perpendicular to each other. Rolling shall provide a uniform even surface with no visible high or low areas.

3.6 WATERING

A. The irrigation system shall be checked daily during sod installation to insure lines, valves and heads are not damaged and the system does not leak. Heads shall be adjusted to proper elevation and shall be cleaned to assure proper pop-up operation.

B. After rolling operations are complete, sod shall be watered sufficiently to wet the sod and root zone material.

C. Watering during the grow-in and maintenance period shall de daily. During the first two weeks the sod shall be watered at least three times a day. The times shall be evenly spaced between sun up and two hours before sun set. When the sod has established at least 2 to 3 inches of root system into the root zone material, the watering may de reduced to two applications during the day. Application of water shall be at a rate of ¼ inch per application.

3.7 GROW-IN AND MAINTENANCE PERIOD

A. The grow-in and maintenance period for the installed turf shall begin when all the project sod is in place and shall continue for 60 days.

B. Turf Contractor shall be responsible for watering, rolling, mowing, aerating, applying fertilizer, herbicides, pesticides and replacing defective sod.

C. Turf Contractor shall start mowing operations when the turf leaf blades are 1 inch high. Turf shall be cut to a height of 7/8 inch during the grow-in period using a tri-plex reel type mower. Mowing shall be performed 3 times per week with no more than 1/3 of the leaf blade removed at one time.

3.8 PROJECT ACCEPTANCE

A. Substantial Completion:
   1. At the end of the grow-in and maintenance period, Turf Contractor shall request in writing an inspection by the Owner and his representatives. Written Notice shall be given 3 days before the date of inspection
   2. The joint inspection shall be made to note any sod area that is deficient according to the project plans and specifications. The Owner or his representatives shall have sole responsibility in determining work that must done prior to final acceptance of the work.

3. To be considered substantially complete, the inspection will be based on the following criteria:
   a. The root depth for the sod must be at least 3 1/2 " inches based on 10 random cores of the turfed area.
   b. The turf must be green, dense and void of any dead areas and weeds over the entire sodded area.
   c. The turf must be smooth and level.
   d. The turf is cut to a height of 9/16 inch.
   e. The soil and sod must be within allowable parameters as determined by the Owner's testing laboratory.

B. Final Acceptance
1. The Turf Contractor shall notify the Owner in writing 3 days in advance of when the Turf Contractor anticipates the final inspection.
2. Owner and the Architect/Engineer shall review the project to determine that all defective items noted in the substantial completion have been corrected and the finished project complies with the project plans and specifications.
3. Turf Contractor shall prepare a 90 day development program with suggested mowing, watering and fertilizing schedules and submit the program to the Owner.
4. The Owner will issue final acceptance for the turf installation.

END OF SECTION 32 92 31.19.1

SECTION 33 11 00 - WATER DISTRIBUTION SYSTEM (PVC)

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

A. These specifications shall govern the furnishing and placing of water distribution lines, fittings, valves, fire hydrants, and other appurtenances. The pipe and accessories shall be installed in accordance with the requirements of these specifications at the locations and depths indicated on the plans, and shall be of the classes, sizes and dimensions shown thereon. The installation of pipe shall include all joints, connections to new or existing pipes, and installation of all fittings, valves, fire hydrants, and appurtenances.

1.2 GENERAL

A. Piping for water mains shall be of the type and materials specified herein, at the Contractor's option, unless otherwise indicated on the drawings or in this section. The pipe and accessories shall be new and unused. The interior of the pipe shall be thoroughly cleaned of foreign matters before being lowered into the trench, and shall be kept clean during laying operations by plugging or other approved method. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells and joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water, or when trench or weather are unsuitable for the work. Water shall be kept out of the trench until the jointing is complete. When work is not in progress, open ends or pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipes or fittings. Any section of pipe found to be defective before or after laying shall be replaced with sound pipe without additional expense to the Owner.

1.3 SUBMITTALS

A. Submit product data and shop drawings for ALL items to be installed.

B. Refer to Section 01 33 00 for submittal procedures.

1.4 WATER LINE - SANITARY SEWER LINE CROSSINGS

A. The water pipe shall not be laid closer horizontally than 9 feet in all directions and parallel lines must be installed in separate trenches. Where the nine foot separation distance cannot be achieved, the following shall apply. The sewer line need not be disturbed where the water line shall be installed parallel to an existing sewer line that shows no evidence of leakage and the water line is installed above the sewer line a minimum of two feet vertically and four feet horizontally. Should excavation for the water line produce evidence that the sewer is leaking, the sewer line shall be replaced as described in SECTION 33 33 13 - SANITARY SEWER LINES. The sewer line shall not be disturbed where a new water line is to cross over (by two feet or more) existing sewer lines showing no evidence of leakage.

1.5 METHOD OF MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All pipe shall be new and made in the United States. All plastic pipe must also bear the National Sanitation Foundation Seal of Approval (NSF-PW), and have an ASTM design pressure rating of at least 150 psi or a standard dimension ratio of 26 or less. Water Distribution Lines must be installed in accordance with the manufacturer's instructions. All water Line materials and appurtenances shall comply with Section 290.44(b) of the Texas Natural Resource Conservation Commission Rules and Regulations for Public Water Systems regarding lead banned from piping and joints.

2.2 POLYVINYL CHLORIDE (PVC) PIPE

A. Requirements for unplasticized polyvinyl chloride (PVC) pipe with bell joints which are integral to the pipe and are well thickened so that standard dimension ratios are maintained or exceeded.

B. Plastic pipe in 4" and larger sizes shall conform to all requirements of AWWA C900 - DR 18, Class 150.

C. Plastic pipe in 2", 2 1/2" and 3" sizes shall conform to all requirements of ASTM D 2241 for PVC pipe and be pressure rated at 200 psi with a standard dimension ratio (SDR) of 21 for Class 200 for both barrel and bell dimensions.

D. Plastic pipe in sizes smaller than 2" shall conform to all requirements of Schedule 40 and have Schedule 80 fittings.

2.3 COPPER TUBING

A. All 3/4", 1", 1-1/2" and 2" copper tubes for underground service shall Be Type "K" soft annealed with the proper bending temper. All 3/4" And 1" tubes shall be furnished in coils, each containing 60 feet; FLAT coils are preferred. Other diameters of tubes shall be furnished in straight lengths of 20 feet.

2.4 BRASS FITTINGS

A. All brass fittings shall conform to ASTM Specifications B-62- 52 And shall be those manufactured by the Mueller Company or preapproved equivalent.

2.5 FITTINGS

A. All fittings shall be cast iron or ductile iron and shall conform to The latest edition of AWWA Specifications.

B. All ductile iron fittings shall be coated outside with a bituminous coating of either coal tar or asphalt. The inside coating shall be a cement-mortar lining in accordance with AWWA Specification.

C. All fittings shall be new and made in the United States.

D. All ductile iron fittings shall be approved by Underwriters Laboratories and shall be accepted by the State Fire Insurance Commission for use in city water distribution systems without penalty.

E. Rubber gaskets for these fittings shall be manufactured in accordance with AWWA specifications.

2.6 GATE VALVES

A. All gate valves shall be designed for a cold hydrostatic working pressure of 175 pounds per square inch for valves with diameters of 3-12 inches, inclusive with shop test of 300 pounds per square inch and a working pressure of 150 pounds per square inch for valves with diameters of 16-48 inches, inclusive with shop test to 300 pounds per square inch. All gate valves shall conform to the requirements of AWWA C500-86 Specification. Valves will be equipped with O-ring stem seals.

B. Gate valves shall be iron body, *resilient seated*, non-rising stem conforming to the requirements of AWWA C509-87, and shall open counter-clockwise. Tapping valves shall be flanged to fit a tapping sleeve on one side and shall be mechanical joint on the other side, with provisions for attaching a standard tapping machine. Gate Valves, fourteen (14) inches and smaller, shall be designed for vertical installation; gate valves, sixteen (16) inches and larger, shall be designed for operation with the stem horizontal or vertical as shown on the plans. Horizontal valves shall be provided with enclosed lubricated bevel gears, bronze gate roller and tracks, bypass valve, and two (2) inch operating nuts on main and bypass valves. Vertically mounted valves sixteen (16) inches and larger shall be designed for operation with the stem vertical and shall be provided with enclosed lubricated spur gears, bypass valve and two (2) inch operating nuts on main and bypass valves. Valves in two (2) inch cast iron screw joint pipe may be two and one-half (2-1/2) inches brass, non-rising stem, wedge disc with thread hubs. Gate valves shall be Mueller, Stockham, M & H or a preapproved equivalent.

C. Unless otherwise specified, all gate valves shall be installed complete with valve box.

2.7 FIRE HYDRANTS

A. Fire hydrants shall be Mueller Super Centurion or an approved equivalent.

B. Each hydrant shall be factory tested to a hydrostatic pressure of 300 psi with valve in both the open and closed positions. The direction of opening nut shall be counterclockwise and shall be cast on the head of the hydrant. Hose nozzles shall be bronze or non-corrosive metal and threads shall be national standard. The main valve opening shall be either five and one-fourth (5-1/4) inches in diameter or six and one-fourth caps shall be provided with gaskets. Bury length shall be three and one-half (3-1/2) feet unless otherwise noted on the plans. Hydrants shall be provided with "dry top" which prevents stem threads from contacting water, and "break-off" type barrel and stem.

C. Hydrants shall be painted with shop coating in accordance with AWWA C502 specification. Final coats of paint will be applied by Contractor in accordance with fire department requirements.

D. Contractor shall verify and make nozzle threads consistent with local fire department.

2.8 AIR VALVES

A. Air valves shall be of the type indicated on the plans. The assembly shall not leak nor shall the valve stick under service conditions.

2.9 CORPORATION COCKS

A. Corporation cocks shall be of the size specified on the plans. Inlet threads shall be Mueller thread or approved equal. Outlet threads shall be one size larger than listed cock size. Corporation cocks shall be Mueller, H-15000 or a preapproved equivalent.

2.10 VALVE BOXES

A. Valve boxes shall be cast iron, adjustable height with cover marked "water". Valve boxes shall be Alamo Iron Works #813-30 or a preapproved equivalent.

2.11 WATER METERS

A. Water meters shall conform to the requirements of AWWA C700, latest revision and shall be of the displacement type. Case shall be bronze and the register shall be sealed. Accuracy shall be at least 100% plus or minus 1.5% of actual thruput. Maximum operating pressure shall be 150 psi. Unless noted otherwise, meters shall be as manufactured by Sensus Technologies, Inc. or a preapproved equivalent.

B. Boxes for water meters shall be of a key-lock type.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. Unless otherwise specified, the provisions of this section shall conform to AWWA C600-64 specifications.

3.2 LAYING AND JOINTING

A. Pipe, fittings, valves, and hydrants shall be carefully handled to avoid damage. While they are suspended over the trench, before lowering, they shall be inspected for defects and rung with a light hammer to detect cracks. To insure proper seating for the spigot and against the shoulders of the bell, each joint shall be lightly swung against the last joint laid before unhooking the sling. Joints of small diameter pipe, installed by hand, shall be properly seated by using an iron bar or other suitable lever to force the spigot end against the shoulders of the bell of the last previously laid joint. Before any pipe is laid, all dirt shall be removed from the inside, and all lumps, blisters, excess tar coat, dirt, oil, grease, and moisture shall be removed from inside the bell and from outside the spigot end. All pipe shall be laid and maintained to the lines and grades shown on the plans or as established on the ground by the Engineer. Wherever it is necessary to deflect pipe from a straight line, the degree of deflection at each joint shall not exceed the maximum deflection recommended by the manufacturers of the pipe being laid. Bell ends shall face the direction of laying. After pipe is laid, care shall be taken to avoid the entrance of dirt, water or other substances by the use of tight bulkheads or plugs.

B. Gasket material shall be kept in clean containers and shall not be allowed to come in contact with the ground. Gasket material which has become contaminated or dirty shall be destroyed.

C. Mechanical joints shall be installed in accordance with the manufacturer's recommendations.

D. Unless otherwise shown, valves shall be located on the extension of street property line. Every valve, including bypass valves, shall be provided with a valve box. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut, with the cover flush with the pavement surface or such other level as directed.

E. Hydrants shall be located as shown on the Plans and in a manner that will provide complete accessibility and will prevent damage from vehicles. All hydrants shall stand plumb and shall have their pumper connections at right angles to the street. When placed immediately behind the curb, the hydrant barrel shall be set so that no portion of the steamer or hose connection cap will be less than six (6) inches from the gutter face of the curb.

F. Minimum cover on water lines shall be forty-eight (48) inches unless otherwise specified, but in no

case shall the top of any water line be less than 24 inches below the finished ground surface.

3.3 EXCAVATION

A. All excavations are to be by the open-trench method, unless the Engineer orders that certain sections of the mains are to be laid in tunnels or bored.

B. The minimum width of the bottom of the trench shall be such that there will be six inches space on each side between the pipe and the walls of the trench. The width of the trench at the surface is not to be less than at the bottom.

C. When excavating machinery is being used, the same shall cut the trench to a grade slightly higher than the bury indicated by the proposal and the trench shall then be fine graded.

D. The trench must be opened and excavated to the finished grade at all times for a distance of at least 50 feet in advance of the last made-up joint. Water mains into which the mains under construction are to be connected must be definitely located well in advance of such connection to allow for possible adjustment of alignment and/or grade.

E. Bell holes must be excavated in advance of placing the pipe. Materials used shall be placed at locations so as not to interfere unnecessarily with the use of the streets by the public, and not more than two streets intersections shall be closed at any time. The street surface along the line of the trench must be kept free of surplus spoil.

F. The expense of restoring the original condition of improved property in connection with grass, shrubs or any other improvements must be borne by the Contractor. All trees adjacent to the trench must be protected and the trees on public or private property must not be cut unless permission, in writing, is granted.

3.4 BEDDING

A. Sand bedding shall be as shown on the Plans with a minimum compacted depth of six inches.

3.5 ROCK EXCAVATION

A. No rock is anticipated and no extra compensation will be allowed for rock excavation.

3.6 JACKING, BORING & TUNNELING

A. This item shall govern for the furnishing and installation of pipe by the methods of jacking, boring or tunneling as shown on the Plans and in conformity with this Specification.

B. Pipe shall be of the size, type, and class specified on the Plans, or other types as may be specified by the Engineer or designated on the Plans.

C. Jacking: If the grade of the pipe at the jacking end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. Wherever end trenches are cut in the sides of the embankment or beyond it, such work shall be sheeted securely and braced in a manner satisfactory to the Engineer to prevent earth caving.

D. Where pipe is required to be installed under railroad embankments or under highways, streets, or other facilities by jacking or boring methods, construction shall be made in such a manner that will not interfere with the operation of the railroad, street, highway, or other facility, and shall not weaken or damage any embankment or structure. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained, as directed by

the Engineer, until such time as the backfill has been completed and then shall be removed from the site.

E. Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating jacks, even pressure shall be applied to all jacks used. A suitable jacking head, usually of timber, and suitable bracing between jacks and jacking head shall be provided so that pressure will be applied to the pipe uniformly around the ring of the pipe. A suitable jacking frame or back stop shall be provided. The pipe to be jacked shall be set on guides, properly braced together, to support the section of the pipe and to direct it in the proper line and grade. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe. In general, embankment material shall be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the embankment with jacks, into the space thus provided.

F. The Contractor shall furnish for the Engineer's approval, a plan showing his proposed method of handling, including the design for the jacking head, jacking support of back stop, arrangement and position of jacks, pipe guides, etc., complete in assembled position. The approval of this plan by the Engineer will not relieve the Contractor from his responsibility to obtain the specified results.

G. The excavation for the underside of the pipe, for at least one-third of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of not more than two inches (2") may be provided for the upper half of the pipe. This clearance is to be tapered off to zero at the point where the excavation conforms to the contour of the pipe. The distance that the excavation shall extend beyond the end of the pipe depends on the character of the material, but it shall not exceed two feet (2') in any case. This distance shall be decreased on instructions from the Engineer, if the character of the material being excavated makes it desirable to keep the advance excavation closer to the end of the pipe.

H. The pipe, preferably, shall be jacked from the low or downstream end. Lateral or vertical variation in the final position of the pipe from the line and grade established by the Engineer will be permitted only to the extent of one inch (1") in 10 feet, provided that such variation shall be regular and only in one direction and that the final grade of flow line shall be in the direction indicated on the plans. If the Contractor desires, he may use a cutting edge of steel plate around the head end of the pipe extending a short distance beyond the end of the pipe with inside angles or lugs to keep the cutting edge from slipping back onto pipe.

I. When jacking of pipe is once begun, the operation shall be carried on without interruption, insofar as practicable, to prevent the pipe from becoming firmly set in the embankment.

J. Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at his entire expense.

K. The pits or trenches excavated to facilitate jacking operations shall be backfilled immediately after the jacking of the pipe has been completed.

L. Boring: The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation of shoring shall be as outlined above under "Jacking". The location of the pit shall meet the approval of the Engineer. The holes are to be bored mechanically. The boring shall be done using a pilot hole. By this method approximately a two inch (2") pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit.

M. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. Excavated material will be placed near the top of the working pit and disposed of as required. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Jetting will not be permitted.

N. In unconsolidated soil formations a gel-forming colloidal drilling fluid consisting of at least 10% of high grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter.

O. Allowable variation from line and grade shall be as specified under "Jacking". Overcutting in excess of one inch (1") shall be remedied by pressure grouting the entire length of the installation.

P. Tunneling: Where the characteristics of the soil or the size of the proposed pipe would make the use of tunneling more satisfactory than jacking or boring, or where called for on the Plans, a tunneling method may be used.

Q. The excavation for pits and the installation of shoring shall be as outlined above under "Jacking".

R. The lining of the tunnel shall be of steel of sufficient strength to support the overburden. The Contractor shall submit his proposed liner method to the Engineer for review. Review by the Engineer shall not relieve the Contractor of the responsibility for the adequacy of the liner method.

S. The space between the liner plate and the limits of excavation shall be pressure-grouted or mud-jacked.

T. Access holes for pouring concrete shall be spaced at maximum intervals of ten feet.

U. If corrugated galvanized metal pipe is used, joints may be made by field bolting or by connecting bands, whichever is feasible.

V. Clean-up: Contractor's equipment, surplus material and surplus earth shall be removed from the job following the final test of mains and all street surfaces replaced before the final estimate will be approved.

W. The Owner shall have the right to make connections with and operate all or any part of the main when, in the opinion of the Engineer, such connection does not in any way interfere with the progress of the work, but it is understood that by making such use or connections the Owner does not accept the sewer or waive his right to object to any defect found therein, until the same has been finally inspected by the Engineer and found to be in accordance with the specifications.

3.7 CROSSING STATE HIGHWAYS AND RAILROADS

A. When water lines cross highways, railroads, or town streets under the jurisdiction of the TxDOT or other public body or corporation, the Contractor shall secure permission from the controlling authority before installing such lines.

3.8 WET CONNECTIONS

A. Wet connections are defined as connections made to a line in the existing system by interrupting water service. They shall be made at such points as are shown on the plans or as designated by the Engineer. The method and the equipment to be used shall be submitted to the Engineer for approval before any work is done.

B. Any time that the interruption of water service in the existing system is necessary because of operations under this contract, the Contractor shall notify the City Water Superintendent forty-eight (48) hours in advance. The Contractor will not operate any valve in the existing water system.

3.9 LOWERING OF EXISTING MAINS

A. When a main is to be lowered in order to conform with new construction, the initial excavation shall be done in such a manner as to permit the mains to rest on a number of dirt benches, or wooden blocks if soil conditions are unsatisfactory for the benches. The pipe shall then be supported by ropes, cables or chains to overhead supports; the dirt benches or wooden block removed and the pipe slowly and evenly lowered into position. After the mains have been lowered, each damaged joint must be re-tightened as directed by the Engineer.

3.10 REMOVING PIPE

A. Salvageable joint materials from each joint of the pipe must be removed, and reclaimed for the Owner and all corporation cocks disconnected and the holes plugged with plugs furnished by the Owner before the pipe is raised from its original position. After raising the pipe from the trench, it shall be pulled apart at the joints and all foreign material removed from the bells and spigots.

B. All removed materials are to remain the property of the Owner and shall be hauled to the Owner's storage yard.

C. The unit bid prices for removing mains shall include the removal, the cleaning of exterior and connection surface and hauling to designated storage yards, of all fittings, valves, flushing valves, and other appurtenances.

3.11 TRENCH BACKFILL

A. All trench backfill above pipe embedment shall conform to the following requirements:

B. Tamped backfill placed in six inch (6") layers and compacted to 95% density will be required for the full depth of the trench beneath pavement, surfacing, driveways, curbs, gutters, walks, or other surface construction or structures as well as beneath street, road, or highway shoulders.

C. In areas other than that described above, backfill shall be placed and tamped in six inch (6") layers until one foot above top of the pipe, then the balance of the backfill shall be placed in twelve inch (12") layers with Compaction approximately equal to that of the adjacent undisturbed material. To compensate for settlement below surface grade backfill material shall be added as necessary and compacted.

3.12 SURPLUS EARTH

A. Any surplus excavated material shall be disposed of as directed by the Engineer. If the Engineer notifies the Contractor that the Owner does not have use for this material, it shall become the property of the Contractor to dispose of as he wishes without injury to the Owner or any individual.

3.13 STREET SURFACES

A. In all streets the surface of the trenches after being refilled, dried and settled, shall be finished in the most workmanlike manner without needless delay and shall in every respect be equal in quality, character, material and workmanship to the street improvements existing over the line of the trench immediately prior to making the excavation. The expense of restoring the streets must be included in the price bid per linear foot for mains, except as otherwise provided herein.

B. All concrete paving, road gravel, and road shell ordered placed on streets will be paid for at the unit price bid.

C. On gravel, shell and asphalt surfaced streets, the trench shall be filled as otherwise specified up to within eight inches of the surface of the street. The trench shall then be filled with gravel or

shell, as ordered by the Engineer, to a point approximately one (1) inch higher than the street level. After all other work is completed and before the job is finally accepted, the Contractor shall go back and place such additional gravel or shell as is ordered by the Engineer. No extra payment for road gravel or stabilized shell.

D. On concrete streets the trenches shall be filled as otherwise specified within six (6) inches of the surface of the street, and then filled with road gravel or shell to a point approximately one (1) inch higher than the street level. After all other work is completed, the Contractor shall go back and remove sufficient shell and install six (6) inches of concrete as ordered by the Engineer. The concrete used shall be paid for at the unit price bid in the proposal schedules.

E. On asphalt surfaced streets, the gravel or shell base shall be placed as stated above. At such time as directed by the Engineer, the gravel or shell base shall be leveled smooth approximately one (1) inch below the existing asphalt surface. The new asphalt pavement shall then be placed and rolled or tamped to a smooth and even surface.

3.14 CROSSINGS TO BE KEPT OPEN

A. At such street crossings and other intermediate points as may be designated by the Engineer, the trenches shall be bridged in such proper and secure manner as to prevent any serious interruption of travel upon the roadway and sidewalks, the cost thereof to be borne by the Contractor.

B. Clean Up: Contractors equipment, surplus material and surplus earth shall be removed from the job following the final test of mains and all street surfaces replaced before the final estimate will be approved.

C. Laying Pipe: In general, the bottom of the trench shall be shaped to give full support to the lower quarter of each pipe. If the foundation is rock or other hard material, a bed of sand or suitable earth shall be placed upon the subgrade and well compacted. The thickness of the bed shall be not less than two (2) inches nor more than six (6) inches. If the foundation is of such material or if conditions are such that the pipe cannot be otherwise properly supported or if the load on the pipe so requires, a concrete cradle as hereinafter specified shall be provided. In all cases water shall be kept out of the trench until the masonry or jointing material has sufficiently hardened. The pipe shall be laid to grade shown on the plans or as directed by the Engineer. Each pipe shall be inspected for defects prior to being lowered into the trench and shall be carefully cleaned in both bell and spigot. Pipe laying shall proceed up-grade with spigot ends pointing in direction of flow. Pipes shall be laid so that each pipe shall rest upon the full length of its barrel with holes excavated to accommodate bells. Except by special permission, no pipe shall be laid except in the presence of an inspector. Any defective pipe laid or any pipe which has had its grade of joint disturbed after laying shall be taken up and replaced.

D. Before jointing the inside of the bells and outside of the spigots shall be dry and clean. The joint shall be made as recommended by the manufacturer of the joint material. Water shall not be allowed in the trenches while the pipes are being laid. The Contractor shall not open up more trenches than the available pumping facilities are able to de-water, to the satisfaction of the Engineer. Bells shall be entirely free of water when joints are made, regardless of the type of joint, and no water shall be allowed to rise over the joint until it has set.

3.15 HOUSE CONNECTIONS

A. House connections to main pipe shall be made by tapping the main and installed corporation cock of the size designated. The corporation cock shall be screwed securely into position. The copper service, polyethylene or butylene pipe shall be connected to the corporation cock and laid in accordance with the specifications contained herein for laying pipe.

3.16 INSTALLING WATER METERS AND METER BOXES

A. Water Meters: The ground shall be excavated to such depth that the top of the box is flush with normal ground level. The tail piece of the meter shall be inserted into the service lines as near to the curb cock as possible, or directly into the curb cock. The meter shall then be set in such position that the bottom of the meter is at least two (2) inches above ground. The house side of the meter shall then be connected to the service line running to the house. It is essential that the meters shall be set plumb and in line with the service line and all connections made in a neat and workmanlike manner.

B. Meter Boxes: The meter box shall be set on firm ground so that the top of the meter box is flush with the ground surface, and the box is level and plumb. Ground shall be carefully backfield and tamped around the meter box so as to leave a neat appearance.

3.17 SETTING FIRE HYDRANTS

A. Fire hydrants shall be set where shown on the plans or ordered by the Engineer.

B. Excavate underneath the drain outlet of each fire hydrant a space twelve (12) inches square and six (6) inches deep and fill with gravel. Place the gravel up around bottom of the flushing hydrant not less than three (3) inches above the drain outlet. Not less than two (2) cubic feet of gravel shall be placed around each flushing hydrant. The gravel shall be carefully covered with a layer of one ply roofing paper before trench around the hydrant is refilled. All hydrants shall be carefully blocked and placed to prevent expansion of stub line from water pressure. See plan sheet for blocking details.

3.18 STERILIZATION OF PIPE LINES

A. Unless otherwise specified, sterilization of new water lines shall be done in accordance with AWWA C651-86 specification.

B. The contractor shall furnish all labor equipment, and materials necessary for the sterilization of the new pipe lines, which shall be sterilized before being tested and placed in service. The lines shall be sterilized by the application of a chlorinating agent. The chlorinating agent may be liquid chlorine, liquid chlorine gas-water mixture, or a calcium hypochlorite solution, which shall be fed into the lines through a suitable solution-feed device or other methods approved by Engineer. The chlorinating agent shall be applied at or near the point from which the line is being filled, and through a corporation stop or other approved connection inserted in the horizontal axis of the newly laid pipe. The water being used to fill the line shall be controlled to flow into the section to be sterilized very slowly, and the rate of water entering the pipe that the chlorine dose applied to the water entering the line shall be a minimum of 50 ppm of chlorine residual of not less than twenty five (25) ppm after twenty-four (24) hours standing in the pipe. At the end of the retention period, all treated water shall be thoroughly flushed from the lines until the replacement water in the lines shall have a chlorine residual of not more than 0.4 parts per million.

C. Solvent cemented or welded joint pipes shall be sterilized using a sterilizing agent other than liquid chlorine and/or calcium hydrochloride.

D. Where no suitable outlet is available for flushing dead ends, the Contractor shall furnish and install outlet valves of sufficient size to adequately flush the new mains at the locations designated by the Engineer, for which payment shall be made at the unit price bid for the size valve installed. After the lines are sterilized and flushed and tested as specified above, samples of water shall be taken from the mains for bacteriological tests. If the samples fail to meet the health departments standard requirements, the disinfection process as outlined above shall be repeated and continued until the tests show results that meet the health departments requirements.

3.19 HYDROSTATIC TEST

A. The Contractor shall provide all necessary equipment and shall perform all work required in connection with the tests. All pressure pipe installations shall be tested for leakage in the presence of the Engineer. The Engineer shall be given a minimum of 24 hours notice for each and every test. Tests that are not performed in the presence of the Engineer will not be accepted.

B. The test pressure shall be 1.5 times the maximum force main design pressure or 150 pounds per square inch gauge, whichever is greater. The test shall be held for a period of four (4) hours. The new system shall be tested in sections between valves. The length of test sections shall not exceed 2,000 feet unless authorized by the Engineer. Each test section shall be slowly filled with water, care taken to expel all air from the pipe. If necessary, the pipes shall be tapped at high points to vent the air. There will be no extra charge to the Owner for venting.

C. At the end of the test period, the amount of leakage shall be determined by the quantity of water that must be supplied into the pipe, or any valved section thereof, to maintain pressure within five pounds per square inch of the specified test pressure, after the air in the pipe has been expelled. The maximum allowable leakage shall be calculated using the following formula.
   1. L = SD((P)^(1/2))/133,200, where L = leakage in gal/hr
   2. S = length of pipe in feet
   3. D = inside diameter of pipe in inches
   4. P = pressure in pounds per square inch

D. If the quantity of leakage exceeds the maximum amount calculated, the failed section will be rejected and not accepted until it meets the above requirements.

E. Upon completion of all sterilization and testing, the Contractor shall provide personnel to open all valves and operate all hydrants, as directed, in the presence of a representative of the Engineer.

END OF SECTION 33 11 00

SECTION 33 41 00 - STORM SEWERS AND APPURTENANCES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SCOPE

A. This section covers storm sewers, culverts, manholes, headwalls, inlets, junction boxes and miscellaneous items indicated in connection with the storm sewer system, complete. Excavation, trenching and backfilling are covered under SECTION 31 23 00 – CONSTRUCTION OF UNDERGROUND UTILITIES.

1.2 SUBMITTALS

A. Submit product data and shop drawings for ALL items to be installed.

B. Refer to Section 01 33 00 for submittal procedures.

1.3 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price.

PART 2 – PRODUCTS

2.1 MATERIALS FOR STRUCTURES

A. Precast Concrete Structures
   1. **Unless otherwise specified, only precast concrete structures shall be installed**. Precast structures shall be traffic duty. Concrete for precast structures shall have a design strength of 4500 psi at 28 days. Precast structures shall be monolithic in design. Reinforcing steel shall be Grade 60 and shall meet ASTM A615.

B. Mortar
   1. Mortar for pipe joints and connections to other drainage structures shall be composed of one part by volume of Portland Cement and two parts of sand. The Portland Cement shall conform to the requirements of Federal Specification SS-C-192, Type I or II. The sand shall conform to the requirements of AASHO Specification M-45. Hydrated lime may be added to the mixture of sand and cement in an amount equal to ten percent (10%) of the volume of cement used. Hydrated lime shall conform to the requirements of Federal Specification SS-L-351, or ASTM Specification C-141. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar, but shall in no case exceed six gallons of water per sack of cement. Water shall be clean and free of injurious acids, alkalies, and organic impurities. The mortar shall be used within thirty (30) minutes from the time the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar bead on the outside shall be protected for such period as is necessary to obtain satisfactory curing.

C. Cast Iron
   1. Cast iron shall conform to ASTM Standard Specification A 48, latest edition, for Class 20 gray cast iron. Cast iron shapes shall conform to the dimensions shown and shall be clean and perfect, free from sand or blow holes, or other defects. Castings shall be factory coated with asphaltum varnish. Twenty-three and one-half inch (23-1/2") manhole covers will be used for sewers forty-eight inches (48") diameter or less. Thirty-two inch (32") manhole covers will be

used for sewers in excess of forty-eight inches (48") in diameter.

D. Brick

1. **Brick structures shall only be used when specifically indicated on the drawings**. All structures shall be constructed, complete with covers in accordance with the details shown on the Drawings. Structures shall be constructed of solid precast segmental concrete masonry units or circular sections specially cast for use in manhole construction.

a. When Structures are to be constructed of brick, materials shall conform to the following:

Concrete:	As specified in the concrete specification.
Brick:	ASTM 662, Grade MW.
Segmental Concrete:	ASTM C139, except as modified herein. 1) Curing: Steam cured for at least 8 hours 2) Minimum Thickness: Upper 12 feet of manhole - 8 inches; Portion below 12 feet - 12 inches
Circular Precast Sections:	ASTM C478
Mortar:	1) Portland Cement - ASTM C150, Type II 2) Hydrated Lime - ASTM C207, Type S 3) Sand - Concrete Sand (fine aggregate) which has been sieved through an 8-mesh screen 4) Volumetric Proportions - 1 part Portland Cement 1/2 part hydrated lime, 3 parts sand 5) Mixing - Cement, lime, and sand shall be thoroughly mixed dry and only enough water added to form a mortar of the proper consistency.
Castings:	1) Iron - ASTM A 48 2) Coating - Hot asphaltum varnish applied at the foundry.

2.2 PIPE FOR CULVERTS AND STORM DRAINS

A. Pipe for storm drains and culverts shall be reinforced concrete pipe (RCP), ASTM C 76, Class III, unless otherwise indicated. Where HDPE (High-Density Polyethylene) is specified, the joints shall meet ASTM F477 and ASTM D3212 (water tight joints). All pipes shall have a smooth interior.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. All concrete segmental units shall be saturated with water before laying, and shall be damp but free from surface water when laid.

B. All mortar shall be used within 30 minutes after mixing. Mortar which has begun to be taken on initial set, shall be discarded and shall not be mixed with additional cement or new mortar. All segmented concrete manholes shall be plastered on all outside surfaces and three feet (3') above the invert on all

inside surfaces with mortar not less than one-half inch (1/2") thick. Manhole inverts shall be carefully constructed to maintain the proper velocities through the manhole with no increase in the velocity in the outgoing pipe. The shape of the invert shall conform exactly to the lower half of the pipe it connects. Side branches shall be connected with as large radius of curve as practicable. All inverts shall be troweled to smooth clean surface. Concrete filling between the sewer invert and walls of manholes shall be flush with top edges of the inverts and slope up from the invert at the rate of two inches (2") per foot. Circular precast sections shall be provided with a mastic gasket to seal the joints between sections. After the sections are in place, the outside of each joint shall be plastered with cement mortar.

C. Piping shall be constructed of the materials specified in this section, and in the manner indicated on the Drawings. Pipe shall be laid true to the grades shown on the Drawings. Any line in which opening or faulting of the joints occurs during backfill or before final inspection and acceptance, such that infiltration of material or a change in flow characteristics results, must be repaired or replaced to the satisfaction of the Engineer. Under no circumstances shall pipe be laid on unsuitable soft material, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Full responsibility for the diversion of drainage and dewatering of trenches during construction shall be borne by the Contractor. Any section of the pipe already laid that is found to be defective or damaged shall be taken up and relaid or replaced as directed by the Engineer immediately, without additional cost to the Owner.

3.2 INSTALLATION OF CONCRETE PIPE AND PRECAST CONCRETE BOX CULVERT

A. Laying Pipe

1. The laying of pipes on the prepared foundation shall be started at the outlet and with the spigot or tongue ends pointing in the direction of flow and shall proceed toward the inlet end with the abutting sections properly matched, true to the established lines and grades. The Contractor shall furnish and place in position all the necessary batter boards for controlling the work. The batter boards shall be of sufficient size timber and shall be substantially supported. The boards and all location stakes must be properly maintained in place. The Contractor shall also furnish, at his own expense, good sound twilled lines for use in giving lines and grades and necessary plummets and graduated poles of an approved form.

2. Proper facilities shall be provided for hoisting and lowering the sections of pipe into the trenches without disturbing the prepared foundation and the sides of the trench. The ends of the pipe shall be carefully cleaned before the pipes are placed. As each length of pipe is laid, the mouth of the pipe shall be protected to prevent the entrance of earth or bedding material. The pipes shall be fitted and matched so that when laid in the bed they shall form a smooth, uniform conduit. Shape trench bottom and perform excavation as specified under SECTION 31 23 00 – CONSTRUCTION OF UNDERGROUND UTILITIES. Shore and sheet as specified in SECTION 02150 - TRENCH SAFETY per Plans, and referenced documents.

B. Joints in Concrete Pipe

1. Unless otherwise specified, joints in reinforced and unreinforced concrete pipe, shall either be neoprene or rubber gasket joints as hereinafter described. Cold compound joints shall only be allowed when specifically noted in the specifications or contract drawings.

C. Neoprene or Rubber Gasket Joints

1. Joints made with neoprene, rubber, or other similar material that has been approved by the Engineer will be acceptable for use with reinforced or non-reinforced concrete pipe, either tongue and groove or bell and spigot. The ends of the pipe must be accurately made and designed for use with the gaskets. The type of joint and the gasket must have the approval of the Engineer and may be submitted to the Engineer for approval prior to submitting bids for work on which its use is intended. The joint material and workmanship shall be such as to provide a water tight joint. Joints shall, unless otherwise specified, be pointed on the outside with cement mortar.

D. Bell and Spigot Pipe – Cold Compound Joints
   1. The inside of the pipe bells and the outside of the spigot ends shall, while dry, be completely coated with joint primer. This coating shall be applied sufficiently in advance so that the primer will be thoroughly dry when the pipe is laid. Pipe twenty-four inches (24") and larger shall be primed at the point of manufacture. Apply a fillet of compound on the bottom half of the inside of the bell, press enough dry twisted jute into the compound to pass around the pipe and lap at the top and shove home the spigot of the pipe. Bring the jute around the pipe, firmly caulk into place. The jute should be sufficient to fill one-fourth (1/4) the depth of the bell. Fill the remaining three-fourths (3/4) of the depth of the bell with compound, taking care to leave no voids and provide sufficient compound to form a fillet sloping forty-five degrees from the outer end of the bell to the barrel of the next pipe.
   2. Compound used for these joints shall be a well known brand of material of proven worth, uniform in consistency and approved by the Engineer as being equal to RAM-NECK. Primer shall be of the type recommended by the manufacturer of the compound used.

E. Tongue and Groove Pipe – Cold Compound Joints
   1. Unless otherwise specified, this type of joint shall be used for tongue and groove pipe joints not made with approved neoprene or rubber gaskets. The compound and primer shall be the same as described herein for use with bell and spigot pipe.
   2. Both ends of the pipe shall, while clean and dry, be coated with primer on all surfaces that will be in contact with the compound. The primer shall be allowed to dry before the pipe is laid. Twenty-four inches (24") and larger pipe shall be primed at the factory.
   3. After pipe has been set to proper line and grade in the trench a one-half (1/2") thick layer of the compound shall be troweled or otherwise placed on the groove end of the pipe covering about two-thirds (2/3) of the joint face around the entire circumference. Next the tongue end of the next pipe shall be shoved home with sufficient pressure to make a tight joint. Care shall be taken to avoid leaving ridges of the compound projecting into the pipe in a manner that would obstruct the flow. The Contractor will make the necessary adjustment in the quality and consistency of the compound as the work progresses.
   4. An outside band of the joint compound shall be installed completely around the circumference of the pipe at the joint. This will necessitate digging "bell holes" at each joint. The band shall have a thickness at the center of at least three-quarter inch (3/4) tapering uniformly to nothing approximately three inches (3") each side of the center. Where Class A bedding is used, the band may be omitted on portions of the joint that will be embedded in the cement-stabilized sand bedding.

F. Corrugated Steel Pipe
   1. Fully bituminous coated corrugated steel pipe shall conform to FS WWP 405, Class I or II, Shape 1, 2, 3, with Coating A. Gauge of pipe shall be as indicated on the Drawings.
   2. The space between pipe and connecting bands shall be kept free of dirt and grit so that corrugations fit snugly. Connecting band shall be tapped with soft head mallet of wood, rubber or plastic while being tightened to take up slack and insure tight joint. Fill annular space between abutting sections of fully paved pipe and pipe arch with bituminous material after jointing.
   3. Unless otherwise specified, field joints shall be made with outside bands, each consisting of one or two pieces. Type, size, and gauge of band and size of angles and bolts shall be as indicated on the Drawings or as applicable for gauge and type of pipe used.

3.3 INSTALLATION OF HDPE PIPE

A. HDPE Drain Pipe shall be high density corrugated polyethylene heavy duty pipe and shall be manufactured in conformance with the latest AASHTO specifications of M294 Type S and AASHTO M252. (ADS N12 or equivalent are acceptable materials)

B. Joints and Fittings: Pipe and fittings shall conform to AASHTO M294 and AASHTO M252. Couplers

shall cover not less than one full corrugation on each annular section of pipe.

C. Bedding Material: Bedding material shall be 1/4 inch to 3/8 inch diameter washed pea gravel, free of lumps of clay, soil or vegetative material. Provide sample and sieve analysis/testing data to owner's representative prior to work commencement.
   1. Any gravel selected shall have 100% passing a 1/2 inch (12 mm) sieve and not more than 10% passing a No. 10 (2 mm). A four (4) inch thick layer of pea gravel shall be placed over the entire subgrade after installation of subdrainage piping.
   2. The gravel shall be "quality control" tested at the Owner's expense throughout construction at and approved laboratory for every 800 tons brought to the site. Gravel which does not meet specifications shall be removed and replaced at the Contractor's expense.

3.4 MANHOLES

A. Installation
   1. Manhole installation shall be in strict compliance with the manufacturer's recommended installation procedures.
   2. Excavation shall be adequate to accommodate the concrete foundation slab and to provide working room around the manhole.

B. Stubs
   1. Stubs shall be provided in manholes at the locations shown on the Plans. Stubs shall be not less than 2.0 feet long and shall terminate in a bell and plug.

C. Backfilling
   1. Backfilling around manholes shall not begin until concrete base has cured for twenty-four (24) hours. Backfill using native soil free of foreign objects, stones, concrete, or debris. Backfill in layers not to exceed twelve inches (12") to avoid uneven loading. Do not allow equipment to impact manholes during backfill operations.
   2. Do not backfill above flat areas at top of cone of manholes to allow for installation of concrete chimney.

D. Finishing Manhole to Grade
   1. Construct chimneys using precast concrete rings to bring manholes to finish grade.
   2. Seal both the top and the bottom faces of concrete rings with “Ramneck” rope type mastic sealant.

E. Manhole Frames and Covers
   1. Cast iron for manhole frames and covers shall conform to the dimensions shown on detail drawings and shall be clean, free from sand and blow holes or other defects. Manhole covers and Inlet Grates shall include all graphics, logos, and verbiage required by all regulatory agencies having jurisdiction over the project. Holes in cover must be free from plugs or burrs. Bearing surfaces of frames and covers are to be machined so that even bearing occurs when covers are seated in the frame.

END OF SECTION 33 41 00

SECTION 33 44 19 - STORM WATER MANAGEMENT

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 STORM WATER MANAGEMENT

A. "Storm Water Management" shall consist of all requirements to comply with current Environmental Protection Agency (EPA) Municipal Storm Water Permit requirements.

1.2 SCOPE

A. The scope of this item includes satisfying the EPA Storm Water National Pollutant Discharge Elimination System (NPDES) Permit Regulation including, but not limited to, any permits that shall be obtained and any construction practices, equipment, materials, labor, and structures necessary to conform with these regulations.

1.3 STANDARDS

A. This section will be governed by the regulations of the city and or county have jurisdiction over the project.

B. All provisions, technical specifications, guidelines, intent and construction practices detailed within this handbook will be considered a part of the technical specification and will have full force and effect regarding this project.

1.4 PERMITS

A. The Contractor is responsible for the planning and implementation procedures for storm water pollution prevention plans (SWPPP) for this construction site. The SWPPP shall be fully developed and implemented before submitting a Notice of Intent (NOI) that this project will be covered by the final EPA general permit requirements.

B. The Contractor shall file the NOI with the EPA at least 2 days prior to the commencement of construction activities.

C. The Contractor shall also prepare and submit inspection reports pertaining to the Storm Water Management for the City and file the Notice of Termination after the site has been stabilized.

1.5 PAYMENT

A. Storm Water Management will be incidental to all other Bid Items in the bid proposal.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 CONSTRUCTION

A. The Contractor is responsible for all construction activities, structures, etc., associated with implementing the NPDES Permit and the SWPPP. This includes, but is not limited to, filter fabric

fences, straw bale fences, temporary hydro-mulch seeding, sodding, inlet protection barriers, etc. that pertain to the intent of this section.

END OF SECTION 33 44 19

SECTION 33 46 16.34 - SUBDRAINAGE SYSTEM FOR SYNTHETIC TURF ATHLETIC FIELDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work shall include all labor, materials and equipment to complete the underdrain system as indicated on the Field Subdrainage Plan and as herein specified.

1.2 MEASUREMENT AND PAYMENT

A. There will be no separate measurement and payment for work performed under this section.

1.3 REFERENCES

A. The applicable provisions of the following standards shall apply as if written here in their entirety:
   1. AASHTO - American Association of State Highway and Transportation Officials
   2. ASTM - American Society of Testing and Materials

1.4 SUBMITTALS

A. Submit six (6) copies of bound product data which shall include as a minimum manufacturer's product data on: drain pipe, fittings and accessories. Material samples shall also be submitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Perforated Drain Pipe: Perforated drain pipe shall be high density corrugated polyethylene heavy duty pipe and shall be manufactured in conformance with the latest AASHTO specifications of M294 Type S and AASHTO M252. (ADS N12 or equivalent are acceptable materials)

B. Joints and Fittings: Pipe and fittings shall conform to AASHTO M294 and AASHTO M252. Couplers shall cover not less than one full corrugation on each annular section of pipe.

C. Bedding Material:
   1. See Specification 32 11 23.23 Free Draining Stone Base for Synthetic Turf Systems

D. Valve Boxes/Cleanouts: 10 inch round with locking top, Ametek or Carson manufactured.

PART 3 - EXECUTION

3.1 PREPARATION

A. The subgrade for the underdrain system shall be completed by the Contractor using laser control within an elevation tolerance of plus 0.00 inch to minus 1/2 inch of the design subgrade elevations as determined from the Contract Drawings.

B. Subgrade elevations and uniformity shall be verified by a Registered Professional Land Surveyor retained and paid by the Contractor, and approved by the Owner. A certified copy of the survey shall be submitted to the Owner and the Engineer within three (3) days after completion.

C. The completed subgrade shall be compacted to a uniform density of no less than 95% of maximum as determined by ATSM Designation D 698-78. The Engineer and the Contractor shall inspect the subgrade prior to construction of the subdrain system. If the system sybgrade meets the above

specifications, the Contractor may commence construction. It the subgrade is not acceptable, the Contractor shall correct the deficiencies before proceeding.

3.2 INSTALLATION

A. Contractor shall commence the underdrain work upon completion of the prepared subgrade. Subgrade of field shall conform to the grading plan. Contractor shall provide for an elevation tolerance of plus or minus 1/2 inch of the designated subgrade. Certified verification of subgrades shall be provided by the Contractor and approved by the Engineer prior to work commencement.

B. The location of each run of pipe shall be staked out and laser surveyed prior to trenching. Install Geomembrane Liner to bottom and sides of trenches. Extend fabric a minimum of five (5) feet past each side of top of trench on top of the subgrade. All pipe shall be carefully placed in the trenches with bedding material installed per plans an details. The interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipes shall be closed by tape or other approved means.

C. All pipes shall be laid to drain in accordance with the plans. All subdrainage piping shall be emptied into the existing catch basin/storm piping configuration at the west end of the playing fields and at the elevation listed per the plans. Perforation into the exiting storm system shall be concrete grouted after installation of pipe.

D. Coordinate trenching and installation with underground irrigation and exiting storm sewer system. If conflicts exist, modify irrigation lines as required and protect the existing storm sewer and catch basins from damage.

E. Remove all excess waste materials and soils off of field and maintain original subgrade elevations. This work is to be accomplished on a daily basis

F. Keep up to date as-built documents, as the job progresses and make available to Engineer and Owner's Representative for inspection at all times. Revise drawings as required to indicate field changes made during installation.

END OF SECTION 33 46 16.34

SYNTHETIC TURF BASEBALL FIELD

NORTH HIGH SCHOOL

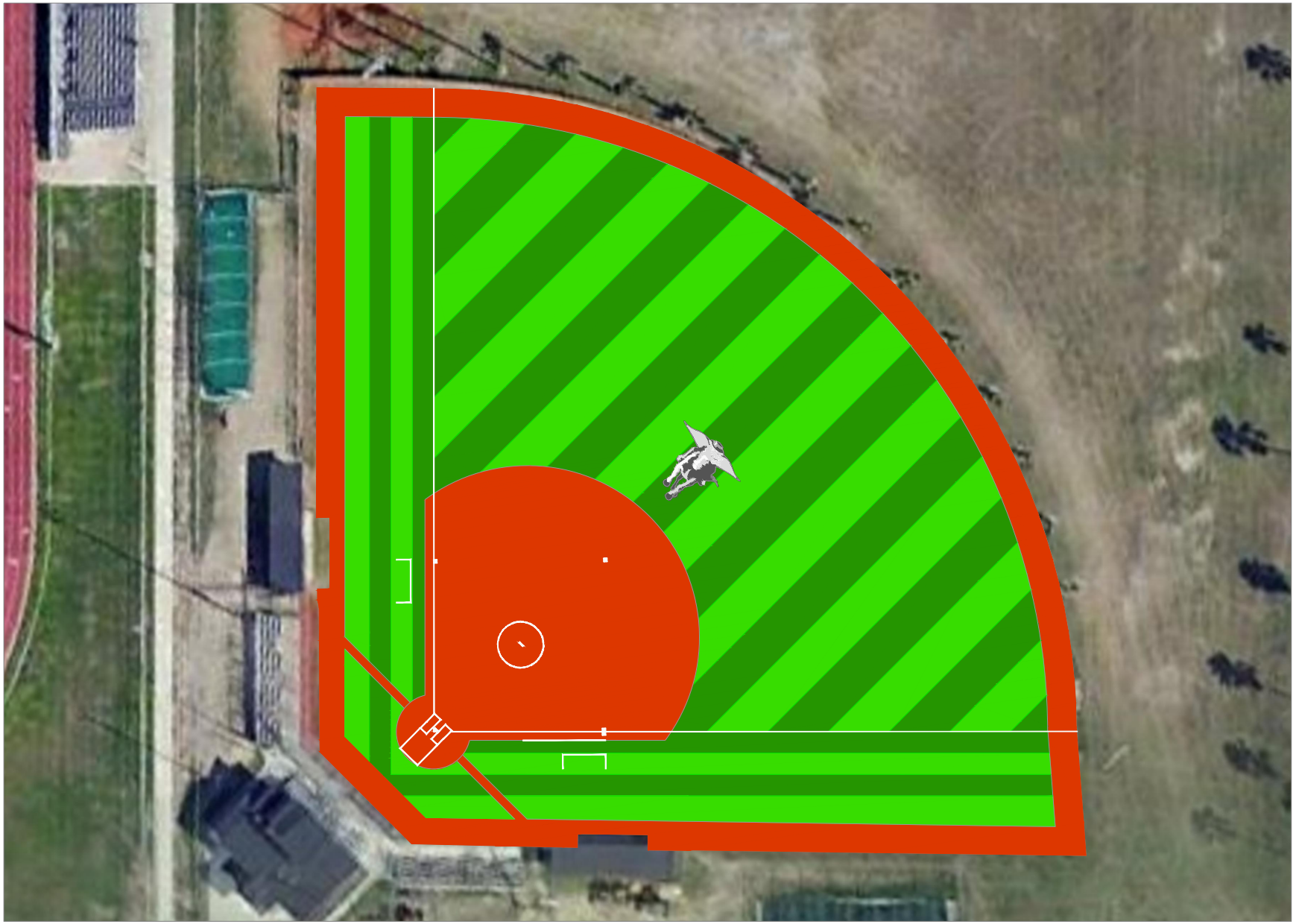
PHARR-SAN JUAN-ALAMO ISD

40 80

80 0 160

N

08/07/2019



SYNTHETIC TURF SOFTBALL FIELD

NORTH HIGH SCHOOL

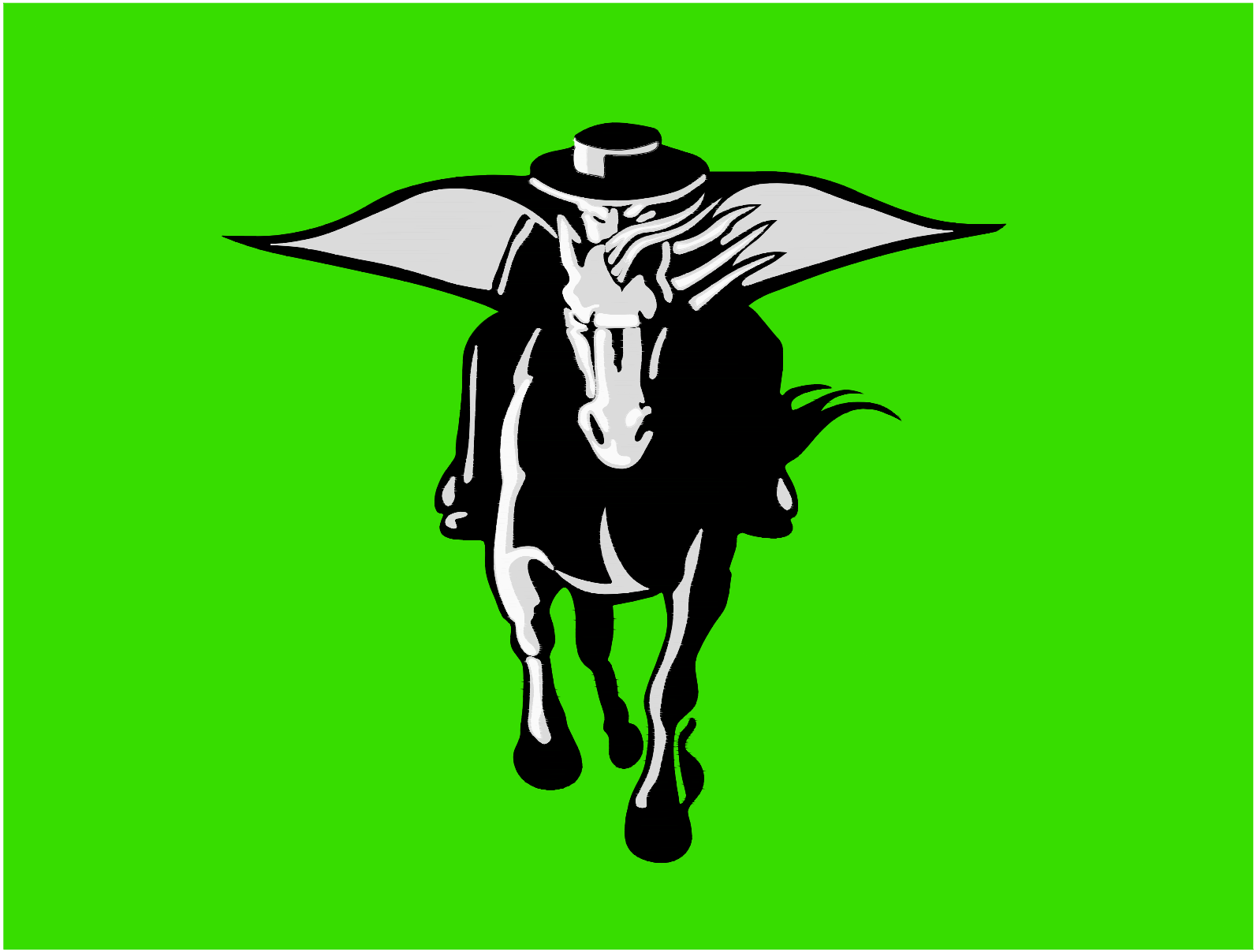
PHARR-SAN JUAN-ALAMO ISD

25 50

50 0 100

N

08/07/2019



LOGO

NORTH HIGH SCHOOL

SYNTHETIC TURF BASEBALL FIELD

MEMORIAL HIGH SCHOOL

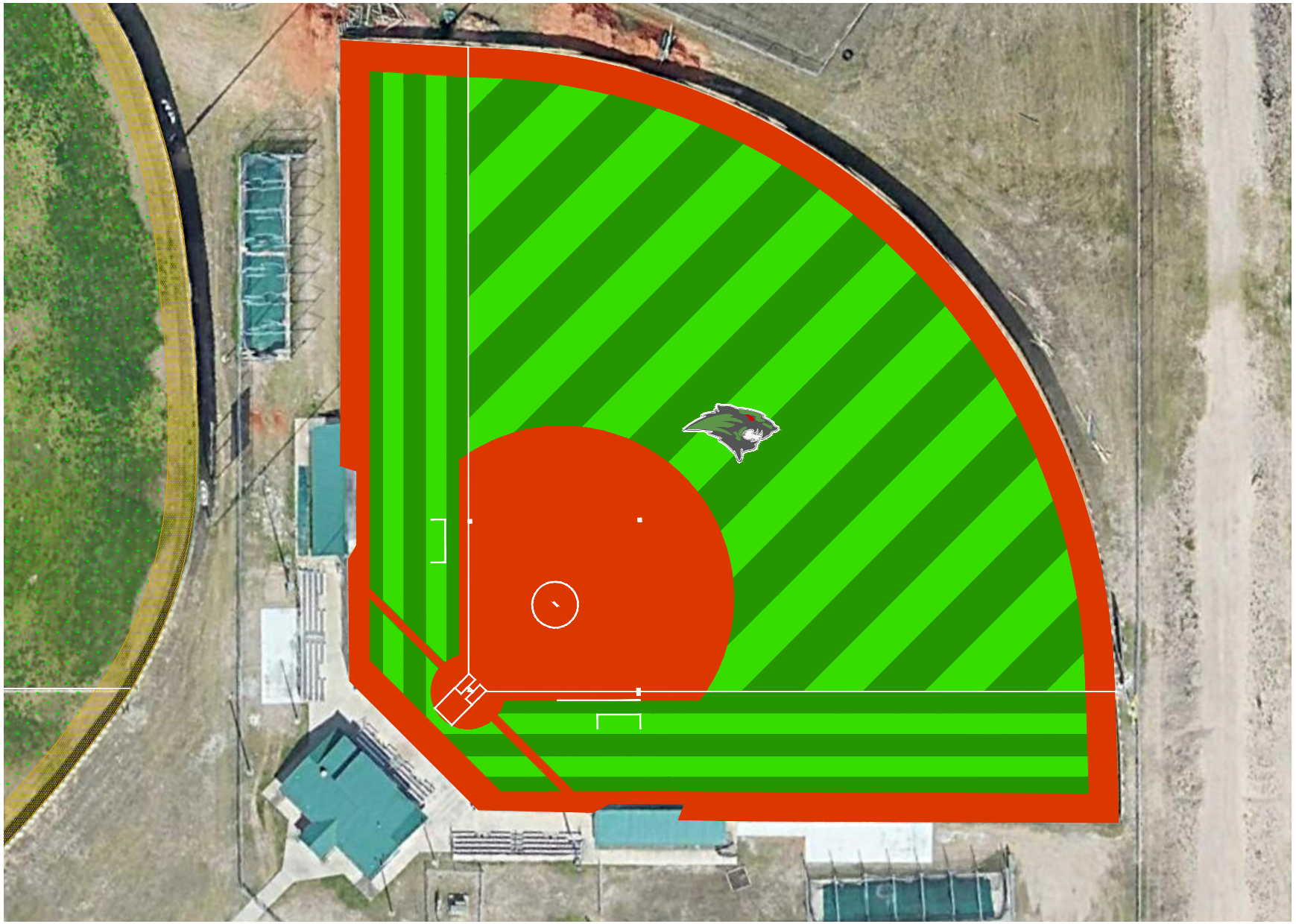
PHARR-SAN JUAN-ALAMO ISD

40 80

80 0 160

N

08/07/2019



SYNTHETIC TURF SOFTBALL FIELD

MEMORIAL HIGH SCHOOL

PHARR-SAN JUAN-ALAMO ISD

25 50

50 0 100

N

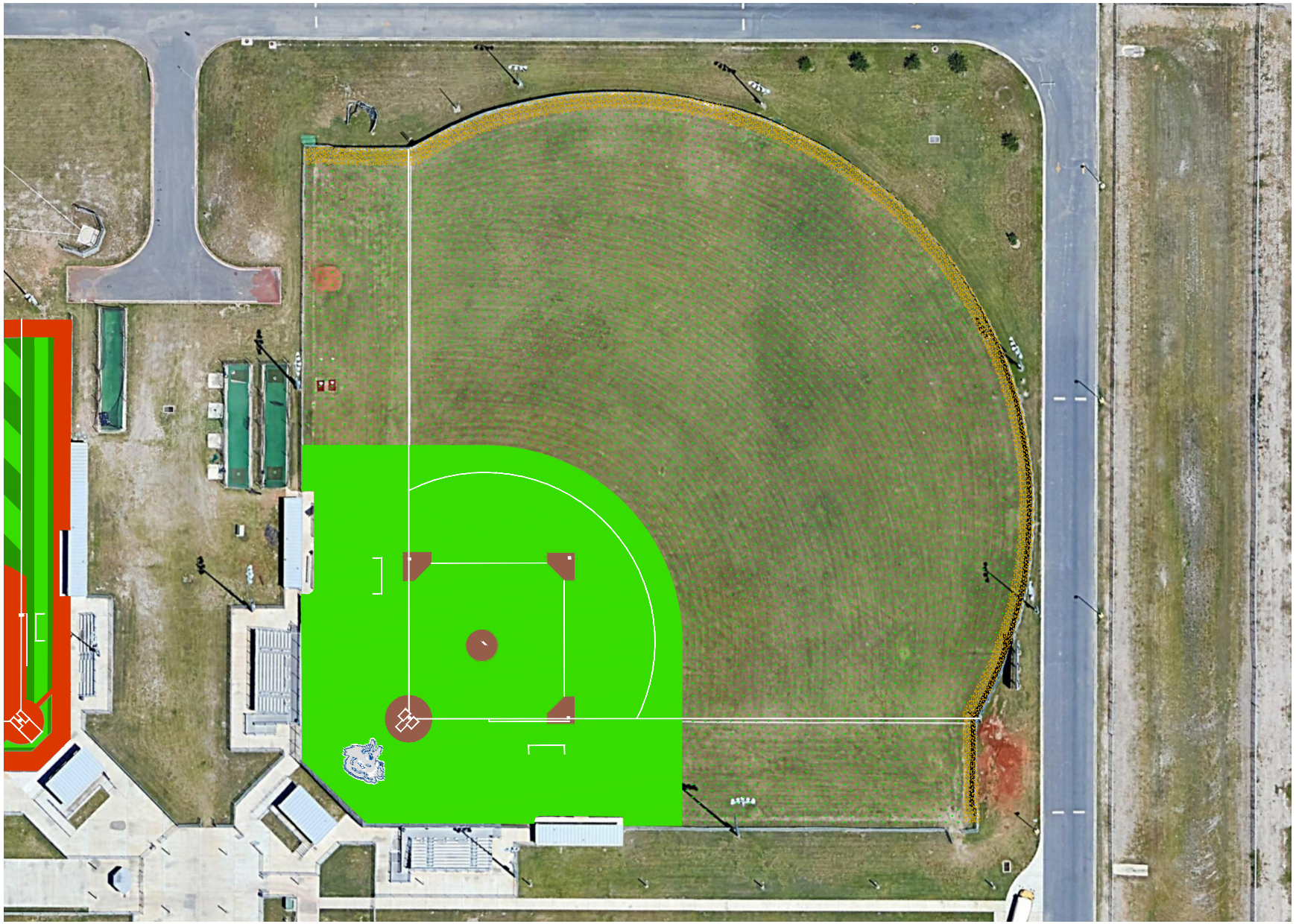
08/07/2019

LOGO

MEMORIAL HIGH SCHOOL

PHARR-SAN JUAN-ALAMO ISD

08/07/2019



SYNTHETIC TURF BASEBALL FIELD

SOUTHWEST HIGH SCHOOL

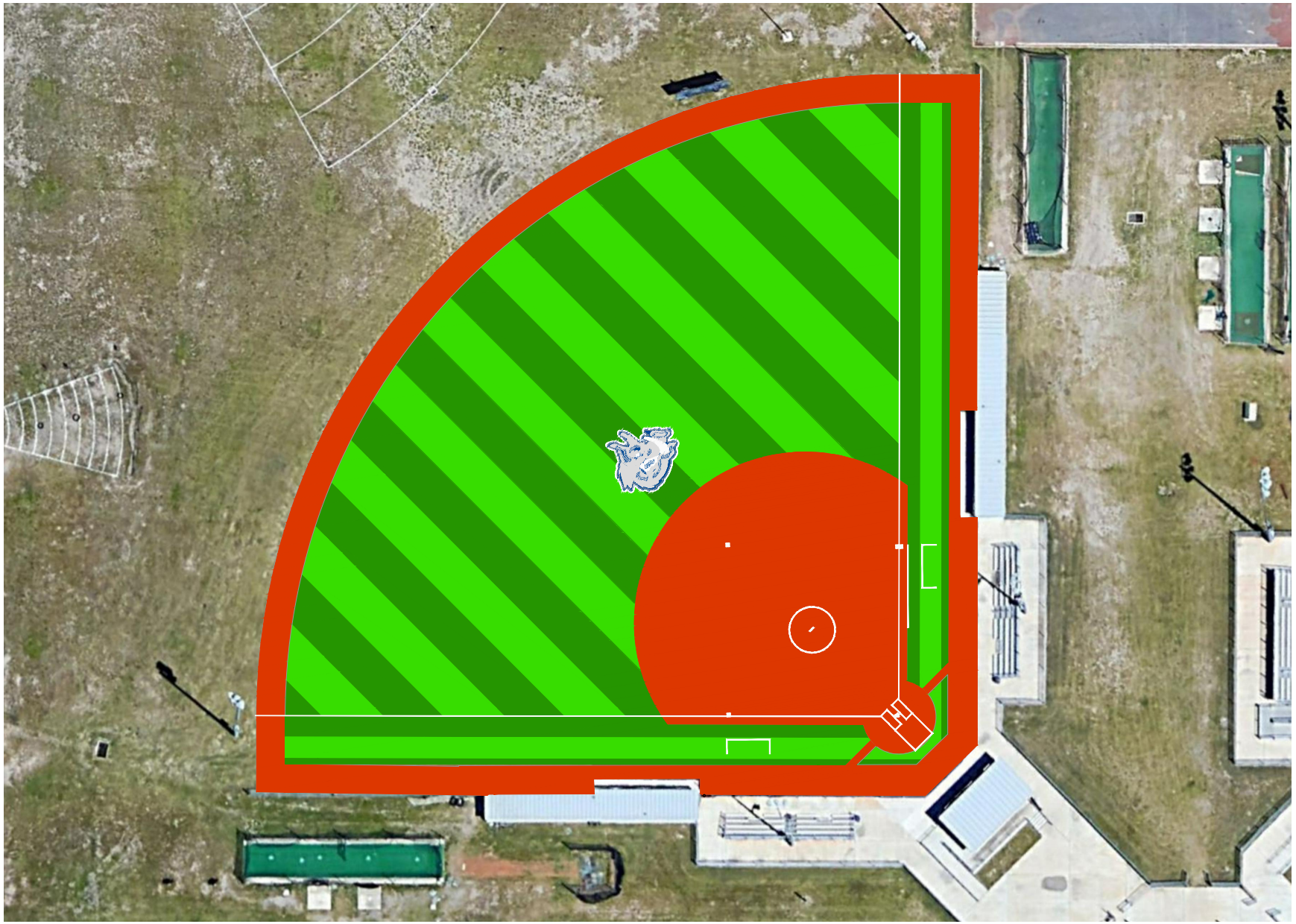
PHARR-SAN JUAN-ALAMO ISD

40 80

80 0 160

N

08/07/2019



SYNTHETIC TURF SOFTBALL FIELD

SOUTHWEST HIGH SCHOOL

PHARR-SAN JUAN-ALAMO ISD

25 50

50 0 100

N

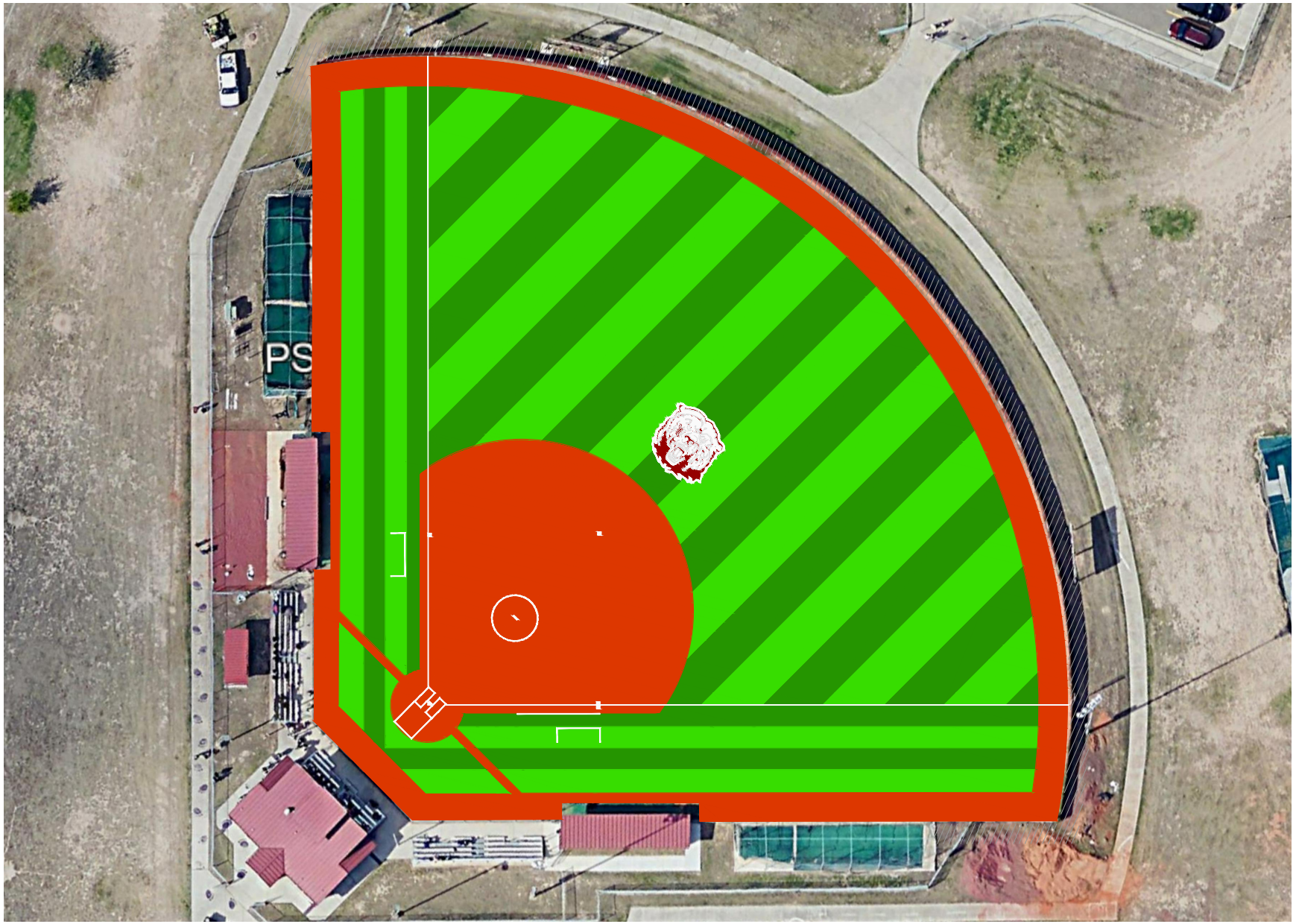
08/07/2019

LOGO

SOUTHWEST HIGH SCHOOL

PHARR-SAN JUAN-ALAMO ISD

08/07/2019



SYNTHETIC TURF SOFTBALL FIELD

PSJA HIGH SCHOOL

PHARR-SAN JUAN-ALAMO ISD

25 50

50 0 100

N

08/07/2019

LOGO

PSJA HIGH SCHOOL