The Woodlands Township Park and Recreation
8203 Millennium Forest Dr.
The Woodlands, TX 77381

Invitation for Bid
Alden Bridge Sports Park Phase 1
Contract Number: C-2025-0453

PURPOSE
Contractors shall provide all labor, materials, equipment, licensing, and supervision necessary for the construction of the Alden Bridge Sports Park Phase 1 improvements utilizing the plans and specifications included in the attached bid documents.

Pre-Bid Meeting Bid at 9:00 a.m. CST at 8203 Millennium Forest Drive, The Woodland, TX 77381	**October 21, 2025**
Deadline for Written Questions at 5:00 p.m. CST	**October 24, 2025**
Bids Due by 2:00 p.m. CST at 14800 St. Mary's Lane, Suite 160, Houston, TX 77079	**November 4, 2025**

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Bidder shall **complete every space** in the bidder proposal column with either **signed initials** to indicate the item being bid is exactly as specified or a description to indicate any deviation of item being bid from the specifications. Bidder may submit additional information explaining any proposed deviation.

1	GENERAL	Bidders Initials
1.1	The contract for these services, if awarded, shall be for **the contract duration agreed upon with the Township and selected bidder**. Any and all financial obligations of The Woodlands Township under a proposed contract are conditional as they relate to a yearly appropriation during the annual budget process.	
1.2	~~Within (180) days before the expiration of the Initial Term (June 1, 2025), The Woodlands Township may give written notice to Contractor of its desire to extend the Agreement (the "Renewal Notice") for an additional period of time. (the "Renewal Term"). If The Woodlands Township delivers the Renewal Notice, the Parties shall within thirty (30) days from the date of receipt of the Renewal Notice, use good faith efforts to negotiate the terms and conditions of the Renewal Term. Any agreed upon Renewal Terms shall be in writing and executed as a Modification of the Agreement. In the event the Parties are unable to agree upon the terms and conditions for the Renewal Term, then the Agreement shall expire upon the expiration of the current Term or otherwise terminate pursuant to the terms of the Agreement. Renewal Terms will be limited to a maximum of two (2), three (3) year renewal periods.~~	N/A
1.3	The Woodlands Township reserves the right to reject any or all bids, including without limitation the rights to reject any or all nonconforming, non-responsive, unbalanced or conditional bids and to reject the bid of any bidder if The Woodlands Township believes that it would not be in the best interest of the project to make an award to that bidder, whether because the bid is not responsive or the bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by The Woodlands Township.	
1.4	The Woodlands Township also reserves the right to waive all informalities and defects in the bids and the bidding process not involving price, time of submittal or changes in the work and to negotiate contract terms with the successful bidder. Discrepancies between the multiplication of units of work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words. In case of ambiguity or lack of clarity in stating the prices in the bid, The Woodlands Township reserves the right to consider the most advantageous bid thereof or to reject the bid.	
1.5	Prospective Bidders may obtain a bid package including specifications and bidding documents from The Woodlands Township website, online at www.thewoodlandstownship-tx.gov/bids and via CivCast at https://www.civcastusa.com/.	
1.6	Bidders should carefully examine the bid documents, specifications and other documents, visit the sites of the work, field verify quantities and fully inform themselves as to all conditions and matters which can in any way affect the work or the cost thereof. Should a bidder find discrepancies in or omissions from specifications, or other documents, or be in doubt as to their meaning, he should at once notify The Township and obtain clarification prior to submitting a bid.	
1.7	Addenda to the specifications shall be considered part of the contract documents. Bidder shall acknowledge receipt of addenda on the Bid Proposal Form. Oral and other interpretations or clarifications will be without legal effect.	
1.8	Any qualification or exception submitted by the contractor pertaining to the specifications and bid items may be cause for rejection of bid. (A conditional bid may be cause for rejection.)	
1.9	The Contractor's bid shall include unit prices as outlined in the Bid Tabulation Form. Quantities required and listed are substantially correct, but The Woodlands Township reserves the right to increase and/or decrease the amount of work to be done by any amount at the same unit cost bid.	

1.10	There will be no public bid opening; however, bid tabulations and related bid documents will be released once the Board of Directors has reviewed and approved them.	
1.11	ANY ALTERATIONS, ADDITIONS OR DELETIONS, TO EITHER THE INSTRUCTIONS TO BIDDERS, OR THE PROPOSAL FORM SHALL CONSTITUTE THE BID(S) AS UNACCEPTABLE.	
1.12	~~It is understood, that in addition to the items outlined in this bid package, The Woodlands Township's facilities, offices, terminals, parks, pools and sports fields are continually growing and the successful contractor must be capable of handling contract additions throughout the term of the contract to the same standards, frequencies and expectations outlined herein.~~	N/A
1.13	Contractor shall be capable of receiving communication by email, or via phone call/message/app.	
1.14	Contractor shall provide all equipment, labor, trucks, and material necessary to perform the required service. No equipment, material or personnel shall be provided by The Township to Contractor unless agreed upon in advance in writing by the Township.	
1.15	Contractor shall remove all rubbish, waste and discarded material on a daily basis that is a result of their services provided to the Township. If Contractor fails to comply with this obligation, and the Township is required to remedy, the Contractor agrees to reimburse the Township for all expenses incurred for the remedy.	
1.16	Each employee will be identified by a company uniform (shirt, pants or cap) and vehicles will be clean, and all marked with company name.	
1.17	Contractor shall behave and operate in an environmentally sound and professional way, as to not create damage or cause exposure by virtue of negligence or omission.	
1.18	Equipment must be well maintained and in good condition.	
1.19	Transportation of staff and equipment shall be done only in vehicles marked with contractor's company logo unless agreed in writing by Township staff.	
1.20	Working Day" is defined as any day not including Sundays or any legal holidays, in which weather or other conditions not under the control of the Contractor, will permit construction of the principal units of the Work for a continuous period of not less than seven (7) hours during the twelve (12) hours between 7:00 AM and 7:00 PM, or as identified in the bid document and by mutual written agreement. Work on Sundays may be permitted upon approval of the Owner. A "calendar day" is defined as any day indicated on the calendar, including Saturdays, Sundays and holidays. A Working Day that involves rain, sleet, and/or snow, shall be coordinated with the Owner's Project Manager. In order to classify rain, sleet, and/or snow, the National Weather Service will be used to determine if certain weather or conditions exist that would not permit construction on a specific Working Day. The Project Manager will determine if a Working Day shall be rescheduled due to weather conditions. The Woodlands Township may direct specific times for certain work to be performed so as to not interfere with lake/pond, park and/or community activities.	
1.21	Safety of residents and visitors is of the utmost importance. It will be the contractor's responsibility to secure areas in and around where the work is taking place.	
1.22	Service can only be requested by authorized personnel who include Township staff having a title of Foreman, Supervisor, Superintendent/Manager, Asst. Director, Director, Assistant General Manager, or President/Chief Executive Officer.	
1.23	Contractors shall understand that one of the main emphases of this community is the preservation of the natural existing environment which includes the trees, bushes, wildflowers and wildlife, and to enhance it by additional landscaping and the development of the lakes and open space. No trees, shrubs or vegetation should be unnecessarily removed or damaged. No trash, lumber, etc. can be dumped in the woods. No vehicles, etc. can be parked except in handicapped spaces or park reserves.	
1.24	~~Work Orders (WO) and service requests may be sent to Contractor multiple times a week via email, these emails or WO's should be acknowledged upon receipt. Work shall be addressed at the latest during the next regularly scheduled service visit.~~	N/A

1.25	Additions and modifications to the Contract, the Township will request a proposal for additional services and will add it to the contract, at their discretion. Missed services will be deducted from the monthly invoice based on the pricing reflected in the service matrix/bid tab.	
1.26	Any measurements contained herein should only be used as an estimate. Contractor is responsible for accurate measurement of all items. All potential bidders should examine areas included in this bid to ensure accurate measurements and price quotes.	
1.27	Contractor is responsible for obtaining such supplies, materials and parts if not provided directly by the Township. Such supplies, materials and parts shall be of good quality and the cost of such shall be billed as reflected in the proposal from the Contractor. Installed materials that fail before warranty shall be replaced by the contractor with new material at no cost to the Township other than labor to reinstall.	
1.28	Service locations are public and extremely sensitive to disruption. Contractor must ensure the general public and user's safety when performing services in and around all locations.	
1.29	Contractor shall not employ any subcontractor to fulfill any of the Contractor's obligations, in whole or in part, without the prior express written approval of The Woodlands Township and shall fully indemnify and defend the Township for any acts or omissions of any such sub-contractor.	
1.30	All maintenance operations shall be performed by the approved contractor or sub-contractor. A list of sub-contractors shall be submitted with the bid.	
1.31	Contractor is responsible for responding to emergencies as deemed by The Township i.e., hurricanes, tornadoes, flooding. Contractor shall provide an emergency response number(s), office and mobile number. Contactor must respond to the emergency in an appropriate amount of time as agreed upon as deemed by the Township and Contractor.	
1.32	Contractors must include a detailed **EQUIPMENT LIST** necessary to complete the work outlined in these specifications and submit with the bid and annual schedule.	
1.33	Contractor is responsible for damage to persons and property caused during the performance of contracted work.	
1.34	The Contractor will be held responsible for any damages to trees, plants, shrubs, fences, walls, brick, pavers, glass, etc. that is caused by the Contractors errors or their failure to comply with the requirements of these specifications and will be assessed a fee. Values will be based on The Township's assessment and/or appraisal in accordance to Council of Tree and Landscape Appraisers or other mutually agreeable source.	
1.35	Contractor is responsible for applying all chemicals in a safe manner consistent with the label directions and federal and state laws and regulations. Application rates and frequencies are determined by the manufacturer's recommendations. Chemical mixing and application shall be supervised by a Licensed Pesticide Applicator. Records must be maintained according to applicable licensing regulatory body. ***These records shall be provided to The Township upon request within 2 hours.***	
1.36	Contractor is responsible for public notification when pesticides are to be applied in advance per manufacturers label instructions. Notification as is to include when, what, where, and how much. Verification of completion is to be noted.	
1.37	If through inspection and verification, in The Woodlands Township opinion, work as defined by the specifications has been carried out to an insufficient standard, the work shall be carried out again by the Contractor without creating a backlog to other maintenance schedule and at the expense of the Contractor.	
1.38	**In the event the contractor fails to accomplish any task under this scope of work, The Woodlands Township will provide reasonable notice to take corrective action. If the Contractor does not perform the service, The Woodlands Township may, at its option, cause the non-performed tasks to be accomplished through another source and deduct the cost of such from the amount normally due to the contractor for that monthly period based on the Supplemental Unit Prices	

2	LAWS, REGULATIONS, AND INSURANCE	Bidders Initials
2.1	Please be advised that in accordance with State of Texas Local Government Code Chapter 176, Bidder must submit Form CIQ	
2.2	In compliance with State of Texas Government Code, Section 2252.908, the successful business entity awarded a contract by the Board of Directors of The Woodlands Township must complete Form 1295 – "Certificate of Interested Parties" – and must provide a signed and notarized printed copy of the form and a separate certification of filing. The form can be found at www.ethics.state.tx.us	
2.3	At Contractor's own cost and expense, Contractor shall comply with all laws, ordinances, rules, and regulations of the federal, state and local and OSHA authorities and departments relating to or affecting the work hereunder, and shall secure and obtain any and all permits, licenses and consents as may be necessary in connection therewith.	
2.4	Contractor shall furnish to The Township copies of said licenses (State Texas Licensed Irrigator and Pesticide Applicator), permits prior to the commencement of any work hereunder.	
2.5	Traffic control, where and when needed, must meet the requirements of all state and local laws and regulations shall be included as part of the unit cost.	
2.6	All work, repairs, preventative maintenance and installations shall be made in compliance with the appropriate Certifications, Laws, and Codes as adopted by the State of Texas.	
2.7	Contractor shall provide The Woodlands Township acceptable proof of insurance and endorsement forms which meets the requirements as identified herein. Proof of Insurance must be provided before any Work is to begin.	
3	**INSTRUCTIONS**	**Bidders Initials**
3.1	A **mandatory Pre-Bid Meeting** will take place at The Woodlands Township, 8203 Millennium Forest Drive, The Woodlands, Texas 77381, **Tuesday, October 21 at 9:00 am CST.**	
3.2	Contractors should visit the locations in their own time in order to best determine scope and expectations: The Woodlands Township strongly encourages all bidders to familiarize themselves with facilities and locations.	
3.3	**INTERPRETATIONS AND ADDENDA**- All questions about the meaning or intent of the Bidding Documents and the Contract Documents shall be submitted in writing to Mitch Hall, Parks Superintendent at mhall@thewoodlandstownship-tx.gov, Tyler Eaton, Halff, at teaton@halff.com, Casey Collins, Halff, ccollins@halff.com, and Kristin LeBlanc, Halff, kleblanc@halff.com. Interpretations, questions, or clarifications will be considered by the Township and if necessary be responded to by issuance of an Addendum. All questions are to be received no later than **Friday, October 24, at 5:00 p.m. CST**. Only answers issued by Addenda will be binding. All addendums will be posted on The Woodlands Township website http://www.thewoodlandstownship-tx.gov/bids and via CivCast at https://www.civcastusa.com/.	
3.4	**Sealed bids**, addressed to The Woodlands Township, Attention: Mitch Hall, Park Superintendent, and delivered to Halff Associates, Inc. at 14800 St. Mary's Lane, Suite 160, Houston, TX 77079, must be received at the above address no later than **Tuesday, November 4 at 2:00 p.m. CST** for furnishing all labor, materials, supplies, equipment, licensing, supervision and performing all work necessary to provide The Woodlands Township based on the bid documents in The Woodlands Township, Montgomery and Harris Counties, Texas. Bids shall be submitted in sealed envelopes using the blank Proposal forms furnished with this bid package, **additionally the Bid Matrix/Tab must be emailed to** mhall@thewoodlandstownship-tx.gov, Tyler Eaton, Halff, at teaton@halff.com, Casey Collins, Halff, at ccollins@halff.com, and Kristin LeBlanc, Halff, at kleblanc@halff.com **on the bid submittal due date.**	
3.5	Each sealed envelope containing the bid(s) must be clearly marked on the outside **BID for** Alden Bridge Sports Park Phase 1 Contract Number: C-2025-0453 – Project (Letter) and the envelope should bear on the outside the name of the bidder and company their address.	

3.6	All companies bidding on this project must include the information outlined in the **ITEMS TO BE INCLUDED IN BID SUBMITTAL** such as bid checklist, bid bond, statement of qualifications, list of subcontractors, list of equipment, references, list of proposed equipment, licenses, insurance requirements, and other items requested in this bid document.	
3.7	All Bids must be made on the required BID TABULATION FORM. All blanks spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted.	
3.8	Bidder is required to submit three (3) references of previous projects of similar or like nature size/value. Reference information shall include name, company, email, and phone number.	
3.9	**Bid Bond** -All bids shall be accompanied by a cashier's check, or certified check drawn upon a National or State bank, in the amount of 2% of total project bid, payable to The Woodlands Township, or a Bid Bond in the same amount, from a Surety Company licensed in the State of Texas, as a guarantee that the bidder will enter into a contract.	
3.10	**Performance/Payment Bond** -Contractor is required to provide The Woodlands Township a performance/payment bond in the full amount of the contract(s) value prior to the commencement of work, with premiums fully paid in advance by the contractor. The bonds will be on forms and drawn on sureties acceptable to The Woodlands Township and are included in the total project cost (s). See attached for sample of Performance Bond.	
4	**INVOICING AND PAYMENT**	**Bidders Initials**
4.1	Unit prices shall remain in effect for the length of this agreement.	
4.2	Evaluation of bid takes into account the following considerations: price, references, familiarization with The Woodlands, etc.	
4.3	THIS IS A TAX-EXEMPT CONTRACT. A TAX EXEMPTION CERTIFICATE WILL BE SUPPLIED TO THE CONTRACTOR WHO MAY THEN ISSUE A RESALE CERTIFICATE TO SUPPLIERS AND SUBCONTRACTORS.	
4.4	Unit price shall be inclusive of all charges (staff time, application equipment, disposal, truck charges, environmental charges, traffic control, etc.).	
4.5	Monthly invoices from the selected vendor must be submitted containing at least the following information: • Month of Service • Description of Unit Price • Copy of Services Tracker for that Month • Total Cost ***No payment will be made without backup documentation***	
4.6	**Added services**- Contractor shall submit to the Township invoices upon completion of any Work Order sent by The Woodlands Township staff no later than thirty (30) days after completion of the work.	
4.7	The Township will remit payment for each invoice to Contractor within 30 days of receipt of an approved Invoice, unless the Township disputes any portion of the Invoice, and the Contractor is not in default under the provisions of this contract.	
4.8	Contract payment will be on a monthly basis, based on a detailed invoice provided to The Township from the selected Contractor. The billing of services is on a per unit per month price which are submitted as a total monthly price.	
4.9	Monthly Statements – Contractor should provide a Monthly Statement of outstanding/pending invoices. Monthly Statement shall be sent on the 1st day of each Month.	

Exhibit A – Bid Certification

I, _____, certify that this bid, including the listed unit price in the bid tabulation, is made without prior understanding, agreement or connection with any corporation, firm, or person submitting a bid for the same materials, supplies or equipment and is in all respects fair and without collusion of fraud. I agree to honor the unit prices as submitted throughout the term of the **Alden Bridge Sports Park Phase 1 project.**

Contract Numbers: C-2025-0453

and abide by all conditions of this bid and certify that I am authorized to sign this bid for the bidder.

_____

Date

_____ _____

Signature Name (please print)

_____ _____

Title Company Name

_____ _____

Address Phone Number

_____ _____

E-mail address Cell Phone Number

Exhibit B – Bid Form and Addendum Acknowledgement

BID PROPOSAL FOR
ALDEN BRIDGE SPORTS PARK EXPANSION PHASE 1
THE WOODLANDS TOWNSHIP

CONTRACTOR:_____ **DATE:**_____

Date visited site and signature:_____

I hereby acknowledge receiving the following addendums as applicable:
Addendum No. 1 **Sign:**_____ **Date:**_____
Addendum No. 2 **Sign:**_____ **Date:**_____
Addendum No. 3 **Sign:**_____ **Date:**_____

ITEM NO.	Spec	DESCRIPTION	QTY	UNIT	UNIT PRICE	EXTENDED TOTAL
SERIES 100: GENERAL						
100	COH 01502	MOBILIZATION	1	LS		
101		BONDS	1	LS		
102	ALL-WEATHER TURF FIELD	PERFORMANCE TESTING OF ARTIFICIAL TURF FIELDS AFTER INSTALLATION TO INCLUDE: BALL ROLL, BALL BOUNCE, FORCE REDUCTION, DEFORMATION, TORQUE, TRACTION, BALL ANGLE, BALL SPEED, EVENNESS, GMAX, SEAMS, INFILL DEPTH. AS SHOWN IN SECTION 9 PART 2.07.M OF THE ALL-WEATHER TURF FIELD SPECIFICATIONS.	1	LS		
					SERIES 100 TOTAL	
SERIES 200: STORM WATER POLLUTION PREVENTION PLAN						
200	COH 01570	SWPPP INSPECTION AND MAINTENANCE (MAX BID - $2,000/MO)	18	MO		
201	COH 01575	CONCRETE TRUCK WASHOUT STRUCTURES (60% OF UNIT COST FOR FURNISH AND INSTALLATION, AND 40% OF UNIT COST FOR REMOVAL)	1	EA		
202	COH 01570	INLET PROTECTION BARRIER (STAGE 1, WITH FIBER ROLLS; 60% OF UNIT COST FOR FURNISH AND INSTALLATION, AND 40% OF UNIT COST FOR REMOVAL)	7	EA		
204	COH 01570	REINFORCED FILTER FABRIC FENCE (60% OF UNIT COST FOR FURNISH AND INSTALLATION AND 40% OF UNIT COST FOR REMOVAL)	3747	LF		
205	COH 01562	TREE PROTECTION, COMPLETE IN PLACE	3915	LF		
206	COH 01570	TPDES GENERAL PERMIT NO. TXR 150000, NOTICE OF INTENT (NOI) APPLICATION FEES (CONTRACTOR'S NOI FEE SHALL BE FIXED PRICE OF $225.00)	1	EA		
					SERIES 200 TOTAL	
SERIES 300: SITE PREPARATION AND EARTHWORK						
300	COH 02221	SITE PREPARATION INCLUDING BUT NOT LIMITED TO CLEARING OF TURF, LANDSCAPING, AND OTHER IMPROVEMENTS WITHIN THE WORK AREA	6.38	AC		
301	COH 02233	CLEARING AND GRUBBING OF EXISTING TREES, ALL SIZES, INCLUDING CHIPPING AND OFF-SITE DISPOSAL AS SHOWN ON APPORVED PLANS AND COORDINATED WITH OWNER	7.30	AC		
302	COH 02322	FILL IMPORT USING LOCAL MATERIAL, INCLUDING HAULING AND COMPACTION	30783	CY		
303	COH 02319	SELECTED BORROW FOR BUILDING PAD (IMPORTED SOIL)	115	CY		
					SERIES 300 TOTAL	
SERIES 400: DEMOLITION						
400	COH 02221	REMOVE AND DISPOSE CONCRETE PAVEMENT (ALL DEPTHS) INCLUDING SUB-BASE, SUBGRADE	1,737	SY		
401	COH 02221	REMOVE AND DISPOSE CONCRETE CURB	375	LF		
402	COH 02221	REMOVE PAVEMENT MARKINGS	428	LF		
403	COH 02221	REMOVE EXISTING PARK AND PARKING LOT SIGNAGE, INCLUDING CONCRETE FOUNDATION. (CONTRACTOR TO PROVIDE SIGNS TO OWNER)	13	EA		
404	COH 02221	REMOVE AND DISPOSE EXISTING IRRIGATION SYSTEM INCLUDING CONTROL VALVES, MAINLINES, AND HEADS	1	ALLOW		
405	COH 02221	REMOVE AND DISPOSE EXISTING ROCK RIP RAP	14	SY		
406	COH 02221	REMOVE AND DISPOSE EXISTING 3" PVC STORM PIPE	44	LF		
407	COH 02222	REMOVE AND DISPOSE EXISTING 8" CPP STORM PIPE	42	LF		

408	COH 02221	REMOVE AND DISPOSE EXISTING 8" PVC STORM PIPE	174	LF		
409	COH 02221	REMOVE AND DISPOSE EXISTING 18" PVC STORM PIPE	125	LF		
410	COH 02221	REMOVE AND DISPOSE EXISTING 18" RCP STORM PIPE	33	LF		
411	COH 02221	REMOVE AND DISPOSE EXISTING 3.5'x3.5' CONCRETE BOX CULVERT	17	LF		
412	COH 02221	REMOVE AND DISPOSE EXISTING STORM CATCH BASINS	6	EA		
413	COH 02222	REMOVE AND DISPOSE EXISTING 18" STORM S.E.T.	4	EA		
414	COH 02221	REMOVE AND DISPOSE EXISTING STEEL CABLE FENCE W/ 8" WOODEN POSTS	312	LF		
415	COH 02221	REMOVE AND DISPOSE EXISTING 16' CHAIN LINK FENCE	177	LF		
416		REMOVE AND DISPOSE EXISTING REMOVABLE BOLLARDS	4	EA		
417	COH 02221	REMOVE EXISTING FIELD LIGHTING, POLES, & FOUNDATIONS (CONTRACTOR TO PROVIDE LIGHTING AND POLES TO OWNER)	12	EA		
418	COH 02221	REMOVE AND DISPOSE ELECTRICAL INCLUDING CONDUIT, WIRE, BOXES, ETC. ASSOCIATED WITH REMOVED FIELD LIGHTING	1	LS		
419	COH 02221	REMOVE AND SALVAGE EXISTING SITE FURNISHINGS, INCLUDING BENCHES, TRASH & RECYCLE RECEPTACLES, & BLEACHERS (CONTRACTOR TO RETURN TO OWNER)	1	LS		
420	COH 02221/ DWG	RELOCATE AND SALVAGE EXISTING FLAGPOLE (CONTRACTOR TO RETURN TO OWNER)	2	EA		
421	COH 02221	REMOVE AND SALVAGE EXISTING DRINKING FOUNTAINS (CONTRACTOR TO RETURN TO OWNER)	2	EA		
					SERIES 400 TOTAL	

SERIES 500: UTILITIES						
500	COH 02511	2" SCHEDULE 40 PVC WATER LINE BY OPEN CUT (ALL DEPTHS), INCLUDING BENDS, WYES, CROSSES, PLUGS AND CLAMPS, REDUCERS AND TEES	449	LF		
501	COH 02445	2" SCHEDULE 40 PVC WATER LINE BY BORE (ALL DEPTHS), INCLUDING BENDS, WYES, CROSSES, PLUGS AND CLAMPS, REDUCERS AND TEES	42	LF		
502	COH 02511	6" C900 DR-18 PVC WATER LINE BY OPEN CUT (ALL DEPTHS), INCLUDING BENDS, WYES, CROSSES, PLUGS AND CLAMPS, REDUCERS AND TEES	144	LF		
503	COH 02445	6" C900 DR-18 PVC WATER LINE BY BORE (ALL DEPTHS), INCLUDING BENDS, WYES, CROSSES, PLUGS AND CLAMPS, REDUCERS AND TEES	73	LF		
504	COH 02511	1/2" SCHEDULE 40 PVC WATER LINE BY OPEN CUT (ALL DEPTHS), INCLUDING BENDS, WYES, CROSSES, PLUGS AND CLAMPS, REDUCERS AND TEES	635	LF		
505	COH 02512	INSTALL RELOCATED WATER FOUNTAIN WITH SPIGOT, INCLUDING DRAIN PIPE AND GRAVEL PIT	1	EA		
506	DWG	2" BACKFLOW PREVENTER, COMPLETE IN PLACE	1	EA		
507	COH 02525	12" X 6" TS&V	1	EA		
508	COH 02512	12" X 2" SERVICE SADDLE	1	EA		
509	COH 02520	FIRE HYDRANT ASSEMBLY	1	EA		
510	COH 02531	6" SDR 26 PVC SANITARY SEWER BY OPEN CUT, ALL DEPTHS, COMPLETE IN PLACE	721	LF		
511	COH 02082	48" SANITARY SEWER MANHOLE, ALL DEPTHS, COMPLETE IN PLACE	3	EA		
512	COH 02534	6" SANITARY SEWER CLEANOUT (ALL DEPTHS), COMPLETE IN PLACE	2	EA		
513	COH 02505	12" HDPE STORM SEWER (ALL DEPTHS), COMPLETE IN PLACE	99	LF		
514	COH 02506	18" HDPE STORM SEWER (ALL DEPTHS), COMPLETE IN PLACE	221	LF		
515	COH 02508	12" SAFETY END TREATMENT (ALL DEPTHS), COMPLETE IN PLACE	2	EA		
516	COH 02509	18" STORM JUNCTION BOX (ALL DEPTHS), COMPLETE IN PLACE	1	EA		
517	COH 02510	48" STORM MANHOLE (ALL DEPTHS), COMPLETE IN PLACE	2	EA		
518	COH 02511	TYPE "A" INLET, COMPLETE IN PLACE	4	EA		
519	COH 02512	TRENCH SAFETY SYSTEM	2384	LF		
520	COH 02534	CONNECT TO EXISTING SANITARY SEWER MANHOLE (ALL DELPTHS, COMPLETE IN PLACE)	1	EA		
521	COH 02513	CONTRACTOR TO ADJUST SANITARY SEWER MANHOLE RIM TO PROPOSED GRADE	3	EA		
					SERIES 500 TOTAL	

SERIES 600: ELECTRICAL						
600	262416	FURNISH AND INSTALL MAIN DISTRIBUTION PANEL 'MDP'	1	EA		
601	262200	FURNISH AND INSTALL TRANSFORMER 'TLDP'	1	LS		
602	262416	FURNISH AND INSTALL PANEL 'LDP'	1	EA		

603	262200 & 262416	FURNISH AND INSTALL MINI POWER ZONE	1	EA		
604	262416	FURNISH AND INSTALL DISTRIBUTION PANEL 'FDP'	1	EA		
605	262816	FURNISH AND INSTALL 200A NONFUSED DISCONNECT	1	EA		
606	N/A	FURNISH AND INSTALL MAIN CONCRETE SLAB & RACK FOR ELEC. EQUIPMENT	1	LS		
607	N/A	FURNISH AND INSTALL CONCRETE SLAB & RACK FOR MINI POWER ZONE	1	LS		
608	260923	FURNISH AND INSTALL TIME CONTROLLER AND PHOTOCELL FOR TRAIL LIGHTING CONTROLS	1	EA		
609	260923	FURNISH AND INSTALL LIGHTING CONTACTOR FOR TRAIL LIGHTING	1	EA		
610	260533	FURNISH AND INSTALL ELECTRICAL GROUND BOXES	33	EA		
611	260519	FURNISH AND INSTALL 350 KCMIL COPPER ELECTRICAL WIRE	90	LF		
612	260519	FURNISH AND INSTALL 250 KCMIL COPPER ELECTRICAL WIRE	7,000	LF		
613	260519	FURNISH AND INSTALL 4/0 AWG COPPER ELECTRICAL WIRE	7,870	LF		
614	260519	FURNISH AND INSTALL 2/0 AWG COPPER ELECTRICAL WIRE	60	LF		
615	260519	FURNISH AND INSTALL 3 AWG COPPER ELECTRICAL WIRE	1,720	LF		
616	260519	FURNISH AND INSTALL 4 AWG COPPER ELECTRICAL WIRE	30	LF		
617	260519	FURNISH AND INSTALL 6 AWG COPPER ELECTRICAL WIRE	2,080	LF		
618	260519	FURNISH AND INSTALL 8 AWG COPPER ELECTRICAL WIRE	23,340	LF		
619	260519	FURNISH AND INSTALL 10 AWG COPPER ELECTRICAL WIRE	9,920	LF		
620	260519	FURNISH AND INSTALL 12 AWG COPPER ELECTRICAL WIRE	16,020	LF		
621	260533	FURNISH AND INSTALL 1" CONDUIT	13,200	LF		
622	260533	FURNISH AND INSTALL 1-1/2" CONDUIT	30	LF		
623	260533	FURNISH AND INSTALL 2" CONDUIT	330	LF		
624	260533	FURNISH AND INSTALL 2-1/2" CONDUIT	30	LF		
625	260533	FURNISH AND INSTALL 3" CONDUIT	3,440	LF		
626	N/A	CONTRACTOR COORDINATION WITH ENTERGY FOR PARKING LOT LIGHTING INSTALLATION, INCLUDED BUT NOT LIMITED TO INSTALLATION OF THE LIGHT POLES AND ACCESS TO THE SITE	1	LS		
627	N/A	CONTRACTOR COORDINATION WITH TECHLINE FOR SPORTS FIELD LIGHTING INSTALLATION, INCLUDING BUT NOT LIMITED TO INSTALLATION OF LIGHT POLE FOUNDATIONS,LIGHT POLES AND FIXTURES.	1	LS		
628	265613 & 265619	TRAIL LIGHTING ASSEMBLIES, INCLUDING LSI INDUSTRIES INC. 5'X5' SQUARE STRAIGHT 11 GAUGE STEEL POLE AT 25' IN HEIGHT WITH BOLT-ON MOUNT AND BEACON RAR2-480L-240-5K7-2-UNV-ASQ-BLT FIXTURES	16	EA		
629	265613	TRAIL LIGHTING LIGHT POLE CONCRETE FOUNDATION	16	EA		
630	260526	FURNISH AND INSTALL ELECTRICAL GROUNDING SYSTEM	1	LS		
631	260519, 260533, & 262726	FURNISH AND INSTALL RECEPTACLES, CABLING, AND CONDUIT FOR SHADE CANOPIES	1	LS		
632	N/A	MISC. ELECTRICAL (RECONNECTION OF EXISTING FIELD LIGHTING TO NEW ELECTRICAL EQUIPMENT)	1	LS		
					SERIES 600 TOTAL	

SERIES 700: PAVING						
700	COH 02775	4" REINFORCED CONCRETE SIDEWALK WITH 2" SAND BASE, COMPLETE IN PLACE	4,894	SY		
701	DWG	4'X8' STEEL PLATE, ASTM A-36 GRADE STEEL WITH ASSOCIATED HARDWARE FOR SIDEWALK CUT, COMPLETE IN PLACE	660	LB		
702	COH 02751	5" REINFORCED CONCRETE PAVEMENT, COMPLETE IN PLACE	4,992.0	SY		
703	COH 02751	6" REINFORCED CONCRETE PAVEMENT, COMPLETE IN PLACE	3,436.0	SY		
704	COH 02751	7" REINFORCED CONCRETE PAVEMENT, COMPLETE IN PLACE	62	SY		
705	COH 02201	6" SUBGRADE PREPARATION. INCLUDES PROOF-ROLLING, MIXING STABILIZER OR SCARIFYING AND COMPACTING TO 95% OF ASTM D 698	18941	SY		
706	COH 02202	HYDRATED LIME FOR SUBGRADE STABILIZATION (15 LB/SY @ 3% BY DRY UNIT WEIGHT), REFERENCE GEOTECHNICAL STUDY BY TERRACON, PROJECT NO. 97235079	142.1	TON		
707	COH 02203	FLY-ASH FOR SUBGRADE STABILIZATION (35 LB/SY @ 7% BY DRY UNIT WEIGHT), REFERENCE GEOTECHNICAL STUDY BY TERRACON, PROJECT NO. 97235079	331.5	TON		
708	DWG	6" REINFORCED SLOTTED CONCRETE CURB, COMPLETE IN PLACE	20.0	LF		
709	COH 02771	6" REINFORCED CONCRETE CURB, COMPLETE IN PLACE	3,487.0	LF		
710	COH 02767	4" SOLID WHITE TYPE II PAVEMENT MARKING, INCLUDING SURFACE PREPARATION, COMPLETE IN PLACE	5,576.0	LF		
711	COH 02775	ADA CURB RAMP, COMPLETE IN PLACE	14	EA		

712	COH 02771/ DWG	CONCRETE WHEELSTOPS, COMPLETE IN PLACE	8	EA		
713	COH 02767	THERMOPLASTIC HANDICAP SYMBOL PREFABRICATED PAVEMENT MARKING, INCLUDING SURFACE PREPARATION, COMPLETE IN PLACE	8	EA		
714	COH 02767	6" RED PAINTED FIRE LANE STRIPING PER MONTGOMERY COUNTY FIRE CODE, COMPLETE IN PLACE	3351	LF		
					SERIES 700 TOTAL	

SERIES 800: PROPOSED FIELD #1 (210 x 280')						
800		CYNODON DACTYLON 'LATITUDE 36' / BERMUDA GRASS BALLFIELD SOD	58900	SF		
801		TURF AREA SOIL, 2" DEPTH, AMEND NATIVE TOPSOIL	364	CY		
802		16' NETTING & POLES	230	LF		
803		SPRAY IRRIGATION (FULL COVERAGE)	58900	SF		
					SERIES 800 TOTAL	

SERIES 900: PROPOSED FIELD #2 (228 x 390')						
900		ARTIFICIAL TURF (INCLUDES 2" LEVELING AGGREGATE, 4" AGGREGATE BASE, IMPERMEABLE LINER SAFETY PADDING, TUFFTED STRIPING & DRAINAGE), COMPLETE IN PLACE	88,920	SF		
901		6" SUBGRADE PREPARATION. INCLUDES PROOF-ROLLING, MIXING STABILIZER OR SCARIFYING AND COMPACTING TO 95% OF ASTM D 698	10018	SY		
902		HYDRATED LIME FOR SUBGRADE STABILIZATION (15 LB/SY @ 3% BY DRY UNIT WEIGHT), REFERENCE GEOTECHNICAL STUDY BY TERRACON, PROJECT NO. 97235079	75.14	TON		
903		FLY-ASH FOR SUBGRADE STABILIZATION (35 LB/SY @ 7% BY DRY UNIT WEIGHT), REFERENCE GEOTECHNICAL STUDY BY TERRACON, PROJECT NO. 97235079	175.32	TON		
904	COH 02507	12" HDPE PERFORATED STORM SEWER (ALL DEPTHS), COMPLETE IN PLACE	958	LF		
905	COH 02505	12" HDPE STORM SEWER (ALL DEPTHS), COMPLETE IN PLACE	50	LF		
906		ARTIFICIAL TURF MANHOLE ACCESS DETAIL	1.00	EA		
907		6" x 12" REINFORCED CONCRETE MOWSTRIP, COMPLETE IN PLACE	1,015	LF		
908		16' CHAINLINK FENCE	395	LF		
					SERIES 900 TOTAL	

SERIES 1000: PRACTICE FIELD (215' x 315') IMPROVEMENTS						
1000		CYNODON DACTYLON 'LATITUDE 36' / BERMUDA GRASS BALLFIELD SOD	67795	SF		
1001		TURF AREA SOIL, 2" DEPTH, AMEND NATIVE TOPSOIL	420	CY		
1002	DWG	ARTIFICIAL TURF AND SAFTEY PADDING TO COVER EXISTING SANITARY SEWER MANHOLE COVER	1	EA		
1003		SPRAY IRRIGATION (FULL COVERAGE)	67795	SF		
					SERIES 1000 TOTAL	

SERIES 1100: SITE HARDSCAPE & FURNISHINGS						
1100		CONTRACTOR COORDINATION FOR PREFABRICATED RESTROOM BUILDING INSTALLATION, INCLUDING BUT NOT LIMITED TO PERMITTING OF THE BUILDING PLANS, INSTALLATION OF THE BUILDING, ACCESS TO THE SITE, MATTING REQUIREMENTS, AND UTILITY CONNECTIONS, COMPLETE IN PLACE	1	LS		
1101		GUTTER ADD-ON FOR RESTROOM BUILDING	115	LF		
					SERIES 1100 TOTAL	

SERIES 1200: FUTURE PLAYGROUND AREA						
1200		BERMUDA SOD (CYNODON DACTYLON)	675	SF		
1201		BERMUDA HYDROMULCH (CYNODON DACTYLON)	12865	SF		
1202		TURF AREA SOIL, 2" DEPTH, AMEND NATIVE TOPSOIL	84	CY		
1203		SPRAY IRRIGATION (FULL COVERAGE)	13540	SF		
					SERIES 1200 TOTAL	

SERIES 1300: LANDSCAPE AND IRRIGATION						
1300		WATER OAK (QUERCUS NIGRA) - 65 GAL.	6	EA		
1301		SOUTHERN LIVE OAK (QUERCUS VIRGINIANA) - 65 GAL.	11	EA		
1302		JAPANESE PRIVET (LIGUSTRUM JAPONICUM) - 3 GAL.	423	EA		

1303		BERMUDA SOD (CYNODON DACTYLON)	54,526	SF		
1304		BERMUDA HYDROMULCH (CYNODON DACTYLON)	238,620	SF		
1305		PLANTING SOIL BED MIX, 6" DEPTH, AMEND NATIVE TOPSOIL	135	CY		
1306		TURF AREA SOIL, 2" DEPTH, AMEND NATIVE TOPSOIL	1,809	CY		
1307		HARDWOOD MULCH, 2" DEPTH AT PLANTING BEDS	70	CY		
1308		IRRIGATION AREA, SPRAY SYSTEM	6,190	SF		
1309		IRRIGATION AREA, DRIP SYSTEM	7,295	SF		
					SERIES 1300 TOTAL	

SERIES 1400: TxDOT DRIVEWAY						
1400		INLET PROTECTION BARRIER (STAGE 1, WITH FIBER ROLLS; 60% OF UNIT COST FOR FURNISH AND INSTALLATION, AND 40% OF UNIT COST FOR REMOVAL)	1	EA		
1401		REINFORCED FILTER FABRIC FENCE (60% OF UNIT COST FOR FURNISH AND INSTALLATION AND 40% OF UNIT COST FOR REMOVAL)	340	LF		
1402		TREE PROTECTION, COMPLETE IN PLACE	500	LF		
1403		SITE PREPARATION INCLUDING BUT NOT LIMITED TO CLEARING OF TURF, LANDSCAPING, AND OTHER IMPROVEMENTS WITHIN THE WORK AREA	0.2	AC		
1404		CLEARING AND GRUBBING OF EXISTING TREES, ALL SIZES, INCLUDING CHIPPING AND OFF-SITE DISPOSAL AS SHOWN ON APPORVED PLANS AND COORDINATED WITH OWNER	0.6	AC		
1405		REMOVE EXISTING SIGNAGE, INCLUDING CONCRETE FOUNDATION. (CONTRACTOR TO COORDINATE REMOVAL AND REPLACEMENT OF SIGNAGE WITH TXDOT)	1	EA		
1406		TYPE 'AZ' INLET	1	EA		
1407		BERMUDA SOD (CYNODON DACTYLON)	875	SF		
1408		4" REINFORCED CONCRETE SIDEWALK WITH 2" SAND BASE, COMPLETE IN PLACE	32	SY		
1409		6" REINFORCED CONCRETE PAVEMENT, COMPLETE IN PLACE	1,200.0	SY		
1410		6" SUBGRADE PREPARATION. INCLUDES PROOF-ROLLING, MIXING STABILIZER OR SCARIFYING AND COMPACTING TO 95% OF ASTM D 698	1320	SY		
1411		HYDRATED LIME FOR SUBGRADE STABILIZATION (15 LB/SY @ 3% BY DRY UNIT WEIGHT), RFERENCE GEOTECHNICAL STUDY BY TERRACON, PROJECT NO. 97235079	9.90	TON		
1412		FLY-ASH FOR SUBGRADE STABILIZATION (35 LB/SY @ 7% BY DRY UNIT WEIGHT), RFERENCE GEOTECHNICAL STUDY BY TERRACON, PROJECT NO. 97235079	23.10	TON		
1413		6" REINFORCED CONCRETE CURB, COMPLETE IN PLACE	633.0	LF		
1414		STRIPING AND SIGNAGE	1	LS		
1415		CONCRETE, REINFORCED RETAINING WALL WITH FOOTING, COMPLETE IN PLACE	1	LS		
1416		TXDOT TRAFFIC CONTROL PERMIT	1	LS		
					SERIES 1400 TOTAL	

BID SUMMARY
SERIES 100 - GENERAL
SERIES 200 - STORM WATER POLLUTION PREVENTION PLAN
SERIES 300 - SITE PREPARATION AND EARTHWORK
SERIES 400 - DEMOLITION
SERIES 500 - UTILITIES
SERIES 600 - ELECTRICAL
SERIES 700 - PAVING
SERIES 800 - PROPOSED FIELD #1 (210 x 280')
SERIES 900 - PROPOSED FIELD #2 (228 x 390')
SERIES 1000 - PRACTICE FIELD (215' x 315') IMPROVEMENTS
SERIES 1100 - SITE HARDSCAPE & FURNISHINGS
SERIES 1200 - PLAYGROUND
SERIES 1300 - LANDSCAPE AND IRRIGATION
SERIES 1400 - TxDOT DRIVEWAY

Base Bid Total _____

CALENDAR DAYS NEEDED FOR SUBSTANTIAL COMPLETION _____

CALENDAR DAYS NEEDED FOR FINAL COMPLETION

SERIES 1600: ADD ALTERNATE NO. 1 - PROPOSED GRASS FIELD #3 (225 x 360') IMPROVEMENTS						
1600		CYNODON DACTYLON 'LATITUDE 36' / BERMUDA GRASS BALLFIELD SOD	84,590	SF		
1601		TURF AREA SOIL, 2" DEPTH, AMEND NATIVE TOPSOIL	523	CY		
1602		SPRAY IRRIGATION (FULL COVERAGE)	84,590	SF		
1603		16' CHAINLINK FENCE	244	LF		
1604		4' CHAINLINK FENCE	1,004	LF		
1605		4' CHAINLINK SINGLE GATE	1	EA		
1606		4' CHAINLINK DOUBLE GATE	3	EA		
1607		4" REINFORCED CONCRETE SIDEWALK WITH 2" SAND BASE, COMPLETE IN PLACE	957.2	SY		
1608	DWG	ARTIFICIAL TURF AND SAFTEY PADDING TO COVER EXISTING SANITARY SEWER MANHOLE COVER	1	EA		
1609	262200 & 262416	FURNISH AND INSTALL MINI POWER ZONE	1	EA		
1610	N/A	FURNISH AND INSTALL SLAB AND RACK FOR MINI POWER ZONE	1	LS		
1611	260533	FURNISH AND INSTALL GROUND BOXES (FIELD 3)	7	EA		
1612	260519	FURNISH AND INSTALL 12 AWG COPPER ELECTRICAL WIRE	3810	LF		
1613	260519	FURNISH AND INSTALL 6 AWG COPPER ELECTRICAL WIRE	4600	LF		
1614	260519	FURNISH AND INSTALL 8 AWG COPPER ELECTRICAL WIRE	10160	LF		
1615	260533	FURNISH AND INSTALL 1" CONDUIT	3660	LF		
1616	260533	FURNISH AND INSTALL 1-1/4" CONDUIT	1150	LF		
1617	260519, 260533, & 262726	FURNISH AND INSTALL RECEPTACLES, CABLING, AND CONDUIT FOR SHADE CANOPIES	1	LS		
1618	265613 & 265619	TRAIL LIGHTING ASSEMBLIES (FIELD 3), INCLUDING LSI INDUSTRIES INC. 5'X5' SQUARE STRAIGHT 11 GAUGE STEEL POLE AT 25' IN HEIGHT WITH BOLT-ON	6	EA		
1619	265613	FURNISH AND INSTALL TRAIL LIGHTING LIGHT POLE CONCRETE FOUNDATION	6	EA		
					SERIES 1600 TOTAL	

SERIES 1700: ADD ALTERNATE NO. 2 - PROPOSED TURF FIELD #3 (225 x 360') IMPROVEMENTS						
1700	ALL-WEATHER TURF FIELD	ARTIFICIAL TURF (INCLUDES 2" LEVELING AGGREGATE, 4" AGGREGATE BASE, IMPERMEABLE LINER SAFETY PADDING, TUFFTED STRIPING & DRAINAGE), COMPLETE IN PLACE	84,590	SF		
1701		6" SUBGRADE PREPARATION. INCLUDES PROOF-ROLLING, MIXING STABILIZER OR SCARIFYING AND COMPACTING TO 95% OF ASTM D 698	9400	SY		
1702		HYDRATED LIME FOR SUBGRADE STABILIZATION (15 LB/SY @ 3% BY DRY UNIT WEIGHT), RFERENCE GEOTECHNICAL STUDY BY TERRACON, PROJECT NO. 97235079	70.50	TON		
1703		FLY-ASH FOR SUBGRADE STABILIZATION (35 LB/SY @ 7% BY DRY UNIT WEIGHT), RFERENCE GEOTECHNICAL STUDY BY TERRACON, PROJECT NO. 97235079	164.50	TON		
1704		6" x 12" REINFORCED CONCRETE MOWSTRIP, COMPLETE IN PLACE	1,140	LF		
1705		16' CHAINLINK FENCE	244	LF		
1706		4" REINFORCED CONCRETE SIDEWALK WITH 2" SAND BASE, COMPLETE IN PLACE	957.2	SY		
1707	COH 02507	12" HDPE PERFORATED STORM SEWER (ALL DEPTHS), COMPLETE IN PLACE	895	LF		
1708	COH 02505	12" HDPE STORM SEWER (ALL DEPTHS), COMPLETE IN PLACE	67	LF		
1709	DWG	ARTIFICAL TURF AND SAFETY PADDING TO COVER EXISTING SANITARY SEWER MANHOLE COVER FOR ACCESSIBILITY	1	EA		
1710	262200 & 262416	FURNISH AND INSTALL MINI POWER ZONE	1	EA		
1711	N/A	FURNISH AND INSTALL SLAB AND RACK FOR MINI POWER ZONE	1	LS		
1712	260533	FURNISH AND INSTALL GROUND BOXES (FIELD 3)	7	EA		
1713	260519	FURNISH AND INSTALL 12 AWG COPPER ELECTRICAL WIRE	3810	LF		
1714	260519	FURNISH AND INSTALL 6 AWG COPPER ELECTRICAL WIRE	4600	LF		
1715	260519	FURNISH AND INSTALL 8 AWG COPPER ELECTRICAL WIRE	10160	LF		
1716	260533	FURNISH AND INSTALL 1" CONDUIT	3660	LF		
1717	260533	FURNISH AND INSTALL 1-1/4" CONDUIT	1150	LF		
1718	260519, 260533, & 262726	FURNISH AND INSTALL RECEPTACLES, CABLING, AND CONDUIT FOR SHADE CANOPIES	1	LS		

1719	265613 & 265619	TRAIL LIGHTING ASSEMBLIES (FIELD 3), INCLUDING LSI INDUSTRIES INC. 5'X5' SQUARE STRAIGHT 11 GAUGE STEEL POLE AT 25' IN HEIGHT WITH BOLT-ON MOUNT AND BEACON RAR2-480L-240-5K7-2-UNV-ASQ-BLT FIXTURES	6	EA		
1720	265613	FURNISH AND INSTALL TRAIL LIGHTING LIGHT POLE CONCRETE FOUNDATION	6	EA		
DEDUCTIONS						
1721		FILL IMPORT USING LOCAL MATERIAL, INCLUDING HAULING AND COMPACTION	5420	CY		
					SERIES 1700 TOTAL	

SERIES 1800: ADD ALTERNATE NO. 3 - PLAYGROUND						
1800		PLAY EQUIP TBD, FURNISH AND INSTALL	1	LS		
1801		ENGINEERED WOOD FIBER SAFETY SURFACING (12" MINIMUM), WITH COMPACTED SUBGRADE & DRAINAGE, COMPLETE IN PLACE	355	CY		
1802		4' ORNAMENTAL METAL FENCE	440	LF		
1803	COH 02507	6" HDPE PERFORATED STORM SEWER (ALL DEPTHS), COMPLETE IN PLACE	223	LF		
1804		12" X 12" REINFORCED CONCRETE MOW BAND, COMPLETE IN PLACE	440	LF		
DEDUCTIONS						
1805		BERMUDA HYDROMULCH (CYNODON DACTYLON)	12865	SF		
1806		BERMUDA SOD (CYNODON DACTYLON)	675	SF		
1807		TURF AREA SOIL, 2" DEPTH, AMEND NATIVE TOPSOIL	84	CY		
1808		SPRAY IRRIGATION (FULL COVERAGE)	13540	SF		
1809		FILL IMPORT USING LOCAL MATERIAL, INCLUDING HAULING AND COMPACTION	597	CY		
					SERIES 1800 TOTAL	

SERIES 1900: ADD ALTERNATE NO. 6 - PROPOSED FIELD #1 (210 x 280')						
2000		4' CHAINLINK FENCE	782	LF		
2001		4' CHAINLINK DOUBLE GATE	1	EA		
2002		4' CHAINLINK SINGLE GATE	1	EA		
					SERIES 1900 TOTAL	

SERIES 2000: ADD ALTERNATE NO. 7 - PRACTICE FIELD (215' x 315') IMPROVEMENTS						
2100		4' CHAINLINK FENCE	808	LF		
2101		4' CHAINLINK DOUBLE GATE	3	EA		
2102		16' CHAINLINK FENCE	292	LF		
					SERIES 2000 TOTAL	

BID SUMMARY
SERIES 100 - GENERAL
SERIES 1600 - ADD ALTERNATE NO. 1 - PROPOSED GRASS FIELD #3 (225 x 360') IMPROVEMENTS
SERIES 1700: ADD ALTERNATE NO. 2 - PROPOSED TURF FIELD #3 (225 x 360') IMPROVEMENTS
SERIES 1800 - ADD ALTERNATE NO. 3 - PLAYGROUND
SERIES 1900 - ADD ALTERNATE NO. 6 - PROPOSED FIELD #1 (210 x 280')
SERIES 2000- ADD ALTERNATE NO. 7 - PRACTICE FIELD (215' x 315') IMPROVEMENTS

Please acknowledge by signing and dating that you have seen the addenda posted with the bid on http://www.thewoodlandstownship-tx.gov/bids and via CivCast at https://www.civcastusa.com/.

Addenda #1 _____ Date Received _____/_____/ 2025
MM DD

Addenda #2 _____ Date Received_____/_____/ 2025
MM DD

Addenda #3 _____ Date Received _____/_____/ 2025
MM DD

Exhibit C – Conflict of Interest Questionnaire

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.** (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

_____

Name of Officer

4 **Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

5 **Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

6 ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

_____ _____

Signature of vendor doing business with the governmental entity Date

Form provided by Texas Ethics Commission www.ethics.state.tx.us Revised 11/30/2015

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

(A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;

(B) a transaction conducted at a price and subject to terms available to the public; or

(C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

***

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds $2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than $100 in the 12-month period preceding the date the officer becomes aware that:

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

Exhibit D – References

Please provide information from three (3) references of similar work scope, representing experience within the past five (5) years:

1. Agency/Company:

   Contact Name:

   Contact Phone:

   Products delivered:

2. Agency/Company:

   Contact Name:

   Contact Phone:

   Products delivered:

3. Agency/Company:

   Contact Name:

   Contact Phone:

   Products delivered:

Exhibit E – Statement of Qualifications

DATE SUBMITTED _____

All questions must be answered, and the data given must be clear and comprehensive. ***This statement must be notarized.*** If necessary, questions may be answered on separate attached sheets. The Firm may submit any additional information that is pertinent.

1. Name of Firm - _____
2. Permanent main office address - _____
3. If a corporation, where incorporated - _____
4. How many years have you been engaged in the construction business? Under what firm or trade names and how long under each?

   _____

   _____

5. Contracts on hand (show gross dollar amount of each contract and the anticipated date of completion):

   _____

   _____

   _____

6. Are you licensed as Contractor in the State of Texas?
   Yes_____ No_____ If "Yes", please provide Contractor numbers?

   _____
7. General character of work performed by your firm - _____
8. Has your firm ever failed to complete any work awarded to you?
   Yes____ No____ If "Yes", where and why?

   _____

   _____

9. Has your firm ever defaulted on a contract?
   Yes____ No____ If "Yes", where and why?

   _____

   _____

10. List 5 projects of similar size and scope:

Firm Name	Contract Value	Contact Information
1.		
2.		
3.		
4.		
5.		

11. Are any lawsuits pending against you or your firm at this time?
    Yes____ No____ If "Yes", PROVIDE DETAILS.

    _____

    _____

    _____

12. Have any charges been filed against you or your firm or the bidding entity with the Texas Office of Contract Compliance, the Equal Opportunity Commission, the State of Texas Civil Rights Commission, or any other similarly constituted entity charges by any state or local government with the enforcement of anti-discrimination legislation or regulations?
    Yes____ No____ If "Yes", PROVIDE DETAILS.

    _____

    _____

    _____

13. The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the Associations in verification of the recitals compromising this Statement of Bidder's Qualifications.

DATED AT _____on this _____ day of _____ 20___.

(SEAL)

_____

(Name of Bidder)

By _____

(Signature)

Title _____

Exhibit F – Subcontractors

LIST OF SUBCONTRACTORS (Required with Bid Submittal)

Please list all subcontractors to be used and work that they will perform as part of this bid. Bidder certifies that all Subcontractors listed are eligible and legally able to perform the Work.

Subcontractor's Name	Subcontractor's Type of Work

If no Subcontractors are to be used, please make this page with the word NO SUBCONTRACTORS WILL BE USED

The Contractor whose Bid is accepted shall not substitute for a Subcontractor who is named herein, without written approval from The Woodlands Township.

Exhibit G – Insurance Requirements

Contractor agrees to procure and maintain at all times, at Contractor's sole cost and expense, during the performance of the Work and for so long as this Contract remains in effect, policies of insurance with carriers reasonably acceptable to the Township in the minimum amounts outlined below:

a. Worker's compensation and employer's liability coverage complying with the applicable laws of the State of Texas, covering all employees, agents and representatives of Contractor and all Subcontractors engaged in any manner in performance of the Work. Employer's liability coverage shall have a minimum limit of $1,000,000 for liability arising out of any accident related to the Work.

b. Comprehensive general liability insurance, including Contractor's protective liability, in Contractor's name, with combined bodily injury and property damage of not less than $1,000,000 per occurrence, and will include, without limitation, the following coverages:

(1) XCU Coverage,

(2) Contractual Liability Coverage,

(3) Completed Operations and/or Products Liability Coverage, commencing with issuance of Final Certificate for Payment, and extending for at least two (2) years from that date, and

(4) (X), (C) and (U) exclusions shall be removed.

c. Comprehensive Automobile Liability Insurance, with combined single limit bodily injury and property damage of not less than $1,000,000 per occurrence. Such coverage shall include owned, hired and non-owned vehicles of Contractor or Contractor's employees, agents, representatives or Subcontractors.

d. Cyber Risk Insurance (including professional oversight liability) covering acts, errors, and omissions arising out of operations or services with minimum limits of $1,000,000 per occurrence, $2,000,000 annual aggregate.

e. All insurance policies required by this Paragraph 7 shall contain a clause waiving any right of subrogation against The Woodlands Township. Insurance policies under (b), and (c), shall include The Woodlands Township as an additional insured.

f. With reference to the foregoing insurance requirement, Contractor shall specifically endorse applicable insurance policies as follows:

(1). The Woodlands Township shall be named as an additional insured with respect to General Liability and Automobile Liability.

(2). Additional insured for The Woodlands Township should be on a primary and non-contributory basis.

(3). All liability policies shall contain no cross-liability exclusions or insured versus insured restrictions.

(4). A waiver of subrogation in favor of The Woodlands Township shall be contained in the Workers Compensation and all liability policies.

(5). All insurance policies shall be endorsed to require the insurer to immediately notify The Woodlands Township of any material change in the insurance coverage.

(6). All insurance policies shall be endorsed to the effect that The Woodlands Township will receive at least thirty- (30) days' notice prior to cancellation or non-renewal of the insurance.

(7). All insurance policies, which name The Woodlands Township as an additional insured, must be endorsed to read as primary coverage regardless of the application of other insurance.

(8). Required limits may be satisfied by any combination of primary and umbrella liability insurances.

(9). Contractor may maintain reasonable and customary deductibles, subject to approval by The Woodlands Township.

(10). Insurance must be purchased from insurers that are financially acceptable to The Woodlands Township.

(11). Transmittal of proof of insurance should reference the Woodlands Township contract number (as listed in the footer below).

All insurance must be written on forms filed with and approved by the Texas Department of Insurance. Certificates of Insurance shall be prepared and executed by the insurance company or its authorized agent and shall contain provisions representing and warranting the following:

a. Sets forth all endorsements and insurance coverages according to requirements and instructions contained herein.

b. Shall specifically set forth the notice-of-cancellation or termination provisions to The Woodlands Township.

c. All contractors and Subcontractors must be meeting minimum OSHA safety requirements as applicable to their operations.

Contractor shall, before the Contract is signed, and at any time following execution thereof at the request of the Township, furnish the Township with a certificate and proof of such additional endorsements or other documentary evidence that the aforementioned insurance policies have been procured with such additional endorsements, that premiums have been paid and that such policies remain in place. Such certificate or other evidence shall bear an agreement that the Township will be given thirty (30) days prior written notice by the Insurance Company furnishing the certificate before the insurance is cancelled or changed in any manner or for any reason during the period of coverage as stated on the certificate.

The Township reserves the right to change the type of insurance required, limits required, and/or endorsements required as the Township sees fit.

Exhibit H – Bid Bond (Sample)

BID BOND – SAMPLE - (Bid Bond Required with Bid Submittal)

KNOW ALL MEN BY THESE PRESENTS: That we, the undersigned, _____ as Principal and _____, a _____duly organized under the laws of the State of _____ as Surety, are hereby held and firmly bound unto The Woodlands Township as Oblige in 2% of Principal's Bid Amount for the payment of which sum will and truly to be made, the Principal and Surety bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally firmly by these presents.

WHEREAS, the above-named Principal submitted a bid for _____.

NOW, THEREFORE, (1) if the Oblige shall accept the Bid of the Principal and the Principal and Oblige shall execute The Township-Contractor Agreement which is part of these Contract Documents and the Principal shall provide all Bonds, as required by the Contract Documents, and the Principal shall, in all other respects, perform any obligations due the Oblige as a result of the submission of its Bid, or (2) the Oblige shall reject the Principal's Bid, or fail to execute The Township-Contractor Agreement within 7 days of receipt from the CONTRACTOR, then this obligation shall be null and void, but otherwise it shall remain in full force and effect.

ATTEST:

_____

PRINCIPAL

_____

By: _____

(Principal) Secretary

(SEAL)

_____

(Address)

_____

_____

(Witness as to Principal)

_____

(Address)

Exhibit I – Performance/Payment Bond (Sample)

_____, as principal, hereinafter call the CONTRACTOR, and _____, as surety, with general offices in _____, a corporation organized under the laws of the State of _____, and authorized to transact business in the State of Texas, are hereby bound unto The Woodlands Township, as oblige, in the sum of 100% of the value of the Contract amount in United States currency, for the payment of which sum the CONTRACTOR and surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally. **WHEREAS**, the CONTRACTOR has entered into a written contract with the Township dated _____, 2025, Alden Bridge Sports Park Phase 1 in accordance with plans and specifications referenced in the Contract documents.

NOW THEREFORE, the conditions of this performance bond are such that, if the CONTRACTOR shall satisfactory perform the Contract for thirty-six (36) months, then this bond shall be null and void; otherwise, the surety shall pay the full amount of this performance bond.

In addition, if the CONTRACTOR or his subcontractor shall fail to duly pay for any labor, materials, team hire, sustenance, provisions, provender, or other supplies used or consumed by such CONTRACTOR or his subcontractor is performance of the Contract or shall fail to duly pay any person who supplies rental machinery, tools, or equipment in the prosecution of the work, then the surety shall pay the same in an amount not exceeding the sum specified in the bond together with interest at a rate of eight percent per annum.

THE UNDERSIGNED SURETY for value received hereby agrees that no extension of time, change in, addition to, or other modification of the terms of the Contract to be performed thereunder or of the specifications of the contract documents shall in any way affect its obligations on this bond and the surety does hereby waive notice of any such extension of time, change, addition, or modifications.

EXECUTED on this _____ day of _____, 2022

BY: _____
(Contractor)

ATTEST:

BY: _____ By: _____
(President) (Surety Company)

By: _____ By: _____
(Secretary) (Attorney-in-Fact)

Exhibit J -Bid Submission Checklist

Only items marked with YES are applicable to this bid
If additional information is needed, please contact the project coordinator identified in this document
Vendor must initial each required task as it is completed.
Vendor must include this form as the cover page to the bid submittal.

Vendor Name:					
Individual submitting:					
Contract Number					
Required	Item	Bidder has included in Submitted Packet (Initial)	Required	Item	Bidder has included in Submitted Packet (Initial)
YES	General Specifications and Acknowledgement		**YES**	References	
YES	Bid Tabulation Form		**YES**	**Notarized** Statement of Bidders Qualifications	
YES	Bid Certification		**YES**	Bid Bond-2% of value of bid	
YES	Addendum Acknowledgment		**YES**	Sub-Contractor List	
YES	State Texas Licensed Pesticide Applicator		**YES**	**Signed** Conflict of Interest Questionnaire (CIQ)	
YES	State Texas Licensed Irrigator		**YES**	Equipment List	
YES	Staffing and Operations Plan		**YES**	Supporting Documents	
After awarded the following documents must be provided- Initial if you are prepared to provide these after awarded, as required					
Required		**Acknowledged**	**Required**		**Acknowledged**
YES	**Form 1295 –** "Certificate of Interested Parties"		**YES**	**Payment Bond** This applies to bids that exceed $25,000	
YES	**Performance Bond** Requirements. This applies to bids that exceed $25,000		**YES**	**Worker's Compensation** Check if you are prepared to provide this after award, inclusive of endorsement forms, as required, if applicable	
YES	**General Liability and Auto** Check if you are prepared to provide this after award, inclusive of endorsement forms, as required, if applicable				

It is the vendors responsibility to be thoroughly familiar with all bid requirements and specifications

Staff Initial _____	Staff Initial_____
Date & Time _____	Date & Time _____

Exhibit K – Contract

CONSTRUCTION CONTRACT
(C-2025-0453)
ALDEN BRIDGE SPORTS PARK PHASE 1

This construction contract ("**Contract**") made and entered into effective as of the date fully executed by and between XXXXXXXXXXXXXX ("**Contractor**"), a Texas corporation registered to do business in Texas as a Domestic For-Profit corporation, and THE WOODLANDS TOWNSHIP (the "**Owner**"), a political subdivision of the State of Texas duly created by Chapter 289, Acts of the 73rd Legislature, Regular Session, 1993, as amended (the "**Act**"), acting herein by and through its Board of Directors and pursuant to a resolution duly adopted by said Board of Directors and pursuant to the authority contained in the Act. The Owner and Contractor may hereinafter sometimes be referred to as a "**Party**" or collectively as the "**Parties**."

1. SCOPE OF WORK

Contractor agrees to furnish and perform the work as described in Exhibit "E" ("**Work**") in strict compliance with this Contract and the exhibits described in Paragraph 65 of this Contract, which are attached hereto and incorporated herein (collectively the "**Contract Documents**"), with all applicable Federal, State, County and local regulations, codes, laws and ordinances, and in conformity with the directions of the Owner. Contractor agrees to furnish all labor, materials and other requirements as set forth herein or as required to perform and complete the Work in a workmanlike and expeditious manner, with adequate, skilled and competent workers.

2. SITE OF THE WORK

The site of the Work is Alden Bridge Sports Park Phase 1 which is located at 4751 TX-242, Conroe, TX 77384.

3. SCHEDULE OF WORK

Contractor shall start the Work not later than **XXXXXXX, 2025** following receipt of Owner's written notice to proceed. Substantial completion for Alden Bridge Sports Park Phase 1 shall be ***XXXXXXX, 2026***. Final Completion for Alden Bridge Sports Park Phase 1 is to be on or before ***XXXXXXX, 2026***. Any provisions in this Contract to the contrary notwithstanding, Owner shall not be liable to Contractor for any delays in Contactor's performance of the Work, including, but not limited to, any of Contractor's subcontractors, or for any other cause whatsoever, including, but not limited to, loss or damage incurred by Contractor in the event Contractor is unable to start or complete its Work, as herein contemplated.

4. EXTENSION OF TIME

Should the Contractor be delayed in the completion of the Work by any act or neglect of the Owner, or by changes ordered in the Work, or by strikes, lock outs, fires, and unusual delays by

common carriers, or unavoidable cause or causes beyond the Contractor's control, then a reasonable extension of time may be allowed for completing the Work, sufficient to compensate for the delay, the amount of the extension to be determined in the sole discretion of the Owner. Any and all claims for extension of time shall be made in writing to the Owner within three (3) days after the occurrence of the delay or after the cause of the delay has become apparent. Otherwise, they shall be deemed waived. In the case of a continuing cause of delay, only one claim is necessary. Delays caused by other Contractors or subcontractors, through no fault of the Owner shall not be a basis of claim by the Contractor herein.

5. SUBCONTRACTOR

The term "subcontractor," as employed herein, includes only those having a contract (which shall be in writing and otherwise in conformance with the requirements of this Contract) with the Contractor to perform any of the Work at the site, and it includes one who furnishes materials worked to a special design according to the drawings or specifications of this Work, but does not include one who merely furnishes material not so worked.

Contractor and any subcontractors must pay the local prevailing wage rates, including any overtime and for legal holidays, as required by TEX. GOVT. CODE §2258 and as determined by The Woodlands Township at http://www.thewoodlandstownship-tx.gov\bids.aspx.

6. PAYMENTS

In consideration of the prompt, complete and faithful performance of every provision of this Contract in accordance with the Contract Documents, Owner will pay to Contractor a total of WRITTEN OUT Dollars and WRITTEN OUT Cents ($_____.__) for the Work. Partial payments shall be made to Contractor according to Paragraph 44. No partial payment made for Work under the Contract shall constitute acceptance by Owner of the performance or non-performance of this Contract by Contractor, in whole or in part, and the final payment shall not constitute an acceptance of defective Work or improper materials. Any Added Work (as defined in Paragraph 50) shall be paid for under the unit prices method set out below. All amounts due under this Contract shall be billed and paid for in accordance with Owner's normal processes and procedures. For all undisputed amounts, each such invoice shall be payable within thirty (30) days after the date the invoice is received by Owner.

7. INSURANCE

Contractor agrees to procure and maintain at all times, at Contractor's sole cost and expense, during the performance of the Work and for so long as this Contract remains in effect, policies of insurance with carriers reasonably acceptable to the Township in the minimum amounts outlined below:

a. Worker's compensation and employer's liability coverage complying with the applicable laws of the State of Texas, covering all employees, agents and representatives of Contractor and all Subcontractors engaged in any manner in performance of the Work. Employer's liability coverage shall have a minimum limit of $1,000,000 for liability arising out of any accident related to the Work.

b. Comprehensive general liability insurance, including Contractor's protective liability, in Contractor's name, with combined bodily injury and property damage of not less than $1,000,000 per occurrence, and will include, without limitation, the following coverages:
   (1) XCU Coverage,
   (2) Contractual Liability Coverage,
   (3) Completed Operations and/or Products Liability Coverage, commencing with issuance of Final Certificate for Payment, and extending for at least two (2) years from that date, and
   (4) (X), (C) and (U) exclusions shall be removed.

c. Comprehensive Automobile Liability Insurance, with combined single limit bodily injury and property damage of not less than $1,000,000 per occurrence. Such coverage shall include owned, hired and non-owned vehicles of Contractor or Contractor's employees, agents, representatives or Subcontractors.

d. Cyber Risk Insurance (including professional oversight liability) covering acts, errors, and omissions arising out of operations or services with minimum limits of $1,000,000 per occurrence, $2,000,000 annual aggregate.

e. All insurance policies required by this Paragraph 7 shall contain a clause waiving any right of subrogation against The Woodlands Township. Insurance policies under (b), and (c), shall include The Woodlands Township as an additional insured.

f. With reference to the foregoing insurance requirement, Contractor shall specifically endorse applicable insurance policies as follows:
   (1). The Woodlands Township shall be named as an additional insured with respect to General Liability and Automobile Liability.
   (2). Additional insured for The Woodlands Township should be on a primary and non-contributory basis.
   (3). All liability policies shall contain no cross-liability exclusions or insured versus insured restrictions.
   (4). A waiver of subrogation in favor of The Woodlands Township shall be contained in the Workers Compensation and all liability policies.
   (5). All insurance policies shall be endorsed to require the insurer to immediately notify The Woodlands Township of any material change in the insurance coverage.
   (6). All insurance policies shall be endorsed to the effect that The Woodlands Township will receive at least thirty- (30) days' notice prior to cancellation or non-renewal of the insurance.

(7). All insurance policies, which name The Woodlands Township as an additional insured, must be endorsed to read as primary coverage regardless of the application of other insurance.
(8). Required limits may be satisfied by any combination of primary and umbrella liability insurances.
(9). Contractor may maintain reasonable and customary deductibles, subject to approval by The Woodlands Township.
(10). Insurance must be purchased from insurers that are financially acceptable to The Woodlands Township.
(11). Transmittal of proof of insurance should reference the Woodlands Township contract number (as listed in the footer below).

All insurance must be written on forms filed with and approved by the Texas Department of Insurance. Certificates of Insurance shall be prepared and executed by the insurance company or its authorized agent and shall contain provisions representing and warranting the following:

a. Sets forth all endorsements and insurance coverages according to requirements and instructions contained herein.
b. Shall specifically set forth the notice-of-cancellation or termination provisions to The Woodlands Township.
c. All contractors and Subcontractors must be meeting minimum OSHA safety requirements as applicable to their operations.

Contractor shall, before the Contract is signed, and at any time following execution thereof at the request of the Township, furnish the Township with a certificate and proof of such additional endorsements or other documentary evidence that the aforementioned insurance policies have been procured with such additional endorsements, that premiums have been paid and that such policies remain in place. Such certificate or other evidence shall bear an agreement that the Township will be given thirty (30) days prior written notice by the Insurance Company furnishing the certificate before the insurance is cancelled or changed in any manner or for any reason during the period of coverage as stated on the certificate.

The Township reserves the right to change the type of insurance required, limits required, and/or endorsements required as the Township sees fit.

8. LIENS

Contractor shall pay promptly when due and shall cause all subcontractors to promptly pay when due, for all labor, materials and other expenses incurred hereunder in connection with the Work, and hold Owner and all of the property comprising the project free from, all claims, liens (where applicable), judgments, court costs, attorney's fees and expenses from Contractor or any subcontractor, or any of their respective employees, agents, representatives, successors and

assigns. Any liens upon any or all of the property not paid or bonded by Contractor with ten (10) days after receipt of written notice thereof from Owner, may be paid or bonded by Owner, and Contractor shall pay to Owner, upon demand, or Owner may deduct from amounts owed Contractor, all costs thereby incurred, including, but not limited to, any of Owner's attorney's fees or administrative fees incurred in removing said liens.

9. DEFECTS, ERRORS AND GUARANTEES

CONTRACTOR HEREBY GUARANTEES THAT ALL WORK SHALL BE FREE FROM DEFECTS DUE TO FAULTY MATERIALS OR WORKMANSHIP FOR A PERIOD OF FIVE (5) YEARS FROM THE DATE OF FINAL ACCEPTANCE OF ALL OF THE WORK. CORRECTION OF DEFECTS, ERRORS AND GUARANTEE WORK SHALL BE PROMPTLY PERFORMED BY CONTRACTOR AT CONTRACTOR'S SOLE COST AND EXPENSE. CONTRACTOR SHALL INDEMNIFY AND HOLD OWNER HARMLESS FROM ANY AND ALL COSTS AND EXPENSES FOR ANY DEFECT OR ERROR CONTAINED IN THE WORK. SHOULD CONTRACTOR, UPON WRITTEN NOTICE FROM OWNER, REFUSE OR FAIL TO CORRECT, WITHIN THE TIME REQUIRED BY OWNER, ALL SUCH DEFECTS AND ERRORS TOGETHER WITH ANY AND ALL DAMAGE TO OTHER WORK CAUSED BY THE PERFORMANCE OF THIS CONTRACT, OWNER SHALL HAVE THE RIGHT TO REMEDY AND MAKE GOOD SUCH DEFECTS AND DAMAGE. OWNER SHALL PROVIDE NOTICE OF SUCH CHARGES, ERRORS OR DAMAGES TO CONTRACTOR IN WRITING, AND, AT OWNER'S SOLE DISCRETION, (I) CONTRACTOR SHALL PAY, WITHIN THE TIME PERIOD SPECIFIED BY OWNER, THE AMOUNT OF SUCH CHARGES SPECIFIED IN SUCH WRITTEN NOTICE, (II) OWNER SHALL DEDUCT THE AMOUNT OF SUCH CHARGES FROM ANY PAYMENT RETAINED AND WITHHELD BY OWNER, OR YET TO BE MADE BY OWNER HEREUNDER, OR (III) IF OWNER HAS ANY MONIES WHICH MAY BE PAYABLE TO CONTRACTOR PURSUANT TO THIS CONTRACT OR ANY OTHER CONTRACT, THEN OWNER SHALL HAVE THE RIGHT TO DEDUCT FROM THE MONIES OWED TO CONTRACTOR PURSUANT TO SUCH OTHER CONTRACT THE AMOUNT OF CHARGES SPECIFIED BY THE WRITTEN NOTICE TO CONTRACTOR. FINAL PAYMENT BY OWNER TO CONTRACTOR HEREUNDER SHALL IN NO EVENT AFFECT, ALTER OR DIMINISH CONTRACTOR'S WARRANTIES AND GUARANTEES PROVIDED TO OWNER HEREUNDER.

10. CLEAN UP

Contractor shall keep the premises neat and, where the Work is to be performed, free at all times from accumulation of waste materials, rubbish and debris, and at the completion of the Work shall clean the premises and improvements in a manner satisfactory to Owner and in compliance with Owner's applicable development standards, restrictions and covenants in regard to the premises. Should Contractor fail to comply with the provisions of this Paragraph within twenty-four (24) hours of receipt of written notice thereof, Owner may clean the area and/or remove said waste materials, rubbish or debris at Contractor's expense, and Contractor shall reimburse Owner, upon demand by Owner, for all costs or expenses thereby incurred.

11. MATERIALS AND WORKMANSHIP

The Contractor shall use only new materials in the permanent structures. The finished Work shall not include materials used for temporary purposes. Where materials or equipment are specified by a trade or brand name, it is not the intention of the Owner to discriminate against an equal product of another manufacturer, but rather to set a definite standard of quality or performance, and to establish an equal basis for the evaluation of bids. Items identified by a manufacturer's name and model designation or their equal shall be complete in every respect and shall be provided as specified under the Contract Documents. To qualify an item as equal to that specified under the Contract Documents, the Contractor shall submit evidence that the material is equal in quality, workmanship, appearance, finish and all other characteristics as specified by the named manufacturer. Where called for in the Contract Documents, the Contractor shall submit test data from an approved independent testing laboratory to show compliance with all characteristics specified. Contractor agrees and understands that Owner and its representatives have the right to observe and inspect the Work, any item of equipment, material, design, engineering, service, or workmanship to be provided hereunder and to observe all tests of the Work and the Project. Any such inspections are for the sole benefit of Owner and shall not relieve Contractor of the responsibility for providing quality control measures to assure that the Work complies with industry standards. No inspection by Owner or its representatives shall be construed as constituting or implying a waiver or acceptance. Upon reasonable written notice to Contractor by Owner, Contractor shall allow Owner and its representatives reasonable access to the Work. Contractor shall incorporate such rights into all purchase orders and subcontracts. To facilitate such observations and inspections, Contractor shall maintain a complete set of all drawings and construction schedule at the work site. Contractor shall comply with all inspection and testing requirements. Contractor shall be responsible for correcting any and all Work which has been found to be defective or which fails to conform to the Work contracts. Contractor shall bear all costs of correcting any rejected Work, including but not limited to, additional testing and inspections. Contractor shall begin correcting the defective or non-conforming Work within ten (10) days unless otherwise agreed upon with Owner in writing. The Owner may accept the manufacturer's certificates of compliance in lieu of the required laboratory tests at its sole discretion. The specifically designated item shall be used, unless a substitute has been approved in writing by the Owner. Owner shall have ample time to consider proposed substitutions.

12. WATER AND ELECTRICITY DURING CONSTRUCTION

The Owner may provide water and electricity in support of the Contractor at existing facilities within the site of the Work. If so provided, the Contractor shall make all connections, furnish all necessary extensions, and remove same upon completion of the Work.

13. PERMITS

Permits and licenses, inclusive of SWPPP, water taps and other service connections, necessary for the prosecution of the Work shall be secured and paid for by the Contractor.

14. WORKING DAY AND CALENDAR DAY

A “Working Day” is defined as any day not including Sundays or any legal holidays, in which weather or other conditions not under the control of the Contractor, will permit construction of the principal units of the Work for a continuous period of not less than seven (7) hours during the twelve (12) hours between 7:00 AM and 7:00 PM, or as identified in the bid document and by mutual written agreement. Work on Sundays may be permitted upon approval of the Owner. A “calendar day” is defined as any day indicated on the calendar, including Saturdays, Sundays and holidays. A Working Day that involves rain, sleet, and/or snow, shall be coordinated with the Owner’s Project Manager. In order to classify rain, sleet, and/or snow, the National Weather Service will be used to determine if certain weather or conditions exist that would not permit construction on a specific Working Day. The Project Manager will determine if a Working Day shall be rescheduled due to weather conditions.

15. LINES AND GRADES

Unless otherwise specified, the Contractor shall furnish and maintain all lines and grades, based upon existing site conditions or a bench mark established by the Owner. The lines and grades shall be checked periodically by the Contractor. The Contractor shall take immediate steps to correct errors or inconsistencies in all Work involved so that it shall be in conformity with the Contractor Documents. For purposes of this Contract, Contractor Documents are to include, but are not limited to, construction plans, standards, and specifications that relate to the Work. The Contractor shall be fully responsible for the accuracy of their work and the correction of it as required.

16. CONTRACTOR’S DUTY AND SUPERINTENDENT’S

The Contractor shall give full and adequate attention to the faithful execution and completion of the Contract Documents and the Work contemplated under the Contract Documents, in a good and workmanlike manner, and shall keep on the Work, during its progress, an experienced and duly qualified superintendent and any necessary assistants. The superintendent shall represent the Contractor in their absence, and all directions given to them shall be as binding as if given to the Contractor, and likewise, all directions and approvals given by them shall be as binding as if given by the Contractor. Other directions shall be so confirmed on written request in each case.

17. CONTRACTOR’S UNDERSTANDING

It is understood and agreed that the Contractor has, by careful examination, satisfied themself as to the nature and location of the Work, the confirmation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under the Contract Documents. No verbal agreement or conversation with any officer, agent or employee of the Owner, either

before or after the execution of the Contract Documents, shall affect or modify any of the terms or obligations herein contained.

18. CHARACTER OF WORKERS

The Contractor agrees to employ only orderly and competent workers, skillful in the performance of the type of Work required under their Contract, to do the Work, and further agrees that whenever the Owner shall inform Contractor in writing that any worker on the Work is, in Owner's opinion, incompetent, unfaithful or disorderly, such worker shall be discharged from the Work and shall not again be employed on the Work without the Owner's written consent.

19. DEFECTS AND THEIR REMEDIES

It is further agreed that if the Work or any part thereof, or any material brought on the site of the Work for use in the Work or selected for the same, shall be deemed by the Owner as unsuitable or not in conformity with the Contract Documents, the Contractor shall, upon receipt of written notice thereof from the Owner, forthwith remove such material and rebuild or otherwise remedy such Work so that it shall be in full accordance with the Contract Documents.

20. CHANGES AND ALTERATIONS

The Contractor further agrees that the Owner may make such changes and alterations as the Owner may see fit, in the line, grade, form dimensions, drawings or materials for the Work herein contemplated, or any part thereof, either before or after the beginning of the construction, without affecting the validity of the Contract Documents and accompanying bonds where required. If such changes or alterations diminish the quantity of the Work to be done, they shall not constitute the basis for a claim for damages, or anticipated profits on the Work that may be dispensed with, except as hereinafter provided for unit price items.

No Work for which Contractor expects compensation in addition to the contract price shall be performed unless Contractor has prepared and secured Owner's written approval to a change order. In approving any change order request, Owner will base approval on the quantity actually done and the unit price, if any, established for such Work. If no unit price has been established nor any unit price agreed to, then such additional work shall be paid for as provided under "Added Work."

21. RIGHT OF ENTRY

The Owner reserves the right at any time, with or without notice, to enter the property or location on which the Work herein contracted for is to be constructed or installed by such agent or agents as he may elect, for the purpose of inspecting the Work, or for the purpose of constructing or installing such collateral Work as said Owner may desire.

22. COLLATERAL CONTRACTS

The Owner agrees to provide by separate contract or otherwise, all labor and materials reasonably essential to the completion of any work specifically excluded from the Contract Documents.

23. CUTTING, PATCHING AND FITTING

The Contractor shall use due diligence in performing all cutting, patching or fitting of its Work that may be required to make its several parts come together properly and fit to receive or to be received by work of others shown on, or reasonably implied by the drawings and specifications, for the completed facility. The Contractor shall not endanger any Work by cutting, digging, or otherwise, and shall not cut or alter the work of others unless specifically noted on the drawings and specifications.

24. OPERATIONS AND BUSINESS OF OWNER

It is of great importance that the Owner's operations meet with a minimum of interference resulting from the Work performed hereunder. The Contractor shall, therefore, conduct the Work in such a manner as to permit these continued operations and so as not to interfere with the activities of the Owner or Owner's employees, agents or representatives, other contractors of the Owner, or persons using Owner's facilities or the street rights-of-way. The Contractor and all subcontractors and suppliers shall use the route of entry designated by the Owner and restrict all work vehicles and personnel to this route and to the site of Work. The blocking or hindering of traffic (pedestrian, vehicle) on the site or in the right of way shall not be permitted.

25. COORDINATION WITH OWNER

The Contractor shall keep in daily contact with Owner and shall have someone responsible for the conduct of the job on the site of Work at all times during the Work, which project manager shall be reasonably available to Owner, in connection with the Work.

26. SAFETY, SECURITY AND INCONVENIENCE TO THE PUBLIC

The safety of the public, the convenience of traffic, and uninterrupted ingress and egress to private property shall be regarded as of prime importance. All operations shall be planned and executed in a manner that will cause minimum interference with traffic (vehicular, pedestrian, etc.). The approval of the proposed plan of operation, sequence of Work, and methods of providing for the safe passage of traffic shall be approved by Owner or appropriate county officials before it is placed into operation. If at any time during construction, the approved plan does not accomplish the intended purpose, due to weather or other conditions affecting the safe handling of traffic, the necessary changes therein to correct the unsatisfactory conditions shall immediately be made. Delays due to weather as mentioned in Section 14 above will be assessed

by the Project Manager and a determination will be made as to whether an extension of Working Days in the Contract is warranted. If an extension is required due to weather conditions, Owner and Contractor shall come to a written agreement on the additional days needed.

26.1 All work such as backfilling of excavations, repairs to roads and drives, and clean-up or other such operations shall follow as closely as practical to the laying or installing operations, in such manner that the public is not unnecessarily inconvenienced and no hazard to the public safety is created. If the Work forces or equipment are insufficient to such a degree that the public is inconvenienced, measures shall immediately be taken to remedy the problem. The Owner may require such changes in Work forces and equipment necessary to prevent or remedy unnecessary inconvenience to the public or hazard to the public safety. The notice of such required changes will be made in writing.

26.2 At night or on days when Work is not being performed by Contractor, all equipment not in use shall be stored and secured in such manner and at such locations as not to interfere with the safe passage of traffic, nor be a visual or an unattractive nuisance to residents of the community. Flagmen shall be provided and maintained at such points and for such periods of time as may be required to provide for the safety and convenience of public travel and Contractor's personnel, and as directed by the Owner.

26.3 Public safety shall be the direct responsibility of the Contractor. The Contractor shall provide barricades, lights, and warning and detour signs as required.

26.4 Contractor shall take any and all precautions that may be reasonably necessary to render all portions of the Work, the site, equipment, tools, materials, and any adjacent areas affected by the Work secure in every respect, to decrease the likelihood of accidents from any cause, and to avoid vandalism and other contingencies which are liable to delay the Work or give rise to any claims or liabilities. Such compliance with these requirements shall not relieve the Contractor of its responsibility to maintain security for the above noted items nor shall it be construed as limiting in any matter the Contractors obligation to undertake such reasonable action as may be required to establish and maintain secure conditions of the work site. All security measures shall be in place through substantial completion. Contractor acknowledges and agrees that they are responsible for all damage caused that can be shown to have been a result of Contractor's lack of sufficient precautions taken.

27. TRAFFIC

27.1 If the Work requires special traffic control signing and/or traffic control plan, including, but not limited to, flagmen or barricades, same shall be provided by Contractor. All signing shall conform to the Manual on Uniform Traffic Control and the applicable county's requirements.

27.2 When performing Work requiring vehicles or equipment to be parked on the shoulder of streets, an approved traffic hazard warning system shall be used, such as flagmen, traffic cones, flashing barricades, etc. No construction equipment or vehicle is to be parked within three (3) feet of any thoroughfare shoulder overnight. If it becomes necessary to leave equipment in a location which may create a traffic hazard, adequate warning devices, visible both day and night, shall be installed. It is the responsibility of Contractor to provide the approved signing as determined by the applicable county.

27.3 It is the responsibility of Contractor to keep the thoroughfare cleared of any traffic hazards that are not properly marked as such.

28. EXCAVATION

All excavations shall be marked with approved warning devices and barricaded or covered, when not attended, in a manner sufficient to keep the motoring public and pedestrian traffic from harm.

29. UNDERGROUND OBSTACLES

The Contractor shall make every effort to locate all underground pipelines, conduits, cables and structures, and shall contact owners of the underground installations by prospecting in advance of excavation. The repair of existing installations cut or damaged by the Contractor shall be made at the expense of the Contractor and shall be scheduled so as to cause the least possible inconvenience to the public and to the owners of the installations.

30. OCCUPATIONAL SAFETY AND HEALTH STANDARDS

The Work and the Contractor's operational activities shall at all times comply with all applicable provisions of the Department of Labor, safety and health regulations for construction, and applicable occupational safety and health standards.

31. EXAMINATION OF SITE

The Contractor shall make an examination of the site of the Work to become familiar with the conditions to be encountered. The actual site and the drawings and specifications shall be compared. No extra compensation will be allowed for any Work made necessary due to unusual conditions or obstacles encountered during the progress of the Work which could have been determined during a site visit.

32. CARE OF TREES AND SHRUBS

This Work is being performed in reserves and natural areas. No trees and shrubs shall be removed without the express written permission of the Owner or its representatives that are outside of

the clearing and grading plans. Needless damage to trees and shrubs which are to remain shall be prevented by means of protective wrapping or safety fencing that provides a buffer from equipment.

33. EQUIPMENT, MATERIALS AND CONSTRUCTION PLANT

The Contractor shall be responsible for the care, preservation, conservation and protection of all materials, supplies, machinery, equipment, tools, apparatus, accessories, facilities, all means of construction, and any and all parts of the Work, whether the Contractor has been paid, partially paid, or not paid for such Work, until the entire Work is completed and accepted.

34. DAMAGES.

In the event the Contractor is damaged in the course of the completion of the Work, and it is shown to be as a result of the sole and gross negligence or a material default of the Owner, the Owner agrees to reimburse the Contractor for the reasonable costs and expenses incurred as a result of such damages. In the event the Owner is damaged in the course of the Work by the negligence or default of the Contractor or its subcontractors, suppliers agents or employees, or should the Contractor unreasonably delay the progress of the Work being done by others on the job so as to cause loss for which the Owner becomes liable, then the Contractor shall reimburse the Owner for any and all such losses. NOTWITHSTANDING ANYTHING TO THE CONTRARY CONTAINED IN THIS CONTRACT, NOTHING CONTAINED IN THIS CONTRACT SHALL BE CONSTRUED AS A WAIVER, CONTRACTUAL OR OTHERWISE, OF THE PROTECTIONS AND LIMITATIONS ON LIABILITY PROVIDED TO OWNER AND ITS EMPLOYEES (INCLUDING ITS OFFICERS AND DIRECTORS).

35. PROTECTION AGAINST ACCIDENT TO EMPLOYEES AND THE PUBLIC

The Contractor shall at all times exercise reasonable precautions for the safety and well-being of employees and others on or near the Work and shall comply with all applicable provisions of Federal, State, and local safety laws and building and construction codes. All machinery and equipment and other physical hazards shall be guarded in accordance with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America except where incompatible with Federal, State or local laws or regulations or Owner's safety regulations, if any. The Contractor shall provide such machinery, guards, safety walkways, ladders, bridges, gangplanks, barricades, lights and other safety devices as may be considered requisite to the prevention of accidents. The safety precautions actually taken and their adequacy shall be the sole responsibility of the Contractor, acting at their discretion as an independent Contractor.

THE CONTRACTOR AGREES TO RELEASE, INDEMNIFY, SAVE AND HOLD HARMLESS THE OWNER FROM ANY AND ALL CLAIMS, DEMANDS, OR CAUSES OF ACTION, INCLUDING, BUT NOT LIMITED TO PROPERTY DAMAGE, PERSONAL INJURIES OR DEATH, AND ALL COURT COSTS AND

ATTORNEY'S FEES, ARISING OR GROWING OUT OF SUCH CLAIM, DEMAND OR CAUSE OF ACTION OR THE PERFORMANCE OF THE CONTRACT DOCUMENTS.

In any and all claims against the Owner or any of Owner's agents or employees or representatives by Contractor or any subcontractor, or any employee, agent or representative of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under Workmen's Compensation Acts, Disability Benefit Acts or other Employee Benefit Acts.

36. LOSSES FROM NATURAL CAUSES

All loss or damage to the Contractor, arising out of the nature of the Work to be done, or from the action of the elements, or from any unforeseen circumstances in the prosecution of the same, or from unusual obstructions or difficulties which may be encountered in the prosecution of the Work, shall be sustained and borne by the Contractor at their sole cost and expense.

37. PROTECTION OF ADJOINING PROPERTY

THE SAID CONTRACTOR SHALL TAKE PROPER MEANS TO PROTECT THE ADJACENT OR ADJOINING PROPERTY OR PROPERTIES IN ANY WAY ENCOUNTERED, WHICH MIGHT BE INJURED OR SERIOUSLY AFFECTED BY ANY PROCESS OF CONSTRUCTION TO BE UNDERTAKEN UNDER THE CONTRACT DOCUMENTS, FROM ANY DAMAGE OR INJURY BY REASON OF SAID PROCESS OF CONSTRUCTION, AND CONTRACTOR SHALL BE LIABLE FOR ANY AND ALL CLAIMS FOR SUCH DAMAGE ON ACCOUNT OF THEIR FAILURE TO FULLY PROTECT ALL ADJOINING PROPERTY. THE CONTRACTOR AGREES TO INDEMNIFY, SAVE AND HOLD HARMLESS THE OWNER AGAINST ANY CLAIM OR CLAIMS FOR DAMAGES DUE TO ANY INJURY TO ANY ADJACENT OR ADJOINING PROPERTY, ARISING OR GROWING OUT OF THE PERFORMANCE OF THE CONTRACT.

38. BONDING REQUIREMENTS AND PROTECTION AGAINST CLAIMS OF SUBCONTRACTORS, VENDORS, ETC.

38.1 The Contractor must furnish the Owner both Performance and Payment Bond prior to commencing Work, each in the amount of 100 percent (100%) of the Contract Price, the Performance Bond as security for the faithful performance and the Payment Bond to ensure payment of all bills and obligations arising from the performance of the Contract, including the payment of the subcontractors, material suppliers and laborers. Contractors' Performance and Payment Bonds, both in the amount of the Contract Price, shall be delivered to the Owner with the executed Contract.

The conditions of this Performance bond are such that, if the Contractor shall satisfactorily perform the Contract, then this bond shall be null and void; otherwise, the surety shall pay the full amount of said performance bond. In addition, if the Contractor or their subcontractor shall fail to duly pay for any labor, materials, team hire, sustenance, provisions, provender, or other supplies used or consumed by such Contractor or their subcontractor is performance of the Contract or shall fail to duly pay any person who supplies rental machinery, tools, or equipment in the prosecution of the work, then the surety shall pay the same in an amount not exceeding the sum specified in the bond together with interest at a rate of eight percent per annum.

38.2 **THE CONTRACTOR AGREES TO INDEMNIFY AND SAVE THE OWNER HARMLESS FROM ANY AND ALL CLAIMS GROWING OR ARISING OUT OF THE LAWFUL DEMANDS OF SUBCONTRACTORS, LABORERS, WORKMEN, MECHANICS, MATERIAL MEN AND FURNISHERS OF MACHINERY AND PARTS THEREOF, EQUIPMENT, POWER TOOLS, AND ALL SUPPLIES, INCLUDING COMMISSARY, INCURRED IN THE FURTHERANCE OF THE PERFORMANCE OF THE CONTRACT DOCUMENTS.** The Contractor shall furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged or waived, as provided in the signed Contract. If the Contractor fails to do so, then the Owner may, at Owner's sole option, either pay directly any unpaid bills or claims, of which the Owner has written notice, and charge Contractor therefore, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to liquidate any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged, whereupon payment to the Contractor shall be resumed in full, in accordance with the terms of the Contract Documents, but in no event shall the exercise by Owner of the option provided in this Paragraph be construed to impose any obligation upon the Owner or to constitute a release or waiver of the duties of the Contractor of their surety.

39. LAWS AND ORDINANCES

39.1 **THE CONTRACTOR SHALL AT ALL TIMES OBSERVE AND COMPLY WITH ALL FEDERAL, STATE AND LOCAL LAWS, ORDINANCES AND REGULATIONS WHICH IN ANY MANNER AFFECT THE CONTRACT OR THE WORK, AND SHALL INDEMNIFY AND SAVE HARMLESS THE OWNER AGAINST ANY CLAIM ARISING FROM THE VIOLATION OF ANY SUCH LAWS, ORDINANCES, AND REGULATIONS WHETHER BY THE CONTRACTOR OR ITS EMPLOYEES, AGENTS OR SUBCONTRACTORS. IF THE CONTRACTOR OBSERVES THAT ANY DIRECTIONS OR SPECIFICATIONS ARE AT VARIANCE THEREWITH, CONTRACTOR SHALL PROMPTLY NOTIFY THE OWNER IN WRITING OF ANY NECESSARY CHANGES IN THE WORK. IF THE CONTRACTOR PERFORMS ANY WORK KNOWING IT TO BE CONTRARY TO SUCH CODES, ORDINANCES, RULES AND REGULATIONS, CONTRACTOR SHALL BEAR ALL SUCH COSTS ARISING THERE FROM.**

Contractor affirms that it has submitted the necessary forms to comply with Texas Gov't Code Section 2252.908, Certificate of Interested Parties (Form 1295) (https://www.ethics.state.tx.us/filinginfo/1295/)
and Chapter 176, Texas Local Gov't Code, Conflict of Interest Questionnaire (Form CIQ) (https://www.ethics.state.tx.us/forms/conflict/) and has returned a fully executed copy of both as Exhibits "A" and "B" to this executed Contract and provide proof of filing of the latter to the Owner after filing with the Texas Ethics Commission as required by the referenced provision of the Texas Government Code.

39.2 **Statutorily Required Provisions:**

1. Verification Regarding Energy Company Boycotts. To the extent this Contract constitutes a contract for goods or services for which a written verification is required under Section 2274.002, Texas Government Code, (as added by Senate Bill 13, 87th Texas Legislature, Regular Session) as amended, Contractor hereby verifies that it and its parent company, wholly- or majority- owned subsidiaries, and other affiliates, if any, do not boycott energy companies and will not boycott energy companies during the term of this Contract. The foregoing verification is made solely to comply with Section 2274.002, Texas Government Code, as amended, to the extent Section 2274.002, Texas Government Code does not contravene applicable Texas or federal law. As used in the foregoing verification, "boycott energy companies" shall have the meaning assigned to the term "boycott energy company" in Section 809.001, Texas Government Code. Contractor understands "affiliate" to mean an entity that controls, is controlled by, or is under common control with the Underwriter and exists to make a profit.

2. Verification Regarding Discrimination Against Firearm Entity or Trade Association. To the extent this Contract constitutes a contract for the purchase of goods or services having a value of at least $100,000 that is paid wholly or partly from public funds for which a written verification is required under Section 2274.002, Texas Government Code, (as added by Senate Bill 19, 87th Texas Legislature, Regular Session), as amended, Contractor hereby verifies that it and its parent company, wholly- or majority- owned subsidiaries, and other affiliates, if any,

1. do not have a practice, policy, guidance or directive that discriminates against a firearm entity or firearm trade association; and
2. will not discriminate during the term of this Contract against a firearm entity or firearm trade association.

The foregoing verification is made solely to comply with Section 2274.002, Texas Government Code, as amended, to the extent Section 2274.002, Texas Government Code does not contravene applicable Texas or federal law. As used in the foregoing verification, "discriminate against a firearm entity or firearm trade association" shall have the meaning assigned to such term in Section 2274.001(3), Texas Government Code (as added by SB

19). Contractor understands "affiliate" to mean an entity that controls, is controlled by, or is under common control with the Underwriter and exists to make a profit.

3. <u>Certifications Regarding Terrorist Organizations and Boycott of Israel.</u> To the extent this Contract constitutes a contract for goods or services for which a written verification is required under Sections 2252.151-.154 Texas Government Code, Contractor hereby certifies that it and its parent company, wholly- or majority- owned subsidiaries, and other affiliates, if any, is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law.

To the extent this Contract constitutes a contract for goods or services for which a written verification is required under Sections 2271.001-002 Texas Government Code, Contractor and its parent company, wholly- or majority- owned subsidiaries, and other affiliates, if any, further certifies and verifies that it does not boycott Israel and agrees that it will not boycott Israel during the term of this Contract. For purposes of this Contract, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory. (Tex. Gov't Code §§ 2270.001-.002, 808.001-.006, .051-.057, .101-.102).

The foregoing verification is made solely to comply with Chapter 2271, Texas Government Code, as amended, to the extent the appliable provision in Chapter 2271.001, Texas Government Code does not contravene applicable Texas or federal law. As used in the foregoing verification, "boycott Israel" shall have the meaning assigned to such term in Section 808.001(1), Texas Government Code. Contractor understands "affiliate" to mean an entity that controls, is controlled by, or is under common control with the Underwriter and exists to make a profit.

40. ASSIGNMENT AND SUBLETTING

The Contractor further agrees that it will retain adequate control and will give sufficient attention to the fulfillment of the Contract Documents, and Contractor further agrees that it will not assign by power of attorney, or otherwise, or sublet said Contract without the prior written consent of the Owner, which consent may be withheld or conditioned by Owner in its absolute discretion. Any purported assignment by Contractor without such consent shall be void. Contractor further agrees that the subletting of any portion or feature of the Work, or materials required in the performance of the Contract Documents, shall not relieve Contractor from its full obligations to the Owner, as provided by the Contract Documents. With regard to the certain Work to be performed under the Contract Documents which the Owner reasonably believes should be performed by specialized experts in the applicable specialized field, Owner shall have the right to identify specific subcontractors for such Work to Contractor, which Contractor shall then contract

for performance of such specialized Work with such subcontractors, absent specific written objection to the contrary.

41. LIQUATED DAMAGES

Time is of the essence of the Contract. Delays inconvenience the traveling public, obstruct traffic, interfere with and delay commerce, and increase risk to roadway users. Because the Owner finds it impractical to calculate the actual cost of delays, it has adopted the following formula to calculate liquidated damages for failure to complete the Work of the Contract on time. Accordingly, the Contractor agrees:

a) To pay $1250 liquidated damages for each Working Day beyond the number of Working Days established for completion of the Work; or
b) To calculate based on the following formula, whichever is greater, and
c) To authorize the Owner to deduct these liquidated damages from any money due or coming due to the Contractor;

Liquidated Damages Formula

LD = 0.15C/T

Where:

LD = liquidated damages per Working Day (rounded to the nearest dollar)
C = original Contract amount
T = original time for completion

Liquidated damages will not be assessed for any days for which an extension of time is granted. No deduction or payment of liquidated damages will, in any degree, release the Contractor from further obligations and liabilities to complete the entire Contract. The Contractor agrees to authorize the Owner to deduct these liquidated damages from any money due or coming due to the Contractor.

42. QUANTITIES AND MEASUREMENT (FOR USE WHERE COMPENSATION IS BASED UPON UNIT PRICE METHOD)

No extra or customary measurements of any kind will be allowed, but the actual measured and/or computed length, solid contents, number and weight only shall be considered unless otherwise specifically provided.

43. ESTIMATED QUANTITIES (FOR USE WHERE COMPENSATION IS BASED UPON UNIT PRICE METHOD)

The Contract Documents are intended to show clearly all Work to be done and materials to be furnished hereunder. Where the estimated quantities are shown of the various classes of Work to be done and material to be furnished under the Contract Documents, they are approximate and are to be used only as a basis for estimating the probable cost of the Work and for comparing the proposals offered for the Work. It is understood and agreed that the actual amount of Work done and material to be furnished under the Contract Documents may differ from these estimates, and that where the basis for payment under the Contract Documents is the unit price method, payment shall be for the actual amount of such Work done and the material furnished.

Contractor agrees that it will make no claim for damages, anticipated profits or otherwise on account of any differences which may be found between the quantities of Work actually done or the materials actually furnished under the Contract Documents and the estimated quantities contemplated and contained in the Contract Documents; provided, however, that in case the actual quantity of any major item should become as much as twenty percent (20%) more than, or twenty percent (20%) less than the estimated or contemplated quantities for such item, then either Party, upon demand, shall be entitled to a revised consideration upon that portion of the Work above or below twenty percent of the estimated quantity. A "major item" shall be construed to be any individual bid item included in the Contract Documents that has a total cost equal to or greater than five percent (5%) of the total contract cost, computed on the basis of the Contract Documents' quantities and the Contract unit prices. Any revised consideration is to be determined by agreement between the Parties, otherwise by the terms of the Contract Documents, as provided under "Added Work."

44. PARTIAL PAYMENTS

Before the first application for payment on lump sum contracts, the Contractor shall submit to the Owner a schedule of values of the various portions of the Work, including quantities as required, aggregating the total contract sum. Each item shall include its proper share of overhead and profit. This schedule of values, when approved by the Owner, shall be used as a basis for review of applications for payment.

The Contractor shall submit to the Owner an application for partial payment, and if required, receipts or other vouchers, showing their payments for materials and labor, including payments to subcontractors. The Owner shall review the statement for its correctness concerning the quantity of the Work done up to and including the last day of the preceding month. Said statements shall include the value of all sound materials in place or fabricated into the Work, and seventy-five percent (75%) of the value of all sound materials delivered on site, but not in place.

The Owner shall then pay the Contractor during the subsequent Accounts Payable cycle, as prescribed by the Woodlands Township-Finance Department, the total amount of the approved statement, less ten percent (10%) of the amount thereof, which ten percent (10%) shall be retained until final payment and further less all previous payments and further sums that may be retained by the Owner under the terms of the Contract Documents.

45. USE OF COMPLETED PORTIONS

The Owner shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding that the time established for the completion or partial completion of such Work may not have expired, but such taking possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents. If such prior use increases the cost or delays the Work, the Contractor shall be entitled to such extra compensation, or extension of time, or both as the Owner may determine.

46. FINAL COMPLETION AND ACCEPTANCE

Within ten (10) days after the Contractor has given the Owner written notice that the Work has been completed, the Owner shall inspect the Work and, if the Work has been found to be completed in accordance with the Contract Documents, the Owner shall issue a certificate of acceptance of the Work to the Contractor. If the Owner finds any defects in the Work, upon such inspection, Owner shall provide a written list of such defects and requirements for remedying such defects. Only upon the Work being found to have been completed in accordance with the Contract Documents and such defects having been remedied, shall a certificate of acceptance of the Work be issued to the Contractor.

47. FINAL PAYMENT

Owner shall pay the Contractor on or before the forty-fifth (45^{th}) day after the date of the certificate of acceptance, the balance due the Contractor under the terms of the Contract Documents, provided Contractor has fully performed its contractual obligations under the terms of the Contract Documents. Neither the certificate of acceptance nor the final payment, nor any provisions in the Contract Documents, shall relieve the Contractor of the obligation for fulfillment of any warranty which may be required in the Contract Documents.

Neither the final payment nor the remaining retained percentage shall become due until the Contractor submits appropriate affidavits of payment of all bills, consent of the Contractor's surety, or other data as may be requested by the Owner and/or required pursuant to the Contract Documents.

48. PAYMENT WITHHELD

The Owner may, on account of subsequently discovered evidence, withhold or nullify the whole or part of any payment to such extent as may be necessary to protect itself from loss resulting from:

a. Defective Work not remedied;
b. Claims filed or reasonable evidence indicating probable filing of claims;

c. Failure of the Contractor to make payments properly to subcontractors or for material of labor;
d. Damage to another contractor;
e. Reasonable doubt that the Work can be completed for the unpaid balance of the Contract sum;
f. Reasonable indication that the Work will not be completed within the contract time; or,
g. Breach of any of the terms of the Contract Documents by the Contractor.

49. DELAYED PAYMENTS

Should the Owner fail to make payment to the Contractor of the sum named in any partial or final statement, when payment is due, then the Owner shall pay the Contractor, in addition to the sum shown as due by such statement, interest thereon at the rate of six percent (6%) per annum from date due until fully paid, which shall fully liquidate any injury to the Contractor growing out of such delay in payment.

50. ADDED WORK

The term "Added Work" as used in the Contract Documents shall be understood to mean and include all work that may be required by the Owner to be done by the Contractor to accomplish any change, alteration or addition to the Work. It is agreed that the Contractor shall perform all Added Work when presented with a written work order signed by the Owner. It is also agreed that, unless otherwise specified in the Contract Documents, the compensation be paid to the Contractor for performing said Added Work shall be determined by agreed unit prices (described in Paragraph 42) or lump sum (described in Paragraph 43).

51. TIME OF FILING CLAIMS

It is further agreed by both Parties hereto that all questions of dispute or adjustment presented by the Contractor shall be in writing and filed with the Owner within ten (10) days after the receipt of the interpretation or decision to which the Contractor desires to take exception.

52. ABANDONMENT BY CONTRACTOR

In case the Contractor should abandon and fail or refuse to resume Work within three (3) days after written notification from the Owner, or if the Contractor fails to comply with the orders of the Owner, when such orders are consistent with the Contract Documents, then, and in that case, where performance bond exists, the surety on the bond shall be notified in writing and directed to complete the Work, and a copy of said notice shall be delivered to the Contractor.

After receiving said notice of abandonment, the Contractor shall not remove from the Work any machinery, equipment, tools, materials or supplies then on the job, but the same, together with any materials and equipment under contract for the Work, may be held for use on the Work by the Owner or the surety on the construction bond, or another contractor in completion of the Work, and the Contractor shall not receive any rental or credit therefore (except when used in connection with Added Work, where credit shall be allowed as hereinabove provided for), it being understood that the use of such equipment and materials will ultimately reduce the cost to complete the Work and be reflected in the final settlement.

Where there is no performance bond provided or in the case surety should fail to commence compliance with the notice for completion hereinabove provided for, within three (3) days after service of such notice then the Owner may provide for completion of the Work in either of the following manners:

52.1 The Owner may thereupon employ such force of men and use such machinery, equipment, tools, materials and supplies as said Owner may deem necessary to complete the Work and charge the expense of such labor, machinery, equipment, tools, materials and supplies to said Contractor, and the expense so charged shall be deducted and paid by the Owner out of such moneys as may be due, or that may thereafter at any time become due to the Contractor under and by virtue of the Contract Documents. In case such expense is greater than the sum which would have been payable under the Contract Documents, the Contractor and/or their surety shall pay the amount of such excess to the Owner; or

52.2 Owner may initiate the process to let the Contract for the completion of the Work under substantially the same terms and conditions, which are provided in the Contract, to any alternative contractor, at Owner's sole discretion. In case of any increase in cost to the Owner under the new contract, as compared to what would have been the cost under the Contract Documents, such increase shall be charged to the Contractor, and Contractor and the surety shall be and remain bound therefore.

When the Work shall have been completed, the Contractor and their surety shall be so notified and certificates of acceptance, as provided under "Final Completion and Acceptance," shall be issued. A complete itemized statement of the Contract accounts shall then be prepared and delivered to the Contractor and their surety, whereupon the Contractor and/or their surety or the Owner as the case may be, shall pay the balance due as reflected by said statement, within fifteen (15) days after the date of such certificate.

In the event the statement of accounts shows that the cost to complete the Work is less than that which would have been the cost to the Owner had the Work been completed by the Contractor under the terms of the Contract Documents, or when the Contractor and/or their surety shall pay the balance shown to be due by them to the Owner, then all

machinery, equipment, tools, materials or supplies left on the site of the Work shall be turned over to the Contractor and/or their surety. Should the cost to complete the Work exceed the Contract price, and the Contractor and/or their surety fail to pay the amount due to the Owner within the time designated hereinabove, and there remains any machinery, equipment, tools, materials, or supplies on the site of the Work, notice thereof, together with an itemized list of such equipment and materials, shall be mailed to the Contractor and their surety at the respective addresses designated in the Contract Documents; provided however, that actual written notice given in any manner will satisfy this condition. After mailing, or other giving of such notice, such property shall be held at the risk of the Contractor and their surety subject only to the duty of the Owner to exercise ordinary care to protect such property. After fifteen (15) days from the date said notice is received by Contractor, the Owner may sell such machinery, equipment, tools, materials or supplies and apply the net sum derived from such sale to the balance due Owner under the Contract Documents. Such sales may be made at either public or private sale, with or without notice, as the Owner may elect. The Owner shall release any machinery, equipment, tools, materials or supplies, which remain on the Work, and belong to persons other than the Contractor or their surety, to their proper owners. The books on all operations provided herein will be made available to Contractor and their surety for review at Owner's offices during normal business hours.

53. ABANDONMENT BY OWNER

Except in the event of Contractor's nonperformance or breach of the Contract Documents, if Owner shall fail to comply with the terms of this Contract, and should fail or refuse to comply with said terms within ten (10) days after written notification by the Contractor, then the Contractor may suspend or wholly abandon the Work, and may remove therefrom all machinery, tools and equipment and all materials on the site of the Work that have not been included in payments to the Contractor and have not been brought into the Work. In such case, Owner shall make an estimate of the total amount earned by the Contractor, which estimate shall include the value of all Work actually completed by said Contractor (at the prices stated in the attached proposal where unit prices are used), the value of all partially completed Work at a fair and equitable price, and the amount of all Added Work performed at the prices agreed upon or provided for by the terms of this Contract, and a reasonable sum to cover the cost of any provisions made by the Contractor to carry the whole Work to completion and which cannot be utilized. The Owner shall then make a final statement of the balance due to Contractor by deducting from the above estimate all previous payments by the Owner and all other sums that may be retained by the Owner under the terms of the Contract Documents, and shall certify same, whereupon Owner shall pay to the Contractor (on or before the 45th day after the date of the notification by the Contractor) the balance shown by said final statement as due the Contractor, if any, under the terms of the Contract Documents.

54. STATE SALES TAX

The Owner is a holder of an Exemption Certificate, and thus the Contractor shall not charge Owner for sales and use taxes attributable to the tangible personal property to be incorporated into the Work.

55. CONTRACT PRICE

It is the intent of this Contract that the contract price specified in Paragraph 6 shall cover all Work required by the Contract Documents, including furnishing of all materials, equipment and tools, and performing all necessary labor to fully complete the project. No item of Work that is required by the Contract Documents for the proper and successful completion of the Contract will be paid for outside of or in addition to the contract price.

56. WRITTEN NOTICE

Any notice required or permitted to be given under the Contract Documents shall be in writing and shall be deemed to have been given when actually delivered if given by hand delivery or transmitted by overnight courier service, or if mailed when deposited in a United States Post Office, registered or certified mail, postage prepaid, return receipt required; provided that the same is delivered to or addressed as follows:

If to Owner:

The Woodlands Township
2801 Technology Forest Blvd
The Woodlands, Texas 77381
Attention: _____
@thewoodlandstownship-tx.gov

If to Contractor:

Attention: _____
_____
_____
_____
_____@_____

or such other address as either Party may from time to time specify in writing to the other.

57. INDEPENDENT CONTRACTOR STATUS OF CONTRACTOR

Contractor shall be an independent contractor with respect to the performance of all Work, and neither Contractor nor anyone employed by Contractor shall be deemed for any purpose to be the employee, agent, servant, borrowed servant, or representative of Owner in the performance of any Work (despite Contractor's obligation to comply with various rules and regulations of the Owner). The Work contemplated herein shall meet the approval of Owner and be subject to the general right of inspection of Owner to secure the satisfactory completion thereof. The actual performance and supervision of all Work shall be by Contractor, but Owner or its representatives shall have full and complete access to the Work site to determine whether the Work is being performed by Contractor in accordance with all provisions of this Contract and for reasons otherwise stated in this Contract. Owner is not responsible for withholding, and shall not withhold, FICA or taxes of any kind from any payments it owes Contractor. Neither Contractor nor its employees shall be entitled to receive any benefits which employees of Owner are entitled to receive, and shall not be entitled to workers' compensation, unemployment compensation, medical insurance, life insurance, paid vacations, paid holidays, pension, profit sharing, or Social Security on account of their Work for Owner. Contractor is not the agent of Owner and is not authorized to make any representation, contract, or commitment on behalf of Owner unless specifically requested to do so, by Owner, in writing. No provisions herein shall be construed as creating a partnership, joint venture or other association whereby the Owner and Contractor would be jointly liable or liable as partners or co-ventures.

58. SUCCESSOR AND ASSIGNS

All of the terms of this Contract will apply to, be binding upon and inure to the benefit of the Parties hereto, their successors, permitted assigns, heirs and legal representatives, and all other persons claiming by, through or under them.

59. RIGHTS AND REMEDIES

The rights and remedies provided by this Contract are given in addition to any other rights and remedies either Party may have by law, statute, ordinance or otherwise. All such rights and remedies are intended to be cumulative, and the use of any one right or remedy by either Party shall not preclude or waive its right to any or all other rights or remedies.

60. NO WAIVER OF RIGHTS

If either Party fails to enforce any of the provisions of this Contract or any rights hereunder or fails to exercise any election provided in the Contract, it will not be considered to be a waiver of those provisions, rights or elections or in any way affect the validity of the Contract. The failure of either Party to exercise any of these provisions, rights or elections will not preclude or prejudice such Party from later enforcing or exercising the same or any other provisions, rights or elections, which it may have under this Contract.

61. SEVERABILITY

If any term, clause, or provision hereof is held invalid or unenforceable by a court of competent jurisdiction, such invalidity shall not affect the validity or operation of any other term, clause or provision, and such invalid term, clause or provision shall be deemed to be severed from this Contract.

62. ENTIRE AGREEMENT

The Contract Documents sets forth the entire agreement and understanding of the Parties relating to the subject matter hereof, and supersedes all prior agreements, arrangements and understandings, written or oral, between or among the Parties, except as specifically provided herein. Except as explicitly set forth herein, there are no promises, conditions, representations, understanding, interpretations or terms of any kind as conditions or inducement to the execution hereof or in effect among the Parties.

63. HEADINGS

The Paragraph headings included in this Contract are for convenience of reference only and shall not affect or be utilized in construing or interpreting this Contract.

64. COUNTERPARTS

(a) This Contract may be executed in several counterparts, each of which shall be deemed an original and all of which shall constitute one Contract, effective when counterparts have been signed by each - and delivered to - the other Parties; it being understood that all Parties need not sign the same counterparts.

(b) The exchange of copies of this Contract and of signature pages by facsimile transmission (whether directly from one facsimile device to another via either a dial-up connection or by the worldwide web), by electronic mail in “portable document format” (“.pdf”) form, or by any other electronic means intended to preserve the document’s original graphic and pictorial appearance, or by combination of such means, constitute effective execution and delivery of this Contract as to the Parties and may be used in lieu of the original Contract for all purposes. Signatures of the Parties transmitted by facsimile or by electronic means as described shall be deemed to be their original signatures for all purposes.

65. EXHIBITS

In the event of a conflict between this Contract and the Contract Documents attached as exhibits, this Contract shall control. All of the following Contract Documents are attached hereto and incorporated for all purposes as part of this Contract:

Exhibit “A”: Completed Certificate of Interested Parties Form 1295
Exhibit “B”: Completed Conflict of Interest Questionnaire
Exhibit “C”: Bond Documents (All required by this Contract)
Exhibit “D”: Certificate/Proof of Insurance
Exhibit “E”: Owner’s Invitation for Bid/Request for Proposal for the Work
Exhibit “F”: Contractor’s Bid Submittal

[Remainder of page intentionally left blank]
[Signatures on following page]

[insert contractor name]	**The Woodlands Township**
By:	By:
[Insert Name] [Insert Title] Tax I.D. No:	Monique Sharp President / Chief Executive Officer
Date:	Date:

Exhibit "A"
Completed Certificate of Interested Parties Form 1295

Exhibit "B"
Completed Conflict of Interest Questionnaire

Exhibit "C"
Bond Documents

Exhibit "D"
Certificate/Proof of Insurance

Exhibit "E"
Owner's Invitation for Bid/Request for Proposals for the Work

Exhibit "F"
Contractor's Bid Submittal

Exhibit L – Geotechnical Report

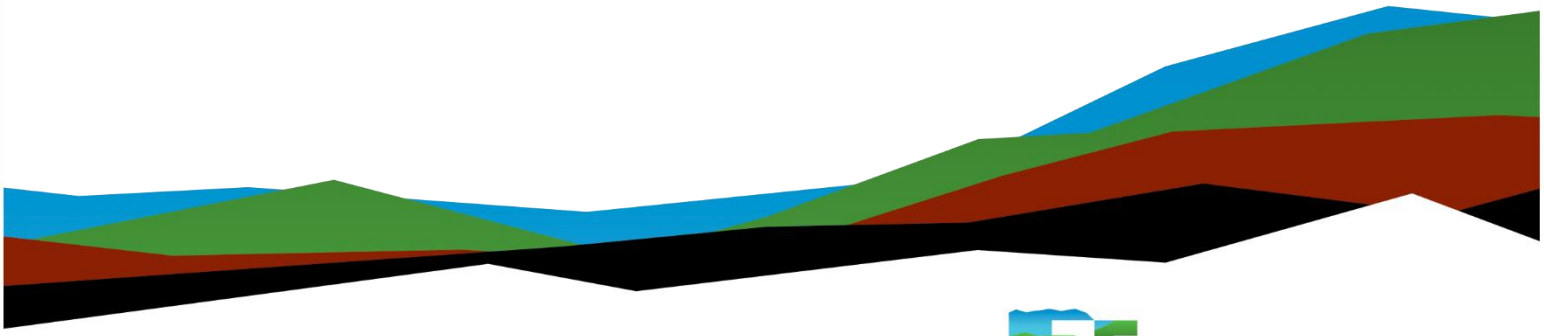
Alden Bridge Sports Fields Additions - Improvements

Geotechnical Engineering Report

January 3, 2025 | Terracon Project No. 97245137.Revision 1

Prepared for:

Halff Associates, Inc.
14800 St. Mary's Lane, Suite 160
Houston, Texas 77079



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January 3, 2025

Halff Associates, Inc.
14800 St. Mary's Lane, Suite 160
Houston, Texas 77079

Attn: Ms. Kristin LeBlanc, P.E.
P: (713) 588-2457
E: kleblanc@halff.com

Re: Geotechnical Engineering Report
Alden Bridge Sports Fields Additions - Improvements
5205 Research Forest Drive
The Woodlands, Texas
Terracon Project No. 97245137.Revision 1

Dear Ms. LeBlanc:

Terracon Consultants, Inc. (Terracon) is pleased to submit our geotechnical engineering report for the project referenced above in The Woodlands, Texas. We trust that this report is responsive to your project needs. Please contact us if you have any questions or if we can be of further assistance.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon
(Texas Firm Registration No.: F-3272)

Kelvin Castillo Dilone

Kelvin Castillo Dilone
Staff Engineer

Bobbie Sue Hood, P.E.
Senior Engineer

Table of Contents

Attachments

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Introduction

Terracon Consultants, Inc. (Terracon) is pleased to submit our geotechnical engineering report for the proposed new restroom building, pavilion, and playground improvements to be located in Alden Bridge Sports Park at 4751 TX-242 in The Woodlands, Texas. This project was authorized by Ms. Kristin LeBlanc, P.E. through signature of the "Standard Subcontract for Subsurface/Underground Services" between Halff Associates and Terracon on November 5, 2024.

The purpose of this report is to describe the subsurface conditions observed at the four test borings drilled for this project, analyze and evaluate the test data, and provide recommendations with respect to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per IBC
- Pavement design and construction

Maps showing the site and boring location are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring log in the **Exploration Results** section.

Project Description

Our initial understanding of the project was provided in our document and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	A written request for geotechnical services and a site plan was provided by the client via email on September 9, 2024. Additionally, a survey map was provided via email on November 21, 2024.
Project Description	The project includes a new restroom/concession stand with a pavilion, a new playground and pavilion, and paved parking and drive areas at the existing Alden Bridge Sports Park in The Woodlands, Texas.

Item	Description
Anticipated Foundations	We anticipate the pavilions will be supported on a conventionally-reinforced monolithically-poured slab-on-grade foundations and the playground equipment will be supported on either shallow spread/strip footings and/or grade-supported slabs. The restroom building will be supported on an 8-inch-thick concrete slab-on-grade over 2 inches of sand over 6 inches of crushed aggregate.
Finished Floor Elevation	Within about one to two feet above existing grade.
Building Code	2018 IBC

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration.

Item	Description
Parcel Information	The project is located in Alden Bridge Sports Park at 5205 Research Forest Drive in The Woodlands, Texas. See **Site Location**
Existing Improvements	Existing sports park, concrete paving, and scattered trees along the northwest to southeast side of the property.
Current Ground Cover	Grass and concrete driveways.
Existing Topography	The site generally slopes down from north to south with approximately 10 feet of grade change.

Geotechnical Characterization

Geology

Based on the geologic maps published by the Bureau of Economic Geology, the site is located on the Willis Formation, is the oldest formation of the Houston Group. The Willis Formation was deposited early in the Pleistocene epoch, during the Aftonian Interglacial

Stage. It is fluviatile, consisting of sands, silts, and clays in approximately equal amounts.

The coastal plain in this region has a complex tectonic geology, several major features of which are: Gulf Coastal geosyncline, salt domes, and major sea level fluctuations during the glacial stages, subsidence and geologic faulting activities. Most of these geologic faulting activities have ceased for millions of years, but some are still active. A detailed geologic fault investigation and study of the site geology are beyond the scope of this report.

Subsurface Profile

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Upper Sands**	Tan and light gray, loose, with clay pockets
2	**Clayey Sand and Sandy lean Clay**	Light gray, tan, and reddish brown, very loose to medium dense or soft to very stiff, with sand pockets
3	**Lower Sands**	Light gray, loose to medium dense, with clay pockets

Groundwater Conditions

Boring B-1 was advanced using dry drilling techniques to a depth of 15 feet in an effort to evaluate groundwater conditions at the time of our field program. Upon reaching groundwater, drilling was suspended for a period of about 15 minutes to allow the groundwater to rise and the groundwater level to be recorded. Wet rotary techniques were used thereafter to the termination depth of the boring (about 20 feet below existing grade). The remaining borings were advanced using dry drilling techniques to the boring termination depths of approximately 10 to 20 feet. Upon reaching

groundwater, drilling was suspended for a period of about 15 minutes to allow the groundwater to rise and the groundwater levels to be recorded, then the boring was completed using dry drilling techniques. The water levels observed in the boreholes can be found on the boring logs and are shown graphically in the **Exploration Results** section.

These water level observations provide an approximate indication of the groundwater conditions existing on the site at the time the observations were made. Longer-term observations using cased holes or piezometers, sealed from the influence of surface water, would be required for a better evaluation of the groundwater conditions on this site.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. Also, trapped or "perched" water could be present within the sand or silt seams within native clay soils and/or in cohesionless soils above lower permeability clay soil layers. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Classification of D** be considered for the project. Subsurface explorations at this site extended to a maximum depth of 20 feet. The site properties below the boring depths to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project. A summary of our findings and recommendations is provided below.

The surficial soils observed in portions of the site exhibited low plasticities and a high silt and sand content. If wet and/or soft conditions are present at the time of construction, remedial efforts may be necessary for preparation of the surficial soils in the building and pavement areas to create a working surface. Remedial effort options are discussed in the **Wet Weather/Soft Subgrade Considerations** section of this report.

Demolition of the existing light poles, utilities, pavements, etc. will be performed to facilitate the construction of the proposed improvements planned at this site. Special care should be exercised to demolish and remove the existing structure, foundations elements, pavements, utilities, and any buried structure to minimize disturbance of the subgrade and potential detrimental effects on construction of the proposed development at this site.

We understand the proposed restroom building at this site is planned to be supported on a foundation system consisting of an 8-inch-thick concrete slab-on-grade over 2 inches of sand over 6 inches of crushed aggregate. The pavilions at this site are planned to be supported on a foundation system consisting of a conventionally-reinforced, monolithically-poured slab-on-grade. This type of foundation may be utilized to support the proposed structures planned at this site provided the subgrade is prepared as discussed in this report.

Foundation systems consisting of either thickened concrete slabs or shallow spread/strip footings may be utilized to support the playground equipment planned at this site.

A minimum 12-inch thick select fill pad should be placed under the proposed grade supported slabs and aggregate pads to provide uniform support to the slabs.

Flexible pavement sections vary from 2.0 to 2.5 inches of asphaltic concrete over 8.0 to 10.0 inches of base material with chemically treated subgrade.

Rigid pavement sections vary from 5.0 to 7.0 of reinforced concrete with chemically treated subgrade

The **General Comments** section provides an understanding of the report limitations. The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include demolition, stripping, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations and floor slab.

Site Preparation

Construction areas should be stripped of vegetation, topsoil, trees, existing pavements/flatwork, and other debris/unsuitable surface material. Roots of trees to be removed within the construction areas should be grubbed to full depths. Care should be taken to replace or recompact all soil removed or loosened by the removal of tree roots and stumps as recommended in subsequent paragraphs Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

Demolition of existing structures and their below-grade portions, pavements/flatwork, utilities, etc. should be addressed as recommended in **Demolition Considerations**. Once final subgrade elevations have been achieved, the exposed subgrade should be carefully proofrolled with a 20 ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck, to detect weak zones in the subgrade. Weak areas detected during proofrolling, as well as zones containing organic matter and/or debris, should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils. Proofrolling should be performed under the direct observation of the geotechnical engineer or his/her representative and may be waived at the discretion of the geotechnical engineer.

Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction area should be evaluated for moisture and density. If the moisture and/or density do not meet the criteria described in **Fill Compaction Requirements** for on-site soils, the subgrade should be scarified to a minimum depth of 6 inches, moisture adjusted, and compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density.

Fill Material Types

Select fill and on-site soils to be used at this site for grade adjustments should meet the following criteria:

Fill Type	USCS Classification	Acceptable Location for Placement
Select fill soils	CL and/or SC (10≤PI≤20)	Must be used to construct the select fill pad under the grade-supported slabs and for all grade adjustments within the structure areas.
Aggregate base	TXDOT Type A or D, Grade 1-2	Must be used to construct the aggregate layer below the concrete slab-on-grade.

Fill Type	USCS Classification	Acceptable Location for Placement
On-site soils[1]	Varies	The on-site soils appear suitable for use as fill within future pavement areas or as general grading fill, provided they are free of organics and debris.

1. The utilization of on-site silty/sandy soils may present difficulties during construction due to the increased sand and silt content of these soils, especially during and soon after periods of wet weather. If the utilization of the silty/sandy soils as fill is planned in the pavement areas, treatment of these soils with lime-flyash should produce a material that would be more suitable for use as fill.

If blended or mixed soils are intended for use as select fill, Terracon should be contacted to provide additional recommendations. Blended or mixed soils do not occur naturally. These soils are a blend of sand and clay and will require mechanical mixing at the site with a pulvimixer. If these soils are not mixed thoroughly to break down the clay clods and blend-in the sand to produce a uniform soil matrix, the fill material may be detrimental to the performance of the foundations. If blended soils are used, we recommend that additional samples of the blended soils as well as the clay clods, be obtained prior to and during earthwork operations to evaluate if the blended soils can be used in lieu of select fill. The actual type and amount of mechanical mixing at the site will depend on the amount of clay and sand, and properties of the clay.

Fill Compaction Requirements

Select fill and on-site soils should meet the following compaction requirements.

Item	Description
Fill lift thickness	The fill soils should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure.
Compaction Requirements	■ Select fill and on-site soils should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ The aggregate base should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ The select fill and on-site soils should be moisture adjusted to within 2 percent of the optimum moisture content.

Prior to any filling operations, samples of the proposed borrow and on-site materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician

should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction, including dry unit weight and moisture content, are being attained.

Utility Trench Backfill

Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the structures should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the structure. The trench should provide an effective trench plug that extends at least 5 feet out from the face of the structure exterior. The plug material should consist of clay compacted at a water content at or above the soils optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report.

Grading and Drainage

All grades must provide effective drainage away from the proposed structures during and after construction. Water permitted to pond next to the structures can result in distress in the structures. These greater movements can result in unacceptable differential slab movements, cracked slabs and walls, and roof leaks. Slabs and foundation performances described in this report are based on effective drainage for the life of the structures and cannot be relied upon if effective drainage is not maintained.

Exposed ground should be sloped away from the structures for at least 10 feet beyond the perimeter of the structure. After construction and landscaping, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the structures should also be periodically inspected and adjusted as necessary, as part of the structures' maintenance program.

Planters located within 10 feet of the proposed structures should be self-contained to prevent water accessing the structure and pavement subgrade soils. Locate sprinkler mains and spray heads a minimum of 5 feet away from the structure lines. Low-volume, drip-style landscaped irrigation should not be used near the structure. Collect roof runoff in drains or gutters. Discharge roof drains and downspouts onto pavements and/or flatworks which slope away from the proposed structure or extend down spouts a minimum of 10 feet away from structure.

Flatworks will be subject to post construction movement. Maximum grades practical should be used for flatwork to prevent water from ponding. Allowances in final grades should also consider post-construction movement of flatwork, particularly if such movement would be critical. Where flatwork abuts the building, effectively seal and maintain joints to prevent surface water infiltration.

Wet Weather/Soft Subgrade Considerations

Due to the high silt and sand content and low plasticities of the surficial soils in portions of the site, proper compaction may be difficult to achieve. In addition, construction during and soon after wet weather periods may encounter difficulties due to wet and soft surficial soils becoming a general hindrance to equipment as a result of rutting and/or pumping of the soil surface. This condition is primarily due to their lack of cohesion (low clay content) and little to no confining pressure near the ground surface. If the subgrade cannot be adequately compacted to the minimum densities as described above, one of the following methods should be used to improve the soils: 1) removal and replacement with select fill, 2) chemical treatment of the soil to dry the subgrade, or 3) drying by natural means if the schedule allows.

Based on our experience with similar soils, chemical treatment is an efficient and effective method to increase the supporting value of wet and soft subgrade such as that observed at this site. Chemical treatment may be necessary to depths of approximately one to two feet or greater of the near-surface silty/sandy soils, depending on the condition of the subgrade at the time of construction. We suggest that a cost be included in the construction budget for chemical treatment of the soils using a lime-flyash mixture to aid drying and improve the condition of the soil if the soil is wet and/or soft at the time of construction. We recommend that this cost be in the form of a contingency or allowance to be used if needed. Terracon should be contacted for additional recommendations if chemical treatment of the soils is planned due to soft and/or wet subgrade.

Demolition Considerations

Special care should be exercised to demolish and remove any existing light poles, pavements, and utilities to minimize disturbance of the subgrade and potential detrimental effects on construction of the proposed development at this site.

We anticipate that the existing light poles are supported on drilled straight shaft footings. We recommend the shafts be broken off at an elevation about 24 inches below the bottom of the proposed grade beam depth. If portions of drilled footings are left in place, they should be surveyed and superimposed on the proposed development plans to evaluate the potential for obstructions to the new development. Terracon should be contacted if drilled footings are planned to be excavated and completely removed. Complete removal of drilled footings will require significant earthwork activities to backfill the resulting excavations in such a manner as to make the site suitable for new construction.

All utilities and associated bedding material that are planned to be abandoned should be completely removed from within the improvement areas. As an alternate to complete removal, the existing utilities may be abandoned in-place if they do not interfere with the planned construction. If the utilities are abandoned in-place, they should be properly pressure-grouted to completely fill the utility.

The excavations resulting from foundation and utility removal should be backfilled in accordance with the recommendations provided in **Earthwork**. If situations are encountered where compaction of fill would not be efficient because of the size or location of an excavation, the use of cement stabilized sand or flowable fill may be considered as a suitable alternative to select fill. The compressive strength of the cement stabilized sand or flowable fill utilized should be maintained between 50 to 100 pounds per square inch (psi).

Although not observed during our field activities, the potential exists that other types of buried structures (wells, cisterns, etc.) could exist on this site. These buried structures will need to be addressed on an individual basis if encountered during construction.

Shallow Foundations

We understand the proposed restrooms and pavilions are planned to be supported by a foundation system consisting of a conventionally-reinforced, monolithically-poured slab-on-grade. Additionally, we understand the playground equipment is planned to be supported by a foundation system consisting of either thickened concrete slabs or shallow spread/strip footings. If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Recommendations – Slab-on-Grade Foundation System

Planned finished grades at the site were not available at the time of this report. We anticipate that the finished floor elevation for the proposed restrooms and pavilions is planned to be within approximately one to two feet of existing grade. If cuts and/or significant fills are planned, Terracon should be notified to review and/or modify our recommendations given in this subsection.

The near-surface soils observed at this site generally exhibited a low to medium expansion potential. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of approximately one inch or less.

To provide uniform support to the grade-supported floor slabs, we recommend that a minimum 12 inches of properly placed and compacted select fill material be constructed immediately beneath the floor slabs. The select fill pad should extend to a minimum of 3 feet beyond the edge of the proposed structures. The final exterior grade adjacent to the structure should be sloped to promote effective drainage away from the structure.

Select fill soils should be utilized for all grade adjustments within the proposed structures. The subgrade soils and select fill pad soils should be prepared as outlined in the **Earthwork**

section of this report, which contains material and placement requirements for select fill, as well as other subgrade preparation recommendations.

Based upon the above recommendations, the grade beams of the slab-on-grade foundation should bear within properly placed and compacted select fill soils, provided that the fill pad and subgrade soils are prepared as outlined in **Earthwork**.

The slab-on-grade foundation for the pavilion structures may be designed using the following parameters provided that the structures subgrade is prepared as discussed above:

Description	Design Parameters
Select fill pad	Minimum thickness of 12 inches
Estimated PVR [1]	Approximately one inch or less
Climatic rating	25
Design Plasticity Index [1]	20
Soil support Index [1]	0.96
Minimum grade beam embedment depth	18 inches below exterior grade
Allowable bearing capacity	Dead Load Plus Sustained Live Load: 1,000 psf Total Net Load: 1,500 psf

1. Design parameters based on a minimum 12-inch thick select fill pad.

The slab-on-grade foundation for the restroom building may be designed using the following parameters provided that the structures subgrade is prepared as discussed above:

Description	Design Parameters
Minimum embedment depth[1]	6 inches below final grade
Allowable bearing pressure[2]	1,500 psf
Approximate total settlement[3]	One inch or less
Estimated differential settlement[4]	Approximately ½ of post-construction settlement
Allowable frictional resistance[5]	250 psf

1. To bear upon properly placed and compacted fill soils.
2. We understand that an 8-inch layer of aggregate base (see **Fill Material Types**) will be constructed below the floor slab of this building. This aggregate base is required to achieve the desire 1,500 psf allowable bearing pressure. The subgrade soil should be prepared and select fill placed as outlined in the **Earthwork** section of this report.
3. This total post construction settlement is estimated provided that proper construction practices are implemented. The isolated thickened concrete foundation should produce a major portion of the estimated settlements during and shortly after construction.
4. Differential settlements will result from variances in subsurface conditions, loading conditions, and construction procedures, such as cleanliness of the bearing area or water seepage in the foundation excavation.

Description	Design Parameters

5. Lateral loads transmitted to the isolated at-grade slab will be resisted by soil-concrete friction on the base of the slab.

Design Recommendations – Thickened Concrete Slab

We understand that various structures and equipment may be supported on thickened slab type foundations. The thickened slab foundations supported at grade may be designed using the following parameters provided that the select fill pad and subgrade soils are prepared as outlined in **Design Recommendations - Slab-on-Grade Foundation System**.

Item	Description
Minimum embedment below finished grade[1]	12 inches
Allowable bearing pressure	1,000 psf
Approximate total settlement[2]	Approximately one inch or less
Estimated differential settlement[3]	Approximately ½ of post-construction settlement
Allowable frictional resistance[4]	250 psf

1. To bear upon properly placed and compacted select fill soils.
2. This total post construction settlement is estimated provided that proper construction practices are implemented. The isolated thickened concrete foundation should produce a major portion of the estimated settlements during and shortly after construction.
3. Differential settlements will result from variances in subsurface conditions, loading conditions, and construction procedures, such as cleanliness of the bearing area or water seepage in the foundation excavation.
4. Lateral loads transmitted to the isolated thickened concrete slab will be resisted by soil-concrete friction on the base of the slab.

Design Recommendations – Shallow Spread/Strip Footings

Item	Description
Minimum embedment depth[1]	2 feet below final grade
Allowable bearing pressures[2] **(individual footings)**	Net dead plus sustained live load – 1,200 psf Net total load – 1,800 psf
Allowable bearing pressures[3] **(strip footing)**	Net dead plus sustained live load – 1,000 psf Net total load – 1,500 psf
Approximate post-construction settlement[4]	Approximately one inch
Estimated post-construction differential settlement[5]	Approximately ½ of post-construction settlement

Item	Description
Allowable passive pressure[6]	750 psf
Allowable frictional resistance[7]	250 psf
Uplift resistance[8]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. The footings should bear upon either native undisturbed soils or the properly placed and compacted select fill soils.
2. Whichever condition yields a larger bearing area.
3. Defined as a footing at least twice as long as it is wide.
4. This estimated post-construction settlement of the shallow footings is based on proper construction practices being followed. A clear distance between footings of one footing size of the larger of the two footings should not produce overlapping stress distributions and would essentially behave as independent foundations.
5. The post-construction differential settlements may result from variances in subsurface conditions, loading conditions, and construction procedures. The settlement response of the footings will be more dependent upon the quality of construction than upon the response of the subgrade to the foundation loads.
6. The passive pressure along the exterior face of the footings should be neglected within the upper 4 feet due to surface effects and the presence of fill and expansive soils unless pavement is provided up to the edge of the structures.
7. To be utilized on the base of the footings.
8. Structural uplift loads on the shallow footings may be resisted by the weight of the foundation plus the weight of any soil directly above the foundation. The ultimate uplift capacity of shallow footings should be reduced by an appropriate factor of safety to compute allowable uplift capacity.

Construction Considerations – Shallow Foundations

Excavations for shallow footings and grade beams should be performed with equipment capable of providing a relatively clean bearing area. The bottom 6 inches of the foundation and grade beam excavations should be completed with a smooth-mouthed bucket or by hand labor. The excavations should be neatly excavated and properly formed. Debris in the bottom of the excavation should be removed prior to steel placement. Based on the groundwater observations obtained during our field program (refer to **Groundwater Conditions**), significant groundwater seepage is not anticipated for shallow footings or grade beams at the recommended bearing depth. However, water should not be allowed to accumulate at the bottom of the foundation excavations. To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that concrete and steel be placed as soon as possible after the excavations are completed. Excavations should not be left open overnight. The bearing surface of the shallow footings should be evaluated immediately prior to placing concrete or a seal slab.

A thin seal slab of lean concrete (approximately 2 to 4 inches thick) should be placed at the bottom of the footing excavation to protect the bearing surface of the footings from disturbance and/or infiltration of ground/surface water if the footing cannot be poured within the same day of excavation.

Foundation Construction Monitoring

The performance of the foundation systems will be highly dependent upon the quality of construction. Thus, we recommend that subgrade preparation, fill compaction, and foundation installation be observed full time by an experienced Terracon soil technician under the direction of our geotechnical engineer. During foundation construction, the base of the footing excavations should be observed to evaluate the condition of the subgrade. We would be pleased to develop a plan for compaction and foundation installation observation to be incorporated in the overall quality control program.

Pavements

Once the subgrade is properly prepared, both flexible pavement systems (consisting of asphaltic concrete and base material) and rigid pavement systems may be considered for this project. Detailed traffic loads and frequencies were not available. However, we anticipate that traffic will consist primarily of passenger vehicles in the parking areas and passenger vehicles combined with garbage trucks and large multi-axle delivery trucks from time-to-time in driveway areas.

Tabulated in the following table are the assumed traffic frequencies and loads used to design pavement sections for this project. When actual traffic conditions have been determined Terracon should be contacted to review the information to consider a need for revision of the pavement designs and related recommendations.

Pavement Area	Traffic Design Index[1]	Description
Automobile Parking Areas	DI-1	Light traffic (Few vehicles heavier than passenger cars, no regular use by heavily loaded two axle trucks.) (EAL[2]<6)
Driveways (Light Duty)	DI-2	Medium to light traffic (Similar to DI-1 including not over 50 loaded two axle trucks or lightly loaded larger vehicles per day. No regular use by heavily loaded trucks with three or more axles.) (EAL = 6-20)

Pavement Area	Traffic Design Index[1]	Description
Driveways and Truck Traffic Areas (Medium Duty)	DI-3	Medium traffic (Including not over 300 heavily loaded two axle trucks plus lightly loaded trucks with three or more axles and no more than 30 heavily loaded trucks with more than three axles per day.) (EAL = 21-75)

1. Based on NSSGA traffic indices.
2. Equivalent daily 18-kip single axle load applications.

The top 6 inches of the finished subgrade soils directly beneath pavements should be chemically treated with a mixture of lime-flyash. The decision about the type and proper amount of additive should be made after the subgrade is open for inspection. Chemical treatment will increase the supporting value of the subgrade and decrease the effect of moisture on subgrade soils. This 6 inches of treatment is a required part of the pavement design and is not a part of the site and subgrade preparation for wet/soft subgrade conditions.

Listed below are pavement component thicknesses, which may be used as a guide for pavement systems at the site for the traffic classifications stated herein. These systems were derived based on general characterization of the subgrade. Specific testing (such as CBR's, resilient modulus tests, etc.) was not performed for this project to evaluate the support characteristics of the subgrade.

Flexible Pavement System		
Component	**Material Thickness, Inches**	
	DI-1	**DI-2**
Asphaltic concrete	2.0	2.5
Base Material	8.0	10.0
Treated subgrade	6.0	6.0

Rigid Pavement System			
Component	**Material Thickness, Inches**		
	DI-1	**DI-2**	**DI-3**
Reinforced concrete	5.0	6.0	7.0
Treated subgrade	6.0	6.0	6.0

Waste dumpster areas should be constructed of at least 7 inches of reinforced concrete pavement. The concrete pad areas should be designed so that the vehicle wheels of the

collection truck are supported on the concrete while the dumpster is being lifted to support the large wheel loading imposed during waste collection.

Presented below are our recommended material requirements for the various pavement sections.

Reinforced Concrete Pavement – The materials and properties of reinforced concrete pavement should meet applicable requirements in the ACI Manual of Concrete Practice. The portland cement concrete mix should have a minimum 28 day compressive strength of 3,500 psi.

Reinforcing Steel – ACI recommendations indicate that distributed steel reinforcement is not necessary when the pavement is properly jointed to form short panel lengths that will help reduce intermediate cracking. Provided the concrete pavement is designed and constructed as stated herein, the installation of reinforcing steel is optional and should be evaluated by the design team. Proper layout and installation of the joints within the pavement is critical to help control intermediate cracking.

If reinforcing steel is planned to be utilized in the concrete pavement by the design team, the following amount of reinforcing steel should be used as a guideline:
DI-1: #3 bars spaced at 18 inches or #4 bars spaced at 24 inches on centers in both directions.
DI-2: #3 bars spaced at 12 inches or #4 bars spaced at 18 inches on centers in both directions.
DI-3: #4 bars spaced at 18 inches on centers in both directions.

Control Joint Spacing – ACI recommendations indicate that control joints should be spaced at a maximum spacing of 30 times the thickness of the pavement for unreinforced parking lot pavements. Furthermore, ACI recommends a maximum control joint spacing of 12.5 feet for 5-inch pavements and a maximum control joint spacing of 15 feet for 6-inch or thicker pavements. Sawcut control joints should be cut within 4 to 12 hours of concrete placement to help control the formation of plastic shrinkage cracks as the concrete cures. The depth of the joint should be at least one-quarter of the slab depth when using a conventional saw or one inch when using early entry saws. The width of the cut should be in accordance with the joint sealant manufacturer recommendations.

Expansion Joint Spacing – ACI recommendations indicate that regularly spaced expansion joints may be deleted from concrete pavements. Therefore, the installation of expansion joints is optional and should be evaluated by the design team.

Construction Joints – When concrete is planned to be placed at different times, we recommend the use of a construction joint between paving areas. The construction joint should consist of a butt joint (not a keyway joint).

Concrete Curing Compound – A concrete curing compound, such as a Type 2 membrane curing compound conforming to TxDOT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" or equivalent, should be applied to the concrete surface immediately after placement of the concrete in accordance with TxDOT 2014 Standard Specifications Item 360.

Dowels at Expansion/Construction Joints – The dowels at expansion/construction joints should be spaced at 12-inch centers and consist of the following:
DI-1: 5/8-inch diameter, 12-inches long with 5-inch embedment.
DI-2: 3/4-inch diameter, 14-inches long with 6-inch embedment.
DI-3: 7/8-inch diameter, 14-inches long with 6-inch embedment.

Hot Mix Asphaltic Concrete Surface Course – The asphaltic concrete surface course should be plant mixed, hot laid Type D (Fine Graded Surface Course) meeting the requirements in TxDOT 2014 Standard Specifications Item 340. Specific criteria for the job specifications should include compaction to within an air void range of 3.8 to 8.5 percent calculated using the maximum theoretical specific gravity of the mix measured by TxDOT Tex-227-F. The asphalt cement content by percent of total mixture weight should be within ± 0.5 percent asphalt cement from the job mix design.

Base Material – Base material should be composed of crushed limestone or crushed concrete meeting the requirements of TxDOT 2014 Standard Specifications Item 247, Type A or D, Grade 1-2. The base material should be compacted to at least 95 percent of the Modified Effort (ASTM D1557) maximum dry density at moisture content within 2 percent of the optimum moisture content.

Lime-Flyash Treated Subgrade – The on-site silty sand, clayey sand, and low to medium plasticity clay soils (PI<20 percent) should be treated with lime-flyash in accordance with TxDOT 2014 Standard Specifications Item 265. Based on the classification test results, we recommend about 2 to 3 percent lime and 7 to 8 percent flyash by dry weight be used for estimating and planning. The percentages are given as application by dry weight and are typically equivalent to about 10 to 15 pounds of lime and 35 to 40 pounds of flyash per square yard per 6-inch depth. Lime-flyash is also available pre-mixed, typically in percentages of 20 to 30 percent lime and 70 to 80 percent flyash. These pre-mixed products may be used if preferred at a rate of 50 pounds per square yard per 6-inch depth. The actual quantity of lime-flyash should be determined at the time of construction based on laboratory testing conducted using bulk samples of the subgrade soils. The subgrade should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content within 2 percent of the optimum moisture content.

Preferably, traffic should be kept off the treated subgrade for 7 days to facilitate curing of the soil-chemical mixture. In addition, the subgrade is not suitable for heavy construction traffic prior to paving.

Post-construction subgrade movements and some cracking of pavements are not uncommon for clay subgrade conditions such as those observed at this site. Reducing moisture changes in the subgrade is important to reduce shrink/swell movements. Although chemical treatment will help to reduce such movement/cracking, this movement/cracking cannot be economically eliminated.

Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations and environmental factors which will significantly affect the service life must be included in the preparation of the construction drawings and specifications. Normal periodic maintenance will be required.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventative maintenance. The following recommendations should be implemented to help promote long-term pavement performance:

- The subgrade and the pavement surface should be designed to promote proper surface drainage, preferably at a minimum grade of 2 percent;
- Install joint sealant and seal cracks immediately;
- Extend curbs into the treated subgrade for a depth of at least 4 inches to help reduce moisture migration into the subgrade soils beneath the pavement section; and
- Place compacted, low permeability clayey backfill against the exterior side of the curb and gutter.

Preventative maintenance should be planned and provided for the pavements at this site. Preventative maintenance activities are intended to slow the rate of pavement deterioration, and consist of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Prior to implementing any maintenance, additional engineering observations are recommended to determine the type and extent of preventative maintenance.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the

absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

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

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

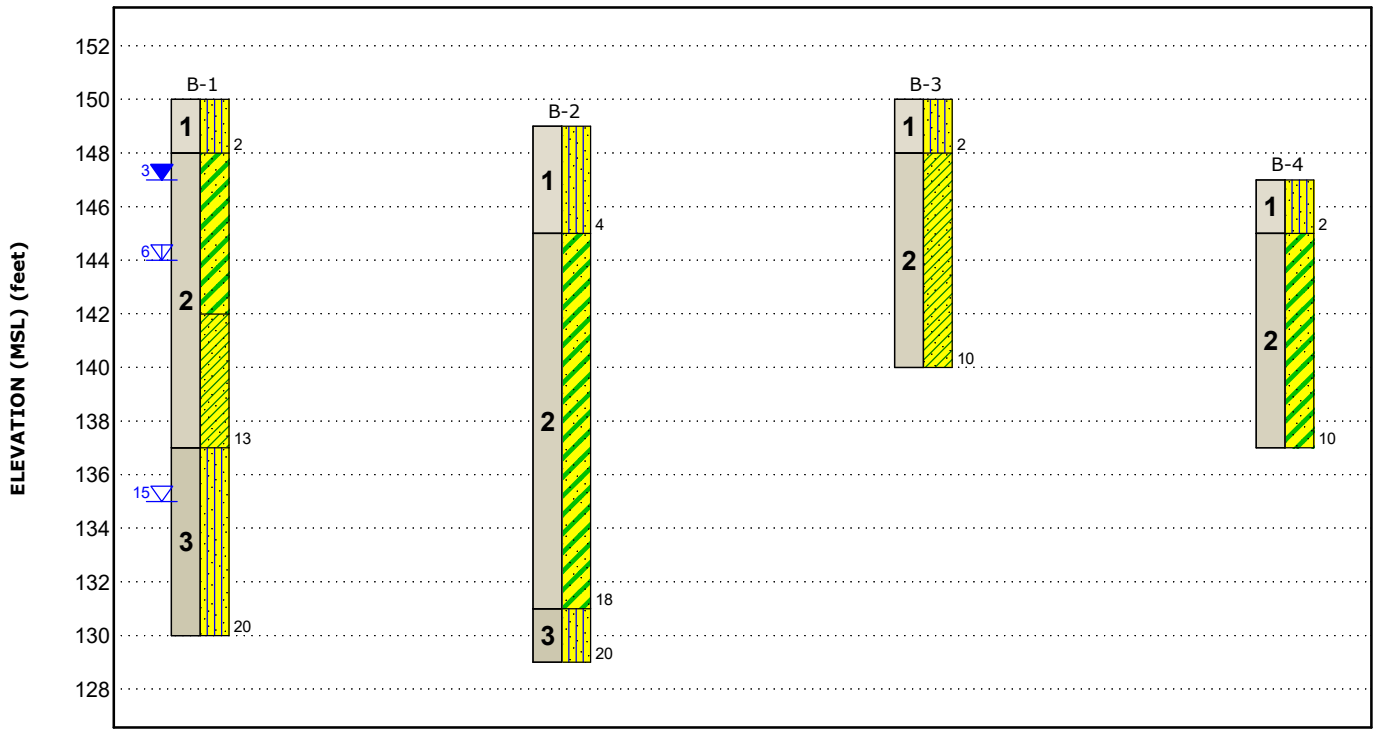
Figures

Contents:

Alden Bridge Sports Fields Additions - Improvements
4751 TX-242 | The Woodlands, Texas
Terracon Project No. 97245137

Terracon
11133 Interstate 45 S Ste T
Conroe, TX

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Upper Sands**	Tan and light gray, loose, with clay pockets
2	**Clayey Sand and Sandy Lean Clay**	Light gray, tan, and reddish brown, very loose to medium dense or soft to very stiff, with sand pockets
3	**Lower Sands**	Light gray, loose to medium dense, with clay pockets

Legend

Silty Sand
Clayey Sand
Sandy Lean Clay

▽ First Water Observation
▽ Second Water Observation
▼ Third Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
1 (B-1)	25	Playground/pavilion areas
1 (B-2)	20	Restrooms/pavilion areas
2 (B-3 and B-4)	10	Parking/driveway area

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±20 feet) and referencing existing site features. Approximate elevations were obtained by interpolation from the site survey provided by Halff dated May 30, 2024.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted rotary drill rig using continuous flight augers (solid stem). Six samples were obtained in the upper 12 feet of each boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. For safety purposes, all borings were backfilled with auger cuttings and capped with concrete cylinder after their completion.

We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater. Groundwater was observed at these times in the boreholes.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Unconfined Compression
- Atterberg Limits
- Percent Passing the No. 200 Sieve

The laboratory testing program included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Samples not tested in the laboratory will be stored for a period of 30 days subsequent to the submittal of this report and will be discarded after this period unless we are notified otherwise

Site Location and Exploration Plan

Contents:

Site Location
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

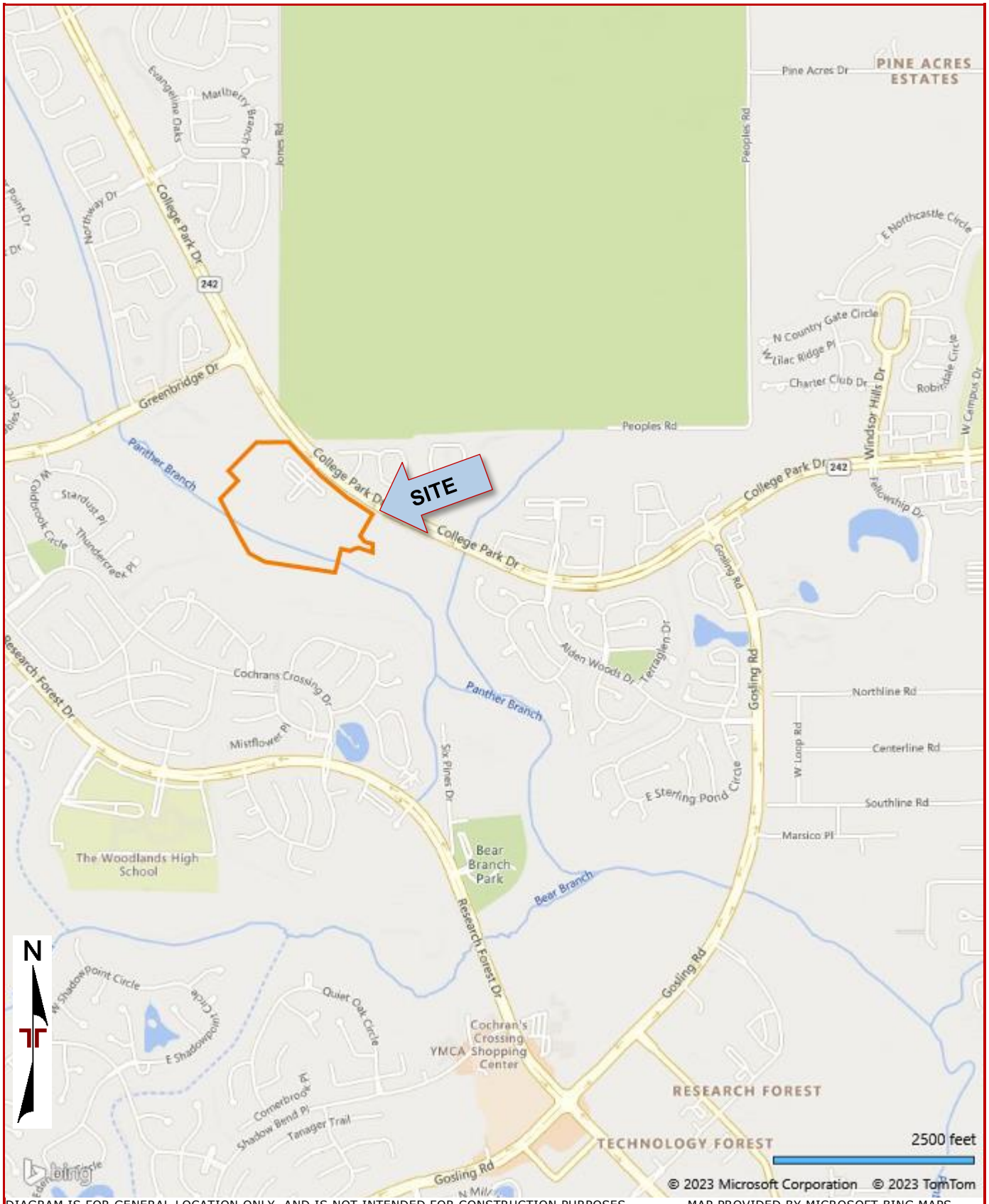


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

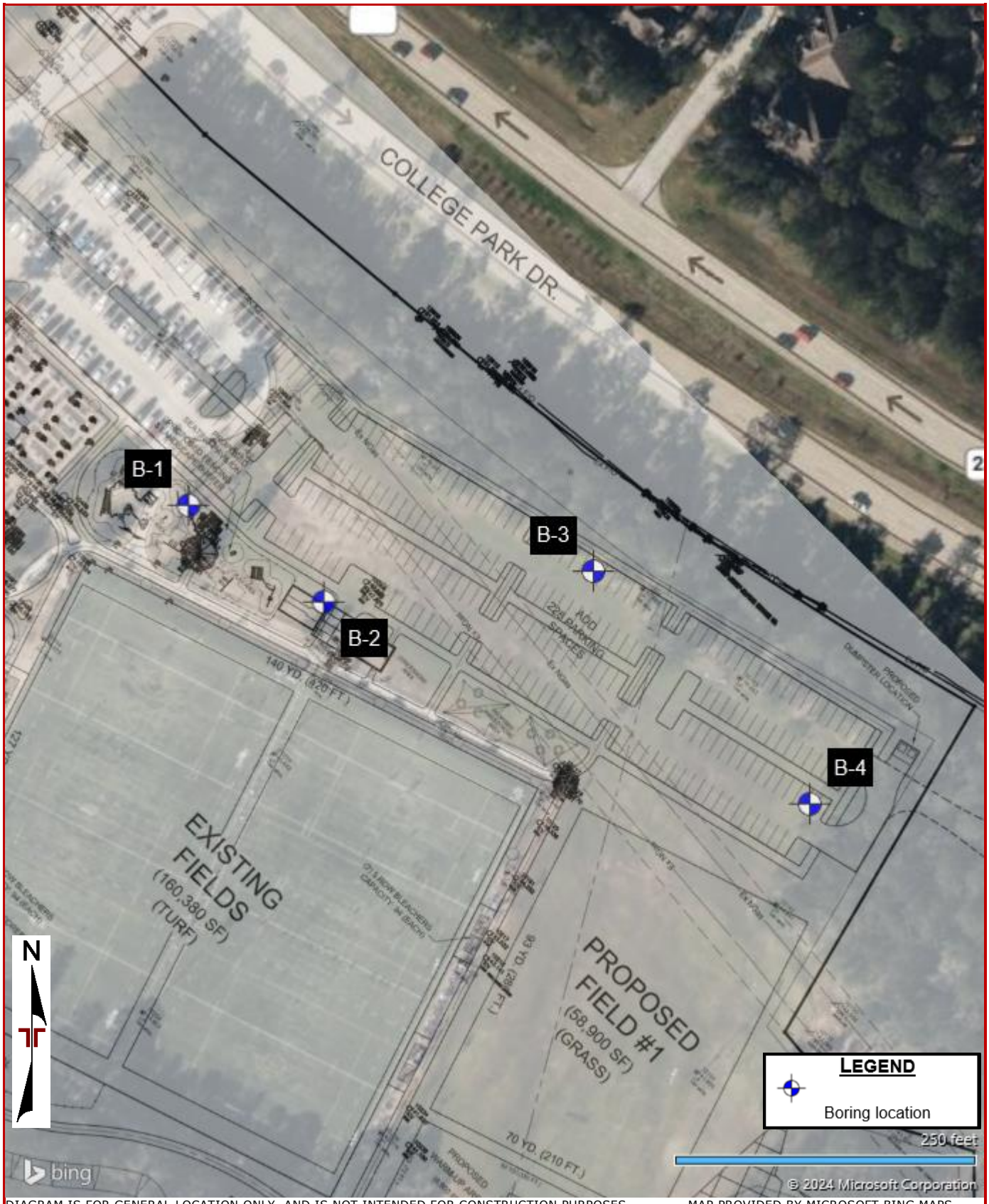


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-4)

Note: All attachments are one page unless noted above.

Terracon
11133 Interstate 45 S Ste T
Conroe, TX

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 30.2052° Longitude: -95.4973°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 150 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0.0	SILTY SAND (SM), tan, loose, with clay pockets				3-4-5 N=9							
		2.0	148											
2		2.0	CLAYEY SAND (SC), light gray and tan, very loose to loose				1-1-2 N=3							
				5			1.0 (HP)	UC	0.59	11.9	15.4	112	23-10-13	46
							1.0 (HP)							
		8.0	142											
		8.0	SANDY LEAN CLAY (CL), light gray and tan, very stiff				4.5 (HP)				13.4		33-12-21	
			- with sand pockets, 10 to 13 feet	10			3.0 (HP)							
		13.0	137											
3		13.0	SILTY SAND (SM), light gray, medium dense				5-8-12 N=20							
				15										
		20.0	130				4-9-12 N=21							
		20.0	*Boring Terminated at 20 Feet*	20										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- While drilling
- After 5 minutes
- After 15 minutes

Drill Rig
Truck

Hammer Type
Automatic

Driller
EG Drillers

Logged by
D. Page

Boring Started
12-04-2024

Boring Completed
12-04-2024

Notes

Advancement Method
Dry auger to 15 feet. Wet rotary from 15 to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Alden Bridge Sports Fields Additions - Improvements
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Terracon
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Boring Log No. B-2

Location: See Exploration Plan
Latitude: 30.2049° Longitude: -95.4969°
Depth (Ft.) Elevation.: 149 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1					0.5 (HP)							
					2-2-3 N=5				15.3			36
		4.0 145										
2		5			3-3-9 N=12							
					3.5 (HP)				14.3		23-12-11	35
					1.5 (HP)							
		10			7-13-10 N=23				13.1		30-12-18	
					1.0 (HP)							
		15										
3		18.0 131			0.5 (HP)							
		20.0 129										
		20										

SILTY SAND (SM), tan, loose, with clay pockets

CLAYEY SAND (SC), tan and light gray, loose to medium dense

- tan, light gray, and reddish brown 10 to 13 feet

SILTY SAND (SM), light gray, loose, with clay pockets

Boring Terminated at 20 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed during or upon completion of drilling

Drill Rig
Truck

Hammer Type
Automatic

Driller
EG Drillers

Logged by
D. Page

Boring Started
12-04-2024

Boring Completed
12-04-2024

Notes

Advancement Method
Dry auger to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

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Boring Log No. B-3

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.2050° Longitude: -95.4962° Depth (Ft.) Elevation.: 150 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		SILTY SAND (SM), tan and light gray, loose, with clay pockets 2.0 148				2-2-2 N=4							
2		SANDY LEAN CLAY (CL), tan, light gray, and reddish brown, soft to very stiff				0.5 (HP)				15.4		30-11-19	
		- with sand pockets, 2 to 6 feet	5			2.5 (HP)							
						3.5 (HP)							
		10.0 140				2.0 (HP)							
		Boring Terminated at 10 Feet	10										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed during or upon completion of drilling

Drill Rig
Truck

Hammer Type
Automatic

Driller
EG Drillers

Notes

Advancement Method
Dry auger to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
D. Page

Boring Started
12-04-2024

Boring Completed
12-04-2024

Alden Bridge Sports Fields Additions - Improvements
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Boring Log No. B-4

Location: See Exploration Plan

Latitude: 30.2045° Longitude: -95.4956°

Depth (Ft.) Elevation.: 147 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0										
					3-2-2 N=4				11.2			35
		2.0										
2					1.0 (HP)							
		5			1.5 (HP)							
					1.5 (HP)							
					2.0 (HP)							
		10.0										
		10										

SILTY SAND (SM), tan and light gray, loose, with clay pockets — 2.0 — 145

CLAYEY SAND (SC), tan and light gray, loose to medium dense — 10.0 — 137

Boring Terminated at 10 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed during or upon completion of drilling

Drill Rig
Truck

Hammer Type
Automatic

Driller
EG Drillers

Logged by
D. Page

Boring Started
12-04-2024

Boring Completed
12-04-2024

Notes

Advancement Method
Dry auger to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Supporting Information

Contents:

Note: All attachments are one page unless noted above.

Terracon
11133 Interstate 45 S Ste T
Conroe, TX

General Notes

Sampling	Water Level	Field Tests
Shelby Tube Standard Penetration Test	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils
(More than 50% retained on No. 200 sieve.)
Density determined by Standard Penetration Resistance

Relative Density	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 50
Very Dense	> 50

Consistency of Fine-Grained Soils
(50% or more passing the No. 200 sieve.)
Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Soft	less than 0.25	0 - 1
Soft	0.25 to 0.50	2 - 4
Medium Stiff	0.50 to 1.00	4 - 8
Stiff	1.00 to 2.00	8 - 15
Very Stiff	2.00 to 4.00	15 - 30
Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 4 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.

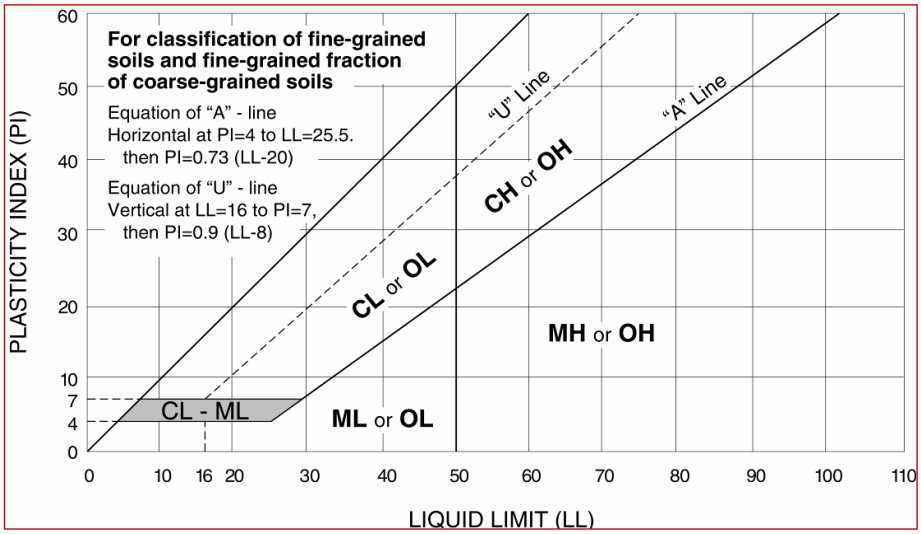


Exhibit M – P66 Encroachment Agreement

ENCROACHMENT AGREEMENT

STATE OF TEXAS §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF MONTGOMERY §

WHEREAS, DCP Southern Hills Pipeline, LLC a Delaware limited liability company, (hereinafter referred to individually as "Pipeline Co.",), is the current owner of the right-of-way specified in an instrument dated the 9/13/1956 from H. Marshall and Celia Marshall his wife covering lands in Montgomery County, Texas, said instrument being filed of record in Book 424, Page 538 of the records of Montgomery County, Texas (hereinafter referred to as the "Right-of-Way"), and

WHEREAS, Pipeline Co. owns and operates a twenty inch (20") Natural Gas Liquids pipeline in the lands covered by Pipeline Co.'s Right-of-Way; and

WHEREAS, Montgomery County Municipal Utility District No. 67 (hereinafter referred to individually as "MUD 67") with an address of 2455 Lake Robbins Road, The Woodlands, Texas 77380, is the owner of a tract of land which is subject to the above specified Right-of-Way, said tract being described in the Deed filed of record in Book 424, Page 538, of the records of Montgomery County, Texas ("MUD Property") (hereinafter Pipeline Co. and MUD 67 may collectively be referred to as "Permittors"); and

WHEREAS, Woodlands Township (hereinafter referred to as "Permittee") with an address of 2801 Technology Forest Blvd, The Woodlands, Texas 77381, is the owner of a tract of land which is subject to the above specified Right-of-Way, said tract being described in the Deed filed of record in Book 424, Page 538, of the records of Montgomery County, Texas; and being 44.425 acres more or less out of the J. Lee Abstract 319 and H. Blood Abstract 101, Montgomery County, Texas ("Township Property"); and

WHEREAS, Permittee has requested permission to encroach upon MUD Property, and Pipeline Co.'s Right-of-Way located on MUD Property and Township Property, as specifically described and/or depicted on Exhibit "A" (hereinafter collectively referred to as the "Encroached Property") by constructing: (1) a concrete parking lot, (2) a shaded picnic area, and (3) a 58,900 sqft Grass Ball Park (hereinafter collectively referred to as the "Encroachment", whether one or more); and

WHEREAS, Permittors are agreeable to permitting said Encroachment subject to the terms and conditions of this Encroachment Agreement ("Agreement").

NOW, THEREFORE, for and in consideration of Ten Dollars ($10.00), and of the premises and of the covenants hereof contained, the receipt and sufficiency of which are hereby acknowledged, the parties hereby agree as follows:

1. Subject to the terms and conditions of this Agreement, Permittors hereby consent to the placement and maintenance of the Encroachment within the Encroached Property as specifically described and/or depicted on Exhibit "A", attached hereto and made a part hereof. The Encroachment within the Encroached Property shall be placed only in the locations described and/or depicted on Exhibit "A". Any changes in the nature or location of the Encroachment shall require the prior written approval of Permittors.

2. Permittee has been advised and is fully aware that Permittors now have, and shall continue to have, the right to utilize the land within the Encroached Property. Pipeline Co. is hereby granted the right to use a reasonable amount of additional workspace outside of Pipeline Co.'s Right-of-Way for pipeline purposes; that in so doing, Permittor may, at any time and from time to time, and without liability to Permittee, enter upon said land, place and transport machinery and equipment thereon, excavate trenches or ditches thereon, and perform other pipeline operations and related activities thereon, any of which may damage or destroy the Encroachment. MUD 67 shall have the right to utilize the MUD Property to carry out its governmental functions and responsibilities, including, without limitation, the construction, installation, maintenance, inspection, repair, replacement, or removal of utility infrastructure or the performance of any

other activities related to MUD 67's purposes, provided said use does not unreasonably interfere with Pipeline Co.'s operations in the Right-of-Way. Permittee agrees that Permittors shall have no obligation to repair, restore or replace the Encroachment or to compensate Permittee for any damage to or destruction of the Encroachment arising out of any such Permittors' activity. Permittee also agrees that Permittors shall not be responsible or liable for, and Permittee hereby releases Permittors from, any lost business or consequential damages resulting from Permittors' above described activities, howsoever caused.

3. Permittee shall give Permittors at least ten (10) days prior written notice before commencing any construction, maintenance, repair, replacement, or removal of the Encroachment on the Encroached Property, or any movement of equipment across the Encroached Property, in order that Permittors shall have an opportunity to have an inspector or representative present during the time such activities are carried out and so that Pipeline Co.'s pipeline(s) can be staked to minimize the possibility of damage and MUD 67 can take actions necessary to minimize the possibility of damage to MUD 67's property. Notice is to be given to the following individuals at the listed email address and phone number:

DCP Southern Hills Pipeline, LLC	MUD 67
Rex Wood	Erich M. Peterson, PE
Supervisor Operations	General Manager, Woodlands Water
713-268-7490 (office)	713-407-2019 (ext. 206)
rex.j.wood@p66.com	epeterson@woodlandswater.org

4. Any future encroachments by Permittee on, or disturbances of, Pipeline Co.'s Right-of-Way or MUD Property are strictly forbidden unless expressly permitted by Permittors under a separate fully executed encroachment agreement. Permittee will not excavate, nor permit others to excavate, on the Encroached Property for subgrade preparations or for any other purposes, except as allowed by this Agreement. Permittee, at its sole cost and expense, shall at all times maintain the Encroachment in a condition which will not interfere with or endanger Pipeline Co.'s pipeline(s) or the operation of such pipelines located within the Encroached Property or MUD 67's utility infrastructure or the operation of such infrastructure located within the Encroached Property.

5. Nothing in this Agreement shall be construed as a release of any of Pipeline Co's rights in the Right-of-Way instrument specified above and this Agreement shall in no way limit or impair said rights.

6. If it becomes necessary in Pipeline Co.'s sole judgment to lower or relocate Pipeline Co's pipeline(s) as a result of any encroachment by Permittee within the Encroached Property, other than the Encroachment, such lowering or relocating of the pipeline(s) shall be undertaken by Pipeline Co. at the sole cost and expense of Permittee including, but not limited to, the cost of acquiring any additional right-of-way. Any relocation of Pipeline Co.'s pipeline(s), as well as the relocation route, shall be at the sole discretion of Pipeline Co. If it becomes necessary in MUD 67's sole judgment to relocate MUD 67's utility infrastructure as a result of any encroachment by Permittee within the Encroached Property, other than the Encroachment, such relocating of the infrastructure shall be undertaken by MUD 67 at the sole cost and expense of Permittee. Any relocation of MUD 67's infrastructure shall be at the sole discretion of MUD 67.

7. Within the Encroached Property, Pipeline Co. shall have the right to adequately mark its pipeline(s) with permanent line markers and ground placards to promote public safety and the future safe operation of said pipeline(s), and to meet applicable governmental regulations.

8. Permittee represents and warrants that it is in compliance with and shall continue to comply with all of the terms and conditions set forth in Permittors' Design Guidelines and Construction Guidelines attached hereto as Exhibit "B".

9. **PERMITTEE SHALL INDEMNIFY, RELEASE, DEFEND AND HOLD PERMITTORS AND THEIR RESPECTIVE PARENTS, SUBSIDIARIES AND AFFILIATES, PARTNERS AND CO-VENTURERS, AND EACH OF THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, CONTRACTORS, SUBCONTRACTORS, AND REPRESENTATIVES (COLLECTIVELY, THE "INDEMNIFIED PARTIES"), HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DEMANDS,**

SUITS, CAUSES OF ACTION, GOVERNMENTAL ORDERS, JUDGMENTS, FINES, PENALTIES, DAMAGES, LOSSES, COSTS AND EXPENSES (INCLUDING ATTORNEYS' FEES, COSTS OF LITIGATION AND/OR INVESTIGATION AND OTHER COSTS ASSOCIATED THEREWITH), AND LIABILITIES, OF EVERY KIND, (COLLECTIVELY REFERRED TO HEREAFTER AS "CLAIMS"), INCLUDING, BUT NOT LIMITED TO, THOSE RELATING TO INJURY OR DEATH OF ANY PERSONS AND/OR DAMAGE (INCLUDING ENVIRONMENTAL DAMAGE) TO, LOSS OR CONTAMINATION OR POLLUTION OF ANY PROPERTY OR RESOURCE ARISING OUT OF, RESULTING FROM, OR CONNECTED DIRECTLY OR INDIRECTLY WITH THIS AGREEMENT AND/OR THE EXERCISE OF ANY OF THE RIGHTS HEREIN, INCLUDING WITHOUT LIMITATION THE CONSTRUCTION, PRESENCE, MAINTENANCE, USE, REPAIR OR REMOVAL OF THE PERMITTED ENCROACHMENT, OR THE FAILURE TO COMPLY WITH ANY OF THE TERMS AND PROVISIONS OF THIS AGREEMENT BY PERMITTEE OR BY ANYONE ACTING FOR OR ON BEHALF OF PERMITTEE, REGARDLESS OF THE CAUSE OR CAUSES THEREOF, INCLUDING WITHOUT LIMITATION STRICT LIABILITY OR ANY CLAIMS CAUSED BY OR CONTRIBUTED TO, IN WHOLE OR IN PART, BY THE ACTIVE OR PASSIVE SOLE, JOINT OR CONCURRENT NEGLIGENCE OR FAULT (WHETHER IMPOSED BY STATUTE, RULE, REGULATION OR OTHERWISE) OF ANY OF THE INDEMNIFIED PARTIES, EXCEPT TO THE EXTENT ANY SUCH CLAIMS ARE CAUSED BY THE INDEMNIFIED PARTIES' WILLFUL MISCONDUCT. THE PROVISIONS OF THIS PARAGRAPH 9 SHALL SURVIVE THE TERMINATION OF THIS AGREEMENT.

10. This Agreement shall be a covenant running with the property rights under which Permittee is conducting its activities on the Encroached Property.

11. Permittee may not assign its rights hereunder without prior written notice to Permittors of such assignment; nevertheless, the provisions hereof shall extend to, be binding upon, and inure to the benefit of the parties hereto and their respective heirs, personal representatives, successors and assigns.

EXECUTED on the dates set forth in the acknowledgments, but effective for all purposes as of June 03, 2025 (the "Effective Date").

[Signatures commence on the following page.]

PIPELINE CO. | PERMITTOR
DCP Southern Hills Pipeline, LLC

By: Michael E. Phillips

Printed Name: Michael E. Phillips

Title: Attorney-in-Fact

STATE OF TEXAS §
§
COUNTY OF HARRIS §

On this 12 day of August, 2025, before me Michael E. Starkey, the undersigned Notary Public, personally appeared Michael E. Phillips, known to me (or proved to me on the oath of _____ or through Driver's License to be the person whose name is subscribed as Attorney-in-Fact of DCP Southern Hills Pipeline, LLC, a Delaware limited liability company and acknowledged that he/she, as such Attorney-in-Fact, being informed of the contents of the conveyance, and being authorized so to do, executed the foregoing Encroachment Agreement as the act of such officer with full authority, executed the same voluntarily for and as the act said limited liability company by himself/herself as Attorney-in-Fact for the purposes and consideration therein expressed.

Notary Public in and for Harris County, Texas

My commission expires:
August 3, 2026

MICHAEL EDWARD STARKEY
Notary ID #131632562
My Commission Expires
August 3, 2026

MUD 67 | PERMITTOR
Montgomery County Municipal Utility District No. 67

By: _____

Printed Name: Erich PETERSON

Title: General Manager

STATE OF TEXAS §
§
COUNTY OF MONTGOMERY §

On this 11 day of August, 2025, before me Shelley Lawson-Kennedy, the undersigned Notary Public, personally appeared Erich Peterson, known to me (or proved to me on the oath of (known to me) or through satisfactory evidence which was _____ to be the person whose name is subscribed as General Manager of Montgomery County Municipal Utility District No. 67, and acknowledged that he/she, as such _____, being informed of the contents of the conveyance, and being authorized so to do, executed the foregoing Encroachment Agreement, as the act of such officer with full authority, executed the same voluntarily for and as the act of said Montgomery County Municipal Utility District No. 67 by himself/herself as General Manager for the purposes and consideration therein expressed.

SHELLEY LAWSON-KENNEDY
My Notary ID # 128445752
Expires January 13, 2027

_____
Notary Public in and for Montgomery County, TX

My commission expires:
January 13, 2027

PERMITTEE
Woodlands Township

By: _____

Printed Name: Chris Nunes

Title: Chief Operating Officer

STATE OF TEXAS §
§
COUNTY OF MONTGOMERY §

On this 4th day of August, 2025, before me CINDY STRAWN, the undersigned Notary Public, personally appeared CHRIS NUNES, known to me (or proved to me on the oath of PERSONALLY KNOWN or through satisfactory evidence which was _____ to be the person whose name is subscribed as COO of Woodlands Township, and acknowledged that he/she, as such CHRIS NUNES, being informed of the contents of the conveyance, and being authorized so to do, executed the foregoing Encroachment Agreement, as the act of such officer with full authority, executed the same voluntarily for and as the act of said Woodlands Township by himself/herself as COO for the purposes and consideration therein expressed.

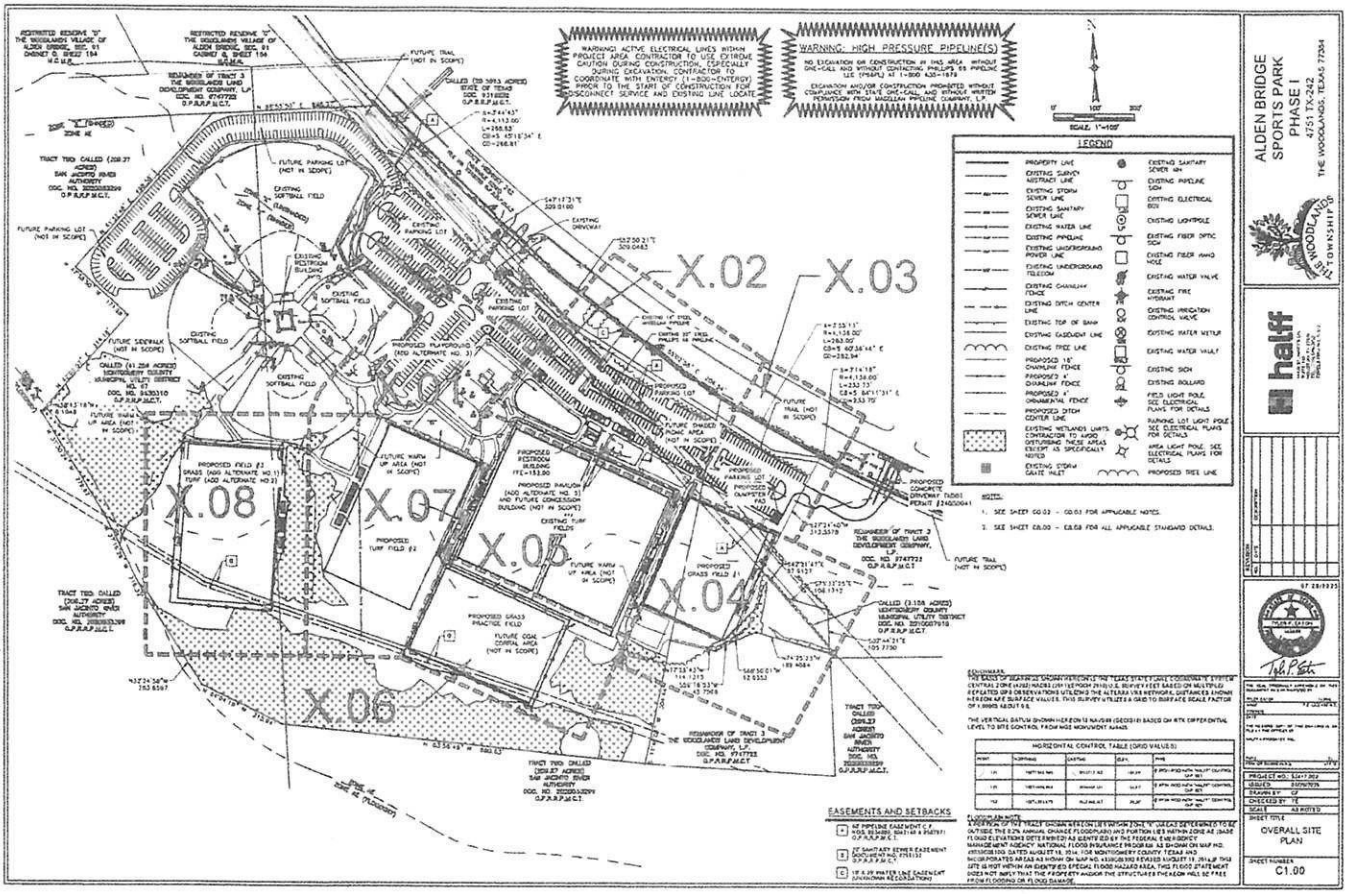
CStrawn
Notary Public in and for MONTGOMERY County, TEXAS

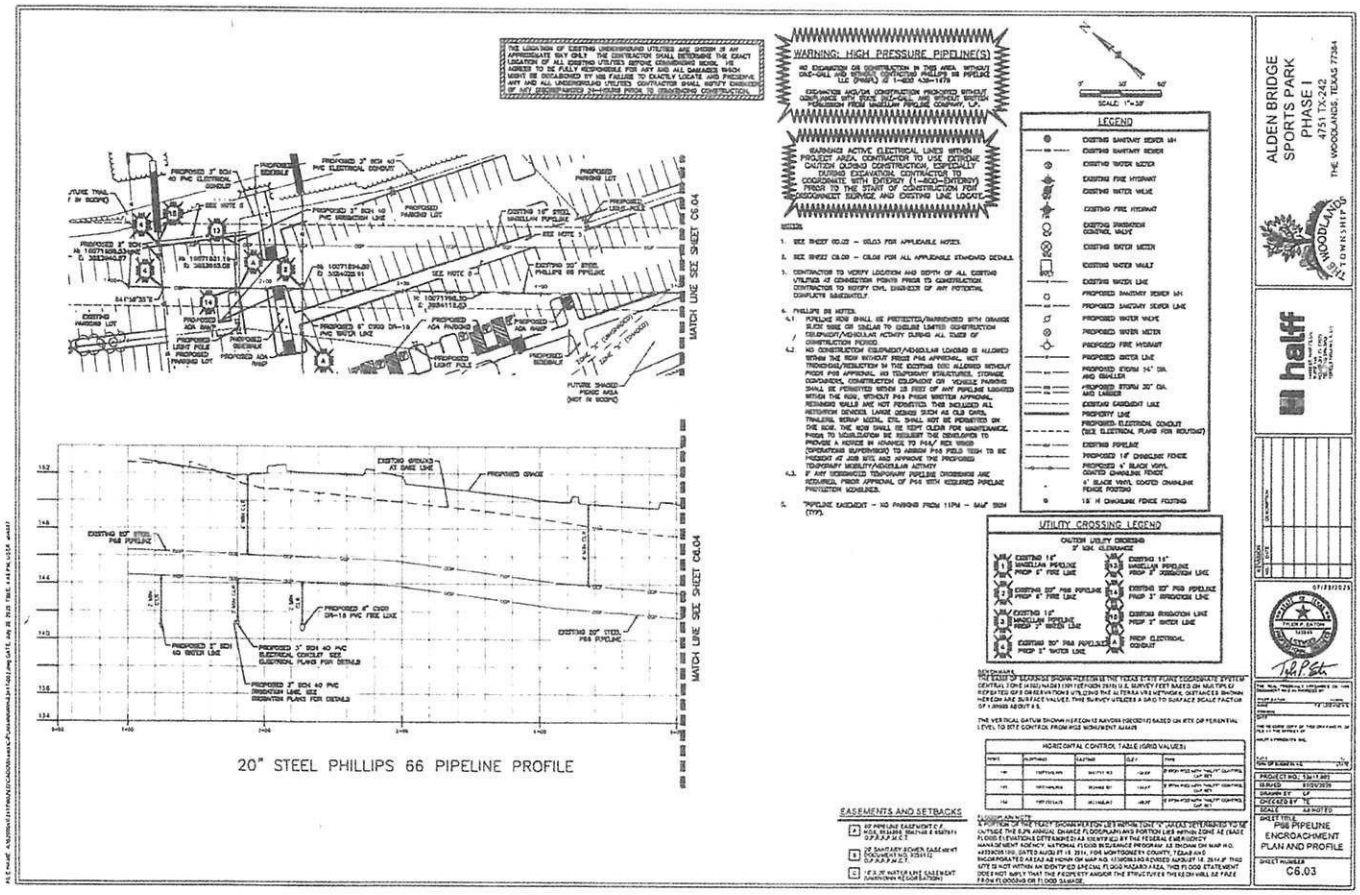
My commission expires:

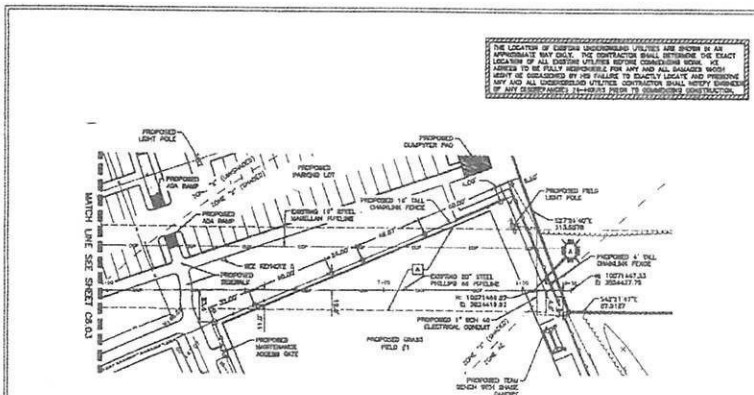
CINDY STRAWN
Notary Public, State of Texas
Comm. Expires 02-14-2027
Notary ID 10477995

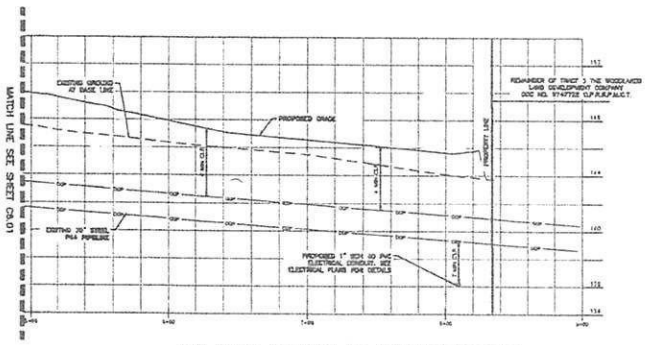
EXHIBIT "A"

Encroachments are located within the limits of the Alden Bridge Sports Park located at 4751 TX 242, The Woodlands, TX 77384 and as show on the attached drawings.


WARNING: ACTIVE ELECTRICAL LINES WITHIN PROJECT AREA. CONTRACTOR TO USE EXTREME CAUTION DURING CONSTRUCTION, ESPECIALLY DURING EXCAVATION. CONTRACTOR TO COORDINATE WITH ENTERGY (1-800-ENTERGY) PRIOR TO THE START OF CONSTRUCTION FOR DISCONNECT SERVICE AND EXISTING LINE LOCATE.
WARNING: HIGH PRESSURE PIPELINE(S)
NO EXCAVATION OR CONSTRUCTION IN THIS AREA WITHOUT ONE-CALL AND WITHOUT CONTACTING PHILLIPS 66 PIPELINE LLC (PHMPL) AT 1-800 420-1876
EXCAVATION AND/OR CONSTRUCTION PROHIBITED WITHOUT COMPLIANCE WITH STATE ONE-CALL AND WITHOUT WRITTEN PERMISSION FROM MAGELLAN PIPELINE COMPANY, LP.
SCALE: 1"=100'
LEGEND
X.02
X.03
X.04
X.05
X.06
X.07
X.08
EASEMENTS AND SETBACKS
FLOODPLAIN NOTE:
ALDEN BRIDGE SPORTS PARK PHASE I
4751 TX-242
THE WOODLANDS, TEXAS 77384
halff
OVERALL SITE PLAN
C1.00


THE LOCATION OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. HE AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY DISCREPANCIES 24-HOURS PRIOR TO BEGINNING CONSTRUCTION.
WARNING: HIGH PRESSURE PIPELINE(S)
NO EXCAVATION OR CONSTRUCTION IN THIS AREA, WITHOUT ONE-CALL AND MAGELLAN SERVICES' APPROVAL
WARNING! ACTIVE ELECTRICAL LINES WITHIN PROJECT AREA. CONTRACTOR TO USE EXTREME CAUTION DURING CONSTRUCTION, ESPECIALLY DURING EXCAVATION. CONTRACTOR TO COORDINATE WITH ENTERGY (1-800-ENTERGY) PRIOR TO THE START OF CONSTRUCTION FOR DISCONNECT SERVICE AND EXISTING LINE LOCATE.
NOTES:
1. SEE SHEET 00.02 – 00.03 FOR APPLICABLE NOTES.
2. SEE SHEET C6.00 – C6.05 FOR ALL APPLICABLE STANDARD DETAILS.
3. CONTRACTOR TO VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITIES AT CONNECTION POINTS PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY CIVIL ENGINEER OF ANY POTENTIAL CONFLICTS IMMEDIATELY.
4. PHILLIPS 66 NOTES:
4.1 PIPELINE ROW SHALL BE PROTECTED/BARRICADED WITH ORANGE SLACK WORK OR SIMILAR TO OUTLINE LIMITED CONSTRUCTION CORRIDOR/LAYDOWN/STAGING ACTIVITY DURING ALL PHASES OF CONSTRUCTION PERIOD.
4.2 NO CONSTRUCTION EQUIPMENT/MATERIALS LOADING IS ALLOWED WITHIN THE ROW WITHOUT PRIOR P66 APPROVAL. NOT TRENCHING/EXCAVATION IN THE EXISTING ROW ALLOWED WITHOUT PRIOR P66 APPROVAL. NO TEMPORARY STRUCTURES, STORAGE, DUMPSTERS, CONSTRUCTION EQUIPMENT OR VEHICLE PARKING SHALL BE PERMITTED WITHIN 25 FEET OF ANY PIPELINE LOCATED WITHIN THE ROW, WITHOUT P66 PRIOR WRITTEN APPROVAL. REMAINS WALLS ARE NOT PERMITTED THIS INCLUDES ALL RETENTION DEVICES. LARGE DEBRIS SUCH AS OLD CARS, TRAILERS, SCRAP METAL, SHALL NOT BE PERMITTED ON THE ROW. THE ROW SHALL BE KEPT CLEAR FOR MAINTENANCE. PRIOR TO MOBILIZATION WE REQUEST THE DEVELOPER TO PROVIDE A NOTICE IN ADVANCE TO P66/ ROW VISION (OPERATIONS SUPERVISOR) TO ASSIGN P66 FIELD TECH TO BE PRESENT AT JOB SITE AND APPROVE THE PROPOSED TEMPORARY MOBILITY/MODULAR ACTIVITY.
4.3 IF ANY PROPOSED TEMPORARY PIPELINE CROSSINGS ARE REQUIRED, PRIOR APPROVAL OF P66 WITH REQUIRED PIPELINE PROTECTION MEASURES.
5. "PIPELINE EASEMENT – NO PARKING FROM 11PM – 6AM" SIGN (TYP).
SCALE: 1"=30'
LEGEND
EXISTING SANITARY SEWER MH
EXISTING SANITARY SEWER
EXISTING WATER METER
EXISTING FIRE HYDRANT
EXISTING WATER VALVE
EXISTING FIRE HYDRANT
EXISTING IRRIGATION CONTROL VALVE
EXISTING WATER METER
EXISTING WATER VAULT
EXISTING WATER LINE
PROPOSED SANITARY SEWER MH
PROPOSED SANITARY SEWER LINE
PROPOSED WATER VALVE
PROPOSED WATER METER
PROPOSED FIRE HYDRANT
PROPOSED WATER LINE
PROPOSED STORM 14" DIA. AND SMALLER
PROPOSED STORM 20" DIA. AND LARGER
EXISTING EASEMENT LINE
PROPERTY LINE
PROPOSED ELECTRICAL CONDUIT (SEE ELECTRICAL PLANS FOR ROUTING)
EXISTING PIPELINE
PROPOSED 16' CHAINLINK FENCE
PROPOSED 6' BLACK VINYL COATED CHAINLINK FENCE POSTING
18" H CHAINLINK FENCE FOOTING
UTILITY CROSSING LEGEND
CAUTION UTILITY CROSSING
3' MIN CLEARANCE
EXISTING 16" MAGELLAN PIPELINE PROP 12" FIRE LINE
EXISTING 16" MAGELLAN PIPELINE PROP 3" IRRIGATION LINE
EXISTING 20" P66 PIPELINE PROP 6" FIRE LINE
EXISTING 20" P66 PIPELINE PROP 3" IRRIGATION LINE
EXISTING 16" MAGELLAN PIPELINE PROP 2" WATER LINE
EXISTING IRRIGATION LINE PROP 2" WATER LINE
EXISTING 20" P66 PIPELINE PROP 1" WATER LINE
PROP ELECTRICAL CONDUIT
BENCHMARK
THE BASIS OF BEARINGS SHOWN HEREON IS THE TEXAS STATE PLANE COORDINATE SYSTEM CENTRAL ZONE (4203) NAD83 (NSRS) (HARN) DATUM IN U.S. SURVEY FEET BASED ON MULTIPLE REPEATED GPS OBSERVATIONS UTILIZING THE ALTERRA VRS NETWORK. DISTANCES SHOWN HEREON ARE SURFACE VALUES. THE SURVEY UTILIZES A 0.9999 TO SURFACE SCALE FACTOR OF LOCATED ABOUT 0,0.
THE VERTICAL DATUM SHOWN HEREON IS NAVD88 (GEOID18) BASED ON RTK GPS PERIMETRAL LEVEL TO SITE CONTROL FROM HCE MONUMENT AAA28
HORIZONTAL CONTROL TABLE (GRID VALUES)
POINT | NORTHING | EASTING | ELEV | DESC
AAA28 | 10071194.995 | 3623757.163 | 138.69' | 3" BRASS HCE DISK WITH "HALFF" STAMPED CAP SET
AAA29 | 10071194.995 | 3624044.163 | 138.69' | 3" BRASS HCE DISK WITH "HALFF" STAMPED CAP SET
AAA30 | 10071194.995 | 3624331.163 | 138.69' | 3" BRASS HCE DISK WITH "HALFF" STAMPED CAP SET
EASEMENTS AND SETBACKS
A) 40' PIPELINE EASEMENT C.F. NOS. 9532068, 9567168 & 9567169 (TYP.)
B) 20' SANITARY SEWER EASEMENT DOCUMENT NO. 9751112 (TYP.)
C) 5' X 5' WATER LINE EASEMENT (VARIOUS RECORDATIONS)
FLOOD PLAIN NOTE:
A PORTION OF THE TRACT SHOWN HEREON LIES WITHIN ZONE "X" (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) AS PORTION LIES WITHIN ZONE AE (BASE FLOOD ELEVATIONS DETERMINED AS IDENTIFIED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, NATIONAL FLOOD INSURANCE PROGRAM AS SHOWN ON MAP NO. 48339C0180G DATED AUGUST 18, 2014, FOR MONTGOMERY COUNTY, TEXAS AND INCORPORATED AREAS AND HOWN ON MAP NO. 48339C0340G REVISED AUGUST 18, 2014 IF THIS SITE IS NOT WITHIN AN IDENTIFIED SPECIAL FLOOD HAZARD AREA. THIS FLOOD STATEMENT DOES NOT IMPLY THAT THE PROPERTY AND/OR THE STRUCTURES THEREON WILL BE FREE FROM FLOODING OR FLOOD DAMAGE.
MATCH LINE SEE SHEET C6.04
EXISTING GROUND AT SAME LINE
PROPOSED GRADE
EXISTING 20" STEEL P66 PIPELINE
PROPOSED 4" CSSD DR-18 PVC FIRE LINE
PROPOSED 3" SCH 40 PVC ELECTRICAL CONDUIT SEE ELECTRICAL PLANS FOR DETAILS
PROPOSED 3" SCH 40 PVC IRRIGATION LINE, SEE IRRIGATION PLANS FOR DETAILS
EXISTING 20" STEEL P66 PIPELINE
20" STEEL PHILLIPS 66 PIPELINE PROFILE
ALDEN BRIDGE SPORTS PARK PHASE I
4751 TX-242
THE WOODLANDS, TEXAS 77384
WOODLANDS
TEXAS
halff
AUSTIN, TX 78746
512.777.4600
HOUSTON, TX 77042
713.953.5200
www.halff.com
TBPE FIRM #312
TBPLS FIRM #10029600
DESCRIPTION
NO. DATE
07/31/2023
TYLER P. EATON
103929
LICENSED PROFESSIONAL ENGINEER
07/31/2023
THE ORIGINAL DOCUMENT OF THIS SEALED AND DATED BY TYLER P. EATON, P.E. ON 07/31/2023. COPIES OF THIS DOCUMENT SHALL NOT BE CONSIDERED SEALED AND SHALL BE VOID.
PROJECT NO: 13611.001
SURVEY: 03/03/2020
DRAWN BY: CP
CHECKED BY: TE
SCALE: AS NOTED
SHEET TITLE:
P66 PIPELINE ENCROACHMENT PLAN AND PROFILE
SHEET NUMBER
C6.03





20" STEEL PHILLIPS 66 PIPELINE PROFILE

THE LOCATION OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. HE AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY DISCREPANCIES 72-HOURS PRIOR TO COMMENCING CONSTRUCTION.

WARNING: HIGH PRESSURE PIPELINE(S)
NO EXCAVATION OR CONSTRUCTION IN THIS AREA WITHOUT ONE-CALL AND P66 COMPANY OFFICE CONTACT. 811 ONE CALL LLC (OKLA.) AT 1-800-522-6543
EXCAVATION AND/OR CONSTRUCTION PROHIBITED WITHOUT COMPLIANCE WITH STATE ONE-CALL AND WRITTEN APPROVAL FROM MAGELLAN PIPELINE COMPANY, L.P.

WARNING: ACTIVE ELECTRICAL LINES WITHIN PROJECT AREA. CONTRACTOR TO USE EXTREME CAUTION DURING CONSTRUCTION, ESPECIALLY DURING EXCAVATION. CONTRACTOR TO COORDINATE WITH ENERGY (1-800-ENTERGY) PRIOR TO THE START OF CONSTRUCTION FOR DISCONNECT SERVICE AND EXISTING LINE LOCATE.

NOTES:

1. SEE SHEET C6.02 – C6.03 FOR APPLICABLE NOTES.
2. SEE SHEET C6.05 – C6.06 FOR ALL APPLICABLE STANDARD DETAILS.
3. CONTRACTOR TO VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITIES AT CONNECTION POINTS PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY CIVIL ENGINEER OF ANY POTENTIAL CONFLICTS IMMEDIATELY.
4. PHILLIPS 66 NOTES:
   - 4.1 PIPELINE ROW SHALL BE PROTECTED/BARRICADED WITH ORANGE SLOW MOVE OR SIMILAR TO ENSURE LIMITED CONSTRUCTION EQUIPMENT/VEHICULAR ACTIVITY DURING ALL TIMES OF CONSTRUCTION ACTIVITIES.
   - 4.2 NO CONSTRUCTION EQUIPMENT/VEHICULAR LOADING IS ALLOWED WITHIN THE ROW WITHOUT PRIOR P66 APPROVAL. NOT TRENCHING/INDUCTION IN THE EXISTING DOC ALLOWED WITHOUT PRIOR P66 APPROVAL. NO TEMPORARY STRUCTURES, STORAGE EQUIPMENT, CONSTRUCTION EQUIPMENT OR VEHICLE PARKING SHALL BE PERMITTED WITHIN 10 FEET OF ANY PIPELINE LOCATED WITHIN THE ROW WITHOUT P66 PRIOR WRITTEN APPROVAL. RETAINING WALLS ARE NOT PERMITTED. THIS INCLUDED ALL EXCAVATION DEBRIS. LARGE DEBRIS SUCH AS OLD CARS, TRAILERS, SCRAP METAL, ETC. SHALL NOT BE PERMITTED ON THE ROW. THE ROW SHALL BE KEPT CLEAR FOR MAINTENANCE. PRIOR TO MOBILIZATION WE REQUEST THE DEVELOPER TO PROVIDE A NOTICE IN ADVANCE TO P66/ KEY WORD: EXPECTATIONS SUPERVISOR TO ASSIGN P66 FIELD TEAM TO BE PRESENT AT JOB SITE AND APPROVE THE PROPOSED TEMPORARY VERSUS/MODULAR ACTIVITY.
   - 4.3 IF ANY DESIGNATED TEMPORARY PIPELINE CROSSINGS ARE REQUIRED, PRIOR APPROVAL OF P66 WITH REQUIRED PIPELINE PROTECTION MEASURES.
5. PIPELINE EASEMENT – NO PARKING FROM 11PM – 6AM SIGN (TYP.).

SCALE: 1"=30'

LEGEND

- EXISTING SANITARY SEWER MH
- EXISTING SANITARY SEWER
- EXISTING WATER METER
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- EXISTING FIRE HYDRANT
- EXISTING IRRIGATION CONTROL VALVE
- EXISTING WATER METER
- EXISTING WATER VAULT
- EXISTING WATER LINE
- PROPOSED SANITARY SEWER MH
- PROPOSED SANITARY SEWER LINE
- PROPOSED WATER VALVE
- PROPOSED WATER METER
- PROPOSED FIRE HYDRANT
- PROPOSED WATER LINE
- PROPOSED STORM 24" DIA AND SMALLER
- PROPOSED STORM 30" DIA AND LARGER
- EXISTING EASEMENT LINE
- PROPERTY LINE
- PROPOSED ELECTRICAL CONDUIT (SEE ELECTRICAL PLANS FOR ROUTING)
- EXISTING PIPELINE
- PROPOSED 18' CHAINLINK FENCE
- PROPOSED 4' BLACK VINYL COATED CHAINLINK FENCE
- 4' BLACK VINYL COATED CHAINLINK FENCE FOOTING
- 10' W CHAINLINK FENCE FOOTING

UTILITY CROSSING LEGEND

CAUTION UTILITY CROSSING 3' MIN. CLEARANCE

(A) PROP. ELECTRICAL CONDUIT

BENCHMARK
THE DATUM OF ELEVATIONS SHOWN HEREON IS THE TEXAS STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983 (NAD83), SURVEY FEET BASED ON MULTIPLE GPS OBSERVATIONS UTILIZING THE VERITAS VRS NETWORK. DISTANCES SHOWN HEREON ARE SURFACE VALUES. THIS SURVEY UTILIZES A 0.9998 SURFACE SCALE FACTOR OF 1.00002 ABOUT 0,0.

THE VERTICAL DATUM SHOWN HEREON IS NAVD88 (GEOID18) BASED ON RTK DIFFERENTIAL LEVELING TO SITE CONTROL FROM NGS MONUMENT AJ6439.

HORIZONTAL CONTROL TABLE (GRID VALUES)

POINT	NORTHING	EASTING	ELEV.	TYPE
101	10071447.33	3554427.70	134.27	5/8" IRON ROD WITH YELLOW PLASTIC CAP "HALFF"
102	10071447.33	3554427.70	134.27	5/8" IRON ROD WITH YELLOW PLASTIC CAP "HALFF"
103	10071447.33	3554427.70	134.27	5/8" IRON ROD WITH YELLOW PLASTIC CAP "HALFF"
104	10071447.33	3554427.70	134.27	5/8" IRON ROD WITH YELLOW PLASTIC CAP "HALFF"

EASEMENTS AND SETBACKS

(A) 15' PIPELINE EASEMENT C/O P66 PIPELINE COMPANY LLC (DOCUMENT NO. 9744722 O.P.R.M.C.T.)

(B) 15' SANITARY SEWER EASEMENT (DOCUMENT NO. 9744722 O.P.R.M.C.T.)

(C) 12 & 20' WATER LINE EASEMENT (SHADOWS AS DEPICTED)

FLOOD PLAIN NOTE
A PORTION OF THE TRACT SHOWN HEREON LIES WITHIN ZONE "X" (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) AND PORTION LIES WITHIN ZONE AE (BASE FLOOD ELEVATIONS DETERMINED) AS IDENTIFIED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, NATIONAL FLOOD INSURANCE PROGRAM, AS SHOWN ON MAP NO. 48339C0810G, DATED AUGUST 18, 2014, FOR MONTGOMERY COUNTY, TEXAS AND INCORPORATED AREAS AS SHOWN ON MAP NO. 48339C0810G REVISED AUGUST 18, 2014. IF THIS SITE IS NOT WITHIN AN IDENTIFIED SPECIAL FLOOD HAZARD AREA, THIS FLOOD STATEMENT DOES NOT IMPLY THAT THE PROPERTY AND/OR THE STRUCTURES THEREON WILL BE FREE FROM FLOODING OR FLOOD DAMAGE.

ALDEN BRIDGE SPORTS PARK PHASE I
4751 TX-242
THE WOODLANDS, TEXAS 77384

THE WOODLANDS TOWNSHIP

halff
1201 N. Bowser Rd.
Richardson, TX 75081
972.235.3031
www.halff.com

07/30/2025
TYLER P. EATON
103139
REGISTERED PROFESSIONAL ENGINEER
STATE OF TEXAS

PROJECT NO.: 52417.001
ISSUED: 07/30/2025
DRAWN BY: CJ
CHECKED BY: PE
SCALE: AS NOTED
SHEET TITLE: P66 PIPELINE ENCROACHMENT PLAN AND PROFILE
SHEET NUMBER: C6.04

EXHIBIT "B"

DESIGN GUIDELINES AND CONSTRUCTION GUIDELINES

[INSERT GUIDELINES]

Exhibit N – Magellan Encroachment Agreement

Please note – we are currently working through an additional encroachment agreement with Magellan. The finalized agreement will be provided to the selected bidder. This existing agreement is provided for reference only.

NOTICE OF CONFIDENTIALITY RIGHTS: IF YOU ARE A NATURAL PERSON YOU MAY REMOVE OR STRIKE ANY OF THE FOLLOWING INFORMATION FROM THIS INSTRUMENT BEFORE IT IS FILED FOR RECORD IN THE PUBLIC RECORDS: YOUR SOCIAL SECURITY NUMBER OR YOUR DRIVER'S LICENSE NUMBER.

(Drafted by & when filed return to: Magellan Pipeline Company, L.P., P. O. Box 22186, MD 27-4 (S. Guthrie), Tulsa, Oklahoma 74121-2186, 918/574-7350.)

ENCROACHMENT AGREEMENT

This Encroachment Agreement ("**Agreement**") is made and entered into by and between Magellan Pipeline Company, L.P., a Delaware limited partnership, whose address is P.O. Box 22186, Tulsa, Oklahoma, 74121-2186, (hereinafter called "**Magellan**" or "**Permittor**"), The Woodlands Township, a political subdivision of the State of Texas duly created and operating pursuant to Chapter 289, Acts of the 73rd Legislature, Regular Session, 1993, as amended ("**The Township**"), whose mailing address is 2201 Lake Woodlands, The Woodlands, Texas, 77380, its heirs, successors, assigns and grantees (hereinafter called "**Township**" or "**Permittee**").

WITNESSETH:

WHEREAS, **Permittee** represents and warrants that **Permittee** has the responsibility to develop, use, operate and maintain all the certain land (hereinafter "**Permittee's Land**"), described on attached **Exhibit "A"** and made a part hereof, per that certain Development, Funding, Use, Operation, and Maintenance Agreement dated May 23, 1996 the with Montgomery County Municipal Utility District No. 67 of Montgomery County, Texas who is the surface owner of Permittee's Land per Special Warranty Deeds dated May 15, 1996 and June 18, 2010 and recorded in File No. 9630311 and 2010057615 of the Montgomery County Real Property Records, and

WHEREAS, **Magellan** is the owner of certain pipelines, pipeline facilities and appurtenances (hereinafter referred to as the "**Magellan Facilities**") and easement rights therefor, (hereinafter referred to as the "**Easement**", whether or not rights were granted in one or more documents or

acquired by operation of law). For purposes of this **Agreement** only, "**Magellan's Easement Tract**" shall be considered to be any area within Fifty (50) feet of any **Magellan Facilities**, unless a different right of way tract width is specifically described in the **Easement,** in which case such specified width shall define **Magellan's Easement Tract**. The land referenced in the Easement includes approximately 547 acres of land out of the James Lee Survey, Abstract No. 319, in Montgomery County, Texas, being the tract described by metes and bounds in the Deed from Ben Hicks, Sheriff, to H. Marshall, dated March 5th, 1931, recorded in Vol. 130, at Page 347, Montgomery County, Texas Deed Records, pursuant to those certain instruments recorded in the records of said county and state and described as follows:

1) A Right of Way Grant dated March 26, 1952 and recorded in Book 329 at Pages 81-82, Montgomery County, Texas Records, from H. Marshall, et ux, to The Texas Pipe Line Company (Magellan's predecessor in title), and

2) Easement Amendment by and between The Texas Pipe Line Company and The Woodlands Development Corporation, The Woodlands Commercial Development Company and American Hospital Supply Corporation as to a pipeline or pipe lines dated September 19, 1980 and recorded under File Number 8034880, Film Number 038-01-2296 of the Deed Records of Montgomery County, Texas; and

WHEREAS, for the purposes of this **Agreement** an "**Encroachment**" is defined as any use of the land within **Magellan's Easement Tract** by someone other than **Magellan,** which could interfere with **Magellan's Easement** rights or could create safety concerns related to **Magellan's Facilities** as more fully described in **Magellan's** *General Encroachment Requirements* as set forth in attached **Exhibit "B"** and incorporated herein by reference. **Magellan does not permit or authorize any Encroachments unless specifically approved in a written agreement identifying all "Approved Encroachments"**; and

WHEREAS, **Permittee** desires to obtain **Magellan's** consent for one or more **Encroachments** on **Magellan's Easement Tract;**

NOW, THEREFORE, in consideration of the covenants and agreements herein and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, **Magellan,** subject to the following terms and provisions, hereby consents to the **Encroachments** listed below as "**Approved Encroachments**" described and limited pursuant to the following specified plan drawings, which were furnished by **Permittee** to **Magellan** ("**Plan Drawings**") and attached hereto as **Exhibit "C"**:

1) Grading, site and irrigation plans and associated notes by LANDology landscape architects located at 25814 Budde Road, Spring, Texas 77380. dated August 27, 2010; and

TERMS AND PROVISIONS

1. **Approved Encroachments.** The **Approved Encroachments,** as further identified, described and limited in the **Plan Drawings** as set forth in **Exhibit "C"** are limited to the following:

   (a) One 3-inch diameter PVC waterline crossing Magellan's Easement Tract and crossing Facilities and Magellan's easement Tract at approximately Magellan ESN 7470+01 as shown on Exhibit "C".

   (b) 6 – 7 irrigation lines ranging in size from 2" – 1", irrigation heads and irrigation valves/valve boxes running mostly longitudinal versus crossing Magellan's Easement Tract as shown on Exhibit C.

   (c) One 3-inch diameter HDPE power line conduit containing 480, 200 amp, 3 phase service crossing Magellan's Easement Tract and crossing Facilities at approximately Magellan ESN 7471+11 as shown on Exhibit "C".

   (d) Existing reinforced concrete parking lot running longitudinally within Magellan's Easement Tract at approximately Magellan ESN 7467+01 – 7469+91 as shown on Exhibit "C".

2. **No Other Encroachments.** Except for the **Approved Encroachments** as allowed by this **Agreement**, **Permittee** shall not create, erect, place or construct any other **Encroachment** on, above or below the surface of the ground on **Magellan's Easement Tract**, or change the grade or elevation of the ground surface within **Magellan's Easement Tract** or at any time plant or allow any trees thereon or cause or permit any of these to be done by others, without the express prior written permission of **Magellan.**

3. **Magellan On-Site Representative.** Exclusive of Saturday, Sunday, and legal holidays, **Permittee** shall notify **Magellan** a minimum of 48 hours in advance of any **Encroachment** activities on **Magellan's Easement Tract** so that **Magellan** may arrange to have a representative present. At **Magellan's** option and at **Permittee's** sole cost and expense, **Magellan's** representative may be on site during all **Encroachment** activities over or within ten feet (10') of the **Magellan Facilities** to confirm that no damage occurs to the **Magellan Facilities**. The presence of **Magellan's** representative or any verbal instructions given by such representative shall not relieve **Permittee** of any liability under the **Easement** or this **Agreement,** and will not change the terms of the **Easement** or this **Agreement,** which may only be changed by written agreement by authorized representatives of **Permittee** and **Magellan.** If pipeline, coating, cathodic protection and/or any other repair of **Magellan Facilities** is required by **Magellan** or if the safety of the **Magellan Facilities** is jeopardized, in **Magellan's** sole judgment, **Permittee** shall stop all construction activities on **Magellan's Easement Tract** until said repairs are completed or until any unsafe construction practices are resolved to the satisfaction of **Magellan's** on-site representative. Written notification of such construction activity shall be made to **MAGELLAN PIPELINE COMPANY, Real**

Estate Representative, Mail Drop 27-5, One Williams Center, Tulsa, Oklahoma 74172, Office:(918) 574-7393, Fax: (918) 574-7249, or such other representative of **Magellan,** which **Magellan** may from time to time designate.

4. **Protection of Magellan Facilities.** **Permittee** shall protect the **Magellan Facilities** if excavating and backfilling become necessary within **Magellan's Easement Tract**. If excavating within 2 feet of any Magellan pipeline or when otherwise deemed necessary by **Magellan's** on-site representative, **Permittee** shall perform any necessary digging or excavation operations by hand digging. **Permittee** shall reimburse **Magellan** for all costs of having a representative of **Magellan** on-site during construction activities related to the **Approved Encroachments**.

5. **Breach.** If either **Permittee** or **Magellan** breaches this **Agreement** and the non-breaching party commences litigation to enforce any provisions of this **Agreement**, the reasonable cost of attorneys' fees and expenses will be payable to the non-breaching party by the breaching party upon demand, for all claims upon which the non-breaching party prevails.

6. **Insurance.** **Permittee** shall procure or cause its contractors and subcontractors to procure and maintain in force throughout the entire term of this **Agreement** insurance coverage described below with insurance companies acceptable to **Magellan** for work performed related to the construction of the **Approved Encroachments**. All costs and deductible amounts will be for the sole account of the **Permittee** or its contractors and subcontractors. Prior to commencing any activities related to the construction of the **Approved Encroachments**, the **Permittee** must deliver to **Magellan** certificate(s) of insurance. Non-renewal or cancellation of policies must be effective only after **Magellan** receives written notice from the insurance company thirty (30) days in advance of such non-renewal or cancellation. The limits set forth below are minimum limits and will not be construed to limit the **Permittee's** liability:

   (a) Workers' Compensation insurance complying with the laws of the State or States having jurisdiction over each employee and Employer's Liability insurance with limits of $1,000,000.

   (b) Commercial or Comprehensive General Liability insurance on an occurrence form with a combined single limit of $5,000,000 each occurrence and project specific annual aggregates of $5,000,000. Coverage must include premises/operations, independent contractors, blanket contractual liability, and products/completed operations coverage, broad form property damage, personal injury, and sudden and accidental pollution; such coverage must be maintained for two (2) years following completion of work activities related to the construction of the **Approved Encroachments**. **Magellan**, its affiliated companies, and its and their respective directors, officers, partners, members, shareholders, employees, agents and contractors shall be included as additional insureds.

(c) In each of the above policies, the **Permittee** or its contractors and subcontractors agrees to waive and will require its insurers to waive any rights of subrogation or recovery either may have against **Magellan** and its affiliated companies.

(d) Regardless of the insurance requirements above, the insolvency, bankruptcy, or failure of any such insurance company providing insurance for the **Permittee** or its contractors and subcontractors, or the failure of any such insurance company to pay claims that occur, such requirements, insolvency, bankruptcy or failure will not be held to waive any of the provisions hereof.

(e) In the event of a loss or claim arising out of or in connection with the construction of the **Approved Encroachments**, the **Permittee** agrees, upon request of **Magellan**, to submit a certified copy of its insurance policies for inspection by **Magellan**.

(f) The **Permittee** shall require all of its contractors and subcontractors for work related to the construction of the **Approved Encroachments** to provide adequate insurance coverage, all to be endorsed with the Waiver of Subrogation wording referenced in Section (c) above; any deficiency in the coverage, policy limits, or endorsements of said contractors and subcontractors, shall be the sole responsibility of the **Permittee**.

7. **Indemnification.** **Permittee** will indemnify, save, and hold harmless **Magellan**, its affiliated companies, directors, officers, partners, employees, agents and contractors from any and all environmental and non-environmental liabilities, losses, costs, damages, expenses, fees (including reasonable attorneys' fees), fines, penalties, claims, demands, causes of action, proceedings (including administrative proceedings), judgments, decrees and orders resulting from **Permittee's** breach of this **Agreement** or caused by or as a result of the construction, use, maintenance, existence or removal of the **Approved Encroachments** or **Other Encroachments** located on the **Magellan Easement Tract**, except to the extent any such claims are caused by the indemnified parties gross negligence, or willful misconduct. The presence of **Magellan's** representative or any instructions given by such representative will not relieve **Permittee** of any liability under this **Agreement,** except to the extent that such liability results from Magellan's or its representative's gross negligence or willful misconduct.

8. **Damage or Loss.** **Permittee** covenants that:

(a) If at any time, in the sole opinion of **Magellan**, it becomes necessary for **Magellan,** to cross, occupy, utilize, move or remove all or portions of the **Approved Encroachments** placed on **Magellan's Easement Tract** or constructed pursuant to this **Agreement**, for any purpose, including but not limited to surveying, constructing new facilities, maintaining, inspecting, operating, protecting, repairing, replacing, removing or changing the size of a pipeline(s) and appurtenances on **Magellan's Easement Tract** and such activities by **Magellan** result in damage to or destruction of the **Approved**

Encroachments, then repair, replacement or restoration of such **Approved Encroachments** shall be at the sole cost and responsibility of **Permittee**. **Magellan** shall give **Permittee** reasonable notice, except in cases of emergency, prior to exercising its rights under this paragraph.

(b) If at any time, any encroachments belonging to or permitted by **Permittee** which are not authorized by this or another written agreement ("**Other Encroachments**") are found to be on **Magellan's Easement Tract**, **Magellan** may at any time request **Permittee** to remove such **Other Encroachments,** and if **Permittee** refuses or fails to do so within a reasonable time, **Magellan's** may remove them from **Magellan's Easement Tract** to **Permittee's Land** at **Permittee's** expense, unless they are allowed to remain by a written agreement between **Magellan** and **Permittee**. Should such removal activities by **Magellan** result in damage to or destruction of the **Other Encroachments**, then repair, replacement or restoration of such **Other Encroachments** shall be at the sole cost and responsibility of **Permittee,** and such **Other Encroachments** may not be repaired, replaced or rebuilt on **Magellan's Easement Tract** without a written agreement between **Magellan** and **Permittee**.

(e) If during the exercise of the rights granted by the **Easement** or by this **Agreement,** the **Approved Encroachments** and **Other Encroachments**, if any, are damaged, destroyed or suffer loss of value, **Permittee** agrees to release **Magellan,** its affiliates, and its and their respective directors, officers, members, partners, shareholders, employees, agents and contractors from and against any and all liabilities, and damages or losses which may arise as a result of the damage to or loss of use of the **Approved Encroachments** and **Other Encroachments**, if any, caused by **Magellan**, its employees, agents and contractors.

9. **Magellan Rights.** **Magellan** and **Permittee** agree that the existence of the **Approved Encroachments** or this **Agreement** does not constitute a waiver of **Magellan's** rights under the **Easement.** **Magellan** hereby reserves and **Permittee** hereby grants and confirms all of **Magellan's** rights, title and estate as set forth in the **Easement.**

10. The terms and conditions of this **Agreement** will constitute covenants running with the land and be binding upon and inure to the benefit of the parties hereto, their successors, assigns and grantees. This **Agreement** may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one instrument. This **Agreement** shall become effective upon its complete execution by the parties hereto.

11. **Other Conditions and Provisions.**

11.1 Heavy equipment crossings -- It is anticipated that construction equipment may need to cross the pipeline. Due to the operating pressures on the pipeline and the pipeline specifications, **construction equipment and other vehicles crossing the pipelines must be limited to a**

maximum axle load of 40,000 lbs with a minimum of 4' of cover over the pipeline. These conditions must be met before equipment will be allowed to cross.

A Magellan field representative will need to be present to verify the pipeline depth of cover prior to allowing equipment to cross. **Owner** may need to add fill over the pipelines prior to crossing.

If equipment is heavier than what is specified, and or if cover is less than specified (that is, less than 48") and equipment will need to cross the easement, detailed information will need to be received in order to perform pipe stress calculations. The following information will need to be received to perform a more thorough analysis of wheeled vehicles: depth of cover, loaded vehicle weight, number of axles on the front and rear, weight distribution between the front and rear axles. For equipment on tracks, the following information is needed: loaded vehicle weight, length of track in contact with the ground and track width. Equipment heavier than 80,000 lbs will not be allowed to cross the pipeline without further evaluation of the pipeline stresses.

IN WITNESS WHEREOF, the parties have set their hands on the dates expressed below.

MAGELLAN PIPELINE COMPANY, L.P.
By Its General Partner, Magellan Pipeline GP, LLC
By Its Undersigned Authorized Signatory:

By: _____
Name: Robert W Miller
Title: Real Estate Representative
Date: _____, 2011

THE WOODLANDS TOWNSHIP,
a political subdivision of the State of Texas

By: _____
Name: Don Norrell
Title: President/ General Manager
Date: _____, 2011

STATE OF OKLAHOMA)
) SS
COUNTY OF TULSA)

Before me, the undersigned, a Notary Public in and for the county and state aforesaid, on this _____day of _____, 2011 personally appeared Robert W Miller, to me personally known to be the Authorized Signatory for MAGELLAN PIPELINE GP, LLC, a Delaware limited liability company, who being duly sworn did acknowledge to me that he/she executed the foregoing instrument on behalf of said limited liability company as the free and voluntary act and deed, for the uses, purposes and consideration therein set forth.

Witness my hand and official seal.

_____
Notary Public

My commission expires:

_____

CORPORATE ACKNOWLEDGEMENT

STATE OF _____)
) SS
COUNTY OF _____)

Before me, the undersigned, a Notary Public in and for the County aforesaid, on this _____day of_____,2011, personally appeared _____ to me known personally to be the _____ of _____, who being duly sworn did acknowledge to me that he/she executed the foregoing instrument on behalf of said _____ as the free and voluntary act and deed of said corporation, for the uses, purposes and consideration therein set forth.

Witness my hand and official seal.

_____
Notary Public

My Commission Expires:

_____

EXHIBIT "A"

PERMITTEE'S LAND

VILLAGE OF ALDEN BRIDGE
41.259 ACRES

Being a 41.259 acre tract of land situated in Montgomery County, Texas in the Henry Blood Survey, A-101, and the James Lee Survey, A-319, and being more particularly described by metes and bounds as follows with all control referred to the Texas State Plane Coordinate System, Lambert Projection, South Central Zone:

BEGINNING at a 5/8 inch iron rod with an aluminum cap set for the most northerly northeast corner of the herein described tract located in the southwest right-of-way line of State Highway No. 242 as recorded in File No. 9318232 of the Montgomery County Real Property Records and having a Texas State Plane Coordinate Value of X= 3,106,018.35, Y= 879,606.15 and being S 70°52'45" E, 320.32 feet from the northeast corner of said Henry Blood Survey, A-101, common to the northwest corner of said James Lee Survey, A-319, located in the south line of the A. W. Springer Survey, A-490;

THENCE along the southwest right-of-way line of said State Highway No. 242 as follows:

along a curve to the left an arc distance of 268.74 feet based on a radius of 4,112.89 feet, a central angle of 03°44'37" and having a chord which bears S 44°30'22" E a chord distance of 268.69 feet to a Texas Department of Transportation 3 inch disk in concrete found for the end of said curve being non-tangent at this point,

S 46°29'17" E, 309.10 feet to a Texas Department of Transportation 3 inch disk in concrete found for an angle point,

S 52°06'07" E, 309.41 feet to a Texas Department of Transportation 3 inch disk in concrete found for an angle point,

And S 54°11'44" E, 206.68 feet to a Texas Department of Transportation 3 inch disk in concrete found for corner;

THENCE leaving said right-of-way line S 12°35'38" W, 901.70 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 83°11'04" W, 880.75 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 63°14'09" W, 215.95 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 31°38'39" W, 263.68 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 26°31'44" W, 216.29 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 30°42'36" W, 279.69 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 36°49'45" W, 6.23 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 42°50'38" E, at 74.10 feet pass the south corner of that certain 2.0000 acre drill site recorded as site No. 1 in File No. 9131809 of the Montgomery County Real Property Records, in all a total distance of 314.10 feet to a 5/8 inch iron rod with an aluminum cap set for the east corner of said drill site;

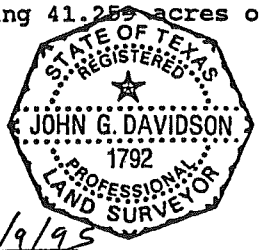
THENCE along the northeast line of said drill site, N 47°09'22" W, 172.00 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

EXHIBIT "A"

THENCE leaving said northeast line N 42°38'31" E, 498.58 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 87°42'21" E, 344.83 feet to a 5/8 inch iron rod with an aluminum cap set for corner;

THENCE N 87°21'21" E, 51.44 feet to the POINT OF BEGINNING and containing 41.259 acres of land.



Date: 6/9/95

John G. Davidson
Registered Professional Land Surveyor
Texas Registration No. 1792

STATE OF TEXAS
COUNTY OF MONTGOMERY
I hereby certify that this instrument was filed in File Number Sequence on the date and at the time stamped herein by me and was duly RECORDED in the official Public Records of Real Property of Montgomery County, Texas.

MAY 21 1996

COUNTY CLERK
MONTGOMERY COUNTY, TEXAS

FILED FOR RECORD
96 MAY 21 PM 2:26
MARK TURNBULL, CO. CLERK
MONTGOMERY COUNTY, TEXAS
DEPUTY

METES AND BOUNDS DESCRIPTION
3.158 ACRES OUT OF THE
JAMES LEE SURVEY, A-319
MONTGOMERY COUNTY, TEXAS

A **METES AND BOUNDS** description of a 3.158 acre tract situated in the James Lee Survey, Abstract Number 319 in Montgomery County, Texas, being out of and part of land owned by The Woodlands Land Development Company, L.P., by virtue of Memorandum of Merger and Ownership dated July 31, 1997 as recorded under Clerk's File No. 9747722 of the Montgomery County Official Public Records of Real Property; said 3.158 acres being more particularly described as follows with all bearings being based on a call of North 12°35'38" East along the east line of a called 41.259 acre tract conveyed to Montgomery County Municipal Utility District No. 67 by Special Warranty Deed filed for record under Clerk's File Number 9630311 of the Montgomery County Official Public Records of Real Property:

COMMENCING at a 5/8-inch iron rod with aluminum cap found for the southeast corner of said 41.259 acres;

THENCE, North 12°35'38" East, 304.70 feet along the east line of said 41.259 acres to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") found for the southwest corner and **POINT OF BEGINNING** of the herein described tract, said 5/8-inch iron rod having a coordinate value of X: 3,106,712.47, Y: 878,308.11 and being situated South 35°23'34" East, 1721.01 feet from the northeast corner of the Henry Blood Survey, Abstract Number 101 and the northwest corner of the James Lee Survey, Abstract Number 319 according to the Control Drawing provided by the Woodlands Land Development Company;

THENCE, North 12°35'38" East, 597.00 feet continuing along the east line of said 41.259 acres to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set in the south right-of-way of State Highway 242 filed for record under Clerk's File Number 9318232 of the Montgomery County Official Public Records of Real Property and for the northeast corner of said 41.259 acres, same being the northwest corner of the herein described tract, being located on a curve to the left;

THENCE, in a southeast direction, along the south right-of-way of said State Highway 242 with the arc of said curve to the left, having a radius of 4,136.00 feet, a central angle of 03°55'38", an arc length of 283.49 feet, and a chord bearing South 59°48'32" East, 283.44 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set for the most northerly northeast corner of the herein described tract, from which a brass disc found has a chord bearing of South 63°23'23" East, 233.47 feet;

THENCE, South 28°12'48" West, 313.59 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set;

THENCE, South 41°31'50" East, 87.78 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set;

THENCE, South 74°44'55" East, 106.30 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set for the most easterly northeast corner of the herein described tract;

THENCE, South 01°55'10" East, 105.67 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") found for the southeast corner of the herein described tract;

THENCE, North 73°38'00" West, 189.41 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") found;

THENCE, South 69°44'12" West, 62.64 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set;

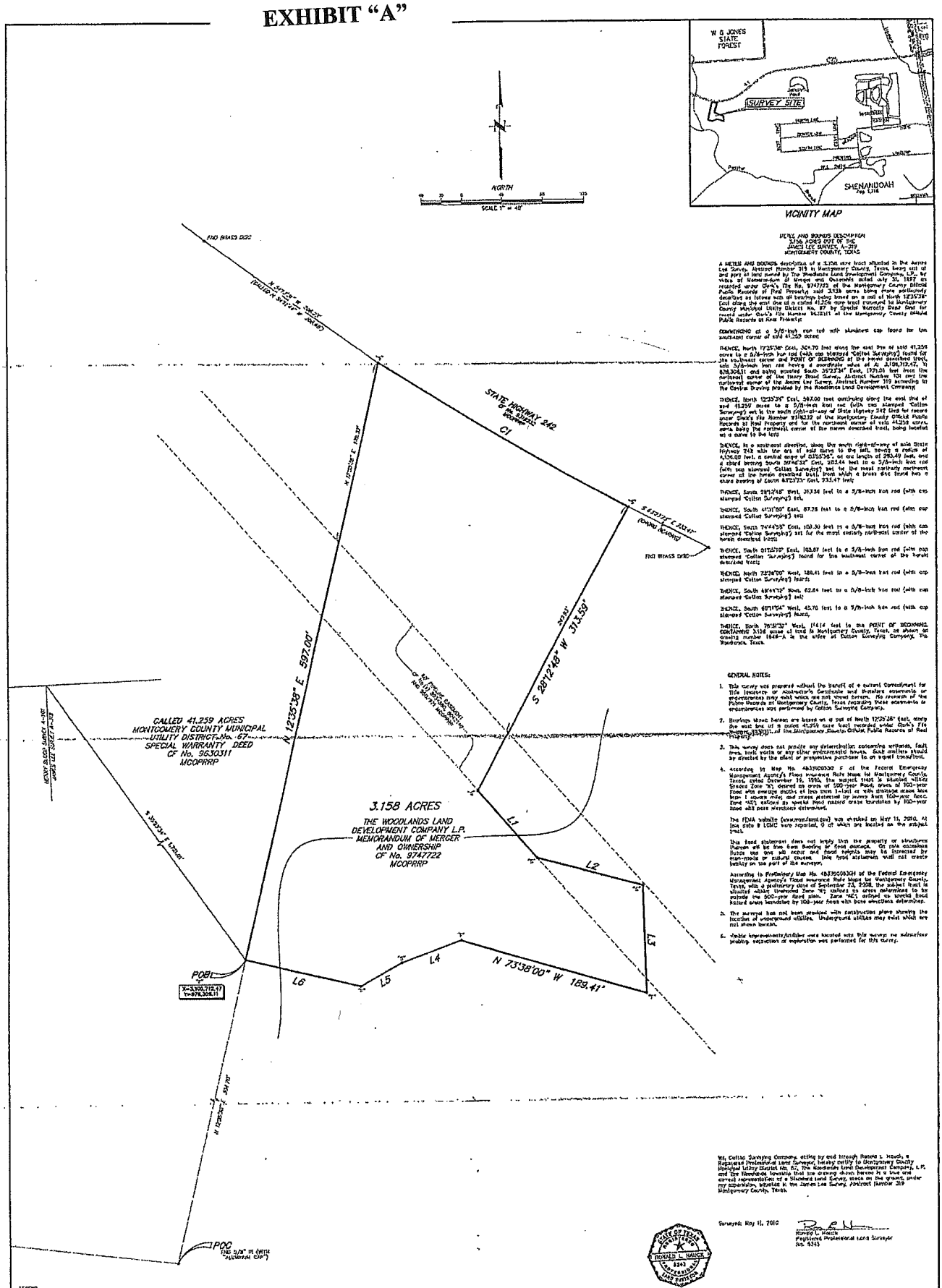
THENCE, South 60°11'04" West, 45.76 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") found;

THENCE, North 76°31'32" West, 114.14 feet to the **POINT OF BEGINNING, CONTAINING** 3.158 acres of land in Montgomery County, Texas, as shown on drawing number 1646-A in the office of Cotton Surveying Company, The Woodlands, Texas.

Alden Bridge Sports Park – 3.158 Acres
Revised: May 26, 2010
P:\PROJECTS\W5398 Wdls Dev Co\W5398-032-00 Alden Bridge Sports Park\Survey\Legal Desc\M&B - 3.1578 Acres.doc

Ron L H
5/24/10

EXHIBIT "A"



METES AND BOUNDS DESCRIPTION
3.158 ACRES OUT OF THE
JAMES LEE SURVEY, A-319
MONTGOMERY COUNTY, TEXAS

A METES AND BOUNDS description of a 3.158 acre tract situated in the James Lee Survey, Abstract Number 319 in Montgomery County, Texas, being part of all and part of land owned by The Woodlands Land Development Company, L.P. by virtue of Memorandum of Merger and Ownership dated July 31, 1997 as recorded under Clerk's File No. 9747722 of the Montgomery County Official Public Records of Real Property, said 3.158 acres being more particularly described as follows with all bearings being based on a call of North 12°35'38" East along the east line of a called 41.259 acre tract conveyed to Montgomery County Municipal Utility District No. 67 by Special Warranty Deed And for recorded under Clerk's File Number 9630311 of the Montgomery County Official Public Records of Real Property;

COMMENCING at a 3/8-inch iron rod with aluminum cap found for the southeast corner of said 41.259 acres;

THENCE, North 12°35'38" East, 304.70 feet along the east line of said 41.259 acres to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") found for the southeast corner and POINT OF BEGINNING of the herein described tract, said 5/8-inch iron rod also having a coordinate value of E: 3,108,712.47, N: 878,306.11 and being situated South 35°23'34" East, 1971.01 feet from the northeast corner of the Henry Sloan Survey, Abstract Number 408 and the northwest corner of the James Lee Survey, Abstract Number 319 according to the Control Drawing provided by the Woodlands Land Development Company;

THENCE, North 12°35'38" East, 592.00 feet continuing along the east line of said 41.259 acres to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set in the south right-of-way of State Highway 242 (100 foot record under Clerk's File Number 9318232 of the Montgomery County Official Public Records of Real Property and for the northeast corner of said 41.259 acres, same being the northwest corner of the herein described tract, being located at a curve to the left;

THENCE, in a southeast direction, along the south right-of-way of said State Highway 242 with the arc of said curve to the left, having a radius of 4,156.00 feet, a central angle of 01°55'36", an arc length of 260.49 feet, and a chord bearing South 39°46'32" East, 260.44 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set for the most northerly southeast corner of the herein described tract, from which a brass disc found bears a chord bearing of South 87°23'30" East, 233.47 feet;

THENCE, South 28°12'48" West, 313.34 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set;

THENCE, South 41°31'50" East, 87.78 feet to a 5/8-inch iron rod (also cap stamped "Cotton Surveying") set;

THENCE, South 74°44'58" East, 150.30 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set for the most easterly northeast corner of the herein described tract;

THENCE, South 01°32'10" East, 103.87 feet to a 5/8-inch iron rod (also cap stamped "Cotton Surveying") found for the southeast corner of the herein described tract;

THENCE, North 73°38'00" West, 189.41 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") found;

THENCE, South 48°44'13" West, 62.84 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") set;

THENCE, South 60°11'54" West, 45.76 feet to a 5/8-inch iron rod (with cap stamped "Cotton Surveying") found,

THENCE, North 78°51'31" West, 114.14 feet to the POINT OF BEGINNING CONTAINING 3.158 acres of land in Montgomery County, Texas, as shown on drawing number 1648-A in the office of Cotton Surveying Company, The Woodlands, Texas.

GENERAL NOTES:

1. This survey was prepared without the benefit of a current Commitment for Title Insurance or Abstractor's Certificate and therefore easements or encumbrances may exist which are not shown hereon. No research of the Public Records of Montgomery County, Texas regarding title easements or encumbrances was performed by Cotton Surveying Company.
2. Bearings shown hereon are based on a call of North 12°35'38" East, along the east line of a called 41.259 acre tract recorded under Clerk's File Number 9630311 of the Montgomery County Official Public Records of Real Property (MCOPRRP).
3. This survey does not provide any determination concerning wetlands, fault zones, toxic waste or any other environmental issues. Such matters should be directed by the client or prospective purchaser to an expert consultant.
4. According to Map No. 48339C0530 G of the Federal Emergency Management Agency's Flood Insurance Rate Maps for Montgomery County, Texas dated December 18, 1996, the subject tract is situated within Shaded Zone "X" defined as areas of 500-year flood; areas of 100-year flood with average depths of less than 1-foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood. Zone "AE" defined as special flood hazard areas inundated by 100-year flood with base elevations determined.

   The FIRM's website (www.msc.fema.gov) was checked on May 11, 2010. At this date 8 LOMC were reported, 0 of which are located on the subject tract.

   This flood statement does not imply that the property or structures thereon will be free from flooding or flood damage. On rare occasions floods can and will occur and flood heights may be increased by man-made or natural causes. This flood statement shall not create liability on the part of the surveyor.

   According to Preliminary Map No. 48339C0530H of the Federal Emergency Management Agency's Flood Insurance Rate Maps for Montgomery County, Texas, with a preliminary date of September 28, 2008, the subject tract is situated within Unshaded Zone "X" defined as areas determined to be outside the 500-year flood plain. Zone "AE" defined as special flood hazard areas inundated by 100-year flood with base elevations determined.
5. The surveyor has not been provided with construction plans showing the location of underground utilities. Underground utilities may exist which are not shown hereon.
6. Visible improvements/utilities were located with this survey. No subsurface probing, excavation or exploration was performed for this survey.

We, Cotton Surveying Company, acting by and through Ronald L. Hauck, a Registered Professional Land Surveyor, hereby certify to Montgomery County Municipal Utility District No. 67, The Woodlands Land Development Company, L.P. and The Woodlands hereby that the drawing shown hereon is a true and correct representation of a Standard Land Survey, made on the ground under my supervision, situated in the James Lee Survey, Abstract Number 319 Montgomery County, Texas.

Surveyed: May 11, 2010

Ronald L. Hauck
Registered Professional Land Surveyor
No. 5343

STATE OF TEXAS
REGISTERED
RONALD L. HAUCK
5343
PROFESSIONAL
LAND SURVEYOR

LEGEND

CF No.	CLERK'S FILE NUMBER
FND	FOUND
SET	SET 5/8" IRON ROD WITH "COTTON SURVEYING" CAP
MCOPRRP	MONTGOMERY COUNTY OFFICIAL PUBLIC RECORDS OF REAL PROPERTY
POC	POINT OF COMMENCING
POBH	POINT OF BEGINNING
○	SET 5/8-INCH IRON ROD WITH /CAP STAMPED "COTTON SURVEYING"
"I"	FOUND 5/8-INCH IRON ROD (WITH /CAP STAMPED "COTTON SURVEYING")

CURVE	RADIUS	DELTA ANGLE	ARC LENGTH	CHORD BEARING	CHORD LENGTH
C1	4156.00'	01°55'36"	260.49'	S 39°46'32" E	260.44'

LINE	BEARING	DISTANCE
L1	S 41°31'50" E	87.78'
L2	S 74°44'58" E	150.30'
L3	S 01°32'10" E	103.87'
L4	S 48°44'13" W	62.84'
L5	S 60°11'54" W	45.76'
L6	N 78°51'31" W	114.14'

DATE	REVISIONS
May 26, 2010	Revised Boundary

Exhibit "A" – Page 3 of 3

STANDARD LAND SURVEY
OF
3.158 ACRES
OUT OF THE
JAMES LEE SURVEY, A-319
MONTGOMERY COUNTY, TEXAS
MAY 2010

COTTON SURVEYING COMPANY
2106 Two Trails Drive, Suite 150
The Woodlands, Texas 77380-1348
Office: (281) 367-0268
a Jones & Carter Company
Austin • Houston • Bryan • Dallas • Corpus Christi • San Antonio • The Woodlands

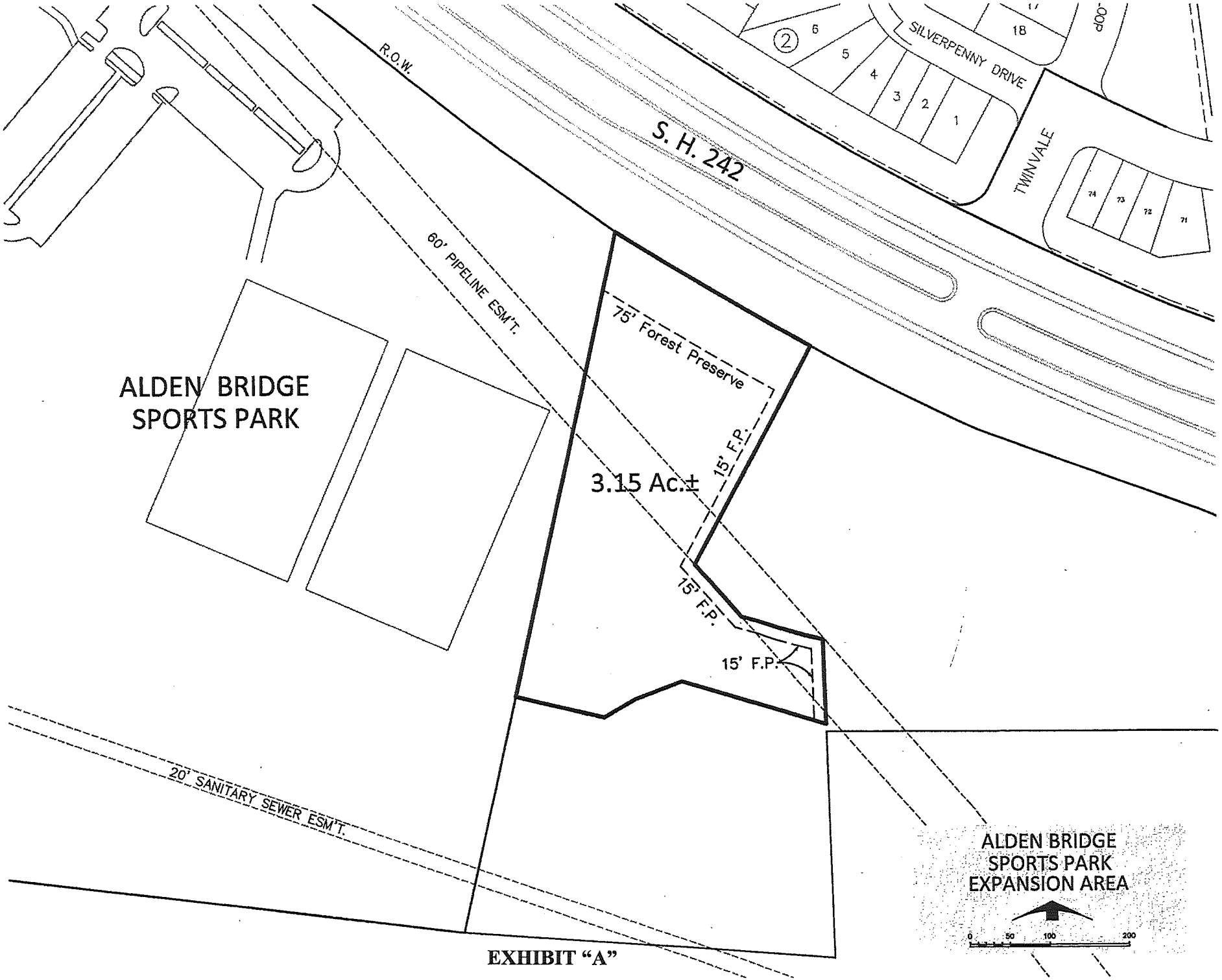

R.O.W.
S. H. 242
SILVERPENNY DRIVE
TWINVALE
6
5
4
3
2
1
18
74
73
72
71
60' PIPELINE ESM'T.
ALDEN BRIDGE
SPORTS PARK
75' Forest Preserve
15' F.P.
3.15 Ac.±
15' F.P.
15' F.P.
20' SANITARY SEWER ESM'T.
ALDEN BRIDGE
SPORTS PARK
EXPANSION AREA
0
50
100
200

EXHIBIT "A"

EXHIBIT "B"

GENERAL ENCROACHMENT REQUIREMENTS

EXHIBIT "B" TO ENCROACHMENT AGREEMENT, 1 of 4

MAGELLAN PIPELINE COMPANY, L.P.

General Encroachment Requirements

A. GENERAL - These requirements define the minimum standards of practice for encroachments by a landowner (including any developer, business entity, utility company or individual working for, or on behalf of, or with permission of landowner) (herein referred to collectively as "Owner") to pipeline corridors and rights of way ("Magellan's Easement Tract") owned or operated by Magellan Pipeline Company, L.P. ("Magellan"). Upon written request by Owner to Magellan, a copy of these minimum requirements shall be provided to any developer, business entity, utility company or individual working on behalf of Owner or with the permission of Owner within Magellan's Easement Tract. Specific circumstances may require additional precautions or more stringent methods in order to protect the integrity of Magellan's pipelines and facilities. Magellan's Easement Tract for purposes of these General Encroachment Requirements shall be considered to be any area within fifty (50) feet of any Magellan pipeline or other Magellan-owned or operated facility unless a different right of way width is specified by one or more recorded right of way or easement documents (herein collectively called "Easement", whether one or more), in which case such specified width shall define Magellan's Easement Tract.

1. Encroachment Definition. An "encroachment" is any use of the land within Magellan's Easement Tract which could interfere with Magellan's Easement rights or which could create safety concerns for Magellan pipelines and/or facilities located on Magellan's Easement Tract. Encroachments include, but are not limited to: structures, fixtures, personal property, landscaping, foreign utilities, foreign pipelines, roadways, railroads, waterway crossings, water impoundments, walls, heavy equipment and heavy loads on Magellan's Easement Tract, and also any excavation, digging, drilling, tunneling and addition, removal or disturbance of soil or subsoil within Magellan's Easement Tract.

2. Magellan Representative Required On-Site. Magellan pipeline systems operate at high pressures, and for safety reasons, Magellan requires its company representatives to be on-site while Owner is excavating or performing other activities which could endanger the Magellan pipelines or other facilities on

Magellan's Easement Tract. For other activities of the Owner on the Magellan Easement Tract, the Magellan field representative shall determine whether Magellan's continuous presence or periodic monitoring of encroachment activities will be required and shall inform the Owner. A Magellan representative will be made available upon 48 hours notice (exclusive of weekends and holidays) to determine the location and approximate depth of any Magellan pipelines. No excavation shall be commenced without prior written approval from Magellan and verification by Magellan of the location and approximate depth of its pipelines.

3. Magellan's Facilities. Magellan's facilities include, but are not limited to, Easement, rights of way, pipelines, meter and valve sites, aboveground piping manifolds and cathodic protection systems.

4. Land Use Change - Notification. The landowner and tenant, if any, must notify Magellan at any and every time when the land use will be changed for land on or adjacent to Magellan's Easement Tract. Examples of such land use changes are:

- Change from pasture to cultivation
- Change in depth of tilling (e.g. plowing deeper or deep-breaking the land)
- Change in that terraces will be cut or re-cut
- Change from agricultural use to residential, commercial or industrial use.
- Change from residential to commercial or from commercial to industrial.

5. Governmental Regulations and Industry Guidelines. Owner must comply with all applicable laws and regulations, as well as Magellan's policies as expressed herein. Owner is also hereby referred to the Common Ground Alliance Best Practices which can be found on the web site: www.commongroundalliance.com (See "Program Information" / "Best Practices") and which is available from Common Ground Alliance in booklet form for easy reference. Best Practices addresses the most common issues for damage prevention for an encroaching party, including, among others: Planning and Design; One-Call Center; Locating and Marking; Excavation; and Mapping. In the even of a conflict between laws and regulations, Magellan's policies and the Common Ground Alliance Best Practices, the following priority shall govern encroachments on Magellan's Easement Tract: 1st -- laws and regulations; 2nd -- Magellan policies; and 3rd -- Common Ground Alliance Best Practices.

B. MAGELLAN RIGHT OF WAY PRACTICE

1. Personal Property and Fixtures To Be Kept Off of Magellan's Easement Tract. In order to keep Magellan rights of way clear for operations, maintenance, inspection and emergency access, personal property and fixtures shall not be placed, stored or maintained on Magellan's Easement Tract. Personal property and fixtures include, but are not limited to, storage sheds, automobiles, trailers, mobile homes, above-ground swimming pools, business equipment, product inventory, scrap metal, boulders, large rocks, debris, junk and piles of materials.

2. Encroachments Subject to Being Cleared from Magellan's Easement Tract. Subject to the terms of its Easement (including right of way agreement[s] and other written agreements) , Magellan may keep Magellan's Easement Tract clear of items that may hinder the exercise of Magellan's rights to construct, operate, inspect, maintain, repair and access its pipelines and other facilities. Clearing of the Magellan's Easement Tract shall include, but not be limited to the following: removal of trees, brush, crops, other vegetation and non-permitted encroachments located on or overhanging all or part of any Magellan's Easement Tract. Trees or other vegetation overhanging Magellan's Easement Tract may be side-trimmed.

C. ENCROACHMENT PLANNING

1. Plan Review Required by Magellan. For any encroachment, Magellan must be provided project plans to review and approve, *prior to the encroachment occurring*, for purposes of damage prevention.

2. Submission of Complete Plans. Owner must submit complete plans to Magellan for review. Incomplete plans could delay Magellan's engineering impact study and insufficient information could result in increased costs. Plans must include:

- A plan view of the project with the pipeline(s) location included.
- An illustration in profile of the existing surface elevations, the proposed surface elevations and the elevation of the Magellan pipeline(s).
- A comprehensive utility /structure /grading plan depicting the relationship to the pipeline(s).
- A proper legal description of the project location.
- Complete landscaping plans.
- Complete plans for backfilling and compaction of backfill material.

3. Plans Must Show Magellan's Easement Tract, Pipelines and Facilities. All construction plans (prints) showing lands where all or any part of Magellan's Easement Tract, any Magellan pipeline or facility is located must contain the

following:

- Location and depth of all Magellan pipelines and facilities
- The width of Magellan's Easement Tract
- A standard warning statement *conspicuously displayed* containing the following language:

WARNING
HIGH-PRESSURE PIPELINE(S)
Excavation and/or Construction Prohibited Without compliance with ***State One-Call*** *AND Without Written Permission From* ***MAGELLAN PIPELINE COMPANY, L.P.***

4. Written Encroachment Agreement Required. A written, fully executed Encroachment Agreement must be in place between Magellan and Owner before Owner commences work on any encroachment.

5. Costs. Unless otherwise agreed in writing, all costs to Magellan that result from any encroachment should be paid by Owner. Such costs shall include, but not be limited to: modification, replacement, lowering, and protection of pipelines, including engineering evaluation and design, field labor and real estate research and document preparation and handling,

6. Pipeline Integrity Inspection. Prior to the installation of any structure, parking lot, roadway or other facility which might interfere with or hinder Magellan's inspection of any pipeline or facility, Magellan will perform an integrity review of its pipeline and any other assets which may be affected by the proposed structure, parking lot, roadway or other encroaching facility in order to determine that Magellan's assets comply with integrity requirements and to allow Magellan to make any needed changes prior to construction of any encroachments.

7. Soil On Magellan's Easement Tract -- Removing and Adding. No soil shall be removed from or added to Magellan's Easement Tract without written authorization from Magellan. Any soil added must be clean (without contaminants, trash or debris) fill dirt and must be *limited in amount* so that the

resulting cover (vertical distance from the surface of the land to the top of Magellan's pipeline) is not greater than eight feet (8').

8. Erosion Control Materials. Erosion-control materials may be allowed on Magellan's Easement Tract for temporary periods of construction and restoration.

9. Proof of Title to Property. Magellan may require Owner to provide proof of current ownership of the land where the proposed encroachment is to be located. Such proof may be in the form of a Title Commitment, Title Policy, or a copy of a recorded Warranty Deed.

10. Subdivision Plat. Magellan requires a copy of the Subdivision Plat, if applicable. If the plat has been recorded, Magellan requires a copy indicating the book and the page of the recording.

11. Location and Approximate Depth of Pipelines. A Magellan representative is normally available with 48 hours notice (exclusive of weekends and holidays) to determine the location and approximate depth of the pipeline(s). Determining actual depths of pipelines may require pot-holing or hand-digging by, and at the expense of Owner in the presence of an authorized Magellan representative. No excavation on Magellan's Easement Tract shall take place without approval by Magellan.

12. Vertical Separation Between Magellan Pipeline or Facility and an Encroaching Object or Structure. Vertical separation is defined in this document as the vertical distance between the outermost part of a Magellan pipeline, facility or appurtenance (for example, the outside of the pipe [for uncased pipe] or the outside of the pipe casing [for cased pipe]) and the outermost part of the encroaching object (for example, the outside of the encroaching pipeline or the outside of its conduit).

13. Construction Equipment Information. Owner shall provide to Magellan information as to the type, size, and weight of construction equipment that will be used over or in the vicinity of the pipeline(s).

D. ENCROACHMENT DESIGN REQUIREMENTS & STANDARDS

1. Risk of Loss and Damage. Owner shall bear the risk of loss, damage and/or destruction to any structure, fence, landscaping or improvement placed within the boundaries of Magellan's Easement Tract and shall hold Magellan harmless

EXHIBIT "B" TO ENCROACHMENT AGREEMENT, 2 of 4

for damages, destruction of structures and for any consequential damages which may arise out of Magellan or its designees exercising Magellan's Easement rights or which may arise out of accessing Magellan's Easement Tract, pipelines or facilities.

2. Buildings, Structures and Fences.

a. Buildings and Structures. No buildings, houses, barns, garages, patios, playhouses, sheds, septic systems or drain fields, swimming pools (above-ground or below-ground), reinforced concrete slabs or other similar structures will be permitted on the Magellan's Easement Tract.

b. Septic System not permitted. No septic-system, including any lateral lines will be permitted on Magellan's Easement Tract.

c. Retaining Walls. Retaining walls are not permitted on Magellan's Easement Tract.

d. Fences. No fence shall be constructed or maintained on Magellan's Easement Tract without a written agreement.

e. Requirements for Fences. If fencing on Magellan's Easement Tract is authorized by a written agreement with Magellan, the fencing must comply with the following:

1) **Not Parallel to Pipeline.** No fence shall be allowed to be constructed parallel closer than 10 feet to any Magellan pipeline, within the boundaries of Magellan's Easement Tract.

2) **Fence Posts Location.** No fence posts will be allowed to be within five (5) feet of any Magellan pipeline or facility.

3) **Gates Required.** Magellan may require any fence constructed within the boundaries of Magellan's Easement Tract to have gates of such size and suitability as is necessary or convenient for Magellan to access its pipelines and/or facilities for its operations, including inspections, at each point where the fence crosses a Magellan pipeline or facility boundary. Magellan shall be allowed to put a Magellan lock on such gates, which will allow access to Magellan's Easement Tract and/or facilities through such gates.

4) **Angle of Fence Crossing.** It is preferred that fence crossings be as close to 90 degrees as possible.

3. Landscaping, Elevation Changes and Water.

a. Landscaping Definition. Landscaping shall include, but not be limited to, trees, shrubs, underground irrigation or sprinkler systems, sidewalks or other paths, retaining walls, terraces or other land grade changes, within

Magellan's Easement Tract.

b. General Landscaping Requirements. The following are the general rules for landscaping on Magellan's Easement Tract:

1)Written Approval. Landscaping proposed to be done on Magellan's Easement Tract must be approved by Magellan in a **written *encroachment agreement***. Among other terms, the encroachment agreement will release Magellan from any liability for damages to the landscaping from the exercise of Magellan's Easement rights.

2) Trees Not Permitted. Trees are not permitted on Magellan's Easement Tract.

3) Shrubs. Shrubs exceeding 3 feet in height and/or obstructing the view of any Magellan pipeline marker posts are not permitted on Magellan's Easement Tract.

4) Irrigation Systems, Field Drain Lines, and Sidewalks. Irrigation systems, field drain lines and sidewalks that are to cross a Magellan pipeline must cross such pipeline at an angle as close to 90 degrees as possible, but in no event at an angle less than 45 degrees and must comply with other applicable provisions of this document.

c. No Water Bodies on Magellan's Easement Tract. Retention of water, including but not limited to, Livestock ponds, lakes, retention ponds, or wetlands may not be constructed or formed on Magellan's Easement Tract.

d. Surface Grade and Elevation Changes. Surface grade or elevation changes must be reviewed and approved in writing by Magellan.

4. Foreign Pipeline & Utility Crossings. No foreign pipelines or utility lines of any type shall be allowed to be constructed parallel to any Magellan pipeline within the boundaries of Magellan's Easement Tract.

a. Minimum Angle for Pipeline/Utility Crossing. Any foreign pipeline or utility that is proposed to cross a Magellan pipeline must cross the Magellan pipeline at an angle as close to 90 degrees as possible, but in no event at an angle less than 45 degrees.

b. Vertical Separation Requirements for Crossing. Foreign pipeline(s), utilities (except high-voltage lines – see below) or flow lines should cross Magellan pipeline(s) with at least 24 inches of vertical separation. Special written authorization must be given in the event vertical separation is less than that specified in these General Encroachment Requirements. The preferred method for a foreign pipeline or utility to cross a Magellan pipeline is to cross ***below*** the Magellan pipeline.

c. Warning Tape Required. When any foreign pipeline or utility line is proposed to cross a Magellan pipeline, Owner must place 6" wide McMaster-Carr No. 8288T12 or equal within Magellan's Easement Tract

in the following manner:

1) The tape must be placed directly over (parallel to) and at least 15 inches above the foreign line for the entire distance that it occupies Magellan's Easement Tract. Additionally, the tape must be placed directly over (parallel to) and at least 15 inches above each Magellan pipeline that is crossed for a minimum distance which is the greater of:
   (a) a minimum distance of 20 feet on each side of the Magellan pipeline, or
   (b) across the entire width of Magellan's Easement Tract
2) The placement of warning tape on each side of *Magellan* pipeline(s) will not be required for utility cables that are installed using the directional drill or jacking method.

d. Crossings By Metal Pipelines or Conduits. Metallic pipe crossing Magellan pipeline(s) may require Magellan to perform a cathodic protection interference survey. If interference with Magellan's cathodic protection system is detected and remediation is necessary, Owner agrees to cooperate with Magellan and to make necessary adjustments in Owner's interfering metallic pipe or other remediation to correct such interference problem insure that the Magellan cathodic protection system is operating properly.

e. Crossing Requirements. Electrical, fiber optic, local service communication, long distance carrier telephone, and utility cables should cross Magellan pipeline(s) with a ***minimum of 24-inches of vertical separation***. All such lines must be covered with a *Concrete Slab* for the full width of the Easement Tract, if requested by Magellan. If such lines have an exposed concentric neutral, a test point from the ground wire shall be installed by the power company.

f. Crossing Requirements For Lines Going Over a Magellan Pipeline. In the event the electrical, fiber optic, local service communication, long distance carrier telephone, and utility cables cable crosses ***over*** a Magellan pipeline, such line shall be ***encased in red concrete across the full width of Magellan's Easement Tract***, unless a variance is granted by Magellan, as set forth below.

g. Written Authorization for Variance. Owner must have written authorization from Magellan for any variance from the vertical separation requirements listed above and/or for any variance from the requirement for

encasement of high-voltage electrical lines in red concrete.

h. Utility Poles and Guy Anchors. Utility poles and guy anchors shall not be placed on Magellan's Easement Tract without a written agreement. With a written agreement, poles and anchors may be placed no closer than 20 feet to any Magellan pipeline. Poles shall not be allowed to run parallel to a Magellan pipeline within the Magellan Easement Tract.

i. Directional Drilling / Boring.

1) Prior to commencing any horizontal directional drilling, Owner shall submit plans showing procedure and material descriptions for Magellan's approval. The plans and description shall include, but not be limited to the following:
   - Profile and plan showing location of entry and exit points
   - Work space required to perform the work
   - Mud containment and disposal sites
2) Owner shall positively locate and stake the location of Magellan's existing pipelines and other underground facilities, including exposing any facilities located within 10 feet of the designed drilled path. Prior to commencing drilling operations, Owner shall modify drilling practices and down-hole assemblies to prevent damage to Magellan's existing pipelines and other facilities. Owner shall be responsible for losses and repairs occasioned by damage all Magellan pipelines and other facilities resulting from drilling or boring operations.
3) At all times, Owner shall provide and maintain instrumentation to document and accurately locate the pilot hole and the drill bit, to measure drill-string axial and torsional loads, and to measure drilling fluid discharge rate and pressure. At Magellan's request, Owner shall promptly provide Magellan with reasonable access to information and readings provided by these instruments, including copies of any written documentation.
4) Pilot Hole.
   - The pilot hole shall be drilled along the path shown in the plan and profile drawings. No pilot hole shall be made that will result in any of the encroaching utility being installed in violation of laws and regulations or of Magellan's requirements described herein. However, safety for any adjacent utilities and/or structures is of utmost importance. Therefore, the listing of separation distances or tolerances herein does not relieve Owner from responsibility for safe operations or for damage to adjacent utilities and structures.
   - If tolerances are not specified in the plan and profile drawings, the pilot hole shall have the following tolerances:

   - Elevation of +0 feet and -15 feet
   - Alignment of +/-20 feet as long as it does not come to within 10 feet of Magellan's pipeline
   - Initial penetration of ground surface at exact location shown in the plan and profile drawings
   - Final penetration of the ground surface within +/-10 feet of the alignment and within +30 feet and -0 feet of the length shown in the plan and profile drawings
   - Curves shall be drilled at a radius equal to or greater than that specified in the plan and profile drawings. The drilled radius will be calculated over any 3 joints (range 2 type drill pipe) segment using the following formula:
     Rdrilled = (Ldrilled/Aavg) x 180/π
     Where: Rdrilled =drilled radius over Ldrilled
     Ldrilled = length drilled; no less than 75 feet and no greater than 100 feet
     Aavg = total change in angle over Ldrilled
   - At the completion of the pilot-hole drilling, Owner shall provide to Magellan a tabulation of horizontal and vertical coordinates, referenced to the drilled entry point, which accurately describe the location of the pilot hole.

5) Drilling Fluids.

- The composition of drilling fluids proposed for use shall comply with all applicable laws and regulations.
- Owner is responsible for obtaining, transporting and storing any water required for drilling fluids.
- Disposal of drilling fluids and drill cuttings shall be Owner's responsibility and shall be conducted in compliance with applicable laws and regulations. Drilling fluid shall *not* be disposed of by placing fluids on or under the surface of Magellan's Easement Tract.
- Owner shall employ best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than entry and exit points shall be minimized. If annular circulation is lost, Owner shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand-placed barriers (e.g., hay bales, sand bags, silt fences, etc.) and collected using pumps as practical. If the amount of surface return is not great enough to allow practical collection, the affected area will be diluted with fresh water and the fluid will be allowed to dry and dissipate naturally. If

the amount of surface return exceeds that which can be contained with hand-placed barriers, small collection sumps (less than 5 cubic yards) may be used unless permits or other regulations prohibit the use of collection sumps. If the amount of surface return exceeds that which can be contained and collected using barriers or small sumps, or if the return of drilling fluids occurs in the body of water proper, drilling operations will be suspended until surface return volumes can be controlled.

6) As-Built Drawing. Owner shall provide to Magellan an as-built plan and profile drawing of the drilled crossing showing the location of the new crossing as well as the location of Magellan's pipeline.

5. **Roadway, Driveway, Railroad and Equipment Crossings.** No roadway, driveway, railroad or equipment crossings of any type shall be allowed to be constructed parallel to any Magellan pipeline within the boundaries of Magellan's Easement Tract.

a. Pipeline Integrity Inspection. A pipeline integrity review shall be performed by Magellan as described in provision "6" under "*C. Encroachment Planning*" (above).

b. Load Bearing and Stress Limit Requirements. Prior to any road, driveway, rail bed or equipment crossing construction, Magellan's engineer must determine whether the proposed compacted cover meets load-bearing requirements and provides adequate protection to limit stress on Magellan's pipeline or other facilities and must advise Owner of any additional requirements necessary to provide adequate protection.

c. No Crossing Over Pipeline Bend. Paved surfaces or rail beds shall not be allowed to cross a pipeline bend (point of inflection).

d. Minimum Angle of Crossing. Crossings should be as close to 90 degrees to Magellan pipeline(s) as possible, but not less than 30 degrees.

e. Pipeline Casing Issues. Magellan prefers that cased roadway and railroad crossings no longer be installed. If the carrier pipe under roadways and railroads requires adjustment or relocation, then instead of using casing, the carrier pipe will consist of extra strength material or heavier wall thickness to accommodate the additional longitudinal stress due to external loads. If a road or railroad crossing currently uses casing and the road or railroad is being widened and no other adjustment or relocation of the carrier pipe is required, then Magellan may elect to extend the casing pipe on the existing crossing(s) to accommodate additional road surface. If casing is used, it must not end under the roadway surface or track structure, but must extend across the entire length of the roadway or railroad right of way.

f. Railroad Crossing Requirements. Railroads shall be installed with a minimum compacted cover over the carrier pipe, as measured from the base of the rail to the top of the pipe, as follows (*see Figures 1 and 3*):

Location of Pipeline	Minimum Compacted Cover Over Top of Pipeline
Under track structure proper (Below bottom of rail)	6.0 feet
Under all other surfaces within the right of way or from the bottom of ditches	3.0 feet

g. Roadway and Driveway Crossings. Roadways and driveways, shall be installed with a minimum compacted cover over the carrier pipe, as measured from the top of the roadway surface to the top of the pipe, as follows (*see Figures 2 and 4*):

Location of Pipeline	Minimum Compacted Cover Over Top of Pipeline
Under roadway surface proper (Below surface of pavement)	4.0 feet
Under all other surfaces within the right of way or from the bottom of ditches	3.0 feet

h. Crossing Pipelines Transporting Highly Volatile Liquids. For Magellan pipelines transporting highly volatile liquids, minimum cover for a crossing at a drainage ditch must be 4.0 feet.

i. When Additional Depth Required. Depth greater than the minimum depths stated above may be required for a pipeline due to the combined stress of internal pipeline pressure and external loading pressure. Magellan will analyze each proposed crossing based on information provided by Owner to determine any additional depth that may be required for the pipeline for safe operation.

j. Temporary Roads and Equipment Crossings. Any such road or crossing must meet the following requirements:

- Must be located at a site approved by a Magellan field representative.
- Must provide adequate protection for Magellan's pipeline and other facilities, as determined by the appropriate Magellan engineer, so that the compacted cover meets load-bearing requirements and provides adequate protection to limit stress on the pipeline or other facilities.
- Owner shall place Six-inch wide plastic warning tape, McMaster-Carr No. 8288T12 or equal, over each pipeline for the width of the temporary road or equipment crossing, plus an additional 20 feet past each outside edge of such temporary road or equipment crossing

k. Owner Required to Protect Magellan Pipelines. Magellan may require Owner to put in place additional cover and/or stabilization (timbers, steel plate, crushed rock, concrete slab, etc.) at any approved equipment crossing in order to protect Magellan pipelines, taking into account possible effects of weather, pipeline depth, and type of vehicles proposed to cross the pipelines. Magellan will analyze each proposed crossing based on information provided by Owner to determine any additional depth or protection that may be required for safe pipeline operation.

l. Heavy Equipment - Definition and Requirements. Heavy equipment shall be defined as vehicles having a *gross weight* in excess of 80,000 pounds. Heavy equipment shall be prohibited from working directly on top of the active pipeline. For vehicles having a *gross weight* of 80,000 pounds or less, the pipeline must have a minimum of 4 feet of cover. Magellan must analyze the additional longitudinal stress due to external loads if the vehicles have a *gross weight* in excess of 80,000 pounds in order to determine required pipeline depth for safe operation.

6. **Parking Lots and Other Pavement.**

a. Parking Lot and Pavement Requirements. All parking lots and other pavement installed on Magellan's Easement Tract shall consist of a flexible surface such as asphalt. No reinforced concrete will be allowed.

b. Pipeline Depth Under Parking Lot. The depth of Magellan's pipelines under a parking lot must meet or exceed compacted cover requirements listed in the previous "Roadway, Driveway, Railroad, and Equipment Crossings" section above

7. **Waterway Crossings.**

a. Pipeline Depth Requirements. If Owner proposes to cross a Magellan pipeline with a waterway (river, stream, creek, irrigation canal, or drainage ditch), such crossing must result in Magellan's pipelines meeting or exceeding the minimum depth below the bottom of the waterway for compliance with then current pipeline construction standards and federal, state, and local regulations.

b. Requirements for Waterway Crossings:

1) Minimum Angle or Crossing. Crossings should be as close to 90 degrees to Magellan pipeline(s) as possible, but not less than 45 degrees.

2) Vertical Separation Requirements for Waterway Crossing. Pipelines to be crossed must have a minimum vertical separation of five (5) feet, as measured from the bottom of the waterway to the outermost part of a Magellan pipeline, facility or appurtenance

3) Adding Weight to Pipeline for Negative Buoyancy. Owner shall bear the cost of Magellan adding sufficient weight or mechanical devices to any Magellan pipeline crossed by a waterway in order to create negative buoyancy for such pipeline.

8. **Blasting.**

a. Magellan Written Approval Required – Plan To Be Submitted. Magellan must approve any proposed blasting operations that could affect its pipelines or facilities. Should blasting be necessary, a comprehensive plan must be submitted to Magellan for review and written approval.

b. Safety Considerations – Damage Prevention Plan. For safety and preservation of Magellan assets, all blasting shall be in accordance with federal, state, and local governing agencies and the Magellan's "Damage Prevention Plan for Blasting Near Company Facilities". A copy of said plan will be made available upon request.

E. EXCAVATION NEAR MAGELLAN PIPELINES.

1. STATE "ONE-CALL" REQUIRED. No excavation or activity listed in "*A. GENERAL - 1. Encroachment Definition*" above shall be performed by Owner in the vicinity of Magellan's facilities or within Magellan's Easement Tract until proper telephone notification has been made to the appropriate "One Call" system and a Magellan representative is on-site to monitor excavation activities. All of the states in which Magellan conducts pipeline operations have "One Call" laws, which require 48-72-hours notification prior to any excavation related activities. After making a One-Call, the state One-Call agency will notify Magellan to mark accurately, in a reasonable and timely manner, the location of the Magellan's pipeline facilities in the vicinity of the proposed encroachment.

2. ONE-CALL NOTIFICATION. *The following list is provided for convenience, but is not warranted by Magellan to be complete or accurate (telephone numbers were copied from each state's web site on 1/5/2004).* **Owner is required to acquire and call the appropriate One-Call number(s) for its location of activity.**

EXHIBIT "B" TO ENCROACHMENT AGREEMENT, 4 of 4

Current "ONE-CALL" numbers and information can be found on each state's "ONE-CALL" website:

Arkansas - www.arkonecall.com/ - 800 482-8998
Colorado - www.uncc2.org/ - 800 922-1987
Illinois - www.illinois1call.com/ - 800 892-0123
Iowa - www.iowaonecall.com/ - 800 292-8989
Kansas - www.kansasonecall.com/ - 800 344-7233
Minnesota -www.gopherstateonecall.org/ - 800 252-1166
Missouri - www.mo1call.com/ - 800 344-7483
Nebraska - www.ne-diggers.com/ - 800 331-5666
North Dakota -www.ndonecall.com/ - 800 795-0555
Oklahoma - www.callokie.com/ - 800 522-6543
South Dakota -www.sdonecall.com/index.asp - 800 781-7474
Texas - www.texasonecall.com/ - 800 245-4545
Wisconsin - www.diggershotline.com/ - 800 242-8511

Alternatively, the National One-Call number – (888) 258-0808 - may be used to register a proposed excavation and to subsequently notify underground utility operators with assets in the vicinity.

3. Excavation Plan Approval. Owner shall submit to Magellan for its approval plans for any proposed excavation on the Magellan Easement Tract. No excavation on Magellan's Easement Tract shall be commenced until Owner has secured Magellan's written approval of the plans. The excavation work shall be in compliance with all applicable laws and regulations. Owner is also referred to the Common Ground Alliance Best Practices (referenced in this document).

4. Magellan Representative On-Site for Excavation. A Magellan representative must be on-site when an excavation is occurring on Magellan's Easement Tract (*see provision "2" under "A. General" beginning on page 1*).

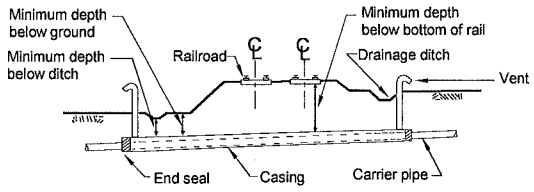
5. Removal of Side-Cutting Teeth from Equipment. Side-cutting teeth shall be removed from buckets of excavating equipment.

6. Parallel Excavating Required. When, in preparation for crossing any Magellan pipeline with any other pipeline or with electric line, communication line, roadway or any other structure or facility, Owner needs to locate a Magellan pipeline by use of mechanical means. Owner must perform such locating activity by excavating parallel to the Magellan pipeline with such mechanical means, but

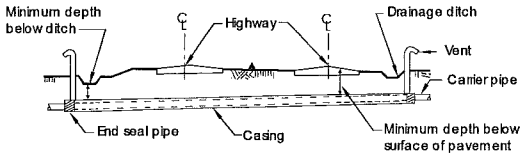
shall cease using the mechanical means when it reaches a point within two feet of the Magellan pipeline (*see next provision*).

7. Exposing Pipeline by Hand. Excavating within 2 feet of any Magellan pipeline shall be done by *hand-digging* until the pipeline is exposed and its location is accurately known. Then, Owner must position the excavation equipment so that from the point of operations the equipment will not reach within 2 feet of any Magellan pipeline.

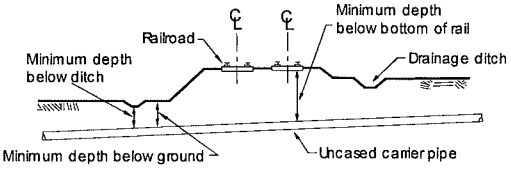
RAILROAD AND HIGHWAY CROSSINGS



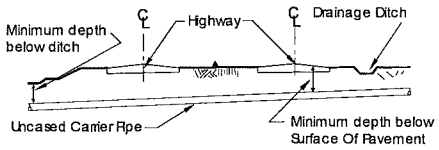
CASED RAILROAD CROSSING
FIGURE 1



CASED HIGHWAY CROSSING
FIGURE 2



UNCASED RAILROAD CROSSING
FIGURE 3

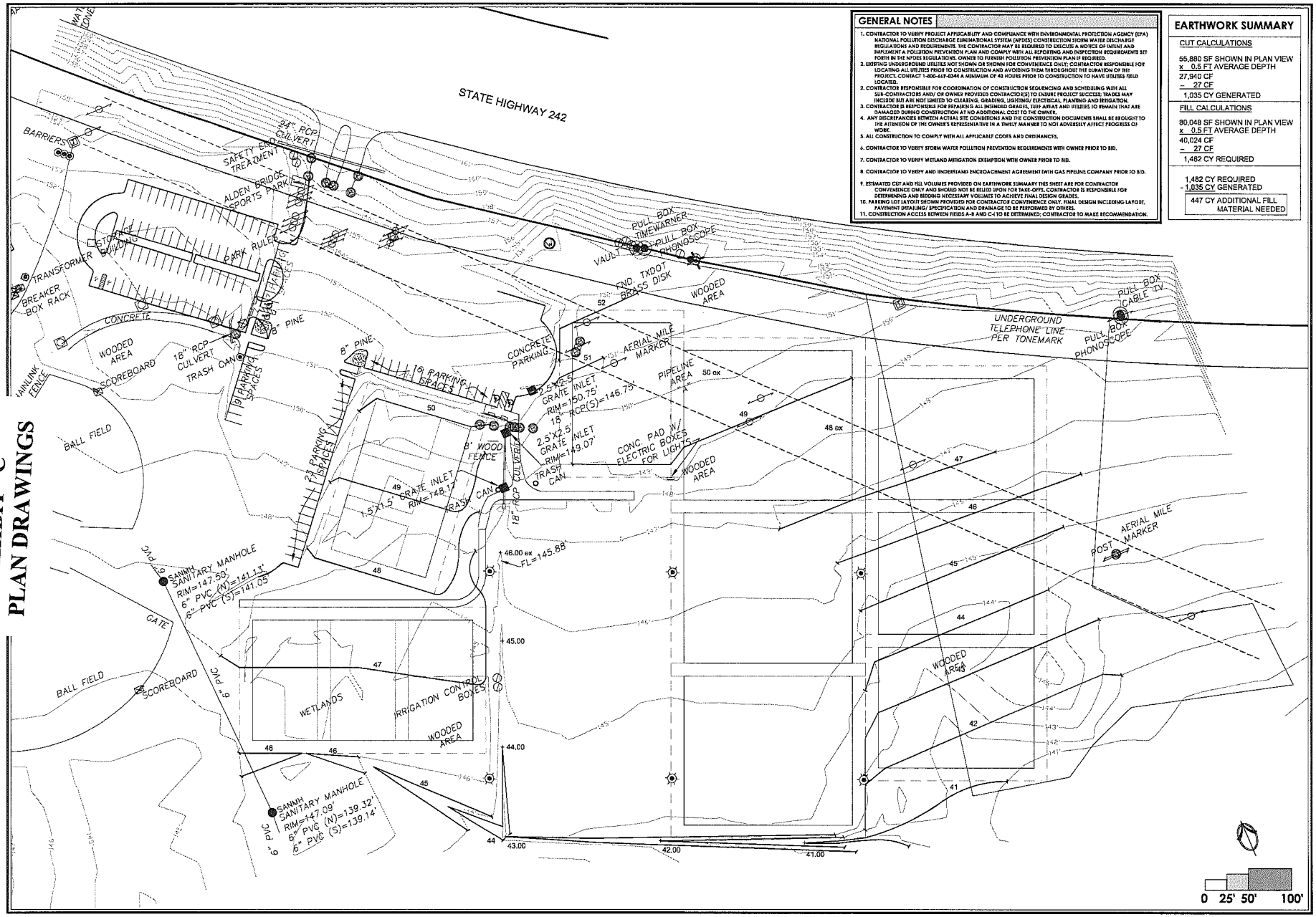


UNCASED HIGHWAY CROSSING
FIGURE 4

EXHIBIT "C"

PLAN DRAWINGS

EXHIBIT "C"
PLAN DRAWINGS



GENERAL NOTES

1. CONTRACTOR TO VERIFY PROJECT APPLICABILITY AND COMPLIANCE WITH ENVIRONMENTAL PROTECTION AGENCY (EPA) NATIONAL POLLUTION DISCHARGE ELIMINATIONAL SYSTEM (NPDES) CONSTRUCTION STORM WATER DISCHARGE REGULATIONS AND REQUIREMENTS. THE CONTRACTOR MAY BE REQUIRED TO EXECUTE A NOTICE OF INTENT AND IMPLEMENT A POLLUTION PREVENTION PLAN AND COMPLY WITH ALL REPORTING AND INSPECTION REQUIREMENTS SET FORTH IN THE NPDES REGULATIONS. OWNER TO FURNISH POLLUTION PREVENTION PLAN IF REQUIRED.
2. EXISTING UNDERGROUND UTILITIES NOT SHOWN OR SHOWN FOR CONVENIENCE ONLY; CONTRACTOR RESPONSIBLE FOR LOCATING ALL UTILITIES PRIOR TO CONSTRUCTION AND AVOIDING THEM THROUGHOUT THE DURATION OF THE PROJECT. CONTACT 1-800-669-8344 A MINIMUM OF 48 HOURS PRIOR TO CONSTRUCTION TO HAVE UTILITIES FIELD LOCATED.
2. CONTRACTOR RESPONSIBLE FOR COORDINATION OF CONSTRUCTION SEQUENCING AND SCHEDULING WITH ALL SUB-CONTRACTORS AND/ OR OWNER PROVIDED CONTRACTOR(S) TO ENSURE PROJECT SUCCESS; TRADES MAY INCLUDE BUT ARE NOT LIMITED TO CLEARING, GRADING, LIGHTING/ ELECTRICAL, PLANTING AND IRRIGATION.
3. CONTRACTOR IS RESPONSIBLE FOR REPAIRING ALL INTENDED GRADES, TURF AREAS AND UTILITIES TO REMAIN THAT ARE DAMAGED DURING CONSTRUCTION AT NO ADDITIONAL COST TO THE OWNER.
4. ANY DISCREPANCIES BETWEEN ACTUAL SITE CONDITIONS AND THE CONSTRUCTION DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE IN A TIMELY MANNER TO NOT ADVERSELY AFFECT PROGRESS OF WORK.
5. ALL CONSTRUCTION TO COMPLY WITH ALL APPLICABLE CODES AND ORDINANCES.
6. CONTRACTOR TO VERIFY STORM WATER POLLUTION PREVENTION REQUIREMENTS WITH OWNER PRIOR TO BID.
7. CONTRACTOR TO VERIFY WETLAND MITIGATION EXEMPTION WITH OWNER PRIOR TO BID.
8. CONTRACTOR TO VERIFY AND UNDERSTAND ENCROACHMENT AGREEMENT WITH GAS PIPELINE COMPANY PRIOR TO BID.
9. ESTIMATED CUT AND FILL VOLUMES PROVIDED ON EARTHWORK SUMMARY THIS SHEET ARE FOR CONTRACTOR CONVENIENCE ONLY AND SHOULD NOT BE RELIED UPON FOR TAKE-OFFS. CONTRACTOR IS RESPONSIBLE FOR DETERMINING AND BIDDING NECESSARY VOLUMES TO ACHIEVE FINAL DESIGN GRADES.
10. PARKING LOT LAYOUT SHOWN PROVIDED FOR CONTRACTOR CONVENIENCE ONLY. FINAL DESIGN INCLUDING LAYOUT, PAVEMENT DETAILING/ SPECIFICATION AND DRAINAGE TO BE PERFORMED BY OTHERS.
11. CONSTRUCTION ACCESS BETWEEN FIELDS A-B AND C-D TO BE DETERMINED; CONTRACTOR TO MAKE RECOMMENDATION.

EARTHWORK SUMMARY

CUT CALCULATIONS

55,880 SF SHOWN IN PLAN VIEW
x 0.5 FT AVERAGE DEPTH
27,940 CF
– 27 CF
1,035 CY GENERATED

FILL CALCULATIONS

80,048 SF SHOWN IN PLAN VIEW
x 0.5 FT AVERAGE DEPTH
40,024 CF
– 27 CF
1,482 CY REQUIRED

1,482 CY REQUIRED
- 1,035 CY GENERATED
447 CY ADDITIONAL FILL MATERIAL NEEDED

LAND·ology
25814 Budde Road
Spring, Texas 77380
832.816.0566
info@LANDology.net

THESE DOCUMENTS ARE NOT COMPLETE AND ARE, RELEASED FOR INTERIM REVIEW ONLY AND ARE NOT FOR REGULATORY APPROVAL, PERMITTING OR CONSTRUCTION.
JENNIFER McMILLAN, LANDSCAPE ARCHITECT
DATE 8/27/10

ISSUE
FOR REVIEW
DATE
Aug. 27, 2010

ABSP: SOCCER EXPANSION
VILLAGE OF ALDEN BRIDGE, THE WOODLANDS, TEXAS

THE WOODLANDS TOWNSHIP

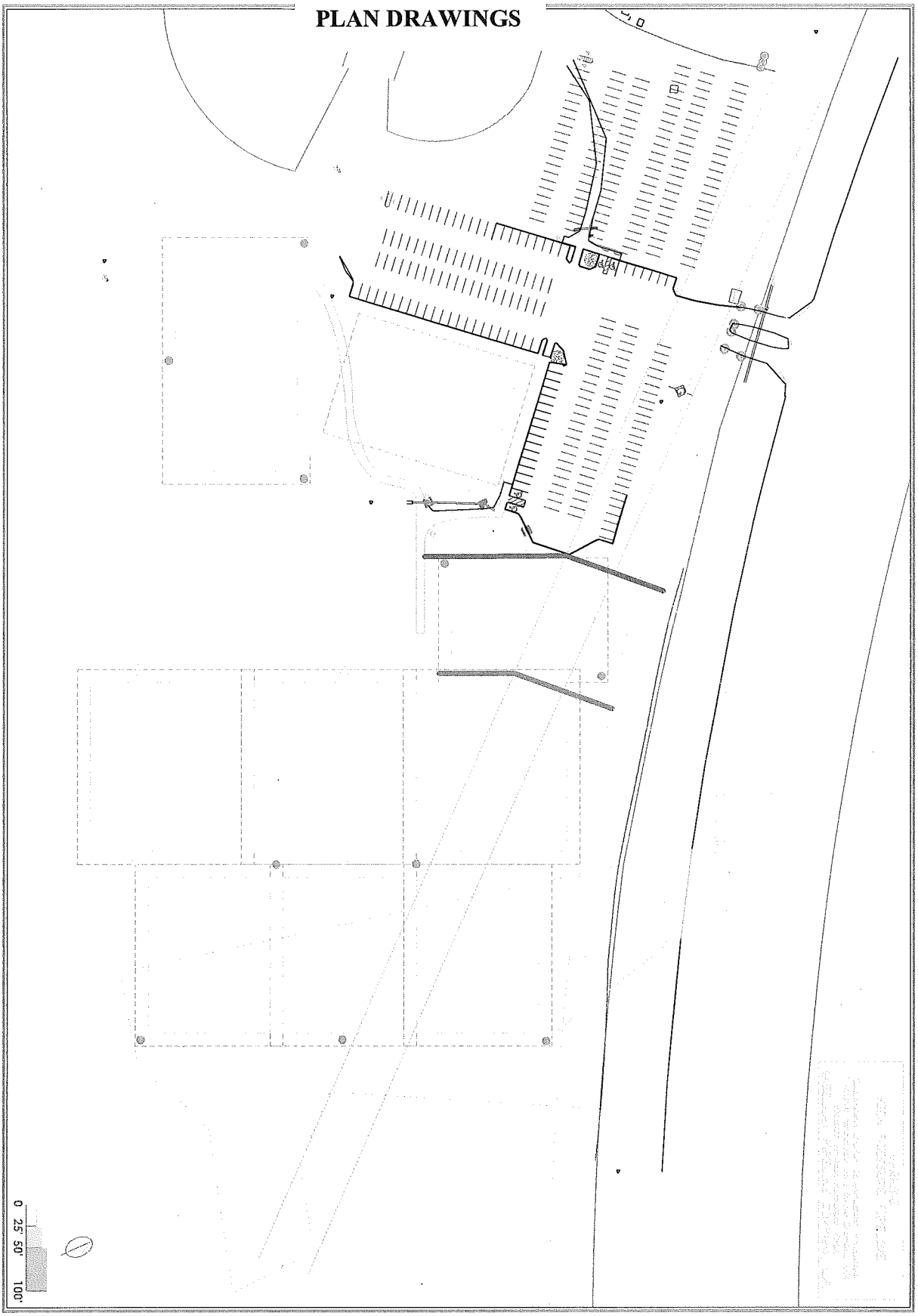
PARKS and RECREATION DEPARTMENT

GRADING PLAN

LANDology project:
010.071.004

L1.03

EXHIBIT "C"
PLAN DRAWINGS



ABSP: SOCCER EXPANSION

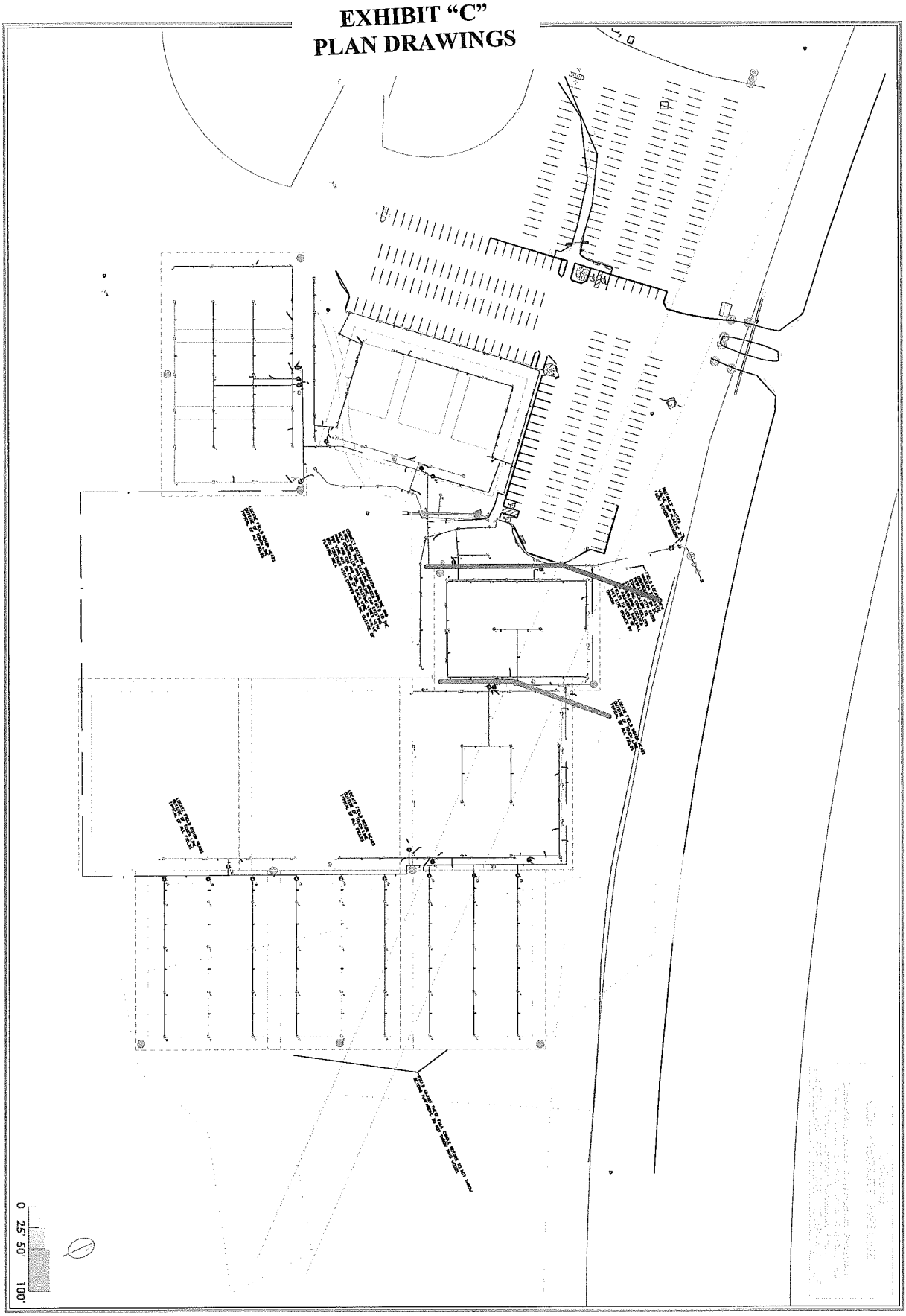
VILLAGE OF ALDEN BRIDGE, THE WOODLANDS, TEXAS

THE WOODLANDS TOWNSHIP

SITE PLAN

PARKS and RECREATION DEPARTMENT

EXHIBIT "C"
PLAN DRAWINGS



ABSP: SOCCER EXPANSION

VILLAGE OF ALDEN BRIDGE, THE WOODLANDS, TEXAS

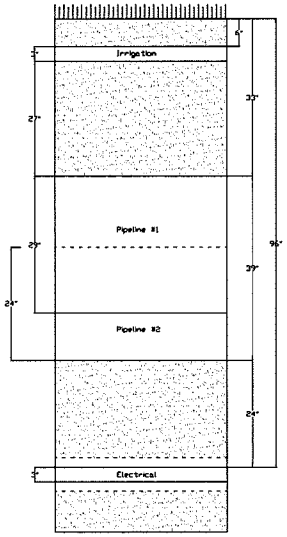
THE WOODLANDS TOWNSHIP

IRRIGATION PLAN

PARKS and RECREATION DEPARTMENT

EXHIBIT "C"
PLAN DRAWINGS

MAGELLAN 16"



Note:
- All irrigation to be trenched to 6" in depth.
- All electrical service to be bored under the Magellan/ Conoco pipeline at 8' depth.
- Magellan's easement tract shall be considered to be any area within Fifty (50) feet of any Magellan pipeline, unless a different right of way width is specified by one or more recorded right of way or easement documents, in which case such specified width shall define Magellan's Easement Tract.
- Magellan requires its company representatives to be on-site while Owner is excavating or performing other activities which could endanger the Magellan pipelines or other facilities on the easement tract.
- Magellan field rep shall determine whether Magellan's continuous presence or periodic monitoring of encroachment activities will be required and shall inform the Owner.
- No soil shall be removed from or added to Magellan's Easement Tract without written consent from Magellan.

Protection and Heavy Equipment Notes:
- Magellan may require Owner to put in place additional cover and/ or stabilization (timbers, steel plate, crushed rock, concrete slab, etc) at and approved equipment crossing in order to protect Magellan pipelines, taking into account possible effects of weather, pipeline depth, and type of vehicles proposed to cross the pipelines. Magellan will analyze each proposed crossing based on information provided by Owner to determine any additional depth or protection that may be required for safe pipeline operation.
- Heavy equipment shall be defined as vehicles having a gross weight in excess of 80,000 pounds. Heavy equipment shall be prohibited from working directly on top of the active pipeline. For vehicles having a gross weight of 80,000 pounds or less, the pipeline must have a minimum of 4 feet of cover. Magellan must analyze the additional longitudinal stress due to external loads if the vehicles have a gross weight in excess of 80,000 pounds in order to determine required pipeline depth for safe operation.

PROFILE OF UTILITIES IN RELATIONSHIP TO PIPELINES

Encroachment Agreement

STATE OF TEXAS §
§
COUNTY OF MONTGOMERY §

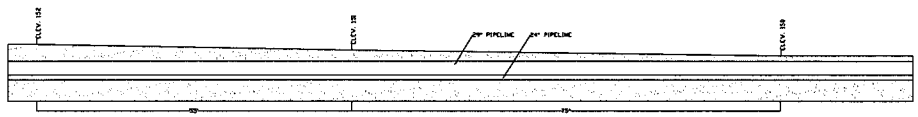
KNOW ALL MEN BY THESE PRESENTS:

WHEREAS, ConocoPhillips, a Texas Corporation, (hereinafter referred to as "Permittor"), is the current owner of right-of-way as specified in an instrument dated the 2nd day of December 2010 from The Woodlands Township covering lands in Montgomery County, State of Texas, said instrument being filed of record in Book Jones Lee Survey, Page 3.158 acres out of A-319 Jones Lee Survey of the Deed Records of Montgomery County, Texas (hereinafter referred to as the "Right-of-Way"), and

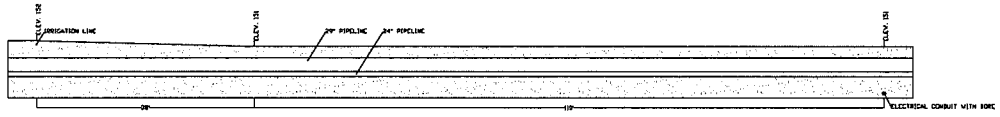
WHEREAS, Permittor owns and operates a (INSERT WIDTH OF PIPELINE) pipeline(s) in the lands covered by Permittor's Right of Way; and

WHEREAS, The Woodlands Township (hereinafter referred to as "Permittee", whether one or more) with an address of 8203 Millennium Forest Drive, The Woodlands, Texas is the owner of a tract of land which is subject to the above specified Right-of-Way, said tract being described in the Deed Filed of 126.2 acres out of A-319 Jones Lee out of Tract 1.

Gross Weights by Contractor	
Al-Earth	
Case 550 Dozer	15000 lbs
Case 850 Dozer	21000 lbs
D7 Caterpillar	44300 lbs
920 Case Excavator	34000 lbs
810 Landscape	
D37 Dozer	18000 lbs
Dump Truck	50000 lbs
Concrete Truck	75000 lbs
Liteco	
Crane	25000 lbs
Excavator	10000 lbs
Sky Trak	20000 lbs



EXISTING PROFILE



PROPOSED PROFILE

PROFILE OF EXISTING & PROPOSED SURFACE ELEVATIONS

ABSP: SOCCER EXPANSION
VILLAGE OF ALDEN BRIDGE, THE WOODLANDS, TEXAS
THE WOODLANDS TOWNSHIP
PARKS and RECREATION DEPARTMENT
NOTES

Exhibit O – Survey

SCALE: 1" = 50'

GRAPHIC SCALE

50 25 0 50

LEGEND

- CONTROL POINT/BENCHMARK LOCATION
- 1/2" REBAR WITH "HALFF" CAP SET
- 1/2" REBAR FOUND (OR AS NOTED)
- S&V 5/8" REBAR WITH "S&V" CAP FOUND
- ALUM 5/8" REBAR WITH ALUMINUM CAP FOUND
- COTTON 5/8" REBAR WITH "COTTON SURVEYING" CAP FOUND
- CONCRETE HIGHWAY MONUMENT FOUND
- TXDOT BRASS DISC FOUND
- CALCULATED POINT
- ( ) RECORD INFORMATION

AU SPRINGER SURVEY
ABSTRACT NO. 490

HENRY BLOOD SURVEY
ABSTRACT NO. 101

JAMES LEE SURVEY
ABSTRACT NO. 319

APPROX. SURVEY/ABSTRACT LINE

RESTRICTED RESERVE "D"
THE WOODLANDS VILLAGE OF ALDEN BRIDGE, SEC. 91
CABINET Q, SHEET 164
M.C.M.R.

RESTRICTED RESERVE "C"
THE WOODLANDS VILLAGE OF ALDEN BRIDGE, SEC. 91
CABINET Q, SHEET 164
M.C.M.R.

REMAINDER OF TRACT 3
THE WOODLANDS LAND DEVELOPMENT COMPANY, L.P.
DOC. NO. 9747722
O.P.R.R.P.M.C.T.

TRACT TWO: CALLED (209.27 ACRES)
SAN JACINTO RIVER AUTHORITY
DOC. NO. 2020033299
O.P.R.R.P.M.C.T.

CALLED (25.5593 ACRES)
STATE OF TEXAS
DOC. 9318232
O.P.R.R.P.M.C.T.

CALLED (41.259 ACRES)
MONTGOMERY COUNTY
MUNICIPAL UTILITY DISTRICT NO. 67
DOC. NO. 9630310
O.P.R.R.P.M.C.T.

STATE HIGHWAY 242
(VARIABLE WIDTH)
FREE R.O.W. 9346267
O.P.R.R.P.M.C.T.

60' PIPELINE EASEMENT
C.F. NOS. 8034880, 8042140 & 9507971
O.P.R.R.P.M.C.T.

10' SANITARY SEWER EASEMENT
DOCUMENT NO. 9255132
O.P.R.R.P.M.C.T.

44.40 ACRES
(1,934,143 SQ. FT.)

DETAIL "A"
NOT TO SCALE

Tree Table	
Point #	Description
13075	12 INCH OAK
13076	12 INCH OAK
13077	6 INCH OAK
13078	6 INCH OAK
13082	12 INCH SUGAR MAPLE
13093	12 INCH SUGAR MAPLE
13099	13 INCH LONGLEAF PINE
13100	11 INCH BALD CYPRESS
13101	8 INCH LONGLEAF PINE

Tree Table	
Point #	Description
13102	6 INCH LIVE OAK
13103	8 INCH LIVE OAK
13104	8 INCH LIVE OAK
13105	10 INCH LIVE OAK
13106	9 INCH LIVE OAK
13107	6 INCH LIVE OAK
13108	6 INCH LONGLEAF PINE
13109	7 INCH LONGLEAF PINE
13110	12 INCH CREPE MYRTLE CLUSTER

Tree Table	
Point #	Description
13111	12 INCH CREPE MYRTLE CLUSTER
13112	12 INCH CREPE MYRTLE CLUSTER
13113	12 INCH CREPE MYRTLE CLUSTER
13114	7 INCH LONGLEAF PINE
13115	8 INCH LONGLEAF PINE
13116	9 INCH LONGLEAF PINE
13117	8 INCH LIVE OAK
13118	6 INCH LIVE OAK
13119	10 INCH BALD CYPRESS

LINE DATA		
LINE #	BEARING	DISTANCE
L1	S 68°50'01" W	62.64'
L2	S 59°16'53" W	45.76'
L3	N 38°13'18" W	6.10'

LINE DATA		
LINE #	BEARING	DISTANCE
L1	(S 69°44'12" W)	(62.64')
L2	(S 60°11'04" W)	(45.76')
L3	(N 36°49'45" W)	(6.23')

CURVE DATA					
CURVE #	RADIUS	DELTA	LENGTH	BEARING	CHORD LENGTH
C1	4136.00'	3°55'13"	283.00'	S 60°36'46" E	282.94'
C2	4113.00'	3°44'43"	268.85'	S 45°18'34" E	268.81'
C3	4113.00'	0°33'07"	39.62'	S 43°09'39" E	39.62'
C4	4113.00'	4°17'50"	308.47'	S 45°02'01" E	308.40'
C5	4136.00'	3°14'16"	233.73'	S 64°11'31" E	233.70'
C6	4136.00'	7°09'29"	516.73'	S 62°13'54" E	516.39'

CURVE TABLE					
CURVE #	RADIUS	DELTA	ARC LENGTH	CHORD BEARING	CHORD DISTANCE
C1	(4136.00')	(03°55'38")	(283.50')	(S 59°48'32" E)	(283.44')
C2	(4112.89')	(03°44'37")	(268.74')	(S 44°30'22" E)	(268.69')
C3					
C4	(4113.00')	(04°17'50")	(308.47')	(S45°02'23"E)	(308.40')
C5					
C6	(4136.00')	(07°09'43")	(517.00')	(S62°13'42"E)	(516.66')

MALCOLM MARTIN 01/03/2025
REGISTERED PROFESSIONAL LAND SURVEYOR
STATE OF TEXAS NO. 6962

BOUNDARY, TOPOGRAPHIC AND TREE SURVEY

ALDEN BRIDGE SPORTS COMPLEX

halff
14800 ST. MARY'S LANE SUITE 160
HOUSTON, TEXAS 77079-2943
VOICE: (713) 588-2450
FAX: (281) 310-5259
INFO-HOUSTON@HALFF.COM

Issued:	1/3/2025
Scale:	1" = 50'
Drawn By:	RWB
AVO:	52417.002
HALFF Office:	HOU
SHEET:	1 OF 2

V-DS-52417.002-83S-R4

LEGAL DESCRIPTION

BEING A 44.40 ACRES (1,934,143 SQ. FT.) TRACT OF LAND OUT OF THE HENRY BLOOD SURVEY ABSTRACT NO. 101 AND THE JAMES LEE SURVEY, ABSTRACT NO. 319, MONTGOMERY COUNTY, TEXAS, BEING ALL OF THE CALLED 41.259 ACRE TRACT OF LAND CONVEYED TO MONTGOMERY COUNTY MUNICIPAL UTILITY DISTRICT NO. 67 IN DOCUMENT NO. 9630310 OF THE OFFICIAL PUBLIC RECORDS OF REAL PROPERTY OF MONTGOMERY COUNTY, TEXAS (O.P.R.R.P.M.C.T.) AND BEING ALL OF THE CALLED 3.158 ACRE TRACT OF LAND CONVEYED TO MONTGOMERY COUNTY MUNICIPAL UTILITY DISTRICT NO. 67 IN DOCUMENT NO. 2010057615, O.P.R.R.P.M.C.T. AND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING AT A FOUND 1/2-INCH IRON ROD WITH CAP STAMPED "COTTON" ON THE SOUTH RIGHT-OF-WAY LINE OF STATE HIGHWAY 242 (VARIABLE WIDTH RIGHT-OF-WAY) AS RECORDED IN DOCUMENT NO. 9318230, O.P.R.R.P.M.C.T., AND THE REMAINDER OF 'TRACT 3' THAT CERTAIN TRACT OF LAND CONVEYED TO THE WOODLANDS DEVELOPMENT COMPANY, L.P. IN DOCUMENT NO. 9747722, O.P.R.R.P.M.C.T. SAME BEING THE NORTHEAST CORNER OF SAID 3.158 ACRE TRACT, FROM WHICH A TXDOT BRASS DISC FOUND BEARS ON A CURVE TO THE LEFT HAVING A RADIUS OF 4,136.00 FEET, WITH A CENTRAL ANGLE OF 07 DEGREES 09 MINUTES 29 SECONDS, AN ARC LENGTH OF 233.73 FEET, A CHORD BEARING AND DISTANCE OF SOUTH 64 DEGREES 11 MINUTES 31 SECONDS EAST, 233.70 FEET;

THENCE WITH THE COMMON LINES OF THE REMAINDER OF 'TRACT 3' AND SAID 3.158 ACRE TRACT THE FOLLOWING COURSES AND DISTANCES:

SOUTH 27 DEGREES 24 MINUTES 40 SECONDS WEST, A DISTANCE OF 313.56 FEET TO A 1/2-INCH REBAR ROD WITH CAP STAMPED "COTTON" FOUND FROM WHICH A 1/2-INCH REBAR FOUND BEARS NORTH 57 DEGREES 10 MINUTES 17 SECONDS WEST, A DISTANCE OF 0.11 OF A FOOT,

SOUTH 42 DEGREES 21 MINUTES 47 SECONDS EAST, A DISTANCE OF 87.91 FEET TO A 1/2-INCH REBAR ROD WITH CAP STAMPED "COTTON" FOUND FROM WHICH A 1/2-INCH REBAR FOUND BEARS NORTH 42 DEGREES 21 MINUTES 47 SECONDS WEST, A DISTANCE OF 0.27 OF A FOOT,

SOUTH 75 DEGREES 32 MINUTES 25 SECONDS EAST, A DISTANCE OF 106.17 FEET TO A 1/2-INCH REBAR ROD WITH CAP STAMPED "COTTON" FOUND FROM WHICH A 1/2-INCH REBAR FOUND BEARS SOUTH 61 DEGREES 50 MINUTES 02 SECONDS WEST, A DISTANCE OF 0.43 OF A FOOT,

SOUTH 02 DEGREES 44 MINUTES 21 SECONDS EAST, A DISTANCE OF 105.78 FEET TO A 1/2-INCH REBAR ROD WITH CAP STAMPED "COTTON" FOUND,

NORTH 74 DEGREES 25 MINUTES 23 SECONDS WEST, A DISTANCE OF 189.41 FEET TO A 1/2-INCH REBAR ROD WITH CAP STAMPED "COTTON" FOUND,

SOUTH 68 DEGREES 50 MINUTES 01 SECOND WEST, A DISTANCE OF 62.64 FEET TO A 5/8-INCH REBAR WITH "HALFF" CAP SET,

SOUTH 59 DEGREES 16 MINUTES 53 SECONDS WEST, A DISTANCE OF 45.76 FEET TO A 5/8-INCH REBAR WITH "HALFF" CAP SET,

NORTH 77 DEGREES 25 MINUTES 43 SECONDS WEST, A DISTANCE OF 114.13 FEET TO A 5/8-INCH REBAR ROD FOUND IN THE EAST LINE OF SAID 41.259 ACRE TRACT, SAME BEING THE SOUTH CORNER OF SAID 3.158 ACRE TRACT,

SOUTH 11 DEGREES 49 MINUTES 01 SECOND WEST, A DISTANCE OF 304.44 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND IN THE NORTH LINE OF A CALLED 209.27 ACRE 'TRACT TWO' CONVEYED TO SAN JACINTO RIVER AUTHORITY IN DOCUMENT NO. 2020033299, O.P.R.R.P.M.C.T., SAME BEING THE SOUTHEAST CORNER OF SAID 41.259 ACRE TRACT,

THENCE WITH THE COMMON LINES OF SAID 41.259 ACRES TRACT AND SAID TRACT TWO THE FOLLOWING COURSES AND DISTANCES:

NORTH 83 DEGREES 56 MINUTES 49 SECONDS WEST, A DISTANCE OF 880.63 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND,

NORTH 64 DEGREES 04 MINUTES 10 SECONDS WEST, A DISTANCE OF 215.94 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND,

NORTH 32 DEGREES 24 MINUTES 58 SECONDS WEST, A DISTANCE OF 263.66 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND,

NORTH 27 DEGREES 16 MINUTES 26 SECONDS WEST, A DISTANCE OF 216.32 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND,

NORTH 31 DEGREES 30 MINUTES 24 SECONDS WEST, A DISTANCE OF 279.67 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND,

NORTH 38 DEGREES 13 MINUTES 18 SECONDS WEST, A DISTANCE OF 6.10 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND,

NORTH 42 DEGREES 02 MINUTES 07 SECONDS EAST, A DISTANCE OF 314.18 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND,

NORTH 47 DEGREES 58 MINUTES 50 SECONDS WEST, A DISTANCE OF 171.98 FEET TO A 5/8-INCH REBAR WITH ALUMINUM CAP FOUND,

NORTH 41 DEGREES 52 MINUTES 48 SECONDS EAST, A DISTANCE OF 498.58 FEET TO A 5/8-INCH REBAR WITH "HALFF" CAP SET IN THE SOUTH LINE OF THE REMAINDER OF TRACT 3 CONVEYED TO THE WOODLANDS LAND DEVELOPEMENT COMPANY, L.P. AS RECORDED IN DOCUMENT NO. 9747722 O.P.R..R.P.M.C.T., SAME BEING THE NORTHEAST CORNER OF SAID TRACT TWO AND A WESTERLY NORTH CORNER OF SAID 41.259 ACRE TRACT,

THENCE NORTH 86 DEGREES 55 MINUTES 50 SECONDS EAST, WITH THE COMMON LINE OF THE REMAINDER OF SAID TRACT 3 AND SAID 41.259 ACRE TRACT A DISTANCE OF 396.27 FEET TO POINT FOR CORNER ON THE SOUTH RIGHT-OF-WAY LINE OF SAID STATE HIGHWAY 242 AND THE MOST EASTERLY NORTH CORNER OF SAID 41.259 ACRE TRACT, AND BEING ON A CURVE TO THE LEFT, FROM WHICH A 5/8-INCH REBAR WITH CAP STAMPED 'S&V' FOUND BEARS NORTH 01 DEGREE 58 MINUTES 20 SECONDS WEST, A DISTANCE OF 0.38 OF A FOOT;

THENCE WITH THE SOUTH RIGHT-OF-WAY LINE OF SAID STATE HIGHWAY 242 AND THE NORTH EAST LINE OF SAID 41.259 ACRE TRACT THE FOLLOWING COURSES AND DISTANCES:

SOUTHEASTERLY WITH SAID CURVE TO THE LEFT HAVING A RADIUS OF 4,113.00 FEET, WITH A CENTRAL ANGLE OF 03 DEGREES 44 MINUTES 43 SECONDS, AN ARC LENGTH OF 268.85 FEET, A CHORD AND BEARING OF SOUTH 45 DEGREES 18 MINUTES 34 SECONDS EAST, 268.81 FEET TO A 5/8-INCH REBAR WITH "HALFF" CAP SET FROM WHICH A 1/2-INCH IRON ROD FOUND BEARS NORTH 51 DEGREES 15 MINUTES 03 SECONDS WEST, A DISTANCE OF 8.84 FEET;

SOUTH 47 DEGREES 17 MINUTES 31 SECONDS EAST, A DISTANCE OF 309.01 FEET CONCRETE HIGHWAY MONUMENT FOUND;

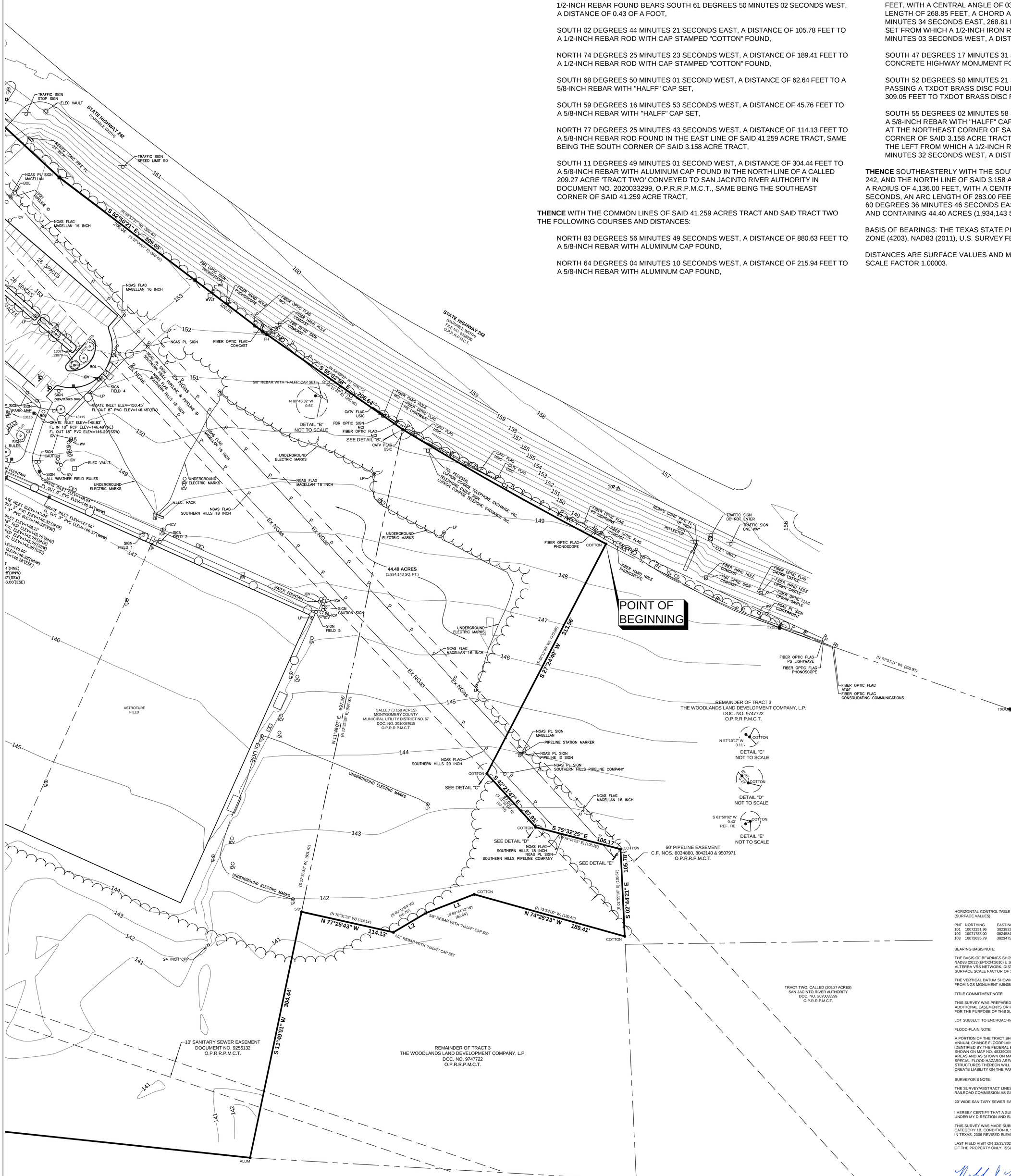
SOUTH 52 DEGREES 50 MINUTES 21 SECONDS EAST, AT A DISTANCE OF 206.04 FEET PASSING A TXDOT BRASS DISC FOUND AND CONTINUING FOR A TOTAL DISTANCE OF 309.05 FEET TO TXDOT BRASS DISC FOUND;

SOUTH 55 DEGREES 02 MINUTES 58 SECONDS EAST, A DISTANCE OF 206.64 FEET TO A 5/8-INCH REBAR WITH "HALFF" CAP SET FROM WHICH A 1/2-INCH IRON ROD FOUND AT THE NORTHEAST CORNER OF SAID 41.259 ACRE TRACT AND THE NORTHWEST CORNER OF SAID 3.158 ACRE TRACT AND BEING AT THE BEGINNING OF A CURVE TO THE LEFT FROM WHICH A 1/2-INCH REBAR FOUND BEARS NORTH 80 DEGREES 45 MINUTES 32 SECONDS WEST, A DISTANCE OF 0.64 OF A FOOT;

THENCE SOUTHEASTERLY WITH THE SOUTH RIGHT-OF-WAY LINE OF SAID STATE HIGHWAY 242, AND THE NORTH LINE OF SAID 3.158 ACRE TRACT, SAID CURVE TO THE LEFT HAVING A RADIUS OF 4,136.00 FEET, WITH A CENTRAL ANGLE OF 03 DEGREES 55 MINUTES 13 SECONDS, AN ARC LENGTH OF 283.00 FEET, A CHORD BEARING AND DISTANCE OF SOUTH 60 DEGREES 36 MINUTES 46 SECONDS EAST, 282.94 FEET TO THE **POINT OF BEGINNING** AND CONTAINING 44.40 ACRES (1,934,143 SQUARE FEET) OF LAND, MORE OR LESS.

BASIS OF BEARINGS: THE TEXAS STATE PLAN COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NAD83 (2011), U.S. SURVEY FEET.

DISTANCES ARE SURFACE VALUES AND MAY BE CONVERTED TO GRID BY UTILIZING THE SCALE FACTOR 1.00003.



LEGEND

CENTER LINE OF ROW	TC=XX.XX	TOP OF CURB ELEVATION	TREE
FENCE LINE, CHAIN LINK	G=XX.XX	GUTTER ELEVATION	HEDGE/SHRUB
EDGE OF CONCRETE	EOW=XX.XX	EDGE OF WATER	HANDICAP
CURB LINE	TP=XX.XX	TOP OF PAVEMENT ELEVATION	FIRE HYDRANT
GUTTER LINE		CONTOUR LINE	GRATE INLET
CONCRETE WALK		ROW LINE	SIGN
EDGE OF ASPHALT		PROPERTY LINE	SPIGOT
EDGE OF SHELL OR GRAVEL	N03°27'59"W 492.96'	PROPERTY LINE DIMS	
TREE LINE		LOT LINES	
PARKING STRIPE		EASEMENT LINE	
BUILDING, COMMERCIAL		BUILDING OUTLINE	

CMP	CORRUGATED METAL PIPE	
CPP	CORRUGATED PLASTIC PIPE	
ICV	IRRIGATION CONTROL VALVE	
LP	LIGHT POLE	
PVC	POLYVINYL CHLORIDE PIPE	
EM	ELECTRIC METER	
RCB	REINFORCED CONCRETE BOX	
RCP	REINFORCED CONCRETE PIPE	
SSCO	SANITARY SEWER CLEAN OUT	
SSMH	SANITARY SEWER MANHOLE	
STMH	STORM SEWER MANHOLE	
WAR	WATER AIR RELEASE	
WV	WATER VALVE	
BOL	BOLLARD	

HORIZONTAL CONTROL TABLE
(SURFACE VALUES)

PNT	NORTHING	EASTING	ELEV.	TYPE
101	10072251.96	3823832.0640	157.44	5/8" IRON ROD WITH "HALFF" CONTROL CAP SET
102	10071783.00	3824584.3650	155.62	5/8" IRON ROD WITH "HALFF" CONTROL CAP SET
103	10072635.79	3823475.0630	159.10	5/8" IRON ROD WITH "HALFF" CONTROL CAP SET

BEARING BASIS NOTE:

THE BASIS OF BEARINGS SHOWN HEREON IS THE TEXAS STATE PLANE COORDINATE SYSTEM CENTRAL ZONE (4203) NAD83 (2011)(EPOCH:2010) U.S. SURVEY FEET BASED ON MULTIPLE/REPEATED GPS OBSERVATIONS UTILIZING THE ALTERRA VRS NETWORK. DISTANCES SHOWN HEREON ARE SURFACE VALUES. THIS SURVEY UTILIZES A GRID TO SURFACE SCALE FACTOR OF 1.00003, SCALED ABOUT 0,0.

THE VERTICAL DATUM SHOWN HEREON IS NAVD88 (GEOID18) BASED ON RTK DIFFERENTIAL LEVEL TO SITE CONTROL FROM NGS MONUMENT AJ6405.

TITLE COMMITMENT NOTE:

THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF A COMMITMENT FOR TITLE, AND MAY BE SUBJECT TO ADDITIONAL EASEMENTS OR RESTRICTIONS NOT SHOWN HEREON. NO ADDITIONAL EASEMENT RESEARCH WAS DONE FOR THE PURPOSE OF THIS SURVEY.

LOT SUBJECT TO ENCROACHMENT AGREEMENT RECORDED IN C.F. NO. 2011046189, O.P.R.M.C.T.

FLOOD-PLAIN NOTE:

A PORTION OF THE TRACT SHOWN HEREON LIES WITHIN ZONE "X" (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) AND PORTION LIES WITHIN ZONE AE (BASE FLOOD ELEVATIONS DETERMINED) AS IDENTIFIED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, NATIONAL FLOOD INSURANCE PROGRAM, AS SHOWN ON MAP NO. 48339C0510G, DATED AUGUST 18, 2014, FOR MONTGOMERY COUNTY, TEXAS AND INCORPORATED AREAS AND AS SHOWN ON MAP NO. 48339C0530G REVISED AUGUST 18, 2014. IF THIS SITE IS NOT WITHIN AN IDENTIFIED SPECIAL FLOOD HAZARD AREA, THIS FLOOD STATEMENT DOES NOT IMPLY THAT THE PROPERTY AND/OR THE STRUCTURES THEREON WILL BE FREE FROM FLOODING OR FLOOD DAMAGE. THIS FLOOD STATEMENT SHALL NOT CREATE LIABILITY ON THE PART OF THE SURVEYOR.

SURVEYOR'S NOTE:

THE SURVEY/ABSTRACT LINES SHOWN HEREON ARE APPROXIMATE IN NATURE, AND WERE PROVIDED BY THE TEXAS RAILROAD COMMISSION AS GIS SHAPEFILES CONVERTED TO DWG AND ARE FOR GENERAL REFERENCE ONLY.

20' WIDE SANITARY SEWER EASEMENT SHOWN HEREON IS BASED ON PHYSICAL EVIDENCE AND NAD27 COORDINATE.

I HEREBY CERTIFY THAT A SURVEY OF THE PROPERTY SHOWN HEREON WAS ACTUALLY MADE UPON THE GROUND UNDER MY DIRECTION AND SUPERVISION ON THE DATE SHOWN.

THIS SURVEY WAS MADE SUBSTANTIALLY IN ACCORDANCE WITH THE STANDARDS AND CONDITIONS SET FORTH FOR A CATEGORY 1B, CONDITION II, STANDARD LAND SURVEY, BASED ON THE MANUAL OF PRACTICE FOR LAND SURVEYING IN TEXAS, 2006 REVISED ELEVENTH EDITION, PREPARED BY THE TEXAS SOCIETY OF PROFESSIONAL SURVEYORS.

LAST FIELD VISIT ON 12/23/2024 TO INCLUDE TOPOGRAPHIC SURVEY TO THE WOODED AREA ON THE SOUTH PORTION OF THE PROPERTY ONLY. ISSUED 01/03/2025

MALCOLM MARTIN 01/03/2025
REGISTERED PROFESSIONAL LAND SURVEYOR
STATE OF TEXAS NO. 6962

STATE OF TEXAS
REGISTERED
MALCOLM T. MARTIN
6962
PROFESSIONAL
LAND SURVEYOR

BOUNDARY, TOPOGRAPHIC AND TREE SURVEY

ALDEN BRIDGE SPORTS COMPLEX

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Drawn By:	RWB
AVO:	52417.002
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SHEET:	2 OF 2

Exhibit P – Specs

Standard Technical Specifications

City of Houston Standard Specifications

Design and Construction Standards | Houston Permitting Center

01255	CHANGE ORDER PROCEDURES
01270	MEASUREMENT AND PAYMENT
01312	COORDINATION AND MEETINGS
01330	SUBMITTAL PROCEDURES
01340	SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
01454	TESTING LABORATORY SERVICES
01502	MOBILIZATION
01504	TEMPORARY FACILITIES AND CONTROLS
01520	TEMPORARY FIELD OFFICE
01562	TREE PROTECTION
01570	STORM WATER POLLUTION PREVENTION CONTROL
02082	PRECAST CONCRETE MANHOLES
01575	STABILIZED CONSTRUCTION ACCESS/ CONCRETE TRUCK WASHOUT
02201	SITE PREPERATION, GRADING RESTORATION AND SITE CLEAN UP
02221	REMOVING EXISTING PAVEMENTS, STRUCTURES, WOOD, AND DEMOLITION DEBRIS
02233	CLEARING AND GRUBBING
02260	TRENCH SAFETY SYSTEM
02317	EXCAVATION AND BACKFILL FOR UTILITIES
02319	BORROW
02322	FLOWABLE FILL
02445	JACK & BORE/JACK & MINE/PILOT TUBE GUIDED BORING TUNNELS
02505	HIGH DENSITY POLYETHYLENE (HDPE) SOLID AND PROFILE WALL PIPE
02511	WATER LINES
02512	WATER TAP AND SERVICE LINE INSTALLATION
02520	FIRE HYDRANTS
02525	TAPPING SLEEVES AND VALVES
02526	WATER METERS
02531	GRAVITY SANITARY SEWERS
02534	SANITARY SEWER SERVICE STUBS OR RECONNECTIONS
02555	MANHOLE REHABILITATION
02631	STORM SEWERS
02632	PRECAST CONCRETE INLETS, HEADWALLS, AND WINGWALLS
02751	CONCRETE PAVING
02761	COLORED CONCRETE FOR MEDIAN AND SIDEWALKS
02767	THERMOPLASTIC PAVEMENT MARKINGS
02771	CURB, CURB AND GUTER, AND HEADERS
02775	CONCRETE SIDEWALKS

Additional Standard Technical Specifications

16505	OUTDOOR SPORTS FIELD LIGHTING SYSTEM
133123	USA SHADE PRE-ENGINEERED SHADE STRUCTURE
260000	BASIC ELECTRICAL REQUIREMENTS
260001	COMMON WORK RESULTS FOR ELECTRICAL
260100	ELECTRICAL SUBMITTAL PROCEDURES
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260543	UNDERGROUND DUCTS AND RACEWAYS AND CABLING
260544	SLEEVES AND SEALS FOR ELECTRICAL RACEWAYS AND CABLING
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
260573	OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY
260574	OVERCURRENT PROTECTIVE DEVICE ARC FLASH STUDY
260900	FIELD ELECTRICAL ACCEPTANCE TEST
260923	LIGHTING CONTROL DEVICES
262200	LOW-VOLTAGE TRANSFORMERS
262416	PANELBOARDS
262715	UTILITY COORDINATION
262726	WIRING DEVICES
262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
264313	SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
265613	LIGHTING POLES AND STANDARDS
265619	LED EXTERIOR LIGHTING
265668	EXTERIOR ATHLETIC LIGHTING
323300	SITE FURNISHINGS
328400	IRRIGATION
329100	SOIL
329200	TURF AND GRASSES
329300	PLANTS
XXXXXX	ALL-WEATHER TURF FIELD
XXXXXX	PUBLIC RESTROOM COMPANY BUILDING

SECTION 16505 - OUTDOOR SPORTS FIELD LIGHTING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Work covered by this section of the specifications shall conform to contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the lighting system performance and design standards for The Woodlands Township for the Alden Bridge Park Additions (4SC) using a turnkey LED sports lighting system. The manufacturer / contractor shall supply the lighting systems to meet or exceed the standards set forth in these specifications.

C. The lighting systems will be for the following venue(s):

1. (4)-Soccer Fields

D. The primary goals of this lighting project are:

1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels are guaranteed to not drop below specified target values for a period of 10 years.
2. Environmental Light Control: Minimize spill light to adjoining properties and glare to the players, spectators and neighbors.
3. Life-cycle Cost: To reduce operating costs, the preferred lighting system shall be energy efficient and cost effective to operate. Accordingly, efficacy should be a minimum of 135 lumens/watt.
4. Control and Monitoring: To reduce system and labor costs and allow for optimal operational flexibility of the lighting system, the customer requires a wireless control system. The system shall be capable of instant on/off/dimming control to reduce energy consumption. The system **must** be accessible by all of the following: Wi-Fi, cellular and LAN connectivity, and permit multiple user, on site or remote control and scheduling/monitoring to detect and monitor system usage and outages. Cellular connectivity with Cloud-Based hosting must be included for a minimum of 10 years.

1.2 LIGHTING PERFORMANCE

A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed, and field measurements taken on the grid spacing with the minimum number of

grid points specified herein. A 0.95 light loss factor shall be applied and submitted for the basis of design.

B. Average illumination level shall be measured in accordance with the latest IESNA Sports and Recreational Area Lighting requirements.

C. Illumination levels shall not drop below desired target values in accordance with latest IESNA Sports and Recreational Area Lighting - Maintained Average Illumination standards and shall be guaranteed for the full warranty period as specified herein.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Soccer Field #1	38FC Avg.	2:1	70	30’ x 30’
Practice Field	38FC Avg.	2:1	70	30’ x 30’
Soccer Field #2	50FC Avg.	2:1	104	30’ x 30’
Soccer Field #3	38FC Avg.	2:1	96	30’ x 30’

D. Hours of usage: Designs shall be based on the following hours of usage:

Area of Lighting	Annual Usage Hours	10 Year Usage Hours
All Fields/Zones	500	5,000

E. Color Temperature: The lighting systems shall have a color temperature of 5700K and a CRI of ≥70.

F. Luminaires must be listed on the QPL of Design Lights Consortium® as “DLC Premium” to ensure quality and energy-efficiency standards are met for qualification in energy efficiency programs.

G. Mounting Heights and Locations: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report to ensure the top of the field angle is a minimum of 20 degrees below horizontal.

Field	# of Poles	Pole Designation	Pole Height
Soccer Fields #1-#4	4	All Poles	70’

1.3 ENVIRONMENTAL LIGHT CONTROL

A. Light Control for Luminaires: All luminaires shall utilize optics designed to minimize glare and spill light while maintaining quality light above the poles for aerial play. **Up Lighting will not be accepted.**

B. Spill Control: To minimize impact on adjacent properties, maximum horizontal spill shall be no more than 1.0 fc 150' from the edge of the field (Spill Line).

C. Light levels shall be taken at 30-foot intervals along the Spill Line; and illumination level shall be measured in accordance with IESNA LM-5-04 after 1 hour warm up. These spill readings must be submitted to the Owner's Representative.

D. Photometric Report: A photometric report that shows aiming points of each luminaire shall be provided to demonstrate the capability of achieving the specified performance.

PART 2 – SPORTS LIGHTING SYSTEM DESIGN AND CONSTRUCTION

2.1 ACCEPTABLE MANUFACTURERS

A. All components shall be designed and manufactured as a system. Pole structure, luminaires, control and integral driver system shall be provided from the below approved manufacturer. All substitutions must provide a complete submittal package and be pre-approved at least 10 days prior to bid.

1. Techline Sports Lighting

2.2 SPORTS LIGHTING SYSTEM

A. The entire sports lighting system (poles, crossarms, wiring and fixtures) must be supplied by a single entity that underwrites the warranty. The complete lighting system shall consist of the listed equipment and features as follows:

1. Factory assembled luminaires: LED Luminaire must be an integral unit with maximum distance of 18 inches between power supply, driver and LED's to minimize power loss and EMI (electromagnetic interference). Entire fixture must be factory assembled and sealed to at least an IP66 rating. The Luminaire must be listed with the DesignLights Consortium® as a "DLC Premium" Luminaire.

2. Poles: The sports lighting pole system shall consist of concrete encased galvanized steel poles with a factory pre-wired crossarm assembly. All wiring/connections should be factory assembled from the fixture mounting location to the base of the pole. Strain relief

device(s) must be factory installed in pre-wired crossarm assembly to ensure no weight or tension is placed on electrical connections.

a. hot dip galvanized steel per ASTM A123

b. Crossarms

c. Wire harnesses, etc.

d. Laser aiming capability for field alignment/realignment of the luminaires

e. A minimum of NEMA 3X rated wireless control system enclosure

f. All system components shall be UL listed for the appropriate application.

2.3 FOUNDATIONS

A. The pole foundations shall be designed for allowable stresses in accordance with latest AASHTO standards. Foundation must be designed by Structural Engineer licensed in the State of Texas. Installation and structure shall be based on wind speed criteria of these specifications.

B. Concrete material for concrete foundations – all concrete shall have minimum compressive strength of 3000 psi at 28 days. Concrete shall have maximum water/cement ratio of 0.5. Foundation installation shall be in accordance with the latest edition of ACI 336, Standard Specifications for the Construction of Drilled Piers.

C. Foundation strength for anchor base poles only – any concrete portions of the pole in which steel components that provide tension strength are contained, shall be allowed to harden for a minimum of 28 days before stress loads of pole attachment are applied.

2.4 POLE STRUCTURE

A. The poles shall be designed for allowable stresses in accordance with latest AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

B. The pole structure shall consist of a modular pole assembly. This shall consist of no more than two shaft components. No single component shall weigh over 1500 pounds to allow handling by light duty equipment in order to minimize damage to site.

C. Embedment shaft section shall be a single piece round tapered shaft section. The taper rate and material cross section properties shall match the adjoining section. The lower shaft section shall be concrete encased with a minimum diameter of 12” greater than the dimension of the pole and embedded into the earth a minimum distance of 10% of the free-standing height of the structure plus 4 feet or as recommended by engineer. The shaft section shall be galvanized in accordance with ASTM A123 specifications. The entire embedded shaft portion shall also be externally coated with Corrocote II epoxy coating or coal tar epoxy up to 6” above the ground line. Concrete stub pole sections are not acceptable due to excessive weight.

D. Each section of pole shaft material shall be of single-ply material and be made from a single sheet of steel with no circumferential welded splices. The pole shafts cross-section shall be round. The pole shaft sections shall be high-strength steel meeting the requirements of ASTM A570 GR65 (65 ksi yield) and/or ASTM A595 GR55 (55 ksi yield).

E. Pole shaft sections shall be hot dip galvanized in accordance with the requirements of ASTM A123 specifications. Each shaft assembly must be completely coated, inside and out, in a single dip. Double dipping will not be permitted in compliance to USGA (United States Galvanizing Association) recommended practices and procedures to prevent acid entrapment. All miscellaneous connecting hardware shall be galvanized in accordance with ASTM A153 specifications.

F. Exposed structures such as electrical components enclosures shall be constructed of corrosion resistant material and/or coated to help prevent corrosion.

G. The structure shall be designed for the combined effective projected area (EPA) and weight of all applicable accessories (i.e. luminaires, crossarms, and other components such as speakers/mounting brackets). Concrete poles or pole sections are not acceptable due to excessive weight and mobilization costs.

H. Wind loads – structure shall be based on the latest specifications of AASHTO and designed to withstand wind speeds of 120mph, exposure Category C.

2.5 CROSS-ARM ASSEMBLY:

A. All crossarms shall be factory pre-wired and assembled.

B. Galvanized steel per ASTM A123

C. All wiring/connections should be factory assembled from the fixture mounting location to the base of the pole.

D. Strain relief device(s) must be factory installed in pre-wired crossarm assembly to ensure no weight or tension is placed on electrical connections.

E. All factory pre-wiring must be done in a manner that requires no electrical connections inside the pole or crossarm assembly to be made in the field.

2.6 LUMINAIRE

A. The luminaires shall meet the following specifications:

1. Operating temperature range: -40°C to +50°C
2. IP Rating: IP66
3. Certified to UL 844 and ANSI C136.31, 3G vibration requirements
4. Correlated Color Temperature (CCT): 5700K
5. Color Rendering Index (CRI): ≥70
6. L70 lumen depreciation rating: >100,000 hours
7. Weight: ≤50lbs, including driver, visor, bracket, and RF system components

8. Driver: Integral to the fixture and thermally isolated, to minimize power loss and EMI (electromagnetic interference).
9. Driver input voltage range: 200VAC to 480VAC
10. Efficacy of ≥135 lumens/watt
11. Power factor ≥0.99 @ 277VAC and ≥0.96 @480VAC
12. Ultra-low standby power ≤1%
13. Each Luminaire must be installed with a glare control visor at least 20" in length, from the face of the luminaire, to the edge of the visor
14. Luminaire shall include custom lensing injection molded from optical grade, impact resistant lens with a UV additive to provide more for long-term sunlight exposure.
15. Luminaire lensing shall be TIR (Total Internal Reflection) based
16. Internal optic control and external visors to minimize glare and spill on and off the playing surface
17. Luminaire must meet or exceed ASTM B117 Testing
18. **Up Lighting will NOT be acceptable.**

2.7 CONTROL SYSTEM

A. The control and monitoring system shall provide instant on/off/capabilities and meet the following specifications:

1. Wireless control
2. Must include the ability to schedule/control system via **all of the following means of connectivity**: Wi-Fi, Cellular, and LAN connectivity for remote operation, with cellular connectivity and Cloud-Based hosting for a minimum of 10 years.
3. IOS and Android compatible wireless control for multiple users
4. Remote monitoring and diagnostics, email alerts and notifications to detect outages
5. Allow multiple user accounts with ability to assign various system permission levels
6. Ability to schedule recurring events at fixed times
7. Capable of in-field firmware/software upgrades
8. Onsite and/or remote commissioning
9. Ability to organize and manage different "zones" of luminaires
10. Map-based interface to adjust lights, activate scenes, or create schedules

B. Control enclosure to be NEMA 4X molded fiberglass reinforced polyester with internal gasket and stainless steel, quick release latches with ability to padlock for security purposes.

C. Controller shall be protected against memory loss during power outages. If power failure to the controller occurs, lights shall fail on to 100%. Once power is restored controller shall resume normal event schedule.

SAFETY

A. All system components shall be UL listed for the appropriate application.

2.8 ELECTRICAL

A. The electrical power requirements for the sports lighting system shall meet the following specifications:

1. Electrical Service: 280 to 480V (single phase or 3 phase)
2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.
3. Energy Consumption: The total system kW consumption shall be 80kW or less.

PART 3 – EXECUTION

3.1 SOIL QUALITY CONTROL

A. It shall be the contractor's responsibility to notify the owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request/estimate for the Owner's approval/payment for additional costs associated with:

1. Providing engineered foundation embedment design by a registered engineer in the State of Texas for soils other than specified soil conditions;
2. Additional materials required to achieve alternate foundation
3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.
4. Slurry drilling or casing would be required if water infiltrates foundation holes while drilling occurs.

3.2 DELIVERY

A. Timing: The equipment shall be on-site **4 to 6** weeks from receipt of approved submittals and receipt of complete order information.

1. The entire system shall be delivered to the jobsite by the supplier.
2. All material (poles, fixtures, crossarm assemblies, etc.) shall arrive the same day.
3. The supplier shall off-load all material and stage required material at pre-determined location to eliminate possibility of lost or damaged material.

3.3 FIELD QUALITY CONTROL

A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with the latest IESNA Sports and Recreational Area Lighting standards RP6 manual.

B. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed representative, the actual performance levels of the system are not in conformance with the requirements of the specifications and submitted information, the Contractor/Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

3.4 WARRANTY AND GUARANTEE

A. 10-Year Material & Labor Warranty: Manufacturer shall supply a signed warranty covering the entire system for 10 years from the date of shipment. Warranty shall cover guaranteed light levels and structural integrity of the system. System energy consumption is to be maintained for entire warranty period and will not increase as the system ages.

B. Manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover damage due to weather conditions, acts of God, accidents, misuse, misapplication, abuse, negligence, failure of owner's electrical service or unauthorized modification of any part of the product.

C. Individual luminaire outages shall be repaired or replaced when the usage of any field is materially impacted by greater than 10%.

PART 4 – DESIGN APPROVAL

4.1 SUBMITTAL REQUIREMENTS

A. Lighting system shop drawings shall include:

Yes / No	Item	Description
	Equipment Layout	Drawing(s) showing field layouts with pole locations
	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), uniformity gradient (UG); number of luminaries, total system kilowatts; light loss factor.
	Photometric Report	A photometric report that shows aiming points to demonstrate the capability of the system to achieve the specified performance.
	Pole Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the State of Texas.
	Foundation Drawings	Project specific foundation drawings stamped by a registered, licensed structural engineer in the state of installation. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.
	Control & Monitoring System	Written definition and schematics for automated control system must be provided.
	Standard Catalog 'Cut' Sheets	Luminaire specification sheets

B. Lay-down and mobilization plan shall include:

1. Method to secure light poles and assemblies prior to final installation to prevent roll-over. Contractor responsible to protect equipment from theft or vandalism.
2. Lay down plan prior to any light pole deliveries. Lay down plan shall include temporary storage locations, rigging methods and delivery locations.
3. Indicate the above on an 11” x 17” drawing and include with shop drawings.

- END OF SECTION -

SECTION 13 31 23
PRE-ENGINEERED SHADE STRUCTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections apply to this section.

1.2 SUMMARY
- A. The shade structure contractor shall be responsible for the design, engineering, fabrication, supply, and installation (including foundations). The intent of this specification is to have only one single contractor be responsible for all the above functions.

1.3 REFERENCES
- A. Shade Structures must comply with the latest revision of applicable codes and regulations including IBC 2021.
- B. American Society for Testing Materials (ASTM)
- C. American Welding Society: Structural Welding Code AWS D1.1: Symbols for Welding and Nondestructive Testing AWS 2.3.
- D. International Accreditation Services (IAS)
- E. American Institute of Steel Construction (AISC): Specifications for the design, fabrication, and erection of structural steel.

1.4 SUBMITTALS
- A. Provide proof of installed reference sites with six structures for similar scope of project and installation that are engineered to IBC 2021 Specifications.
- B. Provide a minimum of 13 fabric samples to demonstrate fabric color range and powder color selections.
- C. Provide proof of all quality assurance items including:
  1. A list of at least three reference projects of similar type structures that have been installed in the last 10 years as described below in 2.1 General, Scope.
  2. Proof of general liability, professional liability, and umbrella insurance as per section 1.5 D.
  3. Proof of a minimum of $25,000,000 aggregate bonding capacity as per Section 1.5 E.
  4. Proof of IAS Certification per Section 1.5 F.
  5. Proof of current status as an ISNetworld Member Contractor.
  6. Proof of a Corporate Safety Program along with an Injury & Illness Prevention Program.
  7. Proof of Corporate Quality Control Manual as per Section 1.5 H

1.5. QUALITY ASSURANCE

Fabrication and erection are limited to firms with proven experience in design and construction of fabric shade structures and such firms shall meet the following minimum requirements. No substitutions shall be allowed for the following:

- A. A single shade contractor shall design, engineer, manufacture, and erect the fabric shade structures including the foundations.
- B. All bidders shall have at least 15 years' experience in the design, engineering, manufacturing, and installation of shade structures.
- C. All bidders shall engineer to IBC 2021 requirements with similar scope.

D. All bidders shall be able to provide proof of a minimum of $1,000,000 general/public liability insurance, $3,000,000 professional liability (PL) insurance, and an additional $10,000,000 umbrella/excess liability insurance.
E. All bidders shall be licensed and bonded with a minimum bonding capacity of $6,000,000 and aggregate bonding capacity of $25,000,000.
F. Steel manufacturer shall be accredited by IAS (International Accreditation Service) for Structural Steel Fabrication under UBC 97 & 2000 Section 1701.7 and IBC 2015 Section 1704.2.2.
G. Proof of current status as an ISNetworld Member Contractor.
H. The shade contractor shall have a Corporate Quality Control program and manual describing their complete quality assurance program.
I. All bidders must have an in-house warranty & service department and local office to assist in repairs and service calls.

1.7 WARRANTY

A. The successful bidder shall provide a 12-month warranty on all labor and materials.
B. A supplemental warranty from the manufacturer shall be provided for a period of 10 years (pro-rated) on fabric and 10 years on the structural integrity of the steel from the date of substantial completion.
C. The warranty shall not deprive the Owner of other rights under the provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 – PRODUCTS

2.1 GENERAL

A. Scope: Provide custom shade structures per design with architect. Minimum steel size 5" diameter columns with minimum footings of 2' x 8' deep with recessed base plate, drilled pier footings. No exceptions.

B. The structures shall be manufactured by Shade Structures, Inc. dba USA SHADE & Fabric Structures, or approved equivalent and include the structural steel frame, fabric roof, steel cables, all fasteners, and installation. Project management and foundations will also be included.

Contact: Shade Structures, Inc.
Dba USA SHADE & Fabric Structures
2580 Esters Blvd, Suite 100
DFW Airport, Texas 75261
Contact Name: Kendall Purgatorio – Phone: 713-203-1729
kendall.purgatorio@usa-shade.com

C. To qualify as an approved equivalent, please submit product documentation, fabric samples and all quality assurance criteria as per Section 1.4 at least 10 days prior to bid date. Approved equals will be issued per addendum prior to bid date.
D. The shade structure shall conform to the current adopted version of the International Building Code 2021 and local agency additions and amendments.
E. All shade structures are engineered and designed to meet a minimum of 115 mph wind load for steel and 115 mph wind load for fabrics, Exposure C, Risk Category II, live load of 5 lbs/sf^2 and a 5 lbs/sft^2 snow load. Fabrics to be removed for snow loads over 5 psf. When ASD Steel Design Method is used based on IBC 2021 Section 1605.3.1, the Dead + 0.75 of

Live + 0.75 of Wind Load cases must be combined. NO EXCEPTIONS.

F. Steel:
   1. All steel members of the shade structure shall be designed in strict accordance with the requirements of the “American Institute of Steel Construction” (AISC) Specifications and the “American Iron and Steel Institute” (AISI) Specifications for Cold Formed Members and manufactured in a IAS (International Accreditation Service) accredited facility for Structural Steel Fabrication as per IBC 2021 Section 1704.2.2.
   2. All connections shall have a maximum internal sleeving tolerance of .0625 inches using high tensile strength steel sections with a minimum sleeve length of 6 inches.
   3. All non-hollow structural steel members shall comply with ASTM A-36. All hollow structural steel members shall be cold formed, high strength steel and comply with ASTM A-500, Grade C. All steel plates shall comply with ASTM A-572, Grade 50. All galvanized steel tubing shall be triple coated for rust protection using an in-line electro-plating coat process. All galvanized steel tubing shall be internally coated with zinc and organic coatings to prevent corrosion.

G. Welding:
   1. All shop-welded connections of the shade structure shall be designed and performed in strict accordance with the requirements of the “American Welding Society” (AWS) Specifications. Structural welds shall be made in compliance with the requirements of the “Prequalified” welded joints where applicable and by certified welders. No onsite or field welding shall be permitted.
   2. All full penetration welds shall be continuously inspected by an independent inspection agency and shall be tested to the requirement of IBC 2021 and local agency additions and amendments.

H. Powder Coating:
   1. Galvanized steel tubing preparation prior to powder coating shall be executed in accordance to solvent cleaning SSPC-SP1. Solvent such as water, mineral spirits, xylol, toluol, which are to be used to remove foreign matter from the surface. A mechanical method prior to solvent cleaning prior to surface preparation shall be executed according to Power Tool Cleaning SSPC-SP3 and utilizing wire brushed abrasive wheels and needle gun, etc.
   2. Carbon structural steel tubing preparation prior to powder coating shall be executed in accordance to commercial blast cleaning SSPC-SP6 or NACE #3. A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, mill scale, rust, coating, oxides, corrosion, products and other foreign material.
   3. Powder coating shall be sufficiently applied, with a minimum three mils thickness and cured at the recommended temperature to provide proper adhesion and stability to meet salt spray and adhesion tests as defined by the American Society of Testing Materials.
   4. Powder used in the powder coat process shall have the following characteristics:
      a. Specific Gravity: 1.77 +/- 0.05 g/cm^3
      b. Coverage at 1.0 mils: 109sq.ft/lb/mil
      c. Storage: 80^o F
      d. Interpron 800 HR is a series of high durability TGIC powder coatings designed for exterior exposure. Tested against the most severe specifications, Interpron 800 HR gives significantly improved gloss retention and resistance to color change.
      e. Rust Protection Powder Under Coat Primer will be required on all structures in close proximity to water or chemicals. POWDURA® Epoxy Powder Coating Z.R. Primer shall be applied in accordance with the manufacturers’ specifications. Primer should be fused only and then top coated with the selected powder coat to ensure proper intercoat adhesion.

d. Color: The paint color shall be as selected by the Architect

I. Tension Cable: Steel cable is determined based on calculated engineering loads.
1. For light and medium loads, ¼" (nominal) galvanized 7 x 19 strand cable to be used.
2. For heavy loads, 3/8" (nominal) galvanized 7 x 19 cable to be used.

J. Fabric Roof Systems
1. UV shade fabric is made of UV stabilized Shadesure® cloth as manufactured by MultiKnit Ltd and made of a UV stabilized high-density polyethylene mesh. Mesh shall be raschel knitted with monofilament and tape yarn filler to ensure that material will not unravel if cut. Panels to be 10ft. wide.
2. Fabric Properties:
a. Life Expectancy: A minimum of 8 years continuous exposure to the sun
b. Fading: Minimum fading after 5 years (3 years for red)
c. Fabric Mass: 2.43-2.58 oz/sqft (190-200g/sm)
d. Fabric Width: 9.8425 (3m)
e. Roll Length: 164.04 (50m)
f. Roll Dimensions: 62.99"x16.5354" (160 cm x 42 cm)
g. Roll Weight: +/- 66 lbs (+/-30 kg)
h. Minimum Temperature: -13^{0}F (-25˚ C)
i. Maximum Temperature: +176°F (80° C)
3. Stitching & Thread:
a. All sewing threads are to be double stitched.
b. Thread shall be GORE Tenara Sewing Thread manufactured from 100% expanded PTFE (Teflon); mildew resistant exterior approved thread. Thread shall meet or exceed the following:
1) Flexible temperature range
2) Very low shrinkage factor
3) Extremely high strength, durable in outdoor climates
4) Resists flex and abrasion of fabric
5) Unaffected by cleaning agents; acid rain, mildew, salt water and rot resistant, unaffected by most industrial pollutants
6) Treated for prolonged exposure to the sun

2.2 SHIPPING AND HANDLING

A. All steel surfaces touched by tie down straps are to be padded before final clinching. This can be accomplished by using carpet pads or factory manufactured padding.
B. All dunnage must be padded before painted products are set in place. Smaller and loose pieces must be padded and totally separate from paint padding.
C. Unloading: Lift forks to be covered with padding. All dunnage must be padded vertically and horizontally to prevent damage to painted surfaces. When unloading, take care to prevent tools and other hard surface items from making contact.

PART 3 – EXECUTION

3.1 INSTALLATION
A. Installation of shade structures shall be performed by manufacturer or manufacturer-approved contractor, which shall be bonded and holding a current contractor's license with

the State of Texas Contractors State License Board. All installation personnel must have experience in the erection of tensioned fabric structures.

B. The contractor installing the structure shall comply with manufactures instructions for assembly, installation, and erection per approved drawings.

C. Concrete:
   1. Unless noted otherwise for footing and piers by General Contractor's Engineer, concrete specification for footings, piers, slabs, curbs and walkways shall meet a minimum 2,500 psi at 28-day strength.
   2. Concrete work is executed in strict accordance with the latest American Concrete Institute Building Code (ACI 318-99).
   3. Slump 4" maximum.
   4. Whenever daily ambient temperatures are below 80 degrees Fahrenheit, the contractor may have mix accelerators and hot water added at the batch plant.
      a. Temperature range between 75-80 degrees, 1% accelerator High Early (non-calcium)
      b. Temperature range between 70-75 degrees, 2% accelerator High Early (non-calcium)
      c. Temperature range below 70 degrees, 3% accelerator High Early (non-calcium)
   5. The contractor shall not pour any concrete when daily ambient temperature is below 55 degrees Fahrenheit.

Temperature Range	% Accelerator	Type Accelerator
75-80 degrees	1%	High Early (non-calcium)
70-75 degrees	2%	High Early (non-calcium)
Below 70 degrees	3%	High Early (non-calcium)

D. Foundations:
   1. All Anchor Bolts set in new concrete shall be ASTM F-1554 GR 55
   2. All Anchor Bolts shall be Galvanized
   3. Pier Footings:
      Minimum footing size shall be 2' diameter x 11' depth and placed in accordance with/ and conform to manufacturers engineered specifications and drawings.

END OF SECTION 13 31 23

SECTION 260000
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions, Division 1 Specification Sections and all relevant documents shall form a part of this Division of the Specifications and shall be incorporated in this Section and each Division 26 Section hereinafter as if repeated verbatim herein. All conditions imposed by these documents shall be applicable to all portions of the work under this Division. Certain specific paragraphs of said references may be referred to hereinafter in this Division. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.

B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve him of responsibility. The omission of details of other portions of the work from this Division shall not be used as a basis for a request for additional compensation.

C. The specific features and details for other portions of the work related to the construction in progress or to the existing building(s) shall be determined by examination at the site.

1.02 SCOPE OF WORK

A. The requirements contained in this Section apply to all work performed under Division 26 of these Specifications.

B. The work covered by this Division of the Specifications comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for, and reasonably incidental to, the installation of the work in accordance with the applicable Contract Documents, and subject to the terms and conditions of the Contract.

C. Refer to other Divisions of the Specifications for related work.

1.03 DEFINITION OF "CONTRACTOR"

A. Where the word "Contractor" is used under any Section of this Division of the Specifications, it shall mean the Contractor engaged to execute the work included under that Section.

1.04 RESPONSIBILITY OF THE CONTRACTOR

A. The Contractor shall be responsible for all work of every description in connection with this Division of the Specifications. The Contractor shall specifically and distinctly assume, and does so assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the work, and undertake the responsibility to defend the Owner against all claims on account of any such damage or injury.

B. The Contractor will be held responsible for the satisfactory execution and completion of the work in accordance with the true intent of the Contract Documents. The Contractor shall provide without extra charge all incidental items required as part of the work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, he shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the work.

1.05 TERMINOLOGY

A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and similar phrases occur, it is the intent that the materials, equipment and devices described be furnished, installed and connected under this Division, complete for operation, unless specifically noted to the contrary.

B. It is also the intent, unless specifically noted to the contrary, that all materials, equipment and devices described and specified under this Division of the Specifications be similarly furnished, installed and connected under this Division, whether or not a phrase as described in the preceding paragraph has been actually included.

1.06 ORDINANCES, PERMITS AND CODES

A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.

B. All work herein shall conform to all applicable laws, ordinances and regulations of the local utility companies.

C. The Contractor shall obtain and pay for all permit and connection fees as required for the complete installation of the specified systems, equipment, devices and materials.

D. The Contractor shall obtain permits, plan checks, inspections and approvals applicable to the work as required by the regulatory authorities. Fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

E. The work shall be in accordance with, but shall not be limited to, the requirements of:
1. National Fire Protection Association
2. National Electrical Code
3. National Safety Code
4. State of Texas Safety Code
5. Applicable City Building Codes
6. State of Texas Building Codes

F. Codes and standards referred to are minimum standards. Where the requirements of the Drawings or Specifications exceed those of the codes and regulations, the Drawings and Specifications govern.

1.07 MATERIALS, EQUIPMENT AND DEVICE DESCRIPTION

A. Materials, equipment and devices shall be of the best quality customarily applied in quality commercial practice, and shall be the products of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

B. Materials, equipment and devices furnished under this Division of the Specifications shall be essentially the standard product of the specified manufacturer, or where allowed, an alternate manufacturer. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.

C. In describing the various materials, equipment and devices, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Contract Documents.

D. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. The Contractor shall verify that all materials, equipment and devices proposed for use on this project are within the constraints of the allocated space.

1.08 QUALITY ASSURANCE

A. Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall not be

repaired at the job site, but shall be replaced with new materials, equipment or devices identical with those damaged, unless specifically approved otherwise by the Owner's Representative.

B. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

1.09 REFERENCE STANDARDS

A. Materials, equipment, devices and workmanship shall comply with applicable local, county, state and national codes, laws and ordinances, utility company regulations and industry standards.

B. In case of differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference. Should the Contractor perform any work that does not comply with local codes, laws and ordinances, industry standards or other governing regulations, the work shall be corrected of noncompliance deficiencies with the Contractor bearing all costs.

C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply:

AABM - American Association of Battery Manufacturers
AIA - American Institute of Architects
ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials
CBM - Certified Ballast Manufacturers Association
ETL - Electrical Testing Laboratories
FM - Factory Mutual
ICEA - Insulated Cable Engineers Associated
IEEE - Institute of Electrical and Electronic Engineers
IES - Illuminating Engineering Society
IRI - Industrial Risk Insurance
NBS - National Bureau of Standards
NEC - National Electrical Code
NECA - National Electrical Contractors Association
NEMA - National Electrical Manufacturers Association
NESC - National Electrical Safety Code
NETA - National Electrical Testing Association
NFPA - National Fire Protection Association
UL - Underwriters Laboratories

D. Where the Contract Documents exceed the above requirements, the Contract Documents shall govern. In no case shall work be installed contrary to or below the minimum legal standards.

1.10 DRAWINGS AND SPECIFICATIONS

A. The interrelation of the Drawings (including the schedules) and the Specifications are as follows:
   1. The Drawings establish quantities, locations, dimensions and details of materials, equipment and devices. The schedules on the Drawings indicate the capacities, characteristics and components.
   2. The Specifications provide written requirements for the quality, standard and nature of the materials, equipment, devices and construction systems.

B. The Drawings and Specifications shall be considered as being compatible; therefore, the work called for by one and not by the other shall be furnished and installed as though called for by both. Resolution of conflicts between Drawings and Specifications shall be as follows:
   1. If the Drawings and Specifications disagree in themselves, or with each other, the Contractor's pricing shall be based on furnishing and installing the most expensive

combination of quality and quantity of work indicated. In the event of this type of disagreement, the resolution shall be determined by the Architect/Engineer.

2. The Contractor shall be responsible for bringing any conflicts in the Drawings and the Specifications to the attention of the Architect/Engineer prior to any work being performed.
3. In general, if there is conflict between the Drawings and Specifications, the Drawings shall govern the Specifications.
4. Where the Specifications do not fully agree with schedules on the Drawings, the schedules shall govern. Actual numerical dimensions indicated on the Drawings govern scale measurements and large scale details govern small scale drawings.
5. Materials, equipment and devices called for on the Drawings and not indicated herein, shall be completely provided and installed as though it were fully described herein.
6. Materials, equipment and devices called for herein shall be completely provided and installed, whether or not it is fully detailed, scheduled or indicated on the Drawings.

C. The Contractor shall examine the Drawings and Specifications of the other portions of the work for fixtures and finishes in connection with this work. The Contractor shall carefully examine the Drawings to determine the general construction conditions, and shall familiarize himself with all limitations caused by such conditions.

D. When discrepancies exist between scale and dimension, or between the Drawings of the various portions of the work, they shall be called to the attention of the Architect/Engineer for further instruction, whose instructions shall be final and binding and work promptly resumed without any additional cost to the Owner.

E. Review the construction details of the building(s) as illustrated on the Drawings of the various portions of the work and be guided thereby. Route conduits and set all boxes as required by the pace of the general construction.

F. The Drawings diagrammatically show the sizes and locations of the various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation requirements. Carefully layout the work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the work. Determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Architect/Engineer, without additional cost to the Owner.

G. The Drawings and Specifications are intended to describe and illustrate systems which will not interfere with the structure of the building(s), fit into the available spaces, and insure complete and satisfactory operating installations. Prepare installation drawings for all critical areas illustrating the installation of the work in this Division as related to the work of all other Divisions and correct all interferences with the other portions of the work or with the building structures before the work proceeds.

H. The Drawings do not indicate the existing electrical installations other than to identify modifications or extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work under this Division.

I. It is the intent of these specifications that the entire electrical power, lighting controls, and low voltage systems be complete and operable. Provide all necessary material and labor for the complete system from source of power to final utilization equipment, including all connections, testing, calibration of equipment furnished by others as well as equipment furnished by the Contractor, whether or not specifically mentioned but which are necessary for successful operation.

J. Provide all Electrical work, including conduit, field wiring, and connections by the electrical subcontractor under the provisions of the Electrical Specifications for all aspects of the work, including heating, ventilating, air conditioning, and plumbing equipment.

1.11 SHOP DRAWINGS AND SUBMITTAL DATA

A. Process shop drawings and submittal data to insure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, and that there are no omissions or duplications. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.

B. Shop drawings shall be drawn on a scale not less than 1/4 inch equals 1 foot showing actual dimensions. Shop drawings shall include, but not be limited to:
   1. Switchboards
   2. Distribution Panelboards
   3. Lighting/Appliance Panelboards

C. Submittal data (manufacturer's catalog data) shall include, but not be limited to:
   1. Equipment: switchboard, panelboards, transformers, disconnect switches, circuit breakers, fuses, etc.
   2. Materials: conduit, conductors, connectors, supports, etc.
   3. Lighting fixtures and lamps.
   4. Wiring devices.

D. The submittal data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

E. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform with Contract Documents.

F. Assemble submittals on related items procured from a single manufacturer in brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.

G. The Contractor shall submit shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Architect/ Engineer. Shop drawings shall be prepared at a scale of not less than 1/4 inch equals 1 foot.

1.12 SUBSTITUTIONS

A. Where a single manufacturer is mentioned by trade name or manufacturer's name, unless specifically noted otherwise, it is the only manufacturer that will be accepted.

B. Where multiple manufacturers are listed, none other than those manufacturers will be accepted.

C. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal 1/4 inch equals 1 foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.

D. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Architect/Engineer, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.

E. The Architect/Engineer reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.

F. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

1.13 INSTALLATION DRAWINGS

A. Prepare installation drawings for coordinating the work of this Division with the work of other Divisions, to illustrate its concealment in finished spaces, to avoid obstructions, and to demonstrate the adaptability of any item of material, equipment or device in the space upon which the Contract Documents are based.

B. Use these drawings in the field for the actual installation of this work. Provide three (3) copies, not for approval, to the Architect/Engineer for his information, review and record.

1.14 WORKMANSHIP AND INSTALLATION

A. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Contract Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall report same to the Owner's Representative and shall secure his approval before the work is started.

B. The work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

C. The NECA "Standards of Installation" as published by the National Electrical Contractors Association shall be considered a part of these Specifications, except as specifically modified by other provisions contained in these Specifications.

1.15 WARRANTY

A. All materials, equipment, devices and workmanship shall be warranted for a period of one year from the date of acceptance by the Architect/Engineer for beneficial use by the Owner, except that where specific equipment is noted to have extended warranties. The warranty shall be in accordance with AIA Document A201. The Contractor shall be responsible for the proper registration of these warranties so that the Owner can make all proper claims should future need develop.

B. The Contractor shall furnish to the Architect/Engineer for transmittal to the Owner, the name, address and telephone number of those persons responsible for service on systems and equipment covered by the warranty.

1.16 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, the Contractor may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments and complete punch list items before final acceptance by the Owner.

1.17 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers and/or technicians acceptable to the Architect/ Engineer to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions

shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

1.18 SCHEDULE AND SEQUENCE OF WORK

A. The Contractor shall meet and cooperate with the Owner and Architect/Engineer to schedule and sequence this work so as to insure meeting scheduled completion dates and avoid delaying other portions of the work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.

1.19 INSPECTIONS AND CERTIFICATIONS

A. Obtain timely inspections of the installation by the regulatory authorities. Remedy any deficiencies to the satisfaction of the inspecting official.

B. Upon final completion of the work, obtain certificates of acceptance from the regulatory authorities. Deliver the certificates to the Architect/Engineer for transmission to the Owner.

1.20 EQUIPMENT INSTALLATION

A. Install equipment and devices in a manner to permit access to all surfaces or components, requiring such access, without the need to disassemble other unrelated parts of the work.

B. Equipment specified to be factory assembled and tested prior to shipment shall not be disassembled at the job site and reassembled at its final location. Apparatus not so specified may be disassembled and reassembled in the proper location.

C. Furnish all scaffolding, rigging and hoisting required for the installation of all the work.

D. Large equipment assemblies and components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is complete.

1.21 EQUIPMENT FOUNDATIONS

A. Where indicated on the Drawings, provide foundations for electrical equipment. This shall consist of concrete housekeeping pads constructed in accordance with the details on the Drawings, these Specifications, manufacturer's recommendations and Division 3.

B. All pads shall be 4" high and extend a maximum 2" beyond the actual equipment size. Coordinate the proper size of the pad with the equipment furnished. Furnish all anchor bolts and other accessories required for casting the concrete pad. After the equipment is set on the pad, the equipment shall be fully grouted to the pad and all void spaces shall be filled with a non-shrinking grout.

1.22 SLEEVES

A. Each conduit, regardless of material, which passes through a concrete slab, masonry wall, or roof or portion of the building structure shall be free from the structure and shall pass through a sleeve.

B. All sleeves shall be constructed from electrical-metallic tubing or equivalent weight galvanized steel tubing and shall be flush on both sides of the surface penetrated, unless noted otherwise. All sleeves penetrating the roof areas shall extend a minimum 10 inches above the roof with approved weatherproof counterflashing attached to the conduit above the roof. All sleeves

penetrating floors shall extend a minimum of 6 inches above the finished floors. The sleeves shall be sized to allow free passage of the conduit to be inserted.

C. Sleeves passing through walls or floors on or below grade or in moist areas shall be constructed of galvanized rigid steel and shall be designed with a suitable flange in the center to form a waterproof passage. After the conduit has been installed in the sleeves, the void space around the conduit shall be caulked with jute twine and filled with an asphalt-base compound to insure a waterproof penetration.

1.23 ESCUTCHEONS

A. In each finished space, provided a chromium plated, sectional escutcheon on each conduit, or hanger rod penetrating a wall, floor or ceiling.

B. Size escutcheons and collars to fit snugly around conduit and rods.

C. Where required, provide escutcheons with set screws so that they fit snugly against the finished surface.

1.24 ACCESS PANELS

A. Provide wall and ceiling access panels for unrestricted access to all concealed electrical equipment items and devices installed behind furrings, chases or non-removable suspended ceilings.

B. Access panels shall be UL listed and labeled as required to suit the fire rating of the surface in which installed, with mounting straps, concealed hinges, screwdriver locks, 180 degree open door design, 16 gauge steel construction and door and frame finished in prime coat finish. Panels shall be 12-inch by 12-inch minimum size, but shall be larger as the access requirement of the concealed electrical equipment item or device increases.

1.25 EXCAVATION, TRENCHING AND BACKFILLING

A. All excavating, trenching and backfilling shall generally be performed in accordance with the procedures and using the materials as described in Division 2. Provide all excavation required in connection with the installation of the work under this Division. After the work has been installed, tested and approved, backfill all excavations with suitable material.

B. Bottoms of trenches shall be cut to grade. Should rock be encountered, same shall be excavated to a depth of six (6) inches below bottom of conduit and space shall be filled and tamped as specified hereinafter. Should it be required to lay conduit on fill, fill shall first be compacted.

C. All conduit shall be installed promptly after excavation has been done so as to keep excavations open as short a time as possible.

D. Trenches shall be excavated to the required depths. Depth of cover shall be as required by the NEC or as indicated on Drawings. Keep banks of trenches as nearly vertical as possible, and provide adequate shoring where required.

E. When excavation is below the shale or subgrade level, backfill with granular fill or approved backfill material from the site to a depth of 12 inches above top of conduit, but in no case less than 1'-0" below the subgrade surface. The remainder of backfill to the shale or subgrade surface shall be an impervious material and shall be compacted at not less than 95 percent of the maximum dry density as defined by ASTM D-698. At all times, the top of the subgrade shall be kept in such condition that it will drain readily and effectively. A mud slab shall be placed over excavation where required by the Drawings or Specifications. Backfill above the subsurface shall be granular fill or approved select backfill from site.

F. Beyond building walls or above the shale or subgrade level, backfill with sand or granular fill to a depth of 12 inches above top of conduit and remainder of trench filled with approved select backfill material from the site.

G. Bottoms of trenches shall be tamped hard and graded to secure the maximum fall. Where rock is excavated below the bottom of the conduit, and before laying the conduit, fill the space between the bottom of the conduit and the rock surface with sand, thoroughly tamped.

H. Trenches dug in fill shall have the conduit supported down to load-bearing soil. After conduits have been inspected and approved by the Owner's Representative, trenches shall be filled with approved backfill material which shall be firmly compacted, flooded if necessary and thoroughly tamped. Do not backfill with any fill containing rocks, frozen earth or debris.

I. Include the cutting of all sidewalks, streets and other pavements and repairing the openings in them to return the surface to approximately its original condition.

1.26 CUTTING AND PATCHING

A. Cut all openings required to install the work or to repair any defective work. This cutting shall be performed under the Architect's/Engineer's direction and due diligence exercised to avoid cutting openings larger than required or in the wrong locations.

B. No cutting or drilling of any sort will be permitted in the webs of prestressed, precast concrete structural elements. Use core drills or power driven saws to cut openings in the flanges of other such elements; the use of reciprocating drills will not be permitted. The cutting of structural members without first having received written permission from the Architect/ Engineer is prohibited.

C. Where openings are cut in fire-rated walls or floors, seal the annular space between the work installed and the fire-rated construction. Sealant, as applied, shall be fire rated to maintain the fire rating of the construction penetrated. Sealant shall be re-enterable (before fire) to alter penetrations. Apply in strict accordance with manufacturer's instructions.

1.27 SEALING OF PENETRATIONS

A. All penetrations in horizontal or vertical fire-rated construction shall be sealed using approved fire-rated sealing materials equivalent to the following:
   1. Foam: Dow Corning 3-6548 RTV silicone foam, liquid component Part 4 (black) and liquid component Part B (off-white).
   2. Sealant: Dow Corning 96-081 RTV silicone adhesive sealant.
   3. Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, plywood or particle board, as selected by applicator.

B. Preparation: Remove combustible materials and loose impediments from penetration opening and involved surfaces. Remove free liquid and oil from penetration surfaces.

C. Installation: In accordance with manufacturer's instructions, install damming materials and sealant to cover and seal penetration openings; inject foam mixtures into openings.

1.28 PROTECTION OF APPARATUS

A. At all times take every precaution to properly protect apparatus from damage due to dust, dirt, water, etc. or from damage due to physical forces. Include the erection of temporary shelters as required, to adequately protect any apparatus stored at the site, the cribbing of any apparatus directly above the construction, and the covering of apparatus in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above to the entire satisfaction of the Architect/Engineer will be sufficient cause for the rejection of the pieces of apparatus in question.

B. Responsibility for the protection of apparatus extend also to existing apparatus involved in this Division of the work, whether such apparatus is designated to be used temporarily and later removed, or is to be reused as a part of the permanent installation. Erect temporary sheltering structures, provide temporary bracing and supports, or cover equipment as required or directed to afford proper protection for that equipment.

C. The Contractor shall protect this work and the work of all other Contractors from damage by his work or workmen and shall make good any damage thus caused. He shall also be responsible for the proper protection of his equipment, machinery, materials and accessories delivered and installed on the job.

1.29 INSTALLATION AND CONNECTION OF OTHER DIVISION'S EQUIPMENT

A. Verify the electrical requirements of all equipment furnished under other Divisions, separate contracts, or by the Owner. Install conduit, power wiring, control wiring, devices, etc. as required for complete operation of all equipment.

1.30 OPTION TO RELOCATE OUTLETS AND RELATED DEVICES

A. The location of power, data and telephone outlets, wall switches and other related devices may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 10 feet of their present location provided the Contractor is notified prior to installation.

1.31 COOPERATION AND CLEAN-UP

A. It shall be the responsibility of the Contractor to cooperate fully to keep the job site in a clean and safe condition. Upon the completion of the job, the Contractor shall immediately remove all of his tools, equipment, surplus materials and debris.

B. After the installation is complete, and before the equipment is energized, clean the interior and exterior of all equipment thoroughly. Clean equipment, removing all debris, rubbish and foreign materials. Each component shall be cleaned and all dust and other foreign material removed. Components shall be cleaned of oxidation. The inside and outside of all switchgear shall also be wiped clean with a lemon-oil rag after all other cleaning is complete.

C. Any portion of the work requiring touch-up finishing shall be so finished to equal the specified finish on the product.

1.32 RECORD DRAWINGS AND DOCUMENTATION FOR OWNER

A. The Contractor shall obtain at his own expense a complete set of blueline prints on which to keep an accurate record of the installation of all materials, equipment and devices covered by the Contract. The record drawings shall indicate the location of all equipment and devices, and the routing of all systems. All piping and conduit buried in concrete slabs, walls and below grade shall be located by dimension; both horizontally and by vertical elevation, unless a surface mounted device in each space indicates the exact location. Obtain one complete reproducible set of the original drawings on which to neatly, legibly and accurately transfer all project related notations and deliver these drawings to the Architect/Engineer at job completion before final payment and delivery to the Owner. The above data, with the exception of the record drawings, shall be delivered prior to final acceptance.

B. The Contractor shall accumulate in duplicate during the job progress, the following data prepared in indexed 3-ring loose leaf, hard-back binders sized for 8-1/2 inch by 11 inch sheets. No binder shall exceed 3-1/2 inches thick. This data shall be turned over to the Architect/Engineer for review and subsequent delivery to the Owner prior to final acceptance.
   1. Warranties, guarantees and manufacturer's directions on material, equipment and devices covered by the Contract.
   2. Approved lighting fixture brochures, wiring diagrams and control diagrams.
   3. Copies of approved submittals and shop drawings.
   4. Operating instructions for major apparatus and recommended maintenance procedures.
   5. Copies of all other data and/or drawings required during construction.
   6. Repair parts list of major apparatus, including name, address and telephone number of local supplier or representative.
   7. Tag charts and diagrams hereinbefore specified.

1.33 FINAL OBSERVATION

A. The purpose of the final observation is to determine whether the Contractor has completed the construction in accordance with the Contract Documents and that in the Owner Representative's opinion the installation is satisfactory for final acceptance

B. It shall be the responsibility of the Contractor to assure that the installation is ready for final acceptance prior to calling upon the Architect/Engineer to make a final observation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 260001
COMMON WORK RESULTS FOR ELECTRICAL

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
   Sleeve seals.
3. Grout.
4. Common electrical installation requirements.

1.02 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.03 SUBMITTALS

A. Product Data: For sleeve seals.

1.04 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

PART 2 PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1 – Standard for Good Workmanship in Electrical Construction.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable

penetration sleeves with firestop materials. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Spec Section 260002 "Through Penetrations Firestopping for Electrical Systems."

END OF SECTION

SECTION 260100
ELECTRICAL SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

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

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer’s responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Division Section as "informational submittals."

C. 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.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.04 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of Division 26/28 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 Engineer’s 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 startup 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.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal category: Action; informational.
      d. Name of subcontractor.
      e. Description of the Work covered.
      f. Scheduled date for Engineer’s final release or approval.
      g. Scheduled date of fabrication.
      h. Scheduled dates for delivery.
      i. Scheduled dates for installation.
      j. Activity or event number.

1.05 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals.
   1. Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing and Project record drawings.
      a. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
      b. Contractor shall execute a data licensing agreement in the form of Halff Associates' Standard form.

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 all submittal items required for each Specification Section within a Construction Division concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule. *
      a. This submittal package shall be comprehensive document by Division and not piecemealed by specification section.
   3. Submit action submittals and informational submittals required by the same Specification Section concurrent.
   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. For example, HVAC Equipment must be submitted and approved prior to approval of Electrical gear.
      a. Engineer 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, as follows. Time for review shall commence on Engineer'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 15 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 10 working days for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals is indicated, allow 15 working days for initial review of each submittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
   3. Include the following information for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name of Engineer.
      d. Name of Construction Manager, where applicable.
      e. Name of Contractor.
      f. Name of subcontractor.
      g. Name of supplier.
      h. Name of manufacturer.
      i. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Division Section or number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

j. Number and title of appropriate Specification.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, initial submittal may serve as final submittal.
   a. When paper copies are required, submit one copy of submittal.
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return without review submittals received from sources other than Contractor.
   a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
      1) Project name.
      2) Date.
      3) Destination (To:).
      4) Source (From:).
      5) Name and address of Engineer.
      6) Name of Construction Manager, where applicable.
      7) Name of Contractor.
      8) Name of firm or entity that prepared submittal.
      9) Names of subcontractor, manufacturer, and supplier.
      10) Category and type of submittal.
      11) Submittal purpose and description.
      12) Specification Section number and title.
      13) Specification paragraph number or drawing designation and generic name for each of multiple items.
      14) Drawing number and detail references, as appropriate.
      15) Indication of full or partial submittal.
      16) Transmittal number, numbered consecutively.
      17) Submittal and transmittal distribution record.
      18) Remarks.
      19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   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. Alternately, submit package as a comprehensive .pdf document by Division with each Specification Section tabbed.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
   3. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
      a. Project name.
      b. Date.
      c. Name and address of Engineer.
      d. Name of Construction Manager, where applicable.
      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.

F. Options: Identify options requiring selection by Engineer.

G. 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 Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. 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 Engineer’s action stamp.

I. 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.

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

PART 2 PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Post electronic submittals as PDF electronic files directly to Project Web site or FTP site specifically established for Project.
a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Action Submittals: For submittal formats 11 x 17 and larger, submit two paper copies of each submittal unless otherwise indicated in addition to the electronically posted submittal. Engineer will return one copy of paper submittal.
3. Certificates and Certifications Submittals: Provide a 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 construction Division 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 (8-1/2 x 11 format only) in the following format:
      a. 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 sheets at least 11 x 17 but no larger than 30 by 42 inches.
   3. Submit Shop Drawings in the following format:
      a. Two opaque (bond) copies of each submittal. Engineer will return one copy. Engineer will return one copy. Submit also one electronic file for record keeping.
   4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
      a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
      b. Refer to Section 01 31 00 "Project Management and Coordination" for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these 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 for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. "Samples for Verification" Subparagraph below can be used with or without Samples for initial selection. Revise to suit Project.

E. 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.

F. 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.

G. 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.

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

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

2.02 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 Engineer.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file 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 following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 EXECUTION

3.01 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 Engineer.

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.

3.02 ENGINEER'S ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer 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 Engineer.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Submittals not required by the Contract Documents may be returned by the Engineer without action.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.03 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.04 ACTION SUBMITTALS

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

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alcan Products Corporation; Alcan Cable Division.
   2. American Insulated Wire Corp.; a Leviton Company.
   3. General Cable Corporation.
   4. Senator Wire & Cable Company.
   5. Southwire Company.
   6. Encore.

C. Copper Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THW THHN-THWN and SO.

2.02 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   2. Hubbell Power Systems, Inc.
   3. O-Z/Gedney; EGS Electrical Group LLC.
   4. 3M; Electrical Products Division.
   5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

I. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

J. Branch Circuits in raceway installed above roof tops: Type XHHW-2, rated for 90 degrees.

K. Class 1 Control Circuits: Type THHN-THWN, in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.06 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.07 FIELD QUALITY CONTROL

A. Torque test conductor connections and terminations to manufacturer's recommended values.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.

1.03 SUBMITTALS

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

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Test wells.
   2. Ground rods.
   3. Grounding arrangements and connections for separately derived systems.
   4. Grounding for sensitive electronic equipment.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Instructions for periodic testing and inspection of grounding features at test wells grounding connections for separately derived systems.
      a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
      b. Include recommended testing intervals.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.02 GROUNDING BUS CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 5/8 inch diameter by 8 feet (15.88 mm by 2.44 m) minimum size.

PART 3 EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper

conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.
   8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
   9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
   1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

3.05 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
   1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.06 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.
   4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
   2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
   3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
   4. Power Distribution Units or Panelboards Serving Electronic Equipment 3 ohm(s).

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Equipment supports.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.07 COORDINATION

A. Coordinate size and location of concrete basis. Cast anchor built inserts into basis. Concrete are specified in Division 07 Section “roof Accessories.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation.
      f. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
2. Mechanical-Expansion Anchors: Insert-wedge-type, steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Hilti Inc.
      3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners or threaded through wall.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
   6. To Steel: Beam clamps complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:
   1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. NBR: Acrylonitrile-butadiene rubber.

F. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.
   2. For handholes and boxes for underground wiring, including the following:
      a. Conduit entry provisions, including locations and conduit sizes.
      b. Frame and cover design.
      c. Grounding details.
      d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
      e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:
   1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.

C. Rigid Steel Conduit: ANSI C80.1.

D. EMT: ANSI C80.3.

E. FMC: Zinc-coated steel

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel -screw or compression type.
3. Coating for Fittings for PVC Coated Conduit: Minimum thickness, 0.040 inch (1mm) with overlapping sleeves protecting threaded joints.

H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. CANTEX Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Lamson & Sessions; Carlon Electrical Products.
6. RACO; a Hubbell Company.
7. Thomas & Betts Corporation.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.03 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for plenum installation.

2.04 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.
4. Wiremolp.
5. Cabolafil.

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, unless otherwise indicated.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Wireway Covers: As indicated.

F. Finish: Manufacturer's standard enamel finish.

2.05 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Thomas & Betts Corporation.
      b. Walker Systems, Inc.; Wiremold Company (The).
      c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Butler Manufacturing Company; Walker Division.
      b. Hubbell Incorporated; Wiring Device-Kellems Division.
      c. Lamson & Sessions; Carlon Electrical Products.
      d. Panduit Corp.
      e. Walker Systems, Inc.; Wiremold Company (The).
      f. Wiremold Company (The); Electrical Sales Division.

2.06 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
   2. Erickson Electrical Equipment Company.
   3. Hoffman.
   4. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
   5. RACO; a Hubbell Company.
   6. Robroy Industries, Inc.; Enclosure Division.
   7. Spring City Electrical Manufacturing Company.
   8. Thomas & Betts Corporation.
   9. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular. (As indicated on drawings)

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic or fiberglass.

J. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.

2.07 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.
   1. Color of Frame and Cover: Gray.
   2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded lettering, "ELECTRIC." or "Data/Comm"
   6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. Armorcast Products Company.
      b. Carson Industries LLC.
      c. CDR Systems Corporation.
      d. NewBasis.
      e. Highline

2.08 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.09 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Advance Products & Systems, Inc.

2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: EMT
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
a. Loading dock.
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT or cable tray. All conduits shall have plastic bushing at the ends.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable EMT.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations. HUBS to match conduit.

C. Minimum Raceway Size: 3/4-inch.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation. Use conduit caps to protect installed conduit against entrance of dirt and moisture before area is dryed in and cable or wire are not immediately installed. Tape covering of conduit ends is not acceptable.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Change from Type EPC-40-PVC to rigid steel conduit, before rising above the floor.
   4. Elbows larger than 1/2" or on runs longer than 50' shall be rigid steel.
   5. Tape all GRC with 2" overlapping tape where underground or where in contact with concrete.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
   1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
   2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
   3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
   1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
      c. Indoor Spaces: Connected with the Outdoors without Physical Separation: [125 deg F temperature change.
      d. Attics: 135 deg F temperature change.
   2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.

3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
4. Unless expansion fitting has internal bonding braid, a green insulated grounding conductor shall be pulled in conduit.

O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:
   1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
   2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.06 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.08 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260543
UNDERGROUND DUCTS AND RACEWAYS AND CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Direct-buried conduit, ducts, and duct accessories.
   2. Concrete-encased conduit, ducts, and duct accessories.
   3. Handholes and boxes.

1.03 DEFINITIONS

A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include duct-bank materials, including separators and miscellaneous components.
   2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
   3. Include accessories for manholes, handholes, boxes, and other utility structures.
   4. Include warning tape.
   5. Include warning planks.

B. Shop Drawings:
   1. Precast or Factory-Fabricated Underground Utility Structures:
      a. Include plans, elevations, sections, details, attachments to other work, and accessories.
      b. Include duct entry provisions, including locations and duct sizes.
      c. Include reinforcement details.
      d. Include frame and cover design and manhole frame support rings.
      e. Include Ladder details.
      f. Include grounding details.
      g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and
      h. sumps.
      i. Include joint details.
   2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
      a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
      b. Include duct entry provisions, including locations and duct sizes.
      c. Include cover design.
      d. Include grounding details.
      e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.05 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
   1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
   2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.

D. Source quality-control reports.

E. Field quality-control reports.

1.06 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.08 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without Architect's written permission.

B. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

2.02 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.03 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-80 and Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.

B. Solvents and Adhesives: As recommended by conduit manufacturer.

C. Duct Accessories:
   1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
   2. Warning Tape: Underground-line warning tape specified in Section 26 05 53 "Identification for Electrical Systems."
   3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
      a. Color: Red dye added to concrete during batching.
      b. Mark each plank with "ELECTRIC" in 2-inch-high, 3/8-inch-deep letters.

2.04 PRECAST CONCRETE HANDHOLES AND BOXES

A. Comply with ASTM C 858 for design and manufacturing processes.

B. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC."
7. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    a. Extension shall provide increased depth of 12 inches.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
9. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
10. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
    a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    b. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    c. Window openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
11. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    a. Type and size shall match fittings to duct or conduit to be terminated.
    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
12. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.05 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
    1. Color: Gray.
    2. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
    3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
    4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
    5. Cover Legend: Molded lettering, "ELECTRIC."
    6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers made of polymer concrete, reinforced concrete, cast iron, hot-dip galvanized-steel diamond plate or fiberglass.

2.06 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 31 10 00 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 31 10 00 "Site Clearing."

3.02 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables More than 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank unless otherwise indicated.

C. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

D. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

E. Underground Ducts Crossing Paved Paths, Walks, Driveways and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.03 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:
   1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-10 or H-20 structural load rating as required.
   2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 or Fiberglass enclosures with polymer concrete frame and cover, SCTE 77, Tier 15 structural load rating.
   3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 or High-density plastic, SCTE 77, Tier 8 structural load rating.
   4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
   5. Cover design load shall not exceed the design load of the handhole or box.

3.04 EARTHWORK

A. Excavation and Backfill: Comply with Section 31 20 00 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 32 92 00 "Turf and Grasses" and Section 32 93 00 "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" Article in Section 01 73 00 "Execution."

3.05 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.

C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
   2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

G. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

H. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

I. Pulling Cord: Install 100-lbf-test nylon cord in empty ducts.

J. Concrete-Encased Ducts: Support ducts on duct separators.
   1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 31 20 00 "Earth Moving" for pipes less than 6 inches in nominal diameter.
   2. Width: Excavate trench 12 inches wider than duct bank on each side.
   3. Width: Excavate trench 3 inches wider than duct bank on each side.
   4. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
   5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
   6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
   7. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
   8. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
   9. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
      a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
      b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
   10. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
   11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
   12. Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.
   13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
      a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.

b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.

14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 03 30 00 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

K. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 31 20 00 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
3. Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
4. Depth: Install top of duct bank at least 36 inches below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
   b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
9. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 31 20 00 "Earth Moving" for installation of backfill materials.
   a. Place minimum 3 inches of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.
   b. Place minimum 6 inches of engineered fill above concrete encasement of duct bank.

L. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

M. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.06 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES

A. Cast-in-Place Manhole Installation:
   1. Finish interior surfaces with a smooth-troweled finish.
   2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches (38 to 50 mm) thick, arranged as indicated.
   3. Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete, formwork, and reinforcement.

B. Precast Concrete Handhole Installation:
   1. Comply with ASTM C 891 unless otherwise indicated.
   2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
   3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:
   1. Install handholes with bottom below frost line.
   2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
   3. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Waterproofing: Apply waterproofing to exterior surfaces of handholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars.

E. Dampproofing: Apply dampproofing to exterior surfaces of handholes after concrete has cured at least three days. After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms as required for installation and support of cables and conductors and as indicated.

G. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.07 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and

with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Section 03 30 00 "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep.

3.08 GROUNDING

A. Ground underground ducts and utility structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.09 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
   2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch-long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
   3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 260544
SLEEVES AND SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   3. Sleeve-seal fittings.
   4. Grout.
   5. Silicone sealants.

B. Related Requirements:
   1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:
   1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.02 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.03 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   4. Underground-line warning tape.
   5. Warning labels and signs.
   6. Instruction signs.
   7. Equipment identification labels.
   8. Miscellaneous identification products.

1.03 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

1.05 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.02 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. 3.5 mils and 6” wide.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Polyethylene tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
   1. Inscriptions for Red-Colored Tapes: BURIED ELECTRIC LINE, CAUTION.
   2. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.03 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches.

C. Warning label and sign shall include, but are not limited to, the following legends:
   1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
   2. Location of multiple main disconnects are at defined locations. Approved by Authority Having Jurisdiction.

2.04 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
   1. Engraved legend with black letters on white face .
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.05 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.06 CABLE TIES

A. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black.

B. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.
   5. Color: Black.

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Secure plastic name plates to equipment fronts using screws or rivets. Use of adhesive shall be per owner's approval only.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

3.02 IDENTIFICATION SCHEDULE

A. Accessible Raceways and 600 V or Less, for Service, Feeder, and Branch Circuits, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
   1. Normal Power – White letters on Black background.
   2. Generator Power – White letters on Red background.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      b. Colors for 208/120-V Circuits:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral: White.
      c. Colors for 480/277-V Circuits:
         1) Phase A: Brown.
         2) Phase B: Orange. (Purple)
         3) Phase C: Yellow.
         4) Neutral: Gray.
      d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps

are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
   1. Comply with 29 CFR 1910.145.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.

I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
      d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
   2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Emergency system boxes and enclosures.
h. Motor-control centers.
i. Enclosed switches.
j. Enclosed circuit breakers.
k. Enclosed controllers.
l. Variable-speed controllers.
m. Push-button stations.
n. Power transfer equipment.
o. Contactors.
p. Remote-controlled switches, dimmer modules, and control devices.
q. Battery-inverter units.
r. Battery racks.
s. Power-generating units.
t. Monitoring and control equipment.
u. UPS equipment.

3. Nameplate Detail:
   a. For circuit breakers, panelboards, switchboards, disconnect switches, motor starters, and contactors: ¼-inch letters, identify source to and device load serves, including location.
4. Enclosure Color Coding:
   a. The following systems shall have each junction and pull box cover completely painted per the following:

System	Color of Box Cover
Ethernet Backbone	Blue
Telecommunications	Brown
FCMS	Green
Emergency Power	Red
Security**	White
Fire Alarm	Yellow
Clock	Fluorescent Violet
U.P.S.	Fluorescent Pink

      1) **Security shall include, but not be limited to, the following systems:
         (a) Card Access\Proximity
         (b) Duress Alarms
         (c) Perimeter Door Alarms
         (d) CCTV

END OF SECTION

SECTION 260573
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1.03 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. The following submittals shall be made concurrent with the approval for system protective devices. Submittals shall be in digital form and hard copy.
   1. Coordination-study input data, including completed computer program input data sheets.
   2. Study and Equipment Evaluation Reports.
   3. Coordination-Study Report.
   4. Completed power company transformer form.

1.04 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:
   1. SKM Systems Analysis, Inc
   2. CGI CYME.
   3. EDSA Micro Corporation.
   4. ESA Inc.
   5. Operation Technology, Inc.

2.02 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device

settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:
    a. Arcing faults.
    b. Simultaneous faults.
    c. Explicit negative sequence.
    d. Mutual coupling in zero sequence.
    e. Voltage drop and voltage dip.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices shall be concurrent with submitted and approved coordination study.

3.02 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance. Utility transformer size and impedance are typically obtained from the actual serving utility engineer.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
    a. Circuit-breaker and fuse-current ratings and types.
    b. Relays and associated power and current transformer ratings and ratios.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and/or X/R ratios.
    d. Generator kilovolt amperes, size, voltage, and source impedance.
    e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Busway ampacity and impedance.
    g. Motor horsepower and code letter designation according to NEMA MG 1.
4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Voltage dip for largest motor based on utility transformer and system layout. Advise engineer if dip is greater than 5%.
    e. Generator thermal-damage curve.
    f. Ratings, types, and settings of utility company's overcurrent protective devices.
    g. Special overcurrent protective device settings or types stipulated by utility company.
    h. Time-current-characteristic curves of devices indicated to be coordinated.
    i. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.

j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.03 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
   1. Switchgear and switchboard bus.
   2. Distribution panelboard.
   3. Branch circuit panelboard.
   4. Disconnect Switches
   5. VFDs
   6. Harmonic Filters
   7. UPS

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 242.
   1. Transformers:
      a. ANSI C57.12.10.
      b. ANSI C57.12.22.
      c. ANSI C57.12.40.
      d. IEEE C57.12.00.
      e. IEEE C57.96.
   2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
   3. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:
   1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
   2. Show interrupting (5-cycle) and time-delayed currents assess the sensitivity of overcurrent relays and devices.

F. Equipment Evaluation Report:
   1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
   2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
   3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.04 COORDINATION STUDY AND VOLTAGE DIP STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
   1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
   2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
   3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 241 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:
   1. Device shall not operate in response to the following:
      a. Inrush current when first energized.
      b. Self-cooled, full-load current or forced-air-cooled, specified for that transformer.
      c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
   2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Motors served by system shall be reviewed for voltage dip. Report shall verify dip on start is less than 5%.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
   1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
      a. Device tag.
      b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
      c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
      d. Fuse-current rating and type.
      e. Ground-fault relay-pickup and time-delay settings.
   2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
      a. Device tag.
      b. Voltage and current ratio for curves.
      c. Three-phase and single-phase damage points for each transformer.
      d. No damage, melting, and clearing curves for fuses.
      e. Cable damage curves.
      f. Transformer inrush points.
      g. Maximum fault-current cutoff point.
   3. Motor voltage dip report shall list motors and report on voltage dip expected at motor. Particular attention shall be paid to chiller and fire pump motors.

G. Completed data sheets for setting of overcurrent protective devices.

3.05 CIRCUIT BREAKER SETTINGS

A. The electrical gear manufacturer performing the study shall adjust the circuit breaker trip settings per the recommendations of this study as well as those of the Arc-Flash Study Section 26 05 74.

END OF SECTION

SECTION 260574
OVERCURRENT PROTECTIVE DEVICE ARC FLASH STUDY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment. Submittals of switchboard and panelboards will NOT be reviewed without the submittals for this section. After award of contract, contact serving utility and request the impedance of transformer to be installed at this location.

1.03 DEFINITIONS

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

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.04 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.
   1. Arc-flash study input data, including completed computer program input data sheets.
   2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.
      a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.
      b. Professional engineer shall be an employee of the electrical gear manufacturer submitting on this project.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.07 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers:
   1. SKM Systems Analysis, Inc.
   2. CGI CYME.
   3. EDSA Micro Corporation.
   4. ESA Inc.
   5. Operation Technology, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.02 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:
   1. Protective device designations and ampere ratings.
   2. Cable size and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 72 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

G. Arc-Flash Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:
   1. Arcing fault magnitude.
   2. Protective device clearing time.
   3. Duration of arc.
   4. Arc-flash boundary.
   5. Working distance.
   6. Incident energy.
   7. Hazard risk category.
   8. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.03 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems." Produce a 3.5-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
   1. Location designation.
   2. Nominal voltage.
   3. Flash protection boundary.
   4. Hazard risk category.
   5. Incident energy.
   6. Working distance.
   7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.02 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies:
   1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 72 "Overcurrent Protective Device Short-Circuit Study."
   2. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

C. Calculate maximum and minimum contributions of fault-current size.
   1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
   2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
   1. Fault contribution from induction motors should not be considered beyond three to five cycles.
   2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:
   1. When the circuit breaker is in a separate enclosure.
   2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.03 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.
   1. Verify completeness of data supplied on the one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to the attention of Architect.
   2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
   3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
   1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Obtain electrical power utility impedance at the service.
   3. Power sources and ties.
   4. Short-circuit current at each system bus, three phase and line-to-ground.
   5. Full-load current of all loads.
   6. Voltage level at each bus.

7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.04 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:
   1. Motor-control center.
   2. Low-voltage switchboard.
   3. Switchgear.
   4. Medium-voltage switch.
   5. Control panel.

3.05 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.06 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION

SECTION 260900
FIELD ELECTRICAL ACCEPTANCE TEST

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Responsibilities for testing the electrical installation.
   2. Routine tests during installation.
   3. Adjusting and calibration.
   4. Acceptance tests.
   5. Demonstration of electrical equipment.
   6. Commissioning and plant start-up.

B. Copyright information:
   1. Some portions of this Section are copyrighted by the InterNational Electrical Testing Association, Inc. (NETA). See NETA publication ATS for details.

1.02 REFERENCES

A. American National Standards Institute (ANSI).

B. ASTM International (ASTM):
   1. D 877 – Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
   2. D 923 – Standard Practices for Sampling Electrical Insulating Liquids.
   3. D 924 – Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.
   4. D 971 – Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method.
   5. D 1298 – Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
   6. D 1500 – Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale).
   7. D 1524 – Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field.
   8. D 1533 – Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration.
   9. D 1816 – Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes.
   10. D 3612 – Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography.

C. Institute of Electrical and Electronics Engineers (IEEE):
   1. 43 – IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
   2. 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.
   3. 95 – IEEE Recommended Practice for Insulation Testing of AC Electric Machinery (2300 V and Above) With High Direct Voltage.
   4. 450 – IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
   5. C57.13 – IEEE Standard Requirements for Instrument Transformers.
   6. C57.13.1 – IEEE Guide for Field Testing of Relaying Current Transformers.
   7. C57.13.3 – IEEE Guide for Grounding of Instrument Transformer Secondary Circuits and Cases.
   8. C57.104 – IEEE Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers.

D. Insulated Cable Engineer's Association (ICEA).

E. InterNational Electrical Testing Association (NETA).
   1. ATS-2009 Standard for Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

F. International Electrotechnical Commission (IEC).

G. Manufacturer's testing recommendations and instruction manuals.

H. National Fire Protection Association (NFPA):
   1. 70 – National Electrical Code (NEC).
   2. 110 – Standard for Emergency and Standby Power Systems.

I. National Institute of Standards and Technology (NIST).

J. The American Society for Nondestructive Testing (ASNT)

K. Specification sections for the electrical equipment being tested.

L. Shop drawings.

1.03 DEFINITIONS

A. Specific definitions:
   1. Testing laboratory: The organization performing acceptance tests.

1.04 SYSTEM DESCRIPTION

A. Testing of all electrical equipment installed under this Contract in accordance with the Manufacturer's requirements and as specified in this Section.

B. The testing and inspections shall verify that the equipment is operational within the tolerances required and expected by the Manufacturer, and these Specifications. The results of the tests shall determine the suitability for continued reliable operation.

C. Responsibilities:
   1. CONTRACTOR responsibilities:
      a. Ensure that all resources are made available for testing, and that all testing requirements are met.
   2. Electrical subcontractor responsibilities:
      a. Perform routine tests during installation.
      b. Demonstrate operation of electrical equipment.
      c. Commission the electrical installation.
      d. Provide the necessary services during testing, and provide these services to the testing laboratory, CONTRACTOR, and other subcontractors, including but not limited to:
         1) Providing electrical power as required.
         2) Operating of electrical equipment in conjunction with testing of other equipment.
         3) Activating and shutting down electrical circuits.
         4) Making and recording electrical measurements.
         5) Replacing blown fuses.
         6) Installing temporary jumpers.
   3. Testing laboratory responsibilities:
      a. Perform all acceptance tests as defined in this Section.
      b. Provide all required equipment, materials, labor, and technical support during acceptance tests.

D. Upon completion of testing or calibration, attach a label to all serviced devices:
   1. The label shall indicate the date serviced and the company that performed the service.

1.05 SUBMITTALS

A. Test report:
   1. Include the following:

a. Summary of Project.
b. Description of equipment tested.
c. Description of tests performed.
d. Test results.
e. Conclusions and recommendations.
f. Completed test forms.
g. List of test equipment used and calibration dates.
h. LAN cable test reports.

B. Testing laboratory qualifications:
1. Submit a complete resume and statement of qualifications from the proposed testing laboratory detailing their experiences in performing the tests specified:
a. This statement will be used to determine whether the laboratory is acceptable, and shall include:
1) Corporate history and references.
2) Resume of individual performing test.
3) Equipment list and test calibration data.

C. Division of responsibilities:
1. Submit a list identifying who is responsible for performing each portion of the testing.

D. Manufacturers' testing procedures:
1. Submit Manufacturers' recommended testing procedures and acceptable test results for review by the ENGINEER.

1.06 QUALITY ASSURANCE

A. Testing laboratory qualifications:
1. The testing laboratory may be qualified testing personnel from the electrical NETA certified independent testing company.
2. Selection of the testing laboratory and testing personnel is subject to approval by the ENGINEER based on testing experience and certifications of the individuals and testing capabilities of the organization.

1.07 SEQUENCING

A. Perform testing in the following sequence:
1. Perform routine tests as the equipment is installed including:
a. Insulation resistance tests.
b. Continuity tests.
c. Rotational tests.
2. Adjusting and preliminary calibration.
3. Acceptance tests.
4. Demonstration.
5. Commissioning and building start-up.

1.08 WARRANTY

A. Provide with 1 year after substantial completion.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. General:
1. Test instrument calibration:
a. Utilize a testing laboratory with a calibration program which maintains all applicable test instrumentation within rated accuracy.
b. The accuracy shall be traceable to the NIST in an unbroken chain.
c. Calibrate instruments in accordance with the following frequency schedule:
1) Field instruments: 6 months maximum.

2) Laboratory instruments: 12 months maximum.
3) Leased specialty equipment where the accuracy is guaranteed by the lessor (such as Doble): 12 months maximum.

d. Dated calibration labels shall be visible on all test equipment.
e. Maintain an up-to-date instrument calibration record for each test instrument:
1) The records shall show the date and results of each calibration or test.
f. Maintain an up-to-date instrument calibration instruction and procedure for each test instrument.

PART 3 - EXECUTION

3.01 PREPARATION

A. Do not begin testing until the following conditions have been met:
1. All instruments required are available and in proper operating condition.
2. All required dispensable materials such as solvents, rags, and brushes are available.
3. All equipment handling devices such as cranes, vehicles, chain falls and other lifting equipment are available or scheduled.
4. All instruction books, calibration curves, or other printed material to cover the electrical devices are available.
5. Data sheets to record all test results are available.

3.02 FIELD QUALITY CONTROL

A. Cables, 600 volts and less:
1. Visual and mechanical inspection:
a. Compare cable data with that indicated on the Drawings and specified in the Specifications.
b. Inspect exposed sections of cables for physical damage and correct connection as indicated on the Drawings.
c. Inspect bolted electrical connections for high resistance using one of the following methods:
1) Use of low resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
(a) Refer to Manufacturer’s instructions for proper foot-pound levels or NETA ATS tables.
3) Thermographic survey.
d. Inspect compression-applied connectors for correct cable match and indentation.
e. Inspect for correct identification and arrangements.
f. Inspect jacket insulation and condition.
2. Electrical tests:
a. Perform resistance measurements through bolted connections with low-resistance ohmmeter.
b. Perform insulation-resistance tests on each conductor with respect to ground and adjacent conductors:
1) Applied voltage shall be:
(a) 500 VDC for 300-volt rated cable.
(b) 1,000 VDC for 600-volt rated cable.
2) Test duration shall be 1 minute.
c. Perform continuity tests to ensure correct cable connection.
d. Verify uniform resistance of parallel conductors.
3. Test values:
a. Compare bolted connection resistance values to values of similar connections:
1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
b. Bolt-torque levels shall be in accordance with Manufacturer’s published data:

1) Refer to NETA ATS tables in the absence of Manufacturer's published data.

c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.

d. Insulation resistance values shall be in accordance with Manufacturer's published data:
   1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
   2) Investigate values of insulation resistance less than the allowable minimum.

e. Cables shall exhibit continuity.

f. Investigate deviations in resistance between parallel conductors.

B. Low voltage molded case and insulated case circuit breakers (Panelboards):

1. Visual and mechanical inspection:
   a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.
   b. Inspect physical and mechanical condition.
   c. Inspect anchorage and alignment.
   d. Verify the unit is clean.
   e. Operate circuit breaker to ensure smooth operation.
   f. Inspect bolted electrical connections for high resistance by one of the following methods:
      1) Use of low resistance ohmmeter.
      2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
         (a) Refer to Manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
      3) Thermographic survey per Thermal Imaging requirements in this section.
   g. Inspect operating mechanism, contacts, and arc chutes in unsealed units.
   h. Perform adjustments for final protective device settings in accordance with the coordination study.
2. Electrical tests:
   a. Perform resistance measurements through bolted connections with a low resistance ohmmeter.
   b. Perform insulation resistance tests for 1 minute on each pole, phase-to-phase and phase-to-ground with the circuit breaker closed and across each open pole:
      1) Apply voltage in accordance with Manufacturer's published data.
      2) Refer to NETA ATS tables in the absence of Manufacturer's published data.
   c. Perform a contact/pole-resistance test.
   d. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 VDC for 300-volt rated cable and 1,000 VDC for 600-volt rated cable. Apply the test voltage for 1 minute:
      1) For solid state devices that can not tolerate the applied voltage, follow the Manufacturer's recommendation.
      2) For breakers 400amp and larger:
   e. Determine long-time pickup and delay by primary current injection.
   f. Determine short-time pickup and delay by primary current injection.
   g. Determine ground-fault pickup and delay by primary current injection.
   h. Determine instantaneous pickup value by primary current injection.
   i. Test functions of the trip unit by means of secondary injection.
   j. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with Manufacturer's published data.
   k. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, antipump function and trip unit battery condition:
      1) Reset all trip logs and indicators.

l. Verify operation of charging mechanism.

3. Test values:
   a. Compare bolted connection resistance values to values of similar connections:
      1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
   b. Bolt-torque levels shall be in accordance with Manufacturer's published data:
      1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
   c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.
   d. Insulation resistance values shall be in accordance with Manufacturer's published data:
      1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
      2) Investigate values of insulation resistance less than the allowable minimum.
   e. Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the Manufacturer's published data:
      1) If Manufacturer's data is not available, investigate any values which deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.
   f. Insulation resistance values of control wiring shall not be less than 2 megohms.
   g. Long-time pickup values shall be as specified, and the trip characteristic shall not exceed Manufacturer's published time-current characteristic tolerance band including adjustment factors:
      1) If Manufacturer's curves are not available, trip times shall not exceed the value shown in NETA ATS tables.
   h. Short-time pickup values shall be as specified, and the trip characteristic shall not exceed Manufacturer's published time-current tolerance band.
   i. Ground fault pickup values shall be as specified, and the trip characteristic shall not exceed Manufacturer's published time-current tolerance band.
   j. Instantaneous pickup values shall be as specified and within Manufacturer's published tolerances:
      1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
   k. Pickup values and trip characteristics shall be within Manufacturer's published tolerances.
   l. Minimum pickup voltage of the shunt trip and close coils shall conform to the Manufacturer's published data:
      1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
   m. Breaker open, close, trip, trip-free, antipump, and auxiliary features shall function as designed.
   n. The charging mechanism shall operate in accordance with Manufacturer's published data.

C. Switchgear and switchboard:
   1. Visual and mechanical inspection:
      a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.
      b. Inspect physical and mechanical condition.
      c. Inspect anchorage, alignment, grounding and required area clearances.
      d. Inspect equipment for cleanliness.
      e. Verify that circuit breaker/fuse sizes and types correspond to the approved submittals and the coordination study.
      f. Verify that current and voltage transformer ratios correspond to that indicated on the Drawings.
      g. Inspect bolted electrical connections for high resistance using one of the following methods:
         1) Use of low resistance ohmmeter.

2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
(a) Refer to Manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
3) Thermographic survey.
(a) Temperature gradients for lug connections, bus connections, circuit breakers, transformers, panels, and switchboards.
(b) Testing agent shall be ITC certified.

h. Mechanical and electrical interlocks:
1) Attempt closure on locked-open devices.
2) Attempt to open locked-closed devices.
3) Make/attempt key-exchanges in all positions.

i. Lubrication requirements:
1) Verify appropriate lubrication on moving current-carrying parts.
2) Verify appropriate lubrication on moving and sliding surfaces.

j. Inspect insulators for evidence of physical damage or contaminated surfaces.

k. Verify correct barrier and shutter installation and operation.

l. Exercise all active components.

m. Inspect all indicating devices for correct operation.

n. Verify that filters are in place and/or vents are clear.

o. Perform visual and mechanical inspection of instrument transformers as specified in this Section.

p. Inspect control power transformers:
1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify that primary and secondary fuse/circuit breaker ratings match the submittal drawings.
3) Verify correct functioning of drawout disconnecting and grounding contacts and interlocks.

2. Electrical tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter if applicable.

b. Perform insulation-resistance tests on each bus section, phase-to-phase and phase-to-ground for 1 minute.
1) Perform test in accordance with NETA ATS tables.

c. Perform a dielectric withstand voltage test on each bus section, each phase to ground with phases not under test grounded, in accordance with Manufacturer's published data or NETA ATS tables. Apply the test voltage for 1 minute.

d. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 VDC for 300-volt rated cable and 1,000 VDC for 600-volt rated cable. Apply the test voltage for 1 minute:
1) For solid state devices that cannot tolerate the applied voltage, follow the Manufacturer's recommendation.

e. Perform electrical tests on instrument transformers as specified in this Section.

f. Perform ground-resistance tests:
1) Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral and derived neutral points.

g. Determine the accuracy of all meters.

h. Control power transformers:
1) Perform insulation resistance tests. Perform measurements from winding-to-winding and each winding-to-ground:
(a) Test voltages shall be in accordance with NETA ATS tables or as specified by the Manufacturer.

2) Perform secondary wiring integrity test:
   (a) Disconnect transformer at secondary terminals and connect secondary wiring to a rated secondary voltage source:
      (1) Verify correct potential at all devices.
3) Verify correct secondary voltage by energizing primary winding with system voltage:
   (a) Measure secondary voltage with the secondary wiring disconnected.
4) Verify correct function of control power transfer relays located in switchgear with multiple control power sources.

i. Voltage transformers:
   1) Perform secondary wiring integrity test:
      (a) Verify correct potential at all devices.
   2) Verify correct secondary voltage by energizing primary winding with system voltage.

j. Perform current injection tests on the entire current circuit of each switchgear or switchboard:
   1) Perform current tests by secondary injection with magnitudes such that a minimum current of 1.0 ampere flows in the secondary circuit:
      (a) Verify the correct magnitude of current at each device in the circuit.
   2) Perform current tests by primary injection with magnitudes such that a minimum current of 1.0 ampere flows in the secondary circuit:
      (a) Verify the correct magnitude of current at each device in the circuit.

k. Perform system function tests.

l. Verify operation of space heaters.

3. Test values:
   a. Compare bolted connection resistance values to values of similar connections:
      1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
   b. Bolt-torque levels shall be in accordance with Manufacturer's published data:
      1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
   c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.
   d. Compare bus connection resistances to values of similar connections.
      1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      2) Insulation-resistance values of bus insulation shall be in accordance with Manufacturer's published data:
         (a) Refer to NETA ATS tables in the absence of Manufacturer's published data.
         (b) Investigate insulation values less than the allowable minimum.
         (c) Do not proceed with dielectric withstand voltage tests until insulation-resistance values are above minimum values.
   e. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric withstand test, the test specimen is considered to have passed the test.
   f. Insulation-resistance values for control wiring shall not be less than 2 megohms.
   g. Instrument transformer test values as specified in this Section.
   h. Investigate grounding system resistance values that exceed 0.5 ohm.
   i. Meter accuracy shall be in accordance with Manufacturer's published data.
   j. Control power transformers:
      1) Insulation resistance values of control power transformers shall be in accordance with Manufacturer's published data:
         (a) Refer to NETA ATS tables in the absence of Manufacturer's published data.
         (b) Investigate insulation values less than the allowable minimum.

(c) Do not proceed with dielectric withstand voltage tests until insulation-resistance values are above minimum values.

2) Secondary wiring shall be as indicated on the Drawings and specified in the Specifications.

3) Secondary voltage shall be as indicated on the Drawings.

4) Control transfer relays shall perform as designed.

k. Voltage transformers:

1) Secondary wiring shall be as indicated on the Drawings and specified in the Specifications.

2) Secondary voltage shall be as indicated on the Drawings.

l. Current-injection tests shall prove current wiring is as indicated on the Drawings and specified in the Specifications.

m. Results of system function tests shall match the Drawings and Specifications.

n. Heaters shall be operational.

o. Phasing checks shall prove the switchgear or switchboard phasing is correct and as indicated on the Drawings and specified in the Specifications.

D. Dry type transformers:

1. Visual and mechanical inspection:

a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.

b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, and grounding.

d. Verify that resilient mounts are free and that any shipping brackets have been removed.

e. Inspect equipment for cleanliness.

f. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use of low resistance ohmmeter.

2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:

(a)

3) Thermographic survey.

g. Verify that as-left tap connections are as specified.

2. Electrical tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.

b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground:

1) Apply voltage in accordance with Manufacturer’s published data.

(a) Refer to NETA ATS tables in the absence of Manufacturer’s published data.

c. Calculate dielectric absorption ration or polarization index.

d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral after energization and before loading.

3. Test values:

a. Compare bolted connection resistance values to values of similar connections:

1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

b. Bolt-torque levels shall be in accordance with Manufacturer’s published data:

1) Refer to NETA ATS tables in the absence of Manufacturer’s published data.

c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.

d. Tap connections are left as found unless otherwise specified.

e. Minimum insulation resistance values of transformer insulation shall be in accordance with Manufacturer’s published data:

1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
2) Investigate insulation values less than the allowable minimum.

f. The dielectric absorption ratio or polarization index shall not be less than 1.0.
g. Turns-ratio results should not deviate more than 1/2 percent from either the adjacent coils or calculated ratio.
h. Phase-to-phase and phase-to-neutral secondary voltages shall be in agreement with nameplate data.

E. Metering devices:
1. Visual and mechanical inspection:
a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.
b. Inspect physical and mechanical condition.
c. Inspect bolted electrical connections for high resistance using one of the following methods:
1) Use of low resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by calibrated torque wrench method:
(a) Refer to Manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
d. Thermographic survey.
e. Inspect cover gasket, cover glass, condition of spiral spring, disk clearance, contacts, and case shorting contacts as applicable.
f. Verify the unit is clean.
g. Verify freedom of movement, endplay, and alignment of rotating disk(s).
2. Electrical tests:
a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
b. Verify accuracy of meter at all cardinal points.
c. Calibrate meters in accordance with Manufacturer's published data.
d. Verify all instrument multipliers.
e. Verify that current transformer, and voltage transformer secondary circuits are intact.
3. Test values:
a. Compare bolted connection resistance values to values of similar connections:
1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
b. Bolt-torque levels shall be in accordance with Manufacturer's published data:
1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.
d. Meter accuracy shall be in accordance with Manufacturer's published data.
e. Calibration results shall be within Manufacturer's published tolerances.
f. Instrument multipliers shall be in accordance with system design specifications.
g. Test results shall confirm the integrity of the secondary circuits of current and voltage transformers.

F. Grounding systems:
1. Visual and mechanical inspection:
a. Inspect ground system for compliance with that indicated on the Drawings, specified in Specifications, and in the National Electrical Code.
b. Inspect physical and mechanical condition.
c. Inspect bolted electrical connections for high resistance using one of the following methods:
1) Use of low resistance ohmmeter.

2) Verify tightness of accessible bolted electrical connections by calibrated torque wrench method:
(a) Refer to Manufacturer's instructions for proper foot-pound levels or NETA ATS tables.

d. Inspect anchorage.

2. Electrical tests:
a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
b. Perform fall of potential test or alternative test in accordance with IEEE 81 on the main grounding electrode or system.
c. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, the system neutral and any derived neutral points.

3. Test values:
a. Grounding system electrical and mechanical connections shall be free of corrosion.
b. Compare bolted connection resistance values to values of similar connections:
1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
c. Bolt torque levels shall be in accordance with Manufacturer's published data:
1) 1. Refer to NETA ATS tables in the absence of Manufacturer's published data.
d. The resistance between the main grounding electrode and ground shall be as specified in Section 16 06 0. Investigate point-to-point resistance values that exceed 0.5 ohm.

G. Variable frequency drive systems:
1. Visual and mechanical inspection:
a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, and grounding.
d. Verify the unit is clean.
e. Ensure vent path openings are free from debris and that heat transfer surfaces are clean.
f. Verify correct connections of circuit boards, wiring, disconnects, and ribbon cables.
g. Motor running protection:
1) Verify drive overcurrent setpoints are correct for their application.
2) If drive is used to operate multiple motors, verify individual overload element ratings are correct for their application.
3) Apply minimum and maximum speed setpoints. Verify setpoints are within limitations of the load coupled to the motor.
h. Inspect bolted electrical connections for high resistance using one of the following methods:
1) Use of low resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
(a) Refer to Manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
3) Thermographic survey.
i. Verify correct fuse sizing in accordance with Manufacturer's published data.
j. Perform visual and mechanical inspection of input circuit breaker as specified in this Section.

2. Electrical tests:
a. Perform resistance measurements through bolted connections with low-resistance ohmmeter.

b. Test the motor overload relay elements by injecting primary current through the overload circuit and monitoring trip time of the overload element.
c. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 VDC for 300-volt rated cable and 1,000 VDC for 600-volt rated cable. Apply the test voltage for 1 minute:
    1) For solid state devices that can not tolerate the applied voltage, follow the Manufacturer's recommendation.
d. Test for the following parameters in accordance with relay calibration procedures specified in this Section or as recommended by the Manufacturer:
    1) Input phase loss protection.
    2) Input overvoltage protection.
    3) Output phase rotation.
    4) Overtemperature protection.
    5) Direct current overvoltage protection.
    6) Overfrequency protection.
    7) Drive overload protection.
    8) Fault alarm outputs.
e. Perform continuity tests on bonding conductors as specified in this Section.
f. Perform start-up of drive in accordance with Manufacturer's published data. Calibrate drive to the system's minimum and maximum speed control signals.
g. Perform operational tests by initiating control devices:
    1) Slowly vary drive speed between minimum and maximum. Observe motor and load for unusual noise or vibration.
    2) Verify operation of drive from remote start/stop and speed control signals.
h. Perform electrical tests of input circuit breaker as specified in this Section.

3. Test values:
    a. Compare bolted connection resistances to values of similar connections:
        1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
    b. Bolt-torque levels shall be in accordance with Manufacturer's published data:
        1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
    c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.
    d. Overload test trip times at 300 percent of overload element rating shall be in accordance with Manufacturer's published time-current curve.
    e. Test values for input circuit breaker shall be as specified in this Section.
    f. Insulation-resistance values for control wiring shall not be less than 2.0 megohms.
    g. Relay calibration results shall be as specified in this Section.
    h. Continuity of bonding conductors shall be as specified in this Section.
    i. Control devices shall perform in accordance with system requirements.
    j. Operational tests shall conform to system design requirements.

H. Engine generator:
1. Visual and mechanical inspection:
    a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, and grounding.
    d. Verify the unit is clean.
2. Electrical and mechanical tests:
    a. Perform insulation-resistance tests in accordance with IEEE 43:
        1) Machines larger than 150 kilowatts: Test duration shall be 10 minutes. Calculate polarization index.

2) Machines 150 kilowatts and less: Test duration shall be 1 minute. Calculate the dielectric-absorption rate.

b. Test protective relay devices as specified in this Section.
c. Verify phase rotation, phasing, and synchronized operation as required by the application.
d. Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
e. Perform vibration test for each main bearing cap.
f. Conduct performance test in accordance with NFPA 110.
g. Verify correct functioning of governor and regulator.

3. Test values:
   a. Anchorage, alignment, and grounding should be in accordance with Manufacturer's published data and system design.
   b. The dielectric absorption ratio or polarization index shall be compared to previously obtained results and should not be less than 1.0. The recommended minimum insulation (IR1 min) test results in megohms shall be corrected to 40 degrees Celsius and read as follows:
      1) IR1 min equals kilovolt + 1 for most windings made before 1970, all field windings, and others not described below.
         (a) kilovolt is the rated machine terminal-to-terminal voltage in rms kilovolt.
      2) IR1 min equals 100 megohms for most dc armature and ac windings built after 1970 (form-wound coils).
      3) IR1 min equals 5 megohms for most machines and random-wound stator coils and form-wound coils rated below 1 kilovolt.
         (a) Dielectric withstand voltage and surge comparison tests shall not be performed on machines having lower values than those indicated above.
   c. Protective relay device test results shall be as specified in this Section.
   d. Phase rotation, phasing, and synchronizing shall be in accordance with system design requirements.
   e. Low oil pressure, overtemperature, overspeed, and other protection features shall operate in accordance with Manufacturer's published data and system design requirements.
   f. Vibration levels shall be in accordance with Manufacturer's published data and shall be compared to baseline data.
   g. Performance tests shall conform to Manufacturer's published data and NFPA 110.
   h. Governor and regulator shall operate in accordance with Manufacturer's published data and system design requirements.

l. Uninterruptible power systems:
   1. Visual and mechanical inspection:
      a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.
      b. Inspect physical and mechanical condition.
      c. Inspect anchorage, alignment, grounding, and required clearances.
      d. Verify that fuse sizes and types correspond to that indicated on the Drawings.
      e. Verify the unit is clean.
      f. Test all electrical and mechanical interlock systems for correct operation and sequencing.
      g. Inspect bolted electrical connections for high resistance using one of the following methods:
         1) Use of low-resistance ohmmeter.
         2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method:
            (a) Refer to Manufacturer's instructions for proper foot-pound levels or NETA ATS tables.

3) Thermographic survey.
h. Verify operation of forced ventilation.
i. Verify that filters are in place and/or vents are clear.

2. Electrical tests:
a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
b. Test static transfer from inverter to bypass and back. Use normal load, if possible.
c. Set free running frequency of oscillator.
d. Test dc undervoltage trip level on inverter input breaker. Set according to Manufacturer's published data.
e. Test alarm circuits.
f. Verify synchronizing indicators for static switch and bypass switches.
g. Perform electrical tests for UPS system breakers as specified in this Section.
h. Perform electrical tests for UPS system automatic transfer switches as specified in this Section.
i. Perform electrical tests for UPS system batteries as specified in this Section.
j. Perform electrical tests for UPS rotating machinery as specified in this Section.

3. Test values:
a. Electrical and mechanical interlock systems shall operate in accordance with system design requirements.
b. Compare bolted connection resistance values to values of similar connections:
1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
c. Bolt-torque levels shall be in accordance with Manufacturer's published data:
1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
d. Results of the thermographic survey shall be in accordance with NETA ATS requirements.
e. Static transfer shall function in accordance with Manufacturer's published data.
f. Oscillator free running frequency shall be within Manufacturer's published tolerances.
g. Direct current undervoltage shall trip inverter input breaker.
h. Alarm circuits shall operate in accordance with design requirements.
i. Synchronizing indicators shall operate in accordance with design requirements.
j. Breaker performance shall be as specified in this Section.
k. Automatic transfer switch performance shall be as specified in this Section.
l. Battery test results shall be as specified in this Section.
m. Rotating machinery performance shall be as specified in this Section.

J. Automatic transfer switches:
1. Visual and mechanical inspection:
a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and required clearances.
d. Verify the unit is clean.
e. Lubrication requirements:
1) Verify appropriate lubrication on moving current-carrying parts.
2) Verify appropriate lubrication on moving and sliding surfaces.
f. Verify that manual transfer warnings are attached and visible.
g. Verify tightness of all control connections.
h. Inspect bolted electrical connections for high resistance using one of the following methods:
1) Use of low-resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench:

(a) Refer to Manufacturer's instructions for proper foot-pound levels or NETA ATS tables.

3) Thermographic survey.

i. Perform manual transfer operation.

j. Verify positive mechanical interlocking between normal and alternate sources.

2. Electrical tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable, in accordance with ATS-2009 Section 7.22.3.1.

b. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500 VDC for 300-volt rated cable and 1,000 VDC for 600-volt rated cable. Test duration shall be 1 minute:

1) For units with solid-state components or for control devices that cannot tolerate the applied voltage, follow Manufacturer's recommendation.

c. Perform a contact/pole-resistance test.

d. Verify settings and operation of control devices.

e. Calibrate and set all relays and timers as specified in this Section.

f. Verify phase rotation, phasing, and synchronized operation as required by the application.

g. Perform automatic transfer tests:

1) Simulate loss of normal power.

2) Return to normal power.

3) Simulate loss of emergency power.

4) Simulate all forms of single-phase conditions.

h. Verify correct operation and timing of the following functions:

1) Normal source voltage-sensing relays.

2) Engine start sequence.

3) Time delay upon transfer.

4) Alternate source voltage-sensing relays.

5) Automatic transfer operation.

6) Interlocks and limit switch function.

7) Time delay and retransfer upon normal power restoration.

8) Engine cool down and shutdown feature.

3. Test values:

a. Compare bolted connection resistance values to values of similar connections:

1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

b. Bolt-torque levels shall be in accordance with Manufacturer's published data:

1) Refer to NETA ATS tables in the absence of Manufacturer's published data.

c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.

d. Insulation-resistance values of control wiring shall not be less than 2 megohms.

e. Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the Manufacturer's published data. If Manufacturer's published data is not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

f. Control devices shall operate in accordance with Manufacturer's published data.

g. Relay test results shall be as specified in this Section.

h. Phase rotation, phasing, and synchronization shall be as specified in the system design specifications.

i. Automatic transfers shall operate in accordance with Manufacturer's design.

j. Operation and timing shall be in accordance with Manufacturer's and system design requirements.

K. Motor starters, low voltage:

1. Visual and mechanical inspection:
   a. Compare equipment nameplate information with that indicated on the Drawings and specified in the Specifications.
   b. Inspect physical and mechanical condition.
   c. Inspect anchorage, alignment, and grounding.
   d. Verify the unit is clean.
   e. Inspect contactors:
      1) Verify mechanical operation.
      2) Verify contact gap, wipe, alignment, and pressure are in accordance with manufacturer's published data.
   f. Motor-running protection:
      1) Verify overload element rating is correct for its application.
      2) If motor running protection is provided by fuses, verify correct fuse rating.
   g. Inspect bolted electrical connections for high resistance using one of the following methods:
      1) Use of low resistance ohmmeter.
      2) Verify tightness of accessible bolted electrical connections by calibrated torque wrench method:
         (a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
      3) Thermographic survey.
   h. Lubrication requirements:
      1) Verify appropriate lubrication on moving current-carrying parts.
      2) Verify appropriate lubrication on moving and sliding surfaces.
2. Electrical tests:
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
   b. Perform insulation resistance tests for 1 minute on each pole, phase-to-phase and phase to ground with the starter closed, and across each open pole for 1 minute:
      1) Test voltage shall be in accordance with manufacturer's published data.
      2) Refer to NETA ATS tables in the absence of manufacturer's published data.
   c. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 VDC for 300-volt rated cable and 1,000 VDC for 600-volt rated cable. Apply the test voltage for 1 minute:
      1) For solid state devices that cannot tolerate the applied voltage, follow the manufacturer's recommendation.
   d. Test motor protection devices in accordance with manufacturer's published data.
   e. Test circuit breakers as specified in this Section.
   f. Perform operational tests by initiating control devices.
3. Test values:
   a. Compare bolted connection resistance values to values of similar connections:
      1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
   b. Bolt-torque levels shall be in accordance with manufacturer's published data:
      1) Refer to NETA ATS tables in the absence of manufacturer's published data.
   c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.
   d. Insulation resistance values shall be in accordance with manufacturer's published data:
      1) Refer to NETA ATS tables in the absence of manufacturer's published data.
      2) Investigate values of insulation resistance less than the allowable minimum.
   e. Insulation resistance values of control wiring shall not be less than 2 megohms.

f. Motor protection parameters shall be in accordance with manufacturer's published data.
g. Circuit breaker test results shall as specified in this Section.
h. Control devices shall perform in accordance with system design requirements.

L. Surge arresters, low-voltage:
1. Visual and mechanical inspection:
a. Compare equipment nameplate data with that indicated on the Drawings and specified in the Specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify the arresters are clean.
e. Inspect bolted electrical connections for high resistance using one of the following methods:
1) Use of low resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
(a) Refer to Manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
f. Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.
g. Verify that stroke counter is correctly mounted and electrically connected, if applicable.
h. Record stroke counter reading.
2. Electrical tests:
a. Perform resistance measurements through bolted connections with a low resistance ohmmeter.
b. Perform an insulation-resistance test on each arrester, phase terminal to ground:
1) Apply voltage in accordance with Manufacturer's published data.
2) Refer to NETA ATS tables in the absence of Manufacturer's published data.
c. Test grounding connection as specified in this Section.
3. Test values:
a. Compare bolted connection resistances to values of similar connections:
1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
b. Bolt-torque levels shall be in accordance with Manufacturer's published data:
1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
c. Insulation resistance values shall be in accordance with Manufacturer's published data:
1) Refer to NETA ATS tables in the absence of Manufacturer's published data.
2) Investigate insulation values less than the allowable minimum.
d. Resistance between the arrester ground terminal and the ground system shall be less than 0.5 ohm.
4. Electrical tests:
a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
b. Measure insulation resistance of each bus, phase to ground with other phases grounded:
1) Apply voltage in accordance with Manufacturer's published data.
2) Refer to NETA ATS tables in the absence of Manufacturer's published data.
c. Perform dielectric withstand voltage test on each bus phase, phase to ground with other phases grounded. Potential application shall be for 1 minute.
5. Test values:
a. Compare bolted connection resistances to values of similar connections:

1) Investigate values which deviate from those of similar connections by more than 50 percent of the lowest value.

b. Bolt-torque levels shall be in accordance with Manufacturer's published data:
1) Refer to NETA ATS tables in the absence of Manufacturer's published data.

c. Results of the thermographic survey shall be in accordance with NETA ATS requirements.

d. Insulation resistance values shall be in accordance with Manufacturer's published data:
1) Refer to NETA ATS tables in the absence of Manufacturer's published data.

e. If no evidence of distress or insulation failure is observed at the end of the total time of voltage application during the dielectric withstand test, the test specimen is considered to have passed the test.

M. Fiber-optic cables:
1. Visual and mechanical inspection:
a. Compare cable, connector, and splice data with that indicated on the Drawings and specified in the Specifications:
b. Inspect cable and connections for physical and mechanical damage.
c. Verify that all connectors and splices are correctly installed.
2. Electrical tests:
a. Perform cable length measurement, fiber fracture inspection, and construction defect inspection using an optical time domain reflectometer (OTDR): Optical time roman reflectometer.
1) OTDR test performed on fiber cables less than 100 meters shall be performed with the aid of a launch cable.
2) Adjust OTDR pulse width settings to a maximum setting of 1/1000th of the cable length or 10 nanoseconds.
b. Perform connector and splice integrity test using an optical time domain reflectometer.
c. Perform cable attenuation loss measurement with an optical power loss test set:
1) Perform attenuation tests with an Optical Loss Test Set capable and calibrated to show anomalies of 0.1 dB as a minimum.
2) Test multimode fibers at 850 nanometer and 1,300 nanometer.
3) Test single mode fibers at 1,310 nanometer and 1,550 nanometer.
d. Perform connector and splice attenuation loss measurement from both ends of the optical cable with an optical power loss test set:
1) At the conclusion of all outdoor splices at one location, and before they are enclosed and sealed, all splices shall be tested with OTDR at the optimal wavelengths (850 and 1,300 for multimode, 1,310 and 1,550 for single mode), in both directions. The splices shall be tested for integrity as well as attenuation.
e. Perform fiber links integrity and attenuation tests using each link shall be an OTDR and an Optical Loss Test Set:
1) OTDR traces shall be from both directions on each fiber at the 2 optimal wavelengths, 1,310 nanometer and 1,550 nanometer for multimode fibers.
2) Optical loss testing shall be done with handheld test sets in 1 direction at the 2 optimal wavelengths for the appropriate fiber type. Test equipment shall equal or exceed the accuracy and resolution of Agilent/HP 8147 high performance OTDR or as specified in spec 271000.
3. Test values:
a. Cable and connections shall not have been subjected to physical or mechanical damage.
b. Connectors and splices shall be installed in accordance with industry standards.
c. The optical time domain reflectometer signal should be analyzed for excessive connection, splice, or cable backscatter by viewing the reflected power/distance graph.

d. Attenuation loss measurement shall be expressed in dB/km. Losses shall be within the manufacturer's recommendations when no local site specifications are available.
e. Individual fusion splice losses shall not exceed 0.1 dB. Measurement results shall be recorded, validated by trace, and filed with the records of the respective cable runs.

N. LAN cable testing:
1. Visual and mechanical inspections:
a. Compare cable type and connections with that indicated on the Drawings and specified in the Specifications.
b. Inspect cable and connectors for physical and mechanical damage.
c. Verify that all connectors are correctly installed.
2. Pre-testing:
a. Test individual cables before installation:
1) Before physical placement of the cable, test each cable while on the spool with a LAN certification test device.
2) Before the cable is installed, verify that the cable conforms to the Manufacturer's attenuation specification and that no damage has been done to the cable during shipping or handling.
3) The test shall be fully documented and the results submitted to the ENGINEER, including a hard copy of all traces, before placement of the cable.
4) The ENGINEER shall be notified if a cable fails to meet specification and the cable shall not be installed unless otherwise directed by the ENGINEER.
3. Electrical tests:
a. Perform cable end-to-end testing on all installed cables after installation of connectors from both ends of the cable.
b. Test shall include cable system performance tests and confirm the absence of wiring errors.
4. Test results:
a. Cables shall meet or exceed TIA standards for a Category 6 installation.
5. Test equipment:
a. LAN certification equipment used for the testing shall be capable of testing Category 6 cable installation to TIA proposed Level III accuracy. Tests performed shall include:
1) Near end cross talk.
2) Attenuation.
3) Equal level far end cross talk.
4) Return loss.
5) Ambient noise.
6) Effective cable length.
7) Propagation delay.
8) Continuity/loop resistance.
b. LAN certification test equipment shall be able to store and produce plots of the test results.
c. Acceptable manufacturers: As specified in spec 271000:

O. Thermal Imaging Test:
1. Perform the following infrared scan tests, inspections and prepare reports by a third party ITC/ASNT Certified Thermographer:
a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each equipment as listed below. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each equipment listed 11 months after date of Substantial Completion.
c. Instruments and Equipment:
1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. The imaging equipment shall be

capable of detecting temperature difference of 1°C at 30°C ambient. Provide calibration record for device.

2) The infrared scan shall include but not be limited to:
   (a) Take a temperature reading of the non-hot surface of the terminals/conductors of the equipment.
   (b) Take a temperature reading of the hot surface of the terminals/conductors of the equipment.
   (c) Record the temperature difference as ΔT.
   (d) The infrared scan test shall contain the following repair criteria and shall be provided in the report for engineers review. Adjustments and/or replacement parts of equipment shall be made at no extra cost to owner.

INFRARED CORRECTION CRITERIA FOR ELECTRICAL EQUIPMENT TABLE

EQUIPMENT DESCRIPTION	ΔT	CORRECTIVE ACTION (By contractor)
Equipment NAME TAG	<10°F	None Required
Equipment NAME TAG	10°F - 30°F	None Required
Equipment NAME TAG	30°F - 100°F	Excessive Heating. Repair ASAP
Equipment NAME TAG	>100°F	Excessive Heating. Repair Immediately

   (e) Infrared Report shall include but not be limited to the following:
      (1) Third party Thermographer's certification.
   (2) An Infrared Correction Criteria for Electrical Equipment Table for each of the following equipment:
      a. Disconnect Switches
      b. Motor Starters
      c. Lighting contactor
      d. Panelboards
      e. Switchboard
      f. Transformers
      g. Automatic Transfer Switches
      h. Generator terminal lugs
   (3) Infrared photographs showing the equipment's temperature readings. Both temperature readings utilized to compute ΔT shall be shown for engineers review. Photographs shall be in color.
   (4) Action taken to repair electrical connection problem if required.
   (5) Provide report in a three ring binder with third party thermographer's and contractor's contact information.

3.03 ADJUSTING

A. Adjust limit switches and level switches to their operating points before testing.

B. Set pressure switches, flow switches, and timing relays to anticipated values before testing:
   1. Final settings shall be as dictated by operating results during testing.

3.04 CLEANING

A. As specified in Section 26 00 00.

B. After the acceptance tests have been completed, dispose of all testing expendables, vacuum all cabinets, and sweep clean all surrounding areas.

3.05 DEMONSTRATION AND TRAINING

A. As specified in Section 26 00 00.

B. Subsystem demonstration:

1. Subsystem, as used in this Section, means individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, air compressors, blowers, lighting control systems and other electrically operated or controlled equipment.
2. Before demonstrating any subsystem:
   a. Demonstrate proper operation of all alarm and status contacts.
   b. Adjust and calibrate all process and control devices as accurately as possible.
3. Operate each subsystem in its manual mode:
   a. Demonstrate compliance with all Contract requirements.
4. After each subsystem has operated successfully in its manual mode, perform automatic and remote operation demonstrations:
   a. Verify that all features are fully operational and meet all Contract requirements.
   b. Demonstrate all operating modes and sequences, including proper start and stop sequence of pumps, proper operation of valves and proper speed control.

3.06 SCHEDULES

A. At least 30 days before commencement of the acceptance tests, submit the Manufacturer's complete field-testing procedures to the ENGINEER and to the testing laboratory, complete with expected test results and tolerances for all equipment to be tested.

END OF SECTION

SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Time switches.
   2. Photoelectric switches.
   3. Standalone daylight-harvesting switching controls.
   4. Indoor occupancy sensors.
   5. Outdoor motion sensors.
   6. Lighting contactors.
   7. Emergency shunt relays.

B. Related Requirements:
   1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.
   1. Interconnection diagrams showing field-installed wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 PRODUCTS

2.01 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Intermatic, Inc.
   2. NSi Industries LLC; TORK Products.
   3. Paragon.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Contact Configuration: SPST.
   3. Contact Rating: 20-A ballast load, 120-/240-V ac, or 277V AC.
   4. Programs: Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
   5. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
   6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
   7. Astronomic Time: All channels.

8. Automatic daylight savings time changeover.
9. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.02 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
   1. Intermatic, Inc.
   2. NSi Industries LLC; TORK Products.
   3. Paragon Electric Co.

B. Description: Solid state, with dry contacts rated for 1800-VA tungsten or 1000-VA inductive or, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
   1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
   2. Time Delay: Fifteen second minimum, to prevent false operation.
   3. Surge Protection: Metal-oxide varistor.
   4. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.03 DAYLIGHT-HARVESTING SWITCHING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Industries, Inc.
   2. Hubbell Building Automation, Inc.
   3. Leviton Mfg. Company Inc.
   4. Lithonia Lighting; Acuity Lighting Group, Inc.
   5. NSi Industries LLC; TORK Products.
   6. Sensor Switch, Inc.
   7. Watt Stopper.

B. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack, to detect changes in indoor lighting levels that are perceived by the eye.

2.04 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Industries, Inc.
   2. Leviton Mfg. Company Inc.
   3. Watt Stopper.
   4. Lutron.
   5. Sensor Switch, Inc.

B. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
   1. Lighting control set point is based on two lighting conditions:
      a. When no daylight is present (target level).
      b. When significant daylight is present.
   2. System programming is done with two hand-held, remote-control tools.
      a. Initial setup tool.
      b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc.

2.05 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hubbell Building Automation, Inc.
   2. Leviton Mfg. Company Inc.
   3. Lutron Electronics Co., Inc.
   4. Sensor Switch, Inc.
   5. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack. Include power packs as required.
   4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
   5. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
      c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
   7. Bypass Switch: Override the "on" function in case of sensor failure.
   8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
   1. Detector Sensitivity: Detect occurrences of 6-inchminimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
   2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inchhigh ceiling.
   3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foothigh ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
   1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
   2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch high ceiling.
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.

4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.

2.06 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Hubbell Building Automation, Inc.
2. Leviton Mfg. Company Inc.
3. Lightolier Controls.
4. Lutron Electronics Co., Inc.
5. Sensor Switch, Inc.
6. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor As indicated on plans:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
2. Sensing Technology: Dual technology.
3. Switch Type: dual circuit. Field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage Dual voltage, 120 and 277 V dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

D. Wall-Switch Sensor Tag as Noted on Plans:
1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
2. Sensing Technology: Dual Technology
3. Switch Type: Dual circuit. Field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage Dual voltage, 120 and 277 V; dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.

7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.07 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Allen-Bradley/Rockwell Automation.
   2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
   3. Eaton Corporation.
   4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
   5. Square D; a brand of Schneider Electric.
   6. Siemens

B. Description: Electrically operated and mechanically or electrically held, combination-type lighting contactors with, complying with NEMA ICS 2 and UL 508.
   1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
   2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
   3. Enclosure: Comply with NEMA 250.
   4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. BAS Interface: Where shown on drawings. Provide hardware interface to enable the BAS to monitor and control lighting contactors.
   1. Monitoring: On-off status.
   2. Control: On-off operation.

2.08 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Control Cable: or Contractor at his option may use multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Verify voltage drop if use of smaller than No. 12 AWG.

PART 3 EXECUTION

3.01 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies. Do not mount sensor in area that will have interference with HVAC systems.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.03 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lighting control devices will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

E. Adjustments of occupancy sensors shall be made by the contractor with the factory authorized representative present. Settings shall be as directed by owner. Include a minimum of 4 hours training.

3.06 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
   1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
   2. For daylighting controls, adjust set points and dead band controls to suit Owner's operations.
   3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.07 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Division 26.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 262200
LOW-VOLTAGE TRANSFORMERS

PART 2 PRODUCTS

1.01 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet (1,000 m).
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F (40 degrees C).
      b. Less than 10 kVA: Not exceeding 77 degrees F (25 degrees C).

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.
   3. Electronic-grade panelboards.

1.03 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.
   8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on log-log graph paper; include selectable ranges for each type of overcurrent protective device.

C. Submitted will only be reviewed if overcurrent protective device coordination study and overcurrent protective device are-flash study, specifications 26 05 73 and 26 05 74 respectively, studies are submitted concurrently with the panelboard submitted.

1.05 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock.
   2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.08 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
      b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
   2. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces.

Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 3R.
      c. Other Wet or Damp Indoor Locations: NEMA 250,Type 4.
      d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrive Liquids: NEMA 250, Type12.
   2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Panel front shall be fabricated so that the panel may be opened to access the breakers and also to allow access to breaker wiring without removal of the front.
   3. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
   4. Finishes:
      a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Galvanized steel.
   5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: As required and as shown on plans.

C. Phase, Neutral, and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear load. Where shown on plans.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Compression Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
   6. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
   1. For doors more than 36 inches high, provide two latches, keyed alike.
   2. Door or doors shall allow access to breakers dead front and also to the breaker wiring without removal of front.

D. Mains: As indicated.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Door shall be available to open over breaker lugs.

2.04 LOAD CENTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Mains: As indicated. On drawings.

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.05 ELECTRONIC-GRADE PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1; with factory-installed, integral TVSS; labeled by an NRTL for compliance with UL 67 after installing TVSS.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

F. Buses:
   1. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
   2. Copper equipment and isolated ground buses.

G. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, bolt-on, solid-state, parallel-connected, type, with sine-wave tracking suppression and filtering modules, short-circuit current rating complying with UL 1449, second edition, and matching or exceeding the panelboard short-circuit rating, redundant suppression circuits, with individually fused metal-oxide varistors.
   1. Accessories:
      a. Fuses rated at 200-kA interrupting capacity.
      b. Fabrication using bolted compression lugs for internal wiring.
      c. Integral disconnect switch.
      d. Redundant suppression circuits.
      e. Redundant replaceable modules.
      f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
      g. LED indicator lights for power and protection status.
      h. Audible alarm, with silencing switch, to indicate when protection has failed.
      i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
      j. Four digit, transient-event counter set to totalize transient surges.
   2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
   3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
      a. Line to Neutral: 70,000 A.
      b. Line to Ground: 70,000 A.
      c. Neutral to Ground: 50,000 A.
   4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
   5. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 208Y/120 - V, three-phase, four-wire circuits shall be as follows:
      a. Line to Neutral: 800 V for 480Y/277 400 V for 208Y/120.
      b. Line to Ground: 800 V for 480Y/277 400 V for 208Y/120.
      c. Neutral to Ground: 800 V for 480Y/277 400 V for 208Y/120.

6. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
    a. Line to Line: 2000 V for 480 V 1000 V for 240 V.
    b. Line to Ground: 1500 V for 480 V 800 V for 240 V.

2.06 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    3. Siemens Energy & Automation, Inc.
    4. Square D; a brand of Schneider Electric.
    5. Thor.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
    1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
    2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; 400 A and Larger and the following field-adjustable settings:
        a. Instantaneous trip.
        b. Long- and short-time pickup levels.
        c. Long- and short-time time adjustments.
    3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
        a. Standard frame sizes, trip ratings, and number of poles.
        b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
        c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

2.07 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install panelboards and accessories according NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Retain option in first paragraph below if retaining "Load Balancing" Paragraph in "Adjusting" Article.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: For distribution panels label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

D. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Perform the following infrared scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
      b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
      c. Instruments and Equipment:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

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

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
   1. Measure as directed during period of normal system loading.
   2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
   3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
   4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.06 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 262715
UTILITY COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Coordination with the utility companies to provide service.
   2. Contractor's responsibilities for connecting to utilities and providing utility service to the facilities.
   3. Descriptions of utility services required.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
   3. The following sections are related to the Work described in this Section. This list of related sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
      a. Section 26 00 00 – Common Work Results for Electrical.
      b. Section 26 01 00 – Electrical Submittal Procedures.

C. Utility contacts:
   1. Electric utility:
      a. Name: Martin Valdes
      b. Utility: AEP Texas
      c. Phone number: (956) 283-2596
      d. E-mail: mavaldes@aep.com

1.02 SYSTEM DESCRIPTION

A. Electrical service:
   1. Provide all Work and materials and bear all costs for providing temporary construction power and the permanent electrical service, including but not limited to:
      a. All Work and materials not provided by the electric utility.
      b. All permits and fees required by the electric utility.
   2. Provide electrical ducts, raceways, conductors , concrete pads and connections indicated on the Drawings, and all other Work and materials required for a complete electrical service, including but not limited to the following:
      a. Electrical service conduits and conductors from the point of electric utility connection to the service entrance equipment.
      b. Metering conduits from the instrument transformers to the meter.
      c. Concrete pad for pad mounted utility transformer. Concrete pad shall be AEP specification requirements.

B. General:
   1. Contractor is responsible for coordinating with the electrical company to de-energize any overhead or underground power lines. Any cost associated with de-energizing the power line and/or any other protective measures required shall be at no cost to owner.
   2. Coordinate and obtain inspections and final installation approval from the serving utilities and other authorities having jurisdiction.
   3. Proposed concrete foundation and conduit alignment for proposed electrical facilities shall be staked by the contractor and approved by the city engineer and utility prior installation.

4. The contractor shall coordinate with the appropriate utility company and TXDOT (If within TXDOT ROW) prior to beginning construction located near any overhead or underground utilities.
5. Electrical work shall be performed by certified electricians in accordance with the requirements of the contract and TDLR and may be rejected as unsuitable for use due to poor workmanship.
6. Texas state law, Article 1436C, makes it unlawful to operate equipment or machines within 10-feet of any overhead electrical lines unless danger against contact with high voltage overhead lines had been effectively guarded against pursuant to the provisions of this article. When construction operations require working near an overhead electrical line, the contractor shall contact the owner/operator of the overhead electrical line to make adequate arrangements and to take necessary safety precautions to ensure that all laws, electrical line owner/operator requirements and standard safety practices are met.

C. Telephone, Internet, Cable Service:
1. Provide all work and materials and bear all costs for the telephone, internet and cable service during construction.
   a. All permits and fees required by AT&T and Spectrum utility.
2. Provide the telephone/cable entrance conduits from the terminal pole or pedestal to the telephone board in the building and all other work and materials required for a complete telephone cable service.

1.03 SUBMITTALS

A. Furnish submittals as specified in Section 26 01 00.

B. Certification:
1. Submit certification that the intended installation has been coordinated with the utility companies.
2. Include a narrative description of the utility's requirements and points of connection, names, and telephone numbers for contacts at the utilities.

1.04 QUALITY ASSURANCE

A. As specified in Section 26 00 00.

B. Materials and equipment used in performance of Electrical Work shall be listed or labeled by UL, or other equivalent recognized independent testing laboratory, for the class of service intended.

1.05 SCHEDULING

A. General:
1. Before start of Site Work, make arrangements for temporary telephone and electrical service as required.

B. Electrical systems:
1. Before bidding, the electrical Contractor shall contact the utilities to determine the Work and materials that will be required from the Contractor, and all fees and permits that will be required, so that all utility systems furnished by the Contractor will be included in the bid.
2. Before commencing Work, coordinate electric service entrance requirements with AEP utility to assure that the installation will be complete as specified in these Contract Documents:
   a. Ensure power transformer size, electrical characteristics, and location are consistent with the design and service voltage provided by the electric utility coordinated with other trades.
   b. Arrange for utility revenue meter.
   c. Coordinate installation of metering CTs and PTs furnished by the electric utility.
3. Contractor shall contact the owner and utility for inspection prior to pouring any concrete foundation and digging for conduit runs at least 48 hours in advance.

4. During the construction of the project, the existing electrical services must remain fully functional in order to supply uninterruptable electrical power to the facilities and its ancillary buildings and structures.

C. Before commencing Site Work, coordinate underground conduit installations with other Work to eliminate conflicts and avoid interferences with other underground systems.

D. Telephone/Cable/Internet Systems
   1. Before commencing work, coordinate complete telephone/cable/internet service.
      a. Verify compliance with telephone/cable utility requirement.
      b. Verify exact location of each service point and type of service.
      c. Pay any charges required by the telephone cable/internet for connection and turn on.
   2. Coordinate complete telephone line connections at locations indicated on drawings and with utilities.

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish materials in accordance with the applicable requirements of the utilities and as specified in these Specifications.

2.02 EQUIPMENT

A. Furnish equipment in accordance with the applicable requirements of the utilities and as specified in these Specifications.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Twist-locking receptacles.
   3. Wall-switch and occupancy sensors.
   4. Pendant cord-connector devices.
   5. Cord and plug sets.

B. Related Sections include the following:
   1. Division 27 and 28 Sections

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. TVSS: Transient voltage surge suppressor.

1.04 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Field quality-control test reports. Submitted prior to final punch list.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

E. Submit on digital wiring analyzer to be used to test voltage drop on receptacles.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.06 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   1. Cord and Plug Sets: Match equipment requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
5. Hubbell Building Automation Systems.

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 5351 (single), 5352 (duplex).
      b. Hubbell; HBL5351 (single), CR5352 (duplex).
      c. Leviton; 5891 (single), 5352 (duplex).
      d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.03 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; GF20.
      b. Pass & Seymour; 2084.

2.04 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; L520R.
      b. Hubbell; HBL2310.
      c. Leviton; 2310.
      d. Pass & Seymour; L520-R.

2.05 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
   1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
   2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.06 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
   1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
   2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.07 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
   b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Key-Operated Switches, 120/277 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221L.
   b. Hubbell; HBL1221L.
   c. Leviton; 1221-2L.
   d. Pass & Seymour; PS20AC1-L.
3. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.08 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
1. 600 W; dimmers shall require no derating when ganged with other devices.
2. Dimmers greater than 600 watts shall have cooling fans with back box to match spacing.

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.09 OCCUPANCY SENSORS

A. Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 6111 for 120 V, 6117 for 277 V.
   b. Hubbell; WS1277.
   c. Leviton; ODS 10-ID.
   d. Pass & Seymour; WS3000.
   e. Watt Stopper (The); WS-200.
3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

2.10 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch- (1-mm-) thick Material for Unfinished Spaces: Galvanized steel.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.11 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring devices connected to normal power system as selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
   2. Include with modification to the Essential Electrical System (EES) associated panelboard: Red.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
   6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
   7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
   8. Tighten unused terminal screws on the device.
   9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
   1. Install ground pin of vertically mounted receptacles up.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings. Verify with Architect and Owner that all floor outlets and service poles are coordinated with furniture to be installed.

3.02 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."
   1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable. Report voltage drop on receptacle circuit as follows: Receptacle circuit L-1 (Typical) Voltage measured = 119V. All receptacle circuits shall be reported. Final close out of project will not be attained without report.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

END OF SECTION

SECTION 262816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Molded-case circuit breakers (MCCBs).
   4. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

D. SPST: Single pole, single throw.

1.04 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current ratings (interrupting and withstand, as appropriate).
   4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
   5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
   2. Altitude: Not exceeding 6600 feet.

1.07 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.08 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Fuse Pullers: Two for each size and type.

PART 2 PRODUCTS

2.01 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide or product by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   5. Hookstick Handle: Allows use of a hookstick to operate the handle.
   6. Lugs: Mechanical type, suitable for number, size, and conductor material.
   7. Service-Rated Switches: Labeled for use as service equipment.

2.02 NONFUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. For isolated grounded systems Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.03 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.04 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R, Type 4X.
   3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
   4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:
   1. Test continuity of each circuit.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 264313
SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Requirements:
   1. Section 26 24 16 "Panelboards" for factory-installed SPDs.
   2. Section 26 24 13 "Switchboards" for factory-installed SPDs.

1.03 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPR’s, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.02 SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 1.

B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.

C. SPDs with the following features and accessories:
   1. Integral disconnect switch.
   2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
   3. Indicator light display for protection status.
   4. Surge counter.

D. Comply with UL 1283.

E. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 320 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
   1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
   2. Line to Ground: 1200 V for 480Y/277 V and 1200 V for 208Y/120 V.
   3. Line to Line: 2000 V for 480Y/277 V and 1000 V for 208Y/120 V.

G. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
   1. Line to Neutral: 700 V.
   2. Line to Ground: 1000 V.
   3. Line to Line: 1000 V.

H. SCCR: Equal or exceed 100 kA.

I. Nominal Rating: 20 kA.

2.03 PANEL SUPPRESSORS

A. SPDs: Comply with UL 1449, Type 2.
   1. Include LED indicator lights for power and protection status.
   2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
   1. Comply with UL 1283.

C. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
   1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
   2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
   3. Neutral to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
   4. Line to Line: 2000 V for 480Y/277 V and 1200 V for 208Y/120.

D. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
   1. Line to Neutral: 700 V.
   2. Line to Ground: 700 V.
   3. Neutral to Ground: 700 V.
   4. Line to Line: 1200 V.

E. SCCR: Equal or exceed 100 kA.

F. Nominal Rating: 20 kA.

2.04 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 3R.

2.05 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 16 AWG, complying with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:
   1. Power Wiring: Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
   2. Controls: Comply with wiring methods in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
   1. Compare equipment nameplate data for compliance with Drawings and Specifications.
   2. Inspect anchorage, alignment, grounding, and clearances.
   3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.03 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 265613
LIGHTING POLES AND STANDARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Steel poles.
   2. Aluminum poles.
   3. Pole accessories.
   4. Lowering system for luminaires.
   5. Mounting hardware.

B. Related Requirements:
   1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.02 DEFINITIONS

A. EPA: Equivalent projected area.

B. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

C. Standard: See "Pole."

1.03 ACTION SUBMITTALS

A. Product Data:
   1. Steel poles.
   2. Aluminum poles.
   3. Pole accessories.
   4. Lowering system for luminaires.
   5. Mounting hardware.

B. Shop Drawings:
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Detail fabrication and assembly of poles and pole accessories.
   4. Anchor bolt templates keyed to specific poles and certified by manufacturer.
   5. Method and procedure of pole installation. Include manufacturer's written installations.

1.04 INFORMATIONAL SUBMITTALS

A. Material Test Reports:
   1. For each foundation component, by qualified testing laboratory.
   2. For each pole, by qualified testing laboratory.

B. Soil test reports.

C. Manufacturers' published instructions.

D. Field Reports:
   1. Manufacturer's field reports for field quality-control support.

1.05 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts and Special Tools: Furnish to Owner spare parts, proprietary equipment, and keys required to operate, maintain, repair, adjust, or implement future changes to poles, that are

packaged with protective covering for storage on-site and identified with labels describing contents.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping in accordance with ASTM B660.

B. Store poles on decay-resistant skids at least 12 inch (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.08 WARRANTY

1. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion; full coverage for labor, materials, and equipment.
2. Warranty Period for Color Retention: Five years from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-6-M.

B. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied in accordance with AASHTO LTS-6-M.

C. Wind Load for Poles
1. Basic Wind Speed: 120 mph
2. Wind Importance Factor: 1.0
3. Minimum Design Life: 25 years
4. Velocity Conversion Factor: 1.0

D. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA used in pole selection strength analysis.

E. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless steel fasteners and mounting bolts unless otherwise indicated.

F. General Finish Requirements:
1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.02 STEEL POLES

A. Lithonia, KW Industries, LSI Industries, or approved equal.

B. Source Limitations: Obtain poles from single manufacturer or producer

C. Carbon-Steel Poles: Comply with ASTM A500/A500M, Grade B carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 ft (12 m) in height with access handhole in pole wall.
1. Shape: Square, straight
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

D. Stainless Steel Poles: Comply with ASTM A240/A240M stainless steel with a minimum yield of 55,000 psig (379 MPa); one-piece construction up to 40 ft (12 m) in height with access handhole in pole wall.
1. Shape: Square, straight
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

E. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as plate.

F. Brackets for Luminaires: Detachable, cantilever, without underbrace.
   1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with stainless steel bolts.
   2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

G. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

H. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
   1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and may not cause galvanic action at contact points.
   2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

I. Grounding and Bonding Lugs: Welded 1/2 inch (13 mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

J. Handhole: Oval shaped, with minimum clear opening of 2-1/2-by-5 inch (65-by-130 mm), with cover secured by stainless steel captive screws.

K. Intermediate Handhole and Cable Support: Weatherproof, 3-by-5 inch (76-by-130 mm) handhole located at midpoint of pole, with cover for access to internal welded attachment lug for electric cable support grip.

L. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported load multiplied by a 5.0 safety factor.

M. Platform for Lamp Ballast Servicing: Factory fabricated of steel, with finish matching that of pole.

N. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

O. Galvanized Finish: After fabrication, hot-dip galvanize in accordance with ASTM A123/A123M.

P. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces in accordance with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
   2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
   3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high gloss, high-build polyurethane enamel.
      a. Color: As indicated by manufacturer's designations

Q. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces in accordance with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
   2. Powder Coat: Comply with AAMA 2604.
      a. Electrostatic-applied powder coating; single application and cured to a minimum 2.5 to 3.5 mil (64 to 89 µm) dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
      b. Color: As indicated by manufacturer's designations

2.03 ALUMINUM POLES

A. Lithonia, KW Industries, LSI Industries, or approved equal.

B. Poles: Seamed, extruded structural tube complying with ASTM B221, Alloy 6063-T6, with access handhole in in pole wall.
   1. Shape: Round, tapered
   2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Mast Arms: Aluminum type, continuously welded to pole attachment plate. Material and finish same as plate.

D. Brackets for Luminaires: Detachable, cantilever, without underbrace.
   1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with stainless-steel bolts.
   2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

E. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

F. Grounding and Bonding Lugs: Bolted 1/2 inch (13 mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Fasteners: Stainless steel size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
   1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and may not cause galvanic action at contact points.
   2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

H. Handhole: Oval shaped, with minimum clear opening of 2-1/2-by-5 inch (65-by-130 mm), with cover secured by stainless steel captive screws.

I. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

J. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
   3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I clear coating of 0.018 mm or thicker), complying with AAMA 611.
   4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

K. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
   2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
   3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As indicated by manufacturer's designations

L. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Powder coat must comply with AAMA 2604.
a. Electrostatic applied powder coating; single application with a minimum 2.5 to 3.5 mil (64 to 89 µm) dry film thickness; cured in accordance with manufacturer's instructions. Coat interior and exterior of pole for equal corrosion protection.
b. Color: As indicated by manufacturer's designations

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A36/A36M and hot-dip galvanized in accordance with ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A36/A36M and hot-dip galvanized in accordance with ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

C. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A36/A36M and hot-dip galvanized in accordance with ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.
1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.

D. Direct-Buried Foundations: Install to depth indicated on Drawings, but not less than one-sixth of pole height. Add backfill in 6 inch (150 mm) to 9 inch (230 mm) layers, tamping each layer before adding the next. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

E. Direct-Buried Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.
1. Make holes 6 inch (150 mm) in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days and finish in a dome above finished grade.
3. Use a short piece of 1/2 inch (13 mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

F. Anchor Bolts: Install plumb using manufacturer-supplied steel template, uniformly spaced.

3.03 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.
   1. Fire Hydrants and Water Piping: 60 inch (1520 mm).
   2. Water, Gas, Electric, Communications, and Sewer Lines: 10 ft (3 m).
   3. Trees: 15 ft (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts in accordance with anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level in accordance with pole manufacturer's written instructions.
   1. Use anchor bolts and nuts selected to resist seismic forces specified for the application and approved by manufacturer.
   2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
   3. Install base covers unless otherwise indicated.
   4. Use a short piece of 1/2 inch (13 mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6 inch (150 mm) wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch (25 mm) below top of concrete slab.

F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.04 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

B. Steel Conduits: Comply with requirements in Section 260533.13 "Conduits for Electrical Systems." In concrete foundations, wrap conduit with 0.010 inch (0.254 mm) thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.05 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
   1. Install grounding electrode for each pole unless otherwise indicated.
   2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground Nonmetallic Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
   1. Install grounding electrode for each pole.
   2. Install grounding conductor and conductor protector.
   3. Ground metallic components of pole accessories and foundation.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect poles for nicks, mars, dents, scratches, and other damage.
2. System function tests.

B. Nonconforming Work:
1. Unit will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

END OF SECTION

SECTION 265619
LED EXTERIOR LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
   2. Luminaire supports.
   3. Luminaire-mounted photoelectric relays.

B. Related Requirements:
   1. Section 26 09 23"Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaire.
   4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
      a. Manufacturer's Certified Data: Photometric data certified by manufacturers laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
      b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
   6. Wiring diagrams for power, control, and signal wiring.
   7. Photoelectric relays.
   8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Luminaires.
   2. Structural members to which equipment and luminaires will be attached.
   3. Underground utilities and structures.
   4. Existing underground utilities and structures.
   5. Above-grade utilities and structures.
   6. Existing above-grade utilities and structures.
   7. Building features.
   8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of the following:
   1. Luminaire.
   2. Photoelectric relay.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Source quality-control reports.

F. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

B. Warranty Documentation.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

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

F. Mockups: For exterior luminaires, complete with power and control connections.
   1. Obtain Architect's approval of luminaires in mockups before starting installations.
   2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including luminaire support components.
      b. Faulty operation of luminaires and accessories.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Verify available warranties and warranty periods.
   2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598 and listed for wet location.

D. CRI and CCT values shall be per basis of design light fixtures shown on the plans.

E. L70 lamp life of 50,000 hours.

F. Lamps dimmable from 100 percent to 0 percent of maximum light output.

G. Internal driver.

H. Nominal Operating Voltage: As indicated on plans.

I. In-line Fusing: Separate in-line fuse for each luminaire.

J. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

K. Source Limitations: Obtain luminaires from single source from a single manufacturer.

L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.02 LUMINAIRE TYPES

A. Area and Site:

1. Luminaire Shape: As specified on plans.
2. Mounting: Pole and Building.
3. Luminaire-Mounting Height: As specified on plans.
4. Distribution: As specified on plans.
5. Diffusers and Globes: As specified on plans.
6. Housings:
    a. Extruded-aluminum housing and heat sink.

2.03 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Stainless steel. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch ((3.175 mm)) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:
1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
    a. "USE ONLY" and include specific lamp type.
    b. Lamp diameter, shape, size, wattage and coating.
    c. CCT and CRI for all luminaires.

2.04 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    a. Color: As selected by Architect from manufacturer's full range.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
   2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
      a. Color: As selected from manufacturer's standard catalog of colors.

2.05 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Support luminaires without causing deflection of finished surface.
   4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls or Attached to a minimum 1/8 inch (3 mm) backing plate attached to wall structural members.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

K. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.04 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.06 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Verify operation of photoelectric controls.

C. Illumination Tests:
   1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
      a. IES LM-5.
      b. IES LM-50.
      c. IES LM-52.
      d. IES LM-64.
      e. IES LM-72.
   2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.07 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.08 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect/Engineer.

END OF SECTION

SECTION 265668
EXTERIOR ATHLETIC LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the lighting system performance and design standards for The Woodlands Township for the Alden Bridge Park Additions (4SC) using a turnkey LED sports lighting system. The manufacturer / contractor shall supply the lighting systems to meet or exceed the standards set forth in these specifications.

C. The lighting systems will be for the following venue(s):
   1. (4)-Soccer Fields

D. Related Sections:
   1. Division 26 Section "Lighting Control Devices" for automatic and remote control of lighting, including time switches, photoelectric relays, and multipole lighting relays and contactors.

1.03 DEFINITIONS

A. CV: Coefficient of variation; a statistical measure of the weighted average of all relevant illumination values for the playing area, expressed as the ratio of the standard deviation for all illuminance values to the mean illuminance value.

B. Delegated-Design Submittals: Documents, including drawings, calculations, and material and product specifications prepared as a responsibility of Contractor to obtain acceptance by Owner and authorities having jurisdiction.

C. Illuminance: The metric most commonly used to evaluate lighting systems. It is the density of luminous flux, or flow of light, reaching a surface divided by the area of that surface.
   1. Horizontal Illuminance: Measurement in foot-candles, on a horizontal surface at ground level.
   2. Target Illuminance: Average maintained illuminance level, calculated by multiplying initial illuminance by LLF.
   3. Vertical Illuminance: Measurement in foot-candles, in two directions on a vertical surface, at an elevation coinciding with plane height of horizontal measurements.

D. LC: Lighting Certified.

E. Light Trespass: Light spill into areas and properties outside the playing areas, which is either annoying or unwanted.

F. LLD: Lamp lumen depreciation, which is the decrease in lamp output as the lamp ages.

G. LLF: Light loss factor, which is the product of all factors that contribute to light loss in the system.

H. Luminaire: Complete lighting fixture, including driver housing, snoot and integral fixture controls.

I. UG: Uniformity gradient; the rate of change of illuminance on the playing field, expressed as a ratio between the illuminances of adjacent measuring points on a uniform grid.

1.04 MANUFACTURERS

A. Subject to compliance with requirments, provide the sports lighting system by the following manufacturer or an approved equal.
   1. Techline Sports Lighting

B. All components shall be designed and manufactured as a system. Pole structure, luminaires, control and integral driver system shall be provided from the approved manufacturer.

1.05 PERFORMANCE REQUIREMENTS

A. Facility Type: Sports Park

B. Illumination Criteria:

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Soccer Field #1	38FC Avg.	2:1	70	30’ x 30’
Practice Field	38FC Avg.	2:1	70	30’ x 30’
Soccer Field #2	50FC Avg.	2:1	104	30’ x 30’
Soccer Field #3	38FC Avg.	2:1	96	30’ x 30’

C. Illumination Calculations: Computer-analyzed point method complying with IESNA RP-6 to optimize selection, location, and aiming of luminaires. A 0.90 light loss factor shall be applied and submitted for basis of design.
   1. Grid Pattern Dimensions: For playing areas of each sport and areas of concern for spill-light control, correlate and reference calculated parameters to the grid areas. Each grid point represents the center of the grid area defined by the length and width of the grid spacing.
   2. Spill-Light Control: Minimize spill light on adjacent and nearby areas.
      a. Light Control for Luminaires: All luminaires shall utilize optics designed to minimize glare and spill light while maintaining quality light above the poles for aerial play. Up Lighting will not be accepted.
      b. Spill Control: To minimize impact on adjacent properties, maximum horizontal spill shall be no more than 1.0 fc 150’ from the edge of the field (Spill Line).
      c. Light levels shall be taken at 30-foot intervals along the Spill Line; and illumination level shall be measured in accordance with IESNA LM-5-04 after 1 hour warm up. These spill readings must be submitted to the Owner’s Representative.
      d. Photometric Report: A photometric report that shows aiming points of each luminaire shall be provided to demonstrate the capability of achieving the specified performance.
   3. Luminaire Mounting Height: Comply with IESNA RP-6, with consideration for requirements to minimize spill light and glare.

Field	# of Poles	Pole Designation	Pole Height
Soccer Fields #1-#4	4	All Poles	70’

   4. Luminaire Placement: Luminaire clusters shall be outside the glare zones defined by IESNA RP-6.

D. Lighting Control:
   1. The control and monitoring system shall provide instant on/off/capabilities and meet the following specifications:
      a. Wireless control
      b. Must include the ability to schedule/control system via all of the following means of connectivity: Wi-Fi, Cellular, and LAN connectivity for remote operation, with cellular connectivity and Cloud-Based hosting for a minimum of 10 years.
      c. IOS and Android compatible wireless control for multiple users
      d. Remote monitoring and diagnostics, email alerts and notifications to detect outages
      e. Allow multiple user accounts with ability to assign various system permission levels

f. Ability to schedule recurring events at fixed times
g. Capable of in-field firmware/software upgrades
h. Onsite and/or remote commissioning
i. Ability to organize and manage different “zones” of luminaires

2. Control enclosure to be NEMA 4X molded fiberglass reinforced polyester with internal gasket and stainless steel, quick release latches with ability to padlock for security purposes.
3. Controller shall be protected against memory loss during power outages. If power failure to the controller occurs, lights shall fail on to 100%. Once power is restored controller shall resume normal event schedule.

E. Electric Power Distribution Requirements:
1. Electric Power: 480 V; three phase.
a. Include roughing-in of service indicated for nonsports improvements on Project site.
b. Include required overcurrent protective devices and individual lighting control for each pole.
c. Include indicated feeder capacity and panelboard provisions for future lighted sports field construction.

F. Maximum Total Load: 200 A per field
1. Maximum Total Voltage Drop from Source to Load: 3 percent, including voltage drops in branch circuit, subfeeder, and feeder.

G. Life-Cycle Cost Criteria:
1. Manufacturer shall submit a 10-year life cycle cost calculation as outlined in the required submittal information.
2. Preventative and Spot Maintenance: Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 10 years from the date of equipment shipment. Individual outages shall be repaired when the usage of the field is materially impacted.

1.06 FOUNDATIONS

A. Delegated Design: Engage qualified professional engineer(s) to design pole foundation and pole power system.

B. Foundations must be designed by a Structural Engineer licensed in the State of Texas. Installation and structure shall be based on wind speed criteria from manufacturer's specifications.

1.07 SUBMITTALS

A. Product Data: For each type of lighting product indicated. Include the following:
1. Lighting system shop drawings shall include:

Item	Description
Equipment Layout	Drawing(s) showing field layouts with pole locations
On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including

	wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), uniformity gradient (UG); number of luminaries, total system kilowatts; light loss factor.
Photometric Report	A photometric report that shows aiming points to demonstrate the capability of the system to achieve the specified performance.
Pole Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the State of Texas.
Foundation Drawings	Project specific foundation drawings stamped by a registered, licensed structural engineer in the state of installation. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.
Control & Monitoring System	Written definition and schematics for automated control system must be provided.
Standard Catalog 'Cut' Sheets	Luminaire specification sheets
Warranty	Warranty documentation

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: Manufacturer's responsibilities include fabricating sports lighting and providing professional engineering services needed to assume engineering responsibility.

C. Luminaire Photometric Data Testing Laboratory: By manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.09 WARRANTY

A. 10-Year Material & Labor Warranty: Manufacturer shall supply a signed warrranty covering the entire system for 10 years from the date of shipment. Warranty shall cover guaranteed light levels and structural integrity of the system. System energy consumption is to be maintained for entire warranty period and will not increase as the system ages.
   1. Luminaire Warranty: Luminaire and luminaire assembly (excluding fuses and lamps) shall be free from defects in materials and workmanship for a period of ten years from date of shipment.
   2. Alignment Warranty: Accuracy of alignment of luminaires shall remain within specified illuminance uniformity ratios for a period of ten years from date of successful completion of acceptance tests.
      a. Realign luminaires that become misaligned during the warranty period.
      b. Replace alignment products that fail within the warranty period.

c. Verify successful realignment of luminaires by retesting as specified in "Field Quality Control" Article.

1.10 MAINTENANCE SERVICE

A. Continuing Maintenance Proposal: From manufacturer to Owner, in the form of a standard maintenance agreement that contains the terms in this article, starting on date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

B. Agreement Period: 10 years from date of Substantial Completion.

C. Services: Repair or replace components of luminaires, lamps, and ballasts; align luminaires.

PART 2 PRODUCTS

2.01 LUMINAIRES AND DRIVERS

A. Luminaires: DRC Listed premium and labeled, by an NRTL acceptable to authorities having jurisdiction, for compliance with UL 1598 for installation in wet locations.
   1. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without using tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent their accidental falling during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lens.
   2. Exposed Hardware: Stainless-steel latches, fasteners, and hinges.
   3. Spill-Light Control Devices: Internal louvers and external baffles furnished by manufacturer and designed for secure attachment to specific luminaire.
   4. Color Temperature: The lighting systems shall have a color temperature of 5700K and a CRI of greater or equal to 70.

B. Manufacturer will supply all drivers and supporting electrical equipment.
   1. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure.
   2. Alternate: Integral drivers mounted at the top of the pole will require a pole mounted enclosure approximately 10 feet above grade. The enclosure shall include a disconnect

2.02 SUPPORT STRUCTURES

A. Support-Structure Wind-Load Strength: Poles and other support structures, brackets, arms, appurtenances, bases, anchorages, and foundations shall comply with AASHTO LTS-4-M and shall be certified by manufacturers to withstand winds up to 120 mph without permanent deflection or whipping.

B. Mountings, Fasteners, and Appurtenances:
   1. Corrosion resistant, compatible with support components, and which shall not cause galvanic action at contact points.
      a. Steel Components: Hot-dip galvanized after fabrication, complying with ASTM A 123/A 123M.
      b. Mounting Hardware Fasteners: Hot-dip galvanized, complying with ASTM A 153/A 153M, or minimum 18-8 grade stainless steel.
   2. Accommodate attachments and wiring of other indicated systems.

C. Concrete for Pole Foundations: 3000-psi, 28-day minimum compressive strength.

D. Direct-buried steel structures or poles shall not be used.

2.03 POWER DISTRIBUTION AND CONTROL

A. Wiring Method for Feeders, Subfeeders, Branch Circuits, and Control Wiring: Underground nonmetallic raceway; No. 12 AWG minimum conductor size for power wiring.

B. Electrical Enclosures Exposed to Weather: NEMA 250, Type 3R enclosure constructed from stainless steel, with hinged doors fitted with padlock hasps or lockable latches.

2.04 SURGE PROTECTION

A. Surge Protection: Comply with requirements in Division 26 Section "Surge Protection for Low-Voltage Electrical Power Circuits" and include surge suppressors with the following requirements:
   1. Panelboard type.
   2. Nonmodular, with digital indicator lights.
   3. Peak Single-Impulse Surge Current Rating: 40kA per phase.
   4. 10kv surge protection on standard in fixture.

PART 3 EXECUTION

3.01 INSTALLATION

A. Use web fabric slings (not chain or cable) to raise and set structural members. Protect equipment during installation to prevent corrosion.

B. Install poles and other structural units level, plumb, and square.

C. Except for embedded structural members, grout void between pole base and foundation. Use nonshrinking or expanding concrete grout firmly packed in entire void space. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole. Nonshrink grout is specified in Division 05 Section "Metal Fabrications."

D. Extend cast-in-place bolted base foundations 36 inches above grade, minimum.

E. Install controls and led driver housings in cabinets mounted on support structure at least 10 feet above finished grade.

3.02 FIELD QUALITY CONTROL

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

B. Perform tests, inspections, and analysis according to IESNA RP-6 and IESNA LM-5 where applicable.

C. Tests and Inspections:
   1. After installing sports lighting system and after electrical circuits have been energized, perform proof-of-performance field measurements and analysis for compliance with requirements.
   2. Make field measurements at established test points in areas of concern for spill light and glare.
   3. Perform analysis to demonstrate correlation of field measurements with specified illumination quality and quantity values and corresponding computer-generated values that were submitted with engineered design documents. Submit a report of the analysis. For computer-generated values, use manufacturer's lamp lumens that are adjusted to lamp age at time of field testing.

D. Correction of Illumination Deficiencies: Make corrections to illumination quality or quantity, measured in field quality-control tests, that varies from specified illumination criteria by plus or minus 10 percent.
   1. Add or replace luminaires, or change mounting height, revise aiming, or install louvers, shields, or baffles.
   2. If luminaires are added or mounting height is changed, revise aiming and recalculate and modify or replace support structures if indicated.
   3. Do not replace luminaires with units of higher or lower wattage without Engineer's approval.
   4. Retest as specified above after repairs, adjustments, or replacements are made.
   5. Report results in writing.

E. Correction of Excessive Illumination in Spill-Light-Critical Areas: If measurements indicate that specified limits for spill light are exceeded, make corrections to illumination quantity, measured in field quality-control tests, that reduce levels to within specified maximum values.
   1. Replace luminaires, or change mounting heights, revise aiming, or install louvers, shields, or baffles.
   2. Obtain Engineer's approval to replace luminaires with units of higher or lower wattage.
   3. If mounting height is changed, revise aiming and recalculate and modify or replace support structures if indicated.
   4. Retest as specified above after repairs, adjustments, or replacements are made.
   5. Report results in writing.

F. Sports lighting will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.03 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain exterior athletic lighting.

END OF SECTION

SECTION 323300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

This Section includes the following:

A. Benches
B. Bleachers

1.2 SUBMITTALS

A. Product data: For each type of product indicated.
B. Samples: For each exposed finish.
C. Material Certificates: For site furnishings, signed by manufacturers.
D. Maintenance Data.
E. Manufacturers layout of play equipment, including fall zones and playground edge layout and location.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service. Provide playground equipment and play structure components bearing the IPEMA Certification Seal.

C. Testing Agency Qualifications: An independent agency qualified according to ANSI Z34.1 for testing indicated.

D. Safety Standards: Provide playground equipment complying with or exceeding requirements in the following:

1. Installer Qualifications: An employer of workers trained and approved by manufacturer.
2. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service. Provide playground equipment and play structure components bearing the IPEMA Certification Seal.
3. Testing Agency Qualifications: An independent agency qualified according to ANSI Z34.1 for testing indicated.
4. Safety Standards: Provide playground equipment complying with or exceeding requirements in the following:
   a. ASTM F 1487.
   b. CPSC No. 325.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to equipment list on drawings for all site furnishings, materials, finishes, colors, etc.

B. Each of the composite play structures consists of an interconnected assembly of various components whose specifications follow. Refer to the Drawings for item quantities and interconnections. All play equipment must provide accessibility to individuals with physical challenges and shall meet the requirements of USCPSC-01 and ASTM F-1487.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine subgrades, finished surfaces and installation conditions. Do not start site furnishings work until unsatisfactory conditions are corrected.

3.2 LOCATION AND INSTALLATION

A. All locations shall be staked by Contractor and approved by Owner's representative prior to commencement of work. Location shall be as indicated on drawings.

B. Install furnishings as per manufacturer's instructions. The manufacturer's instructions shall be considered a part of these Specifications. Installation contractor shall be a contractor approved by manufacturer for installation of manufacturer's equipment.

C. All areas surrounding locations of landscape accessories shall be minimally disturbed. Contractor shall regrade and repair areas and return site and improvements to original condition.

D. Contractor to confirm all fall zone requirements prior to installing equipment. Immediately notify the Owner’s Representative of any discrepancies.

3.3 INSTALLATION

A. Site Furniture

1. Assemble sections per manufacturer's recommendations.
2. Install level and plumb. Shim as required to obtain an unyielding surface.
3. Touch up all abraded, welded and scratched surfaces with matching rust inhibitive paint supplied by manufacturer.

PART 4 – COMPLETION

4.1 CLEAN-UP

A. The Contractor shall clean the site daily from trash and debris resulting from construction operations at no additional cost to Owner. All walks, roads and circulation routes shall be kept clean and free from debris, material and equipment.

B. Upon completion of the work covered by this section, the Contractor shall clean up all areas by removing spoil piles, surplus material and equipment from the site. The ground surface shall be restored to its original condition.

END OF SECTION 323300

SECTION 328400

IRRIGATION SYSTEM

PART ONE -- GENERAL

1.01 GENERAL CONDITIONS

The requirements of the "General Conditions of the Contract" and of Division 1, "General Requirements", shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.02 SCOPE OF WORK

A. Provide all labor, materials, transportation, and services necessary to furnish and install Irrigation Systems as shown on the drawings and described herein.

B. Related work in other sections:
   1. Turf and Grasses

1.03 QUALITY ASSURANCE & REQUIREMENTS

A. Permits and Fees: The Contractor shall obtain and pay for any and all permits and all observations as required.

B. Manufacturer's Directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the drawings and specifications

C. Ordinances and Regulations: All local, municipal, and state laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and make a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations or requirements of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.

D. Explanation of Drawings:
   1. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
   2. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications.
   3. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Licensed Irrigator immediately.

In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.04 SUBMITTALS

A. Material List:
   1. The Contractor shall furnish the articles, equipment, or processes specified by name in the drawings and specifications. No substitution will be allowed without prior written approval by the Licensed Irrigator.
   2. Complete material list shall be submitted prior to performing any work. Material list shall include the manufacturer, model number, and description of all materials and equipment to be used.
   3. Equipment or materials installed or furnished without prior approval of the Licensed Irrigator may be subject to rejection, and the Contractor required to remove such materials from the site at his own expense.
   4. Approval of any item, alternate, or substitute indicates only that the product or products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted.
   5. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

B. Record and As-Built Drawings:
   1. The Contractor shall provide and keep an up-to-date and complete "as-built" record set of blue line ozalid prints which shall be corrected daily and show every change from the original drawings and specifications, the exact "as-built" locations, sizes, and kinds of equipment. Prints for these purposes may be obtained from the Licensed Irrigator at cost. This set of drawings shall be kept on the site and shall be used only as a record set.
   2. These drawings shall also serve as work progress sheets and shall be the basis for measurement and payment for work completed. These drawings shall be available at all times for inspection and shall be kept in a location designated by the Licensed Irrigator. Should the record blue line as-built progress sheets not be available for review or not up-to-date at the time of any inspection (refer to Section 3.09 - Observation Schedule), it will be assumed no work has been completed and the Contractor will be assessed the cost of that site visit at the current billing rate of the Licensed Irrigator. No other observations shall take place prior to payment of that assessment.
   3. The Contractor shall make neat and legible notations on the as-built progress sheets daily as the work proceeds, showing the work as actually installed. For example, should a piece of equipment be installed in a location that does not match the plan, the Contractor must indicate that equipment has been relocated in a graphic manner so as to match the original symbols as indicated in the irrigation legend. The relocated equipment and dimensions will then be transferred to the original as-built plan at the proper time.
   4. Hand drawn: In lieu of electronically drawn, before the date of the final inspection, the Contractor shall transfer all information from the "as-built" prints to a sepia Mylar, or similar Mylar material, procured from the Licensed Irrigator. All work shall be in waterproof India ink and applied to the Mylar be a technical pen made expressly for use on Mylar material. Such pen shall be similar to those manufactured by Rapidograph, Kueffell & Esser, or Faber Castell. The dimensions shall be made so as to be easily readable, even on the final controller chart (see Section C). The original Mylar "as-built" plan shall be submitted to the Licensed Irrigator for approval prior to the making of the controller chart.
   5. Electronically drawn: In lieu of hand drawn, before the date of the final inspection, the Contractor shall transfer all information from the "as-built" prints to an AutoCAD electronic file procured from the Licensed Irrigator. All work shall be documented on a

unique and separate layer. The electronically drawn "as-built" plan shall be submitted to the Licensed Irrigator for approval prior to the making of the controller chart.

6. The Contractor shall dimension from two (2) permanent points of reference - building corners, sidewalks, road intersections, etc. - the location of the following items:
   a. Connection to existing water lines
   b. Connection to existing electrical power
   c. Gate valves
   d. Routing of irrigation pressure lines (dimension maximum 100' along routing).
   e. Irrigation control valves.
   f. Routing of control wiring.
   g. Quick coupling valves.
   h. Road and sidewalk borings
   I. Other related equipment as directed by the Licensed Irrigator
7. On or before the date of the final inspection, the Contractor shall deliver the corrected and completed sepias to the Licensed Irrigator. Delivery of the sepias will not relieve the Contractor of the responsibility of furnishing required information that maybe omitted from the prints.

C. Controller Charts:
   1. As-built drawings shall be approved by the Licensed Irrigator before controller charts are prepared.
   2. Provide on (1) controller chart for each controller supplied.
   3. The chart shall show the area controlled by the automatic controller and any area under a manual irrigation. The chart shall be the maximum size which the controller door will allow.
   4. The chart is to be a reduced drawing of the actual as-built system. However, in the event the controller sequence is not legible when the drawing(s) is reduced, it shall be enlarged to a size that will be readable when reduced.
   5. The chart shall be a black line print. A different color shall be used to indicate the area of coverage for each station.
   6. When completed and approved, the chart will be hermetically sealed between two (2) pieces of plastic, each piece being a minimum 10 mils thickness.
   7. These charts shall be completed and approved prior to final inspection of the irrigation system.

D. Operation and Maintenance Manuals:
   1. Prepare and deliver to the Licensed Irrigator within ten (10) calendar days prior to completion of construction, two (2) hard cover binders with three (3) rings containing the followings information:
      a. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representative
      b. Catalog and parts sheets on every material and equipment installed under this contract.
      c. Guarantee statement.
      d. Complete operating and maintenance instructions on all major equipment, i.e. the automatic controller(s).
   2. In addition to the above mentioned maintenance manuals, provide the Licensed Irrigator with instructions for major equipment and show evidence, in writing, to the Licensed Irrigator at the conclusion of the project that this service has been rendered.

E. Equipment to be Furnished:
   1. Supply as a part of this Contract the following tools:

a. Two (2) sets of special tools required for removing, disassembling and adjusting each type of irrigation head and valve supplied on this project.
b. Two (2) four foot valve keys for operation of the ball and remote control valves.
c. Two (2) keys for each automatic controller.
d. One (1) quick coupler key and matching hose swivel ell for every five (5), or fraction thereof, of each type of quick coupling valve installed.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handling of PVC Pipe and Fittings: The Contractor is cautioned to exercise care in handling, loading, unloading, and storing of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle which allows the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point. Any section of pipe that has been damaged will be discarded and, if installed, shall be replaced with new piping.

1.06 SUBSTITUTIONS

A. If the Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the drawings and specifications, he may do so by providing the following information to the Licensed Irrigator for approval:
   1. Provide a statement indicating the reason for making the substitution. Use a separate sheet of paper for each item to be substituted.
   2. Provide descriptive catalog literature, performance charts, and flow charts for each item to be substituted.
   3. Provide the amount of cost savings if the substituted item is approved.

B. The Licensed Irrigator shall have the sole responsibility in accepting or rejecting any substituted item as an approved equal to those equipment and materials listed on the irrigation drawings and specifications

1.07 GUARANTEE

A. The guarantee for the planting irrigation system shall be made in accordance with the attached form. The general conditions and supplementary conditions of these specifications shall be filed with the Owner and the Licensed Irrigator prior to acceptance of the irrigation system.

B. A copy of the guarantee form shall be included in the operations and maintenance manual.

C. The guarantee form shall be re-typed onto the Contractor's letterhead and contain the following information:

GUARANTEE FOR PLANTING IRRIGATION SYSTEM

We hereby guarantee that the planting irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defects in material or workmanship which may develop to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacement within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT: _____

LOCATION: _____

_____

SIGNED: _____

COMPANY: _____

ADDRESS: _____

_____

_____

PHONE: (_____) _____ -- _____

DATE OF ACCEPTANCE: _____ / _____ / _____

PART 2 -- PRODUCTS

2.01 MATERIALS

A. General: Use only new materials of brands and types noted on drawings, specified herein, or approved equals.

B. PVC pressure main line pipe and fittings:
   1. Pressure main line piping for sizes 3" and larger shall be PVC Class 200 with o-ring gasket joints.
   2. Pressure main line piping for sizes 2 1/2" and smaller shall be PVC Class 200 with solvent welded joints.
   3. Pipe shall be make from NSF approved Type I, Grade II PVC compound conforming to ASTM resin specification D1784. All pipes must meet requirements as set forth in Federal Specification PS-22-70.
   4. PVC solvent-weld fittings shall be Schedule 40, 1-2, II-I NSF approved conforming to ASTM test procedure D2466.
   5. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation methods prescribed by the manufacturer.
   6. All PVC pipe must bear the following markings:
      a. Manufacturer's name
      b. Nominal pipe size
      c. Schedule or class
      d. Pressure rating in P.S.I.
      e. NSF (National Sanitation Foundation) approval
      f. Date of extrusion
   7. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

C. PVC Non-Pressure Lateral Line Piping:
   1. Non-pressure buried lateral line piping shall be PVC class 200 with solvent-weld joints.
   2. Pipe shall be made from NSF approved, Type I, Grade II PVC compound to ASTM resin specification D1784. All pipes must meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.
   3. Except as noted in paragraphs 1 and 2 of Section 2.01B, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as set forth in Section 2.01B of these specifications.

D. Copper Piping and Fittings:
   1. Copper piping shall be type "K" hard-drawn with "sweat" type fittings.
   2. Pipe and fittings shall be assembled with 50/50 soft solder and non-erosive flux. Solder shall take up capillary action and joints shall be made tight without build-up head.
   3. Pipe ends shall be squared, reamed to remove burrs, and cleaned bright with fine sandpaper and steel wool.

E. Ball Valves:
   1. Ball valves shall be similar to those manufactured by Lasco, or approved equal, with threaded ends and equipped with a hand lever.
   2. All ball valves shall be installed per installation detail and the manufacturer's recommendations.

F. Gate Valves:

1. Gate valves shall be manufactured out of bronze, pressure rated to 125 psi WSP, 200 psi WOG nonshock. Valves shall be resistant to rust and moderate atmospheric corrosion. Valves shall be the same size as the mainline. Valve shall have threaded IPS bonnet and non-rising stem, with female threaded inlets and equipped with a “Sure Grip” type handle. Similar to those manufactured by Watts Regulator Company Series GV, or approved equal.
2. All gate valves shall be installed per the manufacturer's recommendations.

G. Quick Coupling Valves: Quick coupling valves shall have a brass two-piece body designed for working pressure of 150 p.s.i. operable with quick coupler. Key size and type shall be as shown on the plans.

H. Backflow Prevention Units:
1. Backflow prevention units shall be of size and type indicated on the drawings. Install backflow prevention units in accordance with irrigation construction details.
2. Wye strainers at backflow prevention units shall have a bronzed, screwed body with 60 mesh monel screen and shall be similar to Bailey #100B, or approved equal.

I. Automatic Drain Valves:
1. Automatic drain valves shall be plunger type, duty virgin PVC construction, with small thread inlet.
2. Drain valve shall be installed at an angle of 30 to 45 degrees horizontal, in a direction to facilitate pipe drainage.
3. Provide sump pit for drainage.

J. Control Wiring:
1. Connections between the automatic controllers and the electric control valves shall be made with direct burial copper wire, AWG-U.F. 600 volt.
2. Pilot wires shall be a different color wire for each automatic controller.
3. Common wires shall be white with a different color stripe for each automatic controller.
4. Install in accordance with valve manufacturer's specifications and wire chart. In no case shall the wire size be less than #14 gauge.
5. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.
6. Where more than one (1) wire in placed in a trench, the wiring shall be taped together at intervals of ten (10) feet.
7. An expansion curl shall be provided within three (3) feet of each wire connection. Expansion curl shall be of sufficient length at each splice connection at each electric remote control valve, so that in case of repair, the valve bonnet may be brought to the surface without disconnecting the control wires. Control wires shall be laid loosely in the trench without stress or stretching of control wire conductors.
8. All splices shall be made with Scotch-Lok #3576 Connector Sealing Packs, Rain Bird Snap-Tite wire connector, or approved equal. Use one (1) splice per connector sealing pack.
9. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of the Licensed Irrigator. All approved field splices shall be placed in a Control Valve Box and labeled appropriately.

K. Automatic Controllers:
1. Automatic controllers shall be of size and type shown on the plans.
2. Final location of the automatic controller shall be furnished by others.

3. Unless otherwise noted on the plans, the 120 volt electrical power to each automatic controller location shall be furnished by others. The final electrical hook-up shall be the responsibility of others.

L. Electrical Control Valves:
   1. All electric control valves shall be the same manufacture as the automatic controller.
   2. All electric control valves shall have a manual flow adjustment.
   3. Furnish and install one (1) control valve box for each electric control valve.

M. Control Valve Boxes:
   1. Use 10" round box for all field splices, Oldcastle Enclosure Solutions Model 910 with green cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.
   2. Use 14" X 19" standard rectangular box for all gate valves and quick coupler valves, Oldcastle Enclosure Solutions Model 1419 with green, “Drop-N-Lock” lid cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.
   3. Use 13" X 24" jumbo rectangular box for all electric control valves, Oldcastle Enclosure Solutions Model 1324 with green, “Drop-N-Lock” lid cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.

N. Irrigation Heads:
   1. All irrigation heads shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the drawings, or specified in these special provisions.
   2. Spray heads shall have a screw adjustment.
   3. Riser units shall be fabricated in accordance with the details shown on the plans.
   4. Riser nipples for all irrigation heads shall be the same size as the riser opening in the irrigation body.
   5. All irrigation heads of the same type shall be of the same manufacture.

PART 3 -- EXECUTION

3.01 INSPECTION

A. Site Conditions:
   1. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions and receive the Licensed Irrigator's approval prior to proceeding with work under this section.
   2. Exercise extreme care in excavating and working near existing utilities. The Contractor shall be responsible for damages to utilities which are caused by his operations or neglect. Check existing utilities drawings for existing utility locations.
   3. Coordinate installation of planting irrigation materials including pipe, so there shall be NO interference with utilities or other construction or difficulty in planting trees, shrubs, and ground covers.
   4. The Contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work on the planting irrigation system.

3.02 PREPARATION

A. Physical Layout:
   1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of irrigation heads.
2. All layout shall be approved by the Licensed Irrigator prior to installation.

B. Water Supply:
   1. Planting irrigation system shall be connected to water supply points of connection as indicated on the drawings.
   2. Connections shall be made at approximate locations as shown on the drawings. The Contractor is responsible for minor changes caused by actual site conditions.
   3. The point of connection shall be as shown on the drawings and shall be furnished by the Contractor, unless otherwise specified.

C. Electrical Supply:
   1. Electrical connections for the automatic controller shall be made to electrical points of connection as indicated on the drawings.
   2. Connections shall be made at approximate locations, as shown on the drawings. The Contractor is responsible for minor changes caused by actual site conditions.

3.03 INSTALLATION

A. Trenching:
   1. All trenches shall be installed prior to topsoil application.
   2. Dig trenches straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout indicated on the drawings, and as noted.
   3. Provide for a minimum of eighteen (18) inches cover for all pressure supply lines.
   4. Provide for a minimum cover of twelve (12) inches for all non-pressure lines.
   5. Provide for a minimum cover of eighteen (18) inches for all control wiring.

B. Backfilling:
   1. Trenches shall be backfilled with sand (a layer of six [6] inches below the pipe and three [3] inches above the pipe) and compacted in layers to 95% standard proctor, using manual or mechanical tamping devices.
   2. The trenches shall be backfilled a maximum of 50% with all joints exposed until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from clods of earth or stones larger than one-half (1/2) inch. Backfill shall be mechanically compacted landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps, or other surface irregularities.
   3. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than one-half (1/2) inch in size will be permitted in the initial backfill.
   4. Flooding of trenches will be permitted only with approval of the Licensed Irrigator.
   5. If settlement occurs and subsequent adjustments in pipe, valves, irrigation heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the Owner.

C. Trenching and Backfill Under Paving:
   1. Trenches located under areas where paving, asphaltic concrete or concrete, will be installed shall be backfilled with sand (a layer of six [6] inches below the pipe and three [3] inches above the pipe) and compacted in layers to 95% standard proctor, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm, unyielding condition. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place, cap, and pressure test all piping under paving prior to the paving work.
   2. Generally piping under existing walks is done by jacking, boring, or hydraulic driving, but where any cutting or breaking of sidewalks or concrete is necessary, it shall be done

and replaced by the Contractor as part of the contract cost, to the satisfaction of the Construction Manager. Permission to cut or break sidewalks or concrete shall be obtained from the Construction Manager. NO hydraulic driving will be permitted under concrete paving.

3. Provide for a minimum cover of eighteen (18) inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

D. Assemblies:
   1. Routing of planting irrigation lines as indicated on the drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform to the details per plans.
   2. Install NO multiple assemblies in plastic lines. Provide each assembly with its own outlet.
   3. Install all assemblies specified herein in accordance with the respective detail. In the absence of detail drawings or specifications pertaining to specific items required to complete the work, perform such work in accordance with the best standard practice, with the approval of the Licensed Irrigator.
   4. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust, and moisture before the installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.
   5. On PVC to metal connections, the Contractor shall work the metal connections first. Teflon tape, or approved equal, shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.

E. Line Clearance: All lines shall have a minimum clearance of six (6) inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Automatic Controller: Install the automatic controller(s) in accordance with the manufacturer's instructions. Remote control valves shall be connected to the controller in the numerical sequence as shown on the drawings.

G. High Voltage Wiring for Automatic Controller:
   1. 120 volt electrical service for the automatic controller shall be the responsibility of the Contractor. The Contractor shall be responsible for permitting and getting the electrical utility service company to install the appropriate electrical service and meter base necessary to operate each automatic controller. The final location of the electrical meter base shall be approved by the Licensed Irrigator.
   2. 120 volt electrical service connection to the automatic controller shall be provided by the Contractor.
   3. All electrical work shall conform to local codes, ordinances, and union authorities having jurisdiction.

H. Remote Control Valves: Install remote control valves where shown on the drawings and per the detail. When valves are grouped together, allow at least thirty-six (36) inches between valves. Install each remote control valve in a separate valve box. Each valve number (per the drawings) shall be stenciled on the valve box lid with exterior paint. Paint color shall be flat black. Stencil number size shall be 3" in height.

I. Gate Valves: Install gate valves where shown on the drawings. When valves are grouped together, allow at least thirty-six (36) inches between valves. Install each gate valve in a sepa

rate valve box. Each gate valve shall have stenciled on the valve box lid, "GV" with exterior paint. Paint color shall be flat black. Stencil letter size shall be 3" in height.

J. Ball Valves: Install ball valves where shown on the drawings and per the detail. When valves are grouped together, allow at least thirty-six (36) inches between valves. Install each ball valve in a separate valve box. Each ball valve shall have stenciled on the valve box lid, "BV" with exterior paint. Paint color shall be flat black. Stencil letter size shall be 3" in height.

K. Quick Coupler Valves: Install where shown on the drawings and per the detail. Install each quick coupler valve in a separate valve box. Each quick coupler valve shall have stenciled on the valve box lid, "QC" with exterior paint. Paint color shall be flat black. Stencil letter size shall be 3" in height.

L. Flushing of the System:
   1. After all new irrigation pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of the irrigation heads, the control valves shall be opened and full head of water used to flush out the system.
   2. Irrigation heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Licensed Irrigator.

M. Irrigation Heads:
   1. Install the irrigation heads as designated on the drawings. Irrigation heads to be installed in this work shall be equivalent in all respects to those itemized.
   2. Spacing of heads shall not exceed the maximum indicated on the drawings. In NO case shall the spacing exceed the maximum recommended by the manufacturer.

N. Field Splices: Install field splices of control valve wiring in a valve box (see Section 2.01 L.1). Each field splice valve box lid shall have stenciled "Field Splice" on it with exterior paint. Paint color shall be flat black. Stencil letter shall be 3" in height.

3.04 TEMPORARY REPAIRS

The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

3.05 FIELD QUALITY CONTROL

A. Adjustment of the System:
   1. The Contractor shall flush and adjust all irrigation heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.
   2. If it is determined by the Licensed Irrigator that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.
   3. Lowering raised irrigation heads by the Contractor shall be accomplished within ten (10) calendar days after notification by the Licensed Irrigator.
   4. All irrigation heads shall be set perpendicular to finished grades unless otherwise designated on the drawings.

B. Testing of Irrigation System:

1. The Contractor shall request the presence of the Licensed Irrigator, in writing, at least 24 hours in advance of the testing.
2. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch, and prove watertight. Note that the testing of pressure main lines shall occur prior to installation of the electric remote control valves.
3. All piping under paved areas shall be tested under hydrostatic pressured of 150 pounds per square inch, and proved watertight, prior to paving.
4. Sustain pressure in lines for not less than four (4) hours. If leaks develop, replace joints and repeat the test until the entire system is proven watertight.
5. All hydrostatic tests shall be made only in the presence of the Licensed Irrigator. NO pipe shall be completely backfilled until it has been inspected, tested, and approved in writing.
6. Furnish necessary force pump and all other test equipment.
7. When the planting irrigation system is completed, perform a coverage test in the presence of the Licensed Irrigator, to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed, as indicated on the drawings, when it is obviously inadequate, without bringing this to the attention of the Licensed Irrigator. This test shall be accomplished before any ground cover is planted.
8. Upon completion of each phase of work, the entire system shall be tested and adjusted to meet site requirements.

3.06 MAINTENANCE

A. The entire planting irrigation system shall be under full automatic operation for a period of seven (7) calendar days prior to any planting.
B. The Licensed Irrigator reserves the right to waive or shorten the operation period.

3.07 CLEAN-UP

Clean-up shall be made daily as each portion of the work progresses. Refuse and excess dirt shall be removed, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to the original condition.

3.08 FINAL OBSERVATION PRIOR TO ACCEPTANCE

A. The Contractor shall operate each system in its entirety for the Licensed Irrigator, at the time of the final observation. Any items deemed not acceptable by the Licensed Irrigator shall be re-worked to the complete satisfaction of the Licensed Irrigator.
B. The Contractor shall show evidence to the Licensed Irrigator that the Owner has received all accessories, charts, record drawings, and equipment as required before final inspection can occur.

3.09 OBSERVATION SCHEDULE

A. The Contractor shall be responsible for notifying the Licensed Irrigator, in advance, for the following observation meetings, according to the time indicated:
   1. Pre-Job Conference - 7 days.
   2. Pressure supply line installation & testing - 48 hours
   3. Automatic controller installation - 48 hours
   4. Control wire installation - 48 hours
   5. Lateral line and irrigation installation - 48 hours

6. Coverage test - 48 hours
7. Final inspection - 7 days

B. When observations have been conducted by other than the Licensed Irrigator, show evidence, in writing, of when and by whom these observations were made.

C. NO site observations will commence without as-built drawings. In the event the Contractor calls for a site visit without as-built drawings, without completing previously noted corrections, or without preparing the system for the said visit, he shall be responsible for reimbursing the Licensed Irrigator at his current billing rates per hour, portal to portal (plus transportation costs) for the inconvenience. NO further site visits will be scheduled until this charge has been paid and received.

END OF SECTION 328400

SECTION 329100

SOILS

PART 1 - GENERAL

1.01 SCOPE

A. This Section specifies all soil materials designated as “Planting Mix”, on the drawings or in the Specifications.

1.02 REFERENCES

A. Related Work Specified elsewhere
   1. Section 329200 – Turf and Grasses

1.03 SUMMARY

A. Section Includes
   1. Improved Top Soil
   2. Turf Soil

1.04 DEFINITIONS

A. CFR: Code of Federal Regulations

B. Clopyralid: Herbicide used to control broadleaf weed.

C. Compost: a stable humus material created by combining organic wastes (e.g. yard trimmings, food wastes, manures) in proper ratios into piles, rows, or vessels; controlling temperature, moisture and oxygen to achieve accelerated decomposition; and adding bulking agents (e.g. wood chips), as necessary, to provide air space; allowing the finished material to fully stabilize and mature through a curing period.

D. pH: A measure of the soil acidity or Soil alkalinity. An acid solution has a pH value less than 7, while a basic solution always has a pH larger than 7. The pH can affect the availability of nutrients in the soil.

E. pH Balanced Compost: A combination of fully composted cotton burrs and local landscape trimmings such as grass, leaves and brush. Has a balanced pH between 5.5-6.5 and a Solvita® Compost Maturity Index Value of 7 or higher; and adds an average of 1.44 pounds of (N) Nitrogen, .22 pounds of (P) Phosphorus and .9 pounds of (K) Potassium.

F. Picloram: Herbicide used to control woody plant material such as trees and shrubs.

G. Professional Compost: A combination of fully composted landscape trimmings such as grass, leaves, brush, and wood chips. Has a Solvita® Compost Maturity Index Value of 7 or higher; and adds an average of 1.1 pounds of (N) Nitrogen, .13 pounds of (P) Phosphorus and .8 pounds of (K) Potassium.

H. Solvita® Maturity Test: A diagnostic test that measures the amount of Carbon Dioxide and Ammonia present in compost.

I. Screened Planting Soil: Very fine existing, native surface topsoil screened to keep soils open.

J. Screened Sharp Sand: Deep sand that is excavated from a minimum of 20 feet below ground level, minimizing the chances of nut sedge and traces of other noxious weed and grass seed, screened to keep sand open.

K. Topsoil: naturally produced and harvested soil from the A horizon or upper layers or the soil as further defined in this specification.

L. TCEQ: Texas Commission on Environmental Quality

M. Washed Concrete Sand: Coarse sand that has been washed clean of clay, silt, and weed seed, and has been screened for consistency.

1.05 SUBMITTALS

A. Submittal to be sent to Owner for approval 30 days before purchasing and delivery to site.

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

C. Product Certificates: Showing soil analysis from a qualified soil-testing laboratory.

D. Samples: To be submitted with the following conditions and items
   1. Representative samples of material shall be provided to the Owner from the supply source.
   2. 1 gallon of material to be provided in a clear, re-sealable, plastic bag.
   3. Product Certificate

1.06 QUALITY ASSURANCE

A. Soil Analysis: For each soil type, furnish soil analysis and a written report by a qualified soil test laboratory.
   1. The soil-testing laboratory shall oversee soil sampling
   2. Report suitability of tested soil for plant growth.
      a. Recommendations for nitrogen, phosphorus, and potassium and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
      b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective actions.

B. Soil Testing Laboratory: Subject to compliance with requirements, Laboratories that may be incorporated into the work include, but are not limited to:
   1. New Earth Compost: Katy, Texas at (281) 574-0316

1.07 DELIVERY

A. Do not dump or store materials near structures, utilities, walkways and pavements, or on existing turf areas or plants

B. Provide erosion-control measures to prevent erosion or displacement of materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways

C. Accompany each delivery of material with appropriate certificates.

PART 2 – PRODUCTS

2.01 MANUFACTURES

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to:
   1. Soil Building Systems
   2. Living Earth Technology

2.02 IMPROVED TOP SOIL

A. A pre-mixed soil created as a low-level organic planting medium to provide maximum plant growing results, without significant settling over time.

B. pH: 7.5 – 8.7

C. Particle Sizes: 98.5% pass through a ½" screen. 99% will pass through a ¾" screen.

D. Color: Light to medium brown.

E. Weight: 2000 – 2200 lbs. per cubic yard

F. Free of: Contains no treated or used lumber, pine bark, man made chemicals, raw manure, or spent mushroom compost waste. Also, there are not trace elements of the herbicides Clopyralid or Picloram.

G. Composition Ratios: 25% Professional Compost, 25% Screened Planting Soil, and 25% Screened Sharp Sand

2.03 TURF SOIL

A. A very loose textured soil created to settle minimally over time with an exceptional percolation capacity, yet will retain enough moisture to adequately supply the vegetation.

B. pH: 7.4 – 8.3

C. Particle Sizes: 98.5% pass through a ½" screen. 99% will pass through a ¾" screen.

D. Color: Medium Tan.

E. Weight: 2000 – 2200 lbs. per cubic yard

F. Free of: Contains no treated or used lumber, pine bark, man made chemicals, raw manure, or spent mushroom compost waste.

G. Composition Ratios: 25% pH Balanced Compost, 75% Washed Concrete Sand.

2.04 ADDITONAL SOIL INFORMATION

A. Meet or exceed the time and temperature standards set in TCEQ., Chapter 332, Subchapter B, Part 23.

B. Meet federal Specifications under guidelines of 40 CFR, Part 503, Standards for Class A Bio-solids.

C. Have a high concentration of aerobic composted organic matter as determined by ASTM D-5268 at 824°F.

PART 3 – EXECUTION

3.01 GENERAL

A. This part shall include the placing of all specified soil at the locations and elevations as shown.

B. Soil mixes shall be mixed in proportions as specified for each soil mix. Thoroughly blend mix to a consistency relatively free of clods, at depth specified or as indicated on drawings.

C. Use an extensive aerobic composting process that includes
   1. Scheduled turns with a minimum of 5 turns.
   2. Completely composted for a minimum of 6 to 12 months

D. The work performed herewith, shall conform in every respect to the Contract Documents, the applicable local ordinances and sanitary codes, the regulations of the State Health Department, the regulations of the Occupational Safety and Hazardous Administration (OSHA) and the regulations of the Environmental Protection Agency (EPA). In the event that the contract documents do not adequately specify materials, methods of construction or workmanship of any potion of the proposed work, the Standards of the Trade shall govern.

3.02 CLEANING, REMOVAL, AND REPAIR

A. Promptly remove materials spilled on pavement adjacent to plant areas. Repair existing lawns damaged by operations under this contract. Repair shall include finish grading and seeding, or turf, as required to match existing grade and lawn, and maintenance of repaired areas.

B. Waste or excess material to placed or disposed of as directed by OWNER.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. Soil for the work shown on the plans shall be measured by the square yard.

4.02 PAYMENT

A. The accepted quantities of Soil shall be paid for at the unit bid price per square yard of specified depth.

B. The unit bid price shall be full compensation for furnishing, hauling, and mixing soils; and for all equipment and incidentals necessary to complete work.

C. The preceding provisions for payment shall not be interpreted to provide payment for soil used for backfill operations or other soils needed to complete construction for which provision is otherwise made in the contract.

END OF SECTION 329100

SECTION 329200

TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Soil Preparation
   2. Sodding
   3. Seeding
   4. Maintenance

B. Related Sections include the following:
   1. Section 329100: “Soils”
   2. Section 329300: “Plants”

1.3 CONTRACT DOCUMENTS

A. Shall consist of specifications and general conditions and the construction drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.4 VERIFICATION

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities and shall immediately inform the Owner’s Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner’s Representative.

B. In the case of a discrepancy in the plant quantities between the plan drawings and the plant call outs, list or plant schedule, the number of plants or square footage of the planting bed actually drawn on the plan drawings shall be deemed correct and prevail.

1.5 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.6 CHANGES IN THE WORK

A. The Owner's Representative may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.7 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

H. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.8 SUBMITTALS

A. See contract general conditions for policy and procedure related to submittals.

B. Product data: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal eight weeks before the installation of turf and grasses. Samples: Submit samples of each product and material where required by the specification to the Landscape Architect for approval.

Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Qualification Data: For Landscape Contractor. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

D. Certification of grass seed: From seed vendor for each grass-seed stating the botanical and common name and percentage by weight of each species and variety, and percentage of PLS (Pure Live Seed), germination, and weed seed. Include the year of production and date of packaging.
   1. Certification of each seed mixture for turfgrass and seed. Include identification of source and name and telephone number of supplier.

E. Product Certificates: For soil amendments from manufacturer. Qualification Data: For landscape Installer.

F. Material Test Reports: For standardized ASTM D 5268 topsoil, existing native surface topsoil, existing in-place surface soil, and imported or manufactured topsoil. Planting Schedule: Indicating anticipated planting dates for each type of planting.

G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and grasses during a calendar year. Submit before expiration of required initial maintenance periods.

1.9 OBSERVATION OF THE WORK

A. The Landscape Architect may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.

B. The Landscape Architect shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Landscape Architect shall be afforded sufficient time to schedule visit to the site. Failure of the Landscape Architect to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.
   1. SITE CONDITIONS PRIOR TO THE START OF PLANTING: review the soil and drainage conditions.
   2. TURF AND SEED QUALITY: Review of turf and seed quality at the time of delivery and prior to installation/
   3. COMPLETION OF THE TURF AND SEEDING INSTALLATION: Review the completed installation.

1.10 QUALITY ASSURANCE

A. Contractor’s Quality Assurance Responsibilities: The Contractor is solely responsible for quality control of the work.

B. Installer Qualifications: The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the work, including the handling and planting of large areas of turf and seeding in urban areas. The same firm shall install top soil and swale soil (where applicable).
   1. Installer Field Supervision: When any planting work is in progress, installer shall maintain, on site, a full-time supervisor who can communicate in English with the Owner's Representative.
   2. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing plants and trees of the quality and scale of the proposed project and can communicate in English with the Owner's Representative.
   3. The installer's crew shall have a minimum of 3 years experienced in the installation of Planting Soil, Plantings, and Irrigation (where applicable) and interpretation of soil plans, planting plans and irrigation plans.
   4. Submit references of past projects, employee training certifications that support that the Contractors meets all of the above installer qualifications and applicable licensures.

C. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

D. Soil Analysis: Furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.
   1. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Landscape Architect. A minimum of four (4) representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
   2. Report suitability of tested soil for turf growth.
      a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m)
      b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
   3. Notify Landscape Architect of sources of planting materials minimum seven (10) days in advance of delivery to site.

1.11 SITE CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion

B. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Landscape Architect, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
   1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the

Landscape Architect in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Landscape Architect of such conditions, he/she shall remain responsible for plant material under the warranty clause of the specifications.

C. It is the responsibility of the Contractor to be familiar with the local growing conditions, and if any specified plants will be in conflict with these conditions. Report any potential conflicts, in writing, to the Landscape Architect.

D. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

E. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
   1. Notify Construction Manager and Owner no fewer than three days in advance of proposed interruption of each service or utility.
   2. Do not proceed with interruption of services or utilities without Construction Manager's or Owner's written permission.

F. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

G. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

H. Coordination with planting of trees, shrubs and groundcover areas:

1.12 WARRANTY

A. Warrant turf and grasses and workmanship for the warranty period indicated, against defects, poor health, unsatisfactory growth, and death, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner or Owner’s Maintenance Contractor or incidents that are beyond Contractor’s control.
   1. Warranty period: Twelve (12) months from date of 90% germination.
   2. Include the following remedial actions as a minimum:
      a. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
      b. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

B. Sod:

1. Digging Sod
    a. Do not dig sod at the nursery or other approved source until ready to transport sod to the project site or approved storage location.
    b. Before stripping, sod shall be mowed at a uniform height of 2".
    c. Cut sod to specified thickness and to standard width and length desired.
2. Transporting Sod
    a. Sod transported to the Project in open vehicles shall be covered with tarps or other suitable covers securely fastened to the body of the vehicle to prevent injury to the sod. Closed vehicles shall be adequately ventilated to prevent overheating of the sod. Evidence of inadequate protection against drying out in transit shall be cause for rejection.
    b. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or in temporary storage.
    c. Upon arrival at the temporary storage location or the site of the work, sod shall be inspected for proper shipping procedures. Should the roots be dried out, the Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall remove it at once from the area of the work and replace it.
    d. Unless otherwise authorized by the Landscape Architect, the Contractor shall notify the Landscape Architect at least 48 hours in advance of the anticipated delivery date of sod. A legible copy of the invoice, showing species and variety of sod included for each shipment shall be submitted to the Landscape Architect. Certificate of Inspection when required must accompany each sod shipment.
2. Transporting Sod
    a. Sod transported to the Project in open vehicles shall be covered with tarps or other suitable covers securely fastened to the body of the vehicle to prevent injury to the sod. Closed vehicles shall be adequately ventilated to prevent overheating of the sod. Evidence of inadequate protection against drying out in transit shall be cause for rejection.
3. Handling and Storage of Sod
    a. No sod shall remain in temporary storage over 30 hours.
    b. Sod shall be kept moist and shall be stored in a compact group to prevent drying out or freezing.
    c. Contractor shall take extreme care in the handling of sod material to avoid breaking or tearing strips. Sod that has been damaged by poor handling may be rejected by the Landscape Architect.

1.14 SCHEDULING

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance until date of Substantial Completion.
    1. Spring Planting: between March 15 – May 1
    2. Fall Planting: between August 15 – November 1

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.15 MAINTENANCE

A. Initial Turf and Seed Grasses Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable grass is established but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.
   a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
   b. Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable grasses is established, but for not less than 40 days after Substantial Completion.
2. Sodded Turf: 60 days from Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be of standard, approved, and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original, unopened container bearing the manufacturer's guaranteed analysis. The Contractor shall supply the Engineer with a sample of all supplied materials accompanied by analytical compliance or bearing the manufacturer's guaranteed analysis.

B. Sod Fertilizer:
Fertilizer shall consist of the following percentages by weight, unless otherwise noted in a project Soils Report, and shall be mixed by a commercial fertilizer supplier:

10% Nitrogen
20% Phosphoric Acid
10% Potash

C. Hydromulch Fertilizer:
Ammonium Phosphate which shall consist of the following percentages by weight, shall be mixed by a commercial fertilizer supplier, and shall be water soluble:

16% Nitrogen
8% Phosphoric Acid
8% Potash

D. Plant Material:

1. Plants shall be in accordance with the Texas State Department of Agriculture's Regulation for nursery inspections, rules, and ratings. Any plants rendered unsuitable for planting because of an inspection will be considered as samples and will be provided at the expense of the Contractor.
2. All plants not conforming to the requirements herein specified, shall be considered defective and such plants, whether in place or not, shall be marked as rejected and imme

diately removed from the site of the work and replaced with new plants at the Contractor's expense. The plants shall be of the species, variety, size, and conditions specified herein. Under no conditions will there be any substitutions of plants or sizes listed on the accompanying plans, except with the expressed, written consent of the Engineer.

3. Plant material shall be true to botanical and common name and variety as specified in the "American Standard of Nursery Stock Editions" and "Standardized Plant Names".

4. Substitute plant material will not be permitted unless specifically approved, in writing, by the Engineer.

5. Sod:
   a. All sod used shall be true to the turf species specified herein and shall be accompanied with signed copies of a statement from the vendor certifying that sod is as specified, and is in accordance with any State of Texas Agricultural Code and is equal to or better than the requirements of these specifications.
   b. Turfgrass Species: Bermudagrass (Cynodon dactylon)& Bermuda 'Latitude 36' (Cynodon dactylon 'Latitude 36')
   c. Sod shall be certified and of species indicated on the plans. Turf grass shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained according to standard horticultural practices for the project locale from planting to harvest.
   d. Sod shall be weed-free, disease and pest-free, and solid.
   e. Sod shall have a minimum of three-quarters (3/4) of an inch of soil, containing the roots of the turf. Thickness of cut shall be to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2" on width and plus or minus 5% on length. Broken strips and torn or uneven ends will not be accepted.
   f. Strength of Sod Strips: Sod strips shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.
   g. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively wet or dry) may adversely affect its survival.
   h. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 30 hour period unless a suitable preservation method is approved by the Landscape Architect prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Landscape Architect prior to its installation.
   i. Thatch: Sod shall be relatively free of thatch. A maximum on 1/2" (uncompressed) thatch will be permitted.
   j. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects.
   k. Weeds: Sod shall be free of objectionable grassy and broadleaf weeds.

6. Seed:
   a. Seed shall be from the previous year's crop, not more than 12 months old at delivery. Seed Species: State-certified seed of grass species.
   b. All seed used shall be labeled and shall be furnished in sealed standard containers with signed copies of a statement from the vendor certifying that each container of seed delivered is fully labeled in accordance with the Texas State Agricultural Code and is equal to or better than the requirements of these specifications.
   b. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.
   c. Seed Species:

1) All quantities are in PLS (pure live seed).
2) Each species shall not exceed 0.1 % weed seed.
3) Common Bermuda Grass: hybrid, high quality, extra fancy grade, hulled and treated, 98 percent purity and 85 percent germination.
4) Detention area HCFCD grass mix: comprised by weight of:
   a) KY-31 Tall Fescue (15%),
   b) Hulled Common Bermuda (30%),
   c) Unhulled Common Bermuda (20%),
   d) Gulf Annual Ryegrass (15%), and
   e) Crimson Clover and Inoculant (20%)

d. For establishing a permanent turfgrass during the period generally between June 15th and September 1st, seed shall be Bermuda, extra fancy, hulled, lawn type (*Cynodon dactylon*).

e. For establishing a temporary turfgrass during the period, generally between September 1st and June 15th, seed shall be Perennial Rye, lawn type (*Lolium perenne*).

D. Hydromulch Fiber Mulch:

1. "Hydromulch" as manufactured by Conwed Fibers, 1985 Tate Blvd., Suite 350, Hickory, NC 28601, (704) 327-6670, or approved equal.

2. The hydromulch shall be composed of virgin wood cellulose fibers and contain no germination or growth-inhibiting factors. It shall have a consistent texture which disperses evenly and remain suspended in agitated water. It shall have a temporary green dye and the following property analysis:

   Moisture Content - 9.0% + 3% O.D. Basis
   Organic Matter - 99.2% + 0.8 %
   Ash Content - 0.8% + 0.2 %
   pH - 4.8% + 0.5%
   Water Holding Capacity (grams of H2O per 100 grams of fiber) - 1150 minimum

E. Hydromulching Additive (Binder):

1. Ecology "Control-M-Binder" organic seeding additive, or approved equal.

F. Water: Source furnished by the Contractor, cost and transport of water, as required, by the Contractor.

G. Soil Saver Netting: Jute mesh netting as manufactured by Ludlow, or approved equal.

2.2 TOP SOILS

A. Reference Special Specification 329100 and Landscape Planting Notes on the drawings.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.

2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.

3. Provide lime in form of ground dolomitic limestone, calcitic limestone, or approved equal.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely g round with 90 percent passing through No. 50 (0.30-mm) sieve.

F. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

G. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

H. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (12.5- mm) sieve; soluble salt content of 5 to 10 decisiemens/m; Carbon to Nitrogen ratio below 25:1, not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 l b/cu. f t. (2.4 k g/cu. m) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 PLANTING ACCESSORIES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required f or Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective f or controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.6 FERTILIZER

Fertilizers should only be applied after the soil is tested and a deficiency that cannot be amended with compost is shown. This shall be approved by the Landscape Architect prior to installation. The contractor shall test soils prior to fertilizer application.

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of **1** percent nitrogen and **10** percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.7 MULCHES

A. Hardwood Shredded Mulch: stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.
2. Produced within 100 miles of the site.

B. Fiber Mulch: Biodegradable, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended for slurry application; nontoxic and free of plant-growth or germination inhibitors. Liquid concentrate diluted with water forming transparent film-like crust permeable to water and air.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that final grades to within 0.025' have been established prior to commencing planting operations. Provide for inclusion of all amendments, settling, etc.
3. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.2 PRE-PLANT PREPARATION

A. Notify Landscape Architect at least 10 working days prior to start of seeding or sodding operations.

B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations. Protect adjacent and adjoining areas from hydroseeding overspray. Perform seeding only after planting and other work affecting ground surface has been completed.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Initial establishment of permanent or temporary turfgrass:

1. Disposal of Excess Soil: Disposal of any unacceptable soil shall be at an off-site location. Disposal of excess soil, acceptable in condition to the Owner, shall be at an on-site location, approved by the Owner.
2. Immediately before seeding, scarify, loosen, float and drag the upper 1-2 inches of topsoil to bring it to the proper condition. Remove foreign matter larger than 1/2" in diameter.
3. Fine Grading: After tillage and cleaning, all areas to be planted shall be leveled, fine graded, and drug with a weighted spike harrow or float drag. The required result shall be the elimination of ruts or depressions that would cause water to stand or pond immediately after rainfall or operation of the lawn irrigation system, humps, and objectionable soil clods. This shall be the final soil preparation step to be completed before the commencement of fertilizing and planting.
4. If the prepared grade is eroded or compacted by rainfall prior to fertilizing, rework the surface to specified condition.
5. If slopes in work area are greater than 3:1, a Soil Saver Netting shall be used in conjunction with the hydromulch operation.

C. Second establishment for permanent turfgrass, if temporary turfgrass was installed:

1. Monitor overnight late spring to early summer temperatures. Once ten (10) consecutive days of 60° or warmer overnight low temperatures has been achieved, permanent turfgrass hydromulch operations can commence.
2. Cease all irrigation operation and apply a glyphosate to all temporary turfgrass and leave undisturbed for a minimum 24 hours. Schedule the glyphosate application during forecasted dry weather.
3. Scalp all temporary turfgrass as low as possible. Collect or rake all clippings and dead vegetation to expose soil surface.
4. Prepare hydromulch area per specification Section 3.02. A.
5. Install permanent turfgrass hydromulch per specification Section 3.03.
6. Provide supplemental watering as needed to germinate and establish the hydromulch
7. Maintain the hydromulched area per specification Section 3.07 and Section 3.08, if necessary.
8. Acceptance of work shall be per specification Section 3.09.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/4 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

D. Moisten prepared seed areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 FERTILIZING

A. Uniformly distribute fertilizer by mechanical means at the rate of 1-2 pounds of Nitrogen per 1,000 square feet.

B. If applying a fertilizer with a percentage by weight not as specified, apply at the rate of 2 pounds actual nitrogen per 1,000 square feet.

C. Work fertilizer into the soil after fine grading & not more than 2 days prior to grass planting. Cultivating equipment shall be set so the fertilizer will not penetrate into the soil more than 1 inch. Do not apply fertilizer when there is a possibility of rain before lawn areas can be sodded

3.5 SPREADING OF TOPSOIL

A. On-site stockpiled topsoil shall be used prior to importing of topsoil

B. Imported topsoil, if necessary to meet minimum depth of 3 inches in sodded areas, shall be blended with the on-site topsoil spread to the full depth of topsoil.

C. Topsoil and subgrade shall be damp and scarified when topsoil is spread.

D. Areas to be sodded shall be topsoiled to a minimum depth of 3 in., compacted measure. Provide additional topsoil depths as required to construct final grades indicated on the drawings. Topsoil shall be compacted to 85% completion, determined in accordance with ASTM: D 1557

3.6 PRE-PLANT WEED CONTROL

A. If live perennial weeds exist on site at the beginning of the work, spray with a non-selective, systemic contract herbicide, as recommended and applied by an approved, licensed landscape pest control applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill.

B. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 1/4" below the surface of the soil over the entire area to be planted.

C. After the irrigation system is operational and approved by the Landscape Architect, apply water for five (5) to ten (10) calendar days, as needed to achieve weed germination. Apply contact herbicides and wait as needed before planting. Repeat, if required by the Landscape Architect.

D. Maintain the site weed-free until final acceptance by the Landscape Architect, utilizing mechanical and chemical treatment.

3.7 SODDING

A. Sod Preparations and Operations:

1. Refer Section 3.06 Pre-Plant Weed Control
2. All trees, shrubs, groundcover, and seasonal color/bulbs shall be installed prior to sodding in the area. The Contractor shall be responsible for coordination with other trades as required.
3. Install only sod that has been cut at the place of growth 24 hours prior to the time of installation.
4. Frequently water sod that is stored on-site, waiting installation. During hot weather conditions, all sod which has not been installed and has not been watered while awaiting installation shall be rejected and removed from the project and disposed of at the Contractor's expense.
5. Apply fertilizer to the finish grade and work into the top 1/2" of soil. Apply the fertilizer at a rate of two (2) pounds of nitrogen per 1000 square feet of area.
6. Lightly water the sod bed prior to sod installation with a fine mist spray.
7. The first row shall be laid in a straight line with subsequent rows parallel to the first row and tightly abutting each other. Install sod so that adjacent strips butt tightly together, with no gaps or spaces between the strips. Lay sod on all slopes perpendicular with the direction of surface drainage. Stagger all sod joints in a running-bond pattern. Sodded areas shall be flush with adjacent seeded or established turf areas.
8. Lateral sod joints shall be staggered. Care shall be exercised to insure that the sod is neither stretched nor overlapped. Joints must be butted tightly to prevent voids that could permit air to dry out roots.
9. After placement of sod, roll the sod thoroughly to establish soil contact and to remove slight grade undulations and air pockets.
10. Plastic mesh: All plastic mesh backing applied to the harvested sod at the growing facility shall be removed in its entirety during the installation of sod at the project. Dispose of plastic mesh off site.
11. Sod placed of a 3:1 slope, or steeper, shall be staked. Stakes shall be galvanized pins, wood pegs or other methods approved by the Landscape Architect, and a minimum of six (6) inch in length. A minimum of 2 stakes shall be installed for each strip of sod and a maximum of 18" spacing of stakes shall not be exceeded.
12. Immediately water sod thoroughly after installation.
13. Remove all sod, sod clumps, and soil immediately after the installation. Wash off all plant material and pavement.
14. Immediately after sodding operations have been completed, entire surface shall be compacted with a roller or other approved equipment. The completed area after sodding shall be uniformly even, firm, and true to finished grade lines.
15. Time Limit: All sod which has not been installed within eight (8) hours of delivery shall be rejected and removed from the project and disposed of at the Contractor's expense.

3.8 HYDROMULCH

A. General: Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Engineer.

B. Pre-Plant Weed Control:

1. If live perennial weeds exist on site at the beginning of the work, spray with a non-selective, systemic contract herbicide, as recommended and applied by an approved, licensed landscape pest control applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill.
2. Clear and remove these existing weeds by mowing or grubbing off all plant parts at least 1/4" below the surface of the soil over the entire area to be planted.
3. After the irrigation system is operational and approved by the Engineer, apply water for five (5) to ten (10) calendar days, as needed to achieve weed germination. Apply contact herbicides and wait as needed before planting. Repeat, if required by the Engineer.
4. Maintain the site weed-free until final acceptance by the Engineer, utilizing mechanical and chemical treatment.
5. Refer Section 3.05 C., Hydromulching.

C. Hydro-Seeding Preparation and Operations:

1. Schedule work for periods of favorable weather.
2. Refer Section 3.03 B, Pre-Plant Weed Control
3. Protect all areas from excessive compaction when trucking plants or other material to the planting site. Existing vegetation identified by the Engineer to remain, shall be protected from trucking operations during the course of construction.
4. Hydromulching Operation:
   a. Mixes shall be:

Bermuda seed (hulled)	85 lbs./acre
OR	
Perennial Rye Grass	300 lbs./acre
OR	
HCFCD seed mix	100 lbs./acre
Hydromulch fiber mulch	2000 lbs./acre
Commercial fertilizer	400 lbs./acre
Seed additive binder	100 lbs./acre
Water	3600 gallons

   b. All hydromulched areas shall be installed by an approved hydromulch company.
   c. The hydromulch operations shall be applied in the form of a slurry consisting of cellulose fiber, seed, chemical additives, commercial fertilizer, and water. When hydraulically sprayed on the soil surface, the hydromulching shall form a blotter-like groundcover impregnated uniformly with seed and fertilizer and shall allow the absorption of moisture and rainfall to percolate to the underlying soil.
   d. Preparation: The slurry preparation shall take place at the site of work and shall 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, full re-circulation shall be es

tablished and the seed added at that time. Fertilizer shall then be added, followed by the fiber mulch. The mulch shall be only added to the mixture after the seed and the tank is at least one-third (1/3) filled with water. All the mulch shall be added by the time the tank is two-thirds (2/3) to three-fourths (3/4) full. Spraying shall commence immediately when the tank if full.

e. Application: The operator shall spray with a uniform, visible coat of slurry by using the green color of the mulch as a guide. The slurry shall be applied in a sweeping motion, in an arched stream so as to fall like rain allowing the wood fibers to build on each other until a good coat is achieved and the material is spread at the required rate per acre.
f. Time Limit: All slurry mixtures which have not been applied within two hours after mixing shall be rejected and removed from the project and disposed of at the Contractor's expense.
g. Protection: Special care should be exercised by the Contractor in preventing any of the slurry being sprayed inside any reservoir basin or into drainage ditches and channels which may impede the free flow of rain or irrigation water. Any slurry spilled into restricted areas shall be immediately cleaned at the Contractor's expense, to the satisfaction of the Owner and Engineer.
h. Immediately following the application of hydromulch, the Contractor shall wash excess material from previously planted materials and architectural features. Care shall be exercised to avoid washing or eroding mulch materials from the area.
i. Equipment: Hydraulic equipment used for the application of the fertilizer, seed, and slurry of the prepared wood pulp shall have a built-in agitation system and operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing not less than 40 pounds of fiber mulch, plus a combined total of seven (7) pounds of fertilizer solids for each 100 gallons of water.
j. The slurry distribution lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic spray nozzles which will provide a continuous, non-fluctuating discharge. The slurry tank shall have a minimum capacity of 1500 gallons and shall be mounted on a traveling unit, either self-propelled or drawn by a separate unit, which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded.
k. The hydraulic equipment used for pesticide applications shall consist of a clean 150-gallon minimum capacity fiberglass tank with complete mechanical agitation. The pump volume shall be ten (10) gallons per minute while operating at a pressure of 100 pounds per square inch (p.s.i.). Distribution lines shall be large enough to carry the volume of water necessary for even chemical distribution. The spray nozzle must cover a 15-foot-wide swath, with a minimum output of five (5) gallons per minute (g.p.m.) at 80 p.s.i.

D. Watering: Provide an adequate supply of water at the site prior to and during planting of turf. Saturate hydromulch with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below grade. Refer to Section 3.05 for additional specifications.

3.9 CLEAN-UP

A. After all planting operations have been completed, remove all trash, excess soil, empty plant containers, rubbish, and all debris associated with this Contract from the site. All scars, ruts, trench settlement, or other marks in the ground caused by this work shall be repaired and the

ground left in a neat and orderly condition throughout the site. The Contractor shall pick up all trash, including surplus subgrade material and stone and goriegn matter, resulting from this work no less frequently than each Friday before leaving the site, once a week, or the last working day of each week. All trash shall be removed completely from the site.

B. Paved areas over which hauling operations have been conducted shall be kept clean. Promptly remove materials spilled on pavement. The Contractor shall leave the site area broom-clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition. All walks shall be left in a clean and safe condition.

C. Excess topsoil not required for lawns or planting shall be stockpiled on site for future use as directed by the Owner's representative.

D. Repair existing lawns damaged by operations under the contract. Repair shall include finish grading or sodding as required to match existing grade and lawn, and maintenance of repaired areas.

3.7 OBSERVATION SCHEDULE

A. The Contractor shall be responsible for notifying the Landscape Architect in advance for the following site visits, according to the time indicated:

1. Pre-job Conference - 7 days
2. Final grade review - 2 days
3. Soil Preparation and planting operations - 2 days
4. Pre-maintenance - 7 days
5. Final inspection - 7 days

B. When observations are conducted by someone other than the Landscape Architect, the Contractor shall show evidence, in writing, of when and by whom these observations were made.

C. NO site visits shall commence without all items noted in previous Observation Reports either completed or remedied unless such compliance has been waived by the Owner. Failure to accomplish punch list tasks or prepare adequately for desired inspections shall make the Contractor responsible for reimbursing the Landscape Architect at his current billing rates per hour, portal to portal (plus transportation costs) for the inconvenience. NO further inspections shall be scheduled until this charge has been paid and received.

3.8 GRASS MAINTENANCE

A. Maintain and establish grass by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable grass. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and irrigation to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
3. Irrigate according to the plant and seed mix requirements and avoid fixed schedules.
4. Water early in the mornings.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow Bermuda turf to a height of 1 inch (25 mm).

D. Turf Post fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer only after soils has been tested and deficiencies are present. that will provide actual nitrogen of at least 1 l b/1000 s q. ft. (0.45 k g/92.9 s q. m) Bermuda grass area. No fertilizers should be used on roadway seed mix.

3.9 HYDROMULCHED AREA MAINTENANCE

A. Maintain the seeded areas until Date of Substantial Completion for entire project.

1. Water daily to maintain adequate surface soil moisture for proper seed germination. Continue daily watering for not less than 30 days. Thereafter, apply water twice weekly as required to promote proper growth until acceptance.
2. Repair, rework, and re-seed all areas that have washed out, are eroded, or do not catch.
3. Coordinate mowing of grass seed mix with Owner.

3.10 SATISFACTORY

A. Installation shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Seed: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m).

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200

SECTION 329300

PLANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The scope of work includes all labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of plant (also known as "landscaping") complete as shown on the drawings and as specified herein.

B. This Section includes the following:

1. Soil preparation and planting mixes
2. Trees, shrubs, and groundcovers
3. Planting accessories
4. Landscape maintenance

C. Related Sections include the following:

1. Section 329100: “Soils”
2. Section 329200: “Turf and Grasses”

1.03 CONTRACT DOCUMENTS

A. Shall consist of specifications and general conditions and the construction drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.04 VERIFICATION

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities and shall immediately inform the Landscape Architect of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Landscape Architect.

B. In the case of a discrepancy in the plant quantities between the plan drawings and the plant call outs, list or plant schedule, the number of plants or square footage of the planting bed actually drawn on the plan drawings shall be deemed correct and prevail.

1.05 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.06 CHANGES IN THE WORK

A. The Landscape Architect may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.07 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with standard ball size for type and size of tree or shrub required, wrapped, tied, rigidly supported, and drum-laced, all as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated.

D. Boxed trees: A container root ball package made of wood in the shape of a four-sided box.

E. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

F. Defective plant: Any plant that fails to meet the plant quality requirement of this specification.

G. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

H. End of Warranty Final Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation work run concurrent with each other.

I. Field grown trees (B&B): Trees growing in field soil for at least 12 months prior to harvest.

J. Finish Grade: Elevation of finished surface of planting soil.

K. Healthy: Plants that are growing in a condition that expresses leaf size, crown density, color; and with annual growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site soil, drainage and weather conditions.

L. Kinked root: A root within the root package that bends more than 90 degrees.

M. Maintenance: Actions that preserve the health of plants after installation and as defined in this specification.

N. Maintenance period: The time period, as defined in this specification, which the Contractor is to provide maintenance.

O. Normal: the prevailing protocol of industry standard(s).

P. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

Q. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

R. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

S. Planting Area: Areas to be planted.

T. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

U. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

V. Reasonable and reasonably: When used in this specification relative to plant quality, it is intended to mean that the conditions cited will not affect the establishment or long term stability, health or growth of the plant. This specification recognizes that it is not possible to produce plants free of all defects, but that some accepted industry protocols and standards result in plants unacceptable to this project.

When reasonable or reasonably is used in relation to other issues such as weeds, diseased, insects, it shall mean at levels low enough that no treatment would be required when applying recognized Integrated Plant Management practices.

This specification recognizes that some decisions cannot be totally based on measured findings and that professional judgment is required. In cases of differing opinion, the Owner's Representative's expert shall determine when conditions are judged as reasonable.

W. Root ball: The mass of roots including any soil or substrate that is shipped with the tree within the root ball package.

X. Root ball package. The material that surrounds the root ball during shipping. The root package may include the material in which the plant was grown, or new packaging placed around the root ball for shipping.

Y. Root collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.

Z. Shrub: Woody plants with mature height approximately less than 15 feet.

AA. Spade harvested and transplanted: Field grown trees that are mechanically harvested and immediately transplanted to the final growing site without being removed from the digging machine.

BB. Stem: The trunk of the tree.

CC. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

DD. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

EE. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project.

FF. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

GG. Stem girdling root: Any root more than ¼ inch diameter currently touching the trunk, or with the potential to touch the trunk, above the root collar approximately tangent to the trunk circumference or circling the trunk. Roots shall be considered as Stem Girdling that have, or are likely to have in the future, root to trunk bark contact.

HH. Structural root: One of the largest roots emerging from the root collar.

II. Tree: Single and multi-stemmed plants with mature height approximately greater than 15 feet.

1.08 SUBMITTALS

A. See contract general conditions for policy and procedure related to submittals.

B. Submit all product submittals 3 weeks prior to installation of plantings.

C. Product data: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal eight weeks

before the installation of plants. Samples: Submit samples of each product and material where required by the specification to the Landscape Architect for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

D. Qualification Data: For Landscape Contractor. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

E. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
   1. Manufacturer's certified analysis of standard products.
   2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

F. Material Test Reports: Material Test Reports: For standardized ASTM D 5268 topsoil, existing native surface topsoil, existing in-place surface soil with compost and imported or manufactured topsoil.

G. Plant growers' certificates: Submit plant growers' certificates for all plants indicating that each meets the requirements of the specification, including the requirements of tree quality, to the Owner's Representative for approval. Provide submittal eight weeks before the installation of plants.

H. Samples: Submit samples of each product and material where required by the specification to the Owner's Representative for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

I. Plant sources: Submit sources of all plants as required by Article 1.11 – "Selection of Plants" to the Owner's Representative for approval.

J. Close out submittals: Submit to the Owner's Representative for approval.
   1. Plant maintenance data and requirements.

K. Installation plan submitted a minimum of 14 days prior to the scheduled installation. Plan should describe the methods, activities, materials and schedule to achieve installation of plants.

1.09 OBSERVATION OF THE WORK

A. The Landscape Architect may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.

B. The Landscape Architect shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Landscape Architect shall be afforded sufficient time to schedule visit to the site. Failure of the Landscape Architect to make field observations shall not relieve the Contractor from meeting all the requirements of

this specification.

1. SITE CONDITIONS PRIOR TO THE START OF PLANTING: review the soil and drainage conditions.
2. COMPLETION OF THE PLANT LAYOUT STAKING: Review of the plant layout.
3. PLANT QUALITY: Review of plant quality at the time of delivery and prior to installation. Review tree quality prior to unloading where possible, but in all cases prior to planting.
4. COMPLETION OF THE PLANTING: Review the completed planting.

1.10 QUALITY ASSURANCE

A. Contractor's Quality Assurance Responsibilities: The Contractor is solely responsible for quality control of the work.

B. Installer Qualifications: The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the work, including the handling and planting of large specimen trees in urban areas. The same firm shall install planting soil (where applicable) and plant material.

1. Installer Field Supervision: When any planting work is in progress, installer shall maintain, on site, a full-time supervisor who can communicate in English with the Owner's Representative.

2. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing plants and trees of the quality and scale of the proposed project, and can communicate in English with the Owner's Representative.

3. The installer's crew shall have a minimum of 3 years experienced in the installation of Planting Soil, Plantings, and Irrigation (where applicable) and interpretation of soil plans, planting plans and irrigation plans.

4. Submit references of past projects, employee training certifications that support that the Contractors meets all of the above installer qualifications and applicable licensures.

C. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

D. Soil Analysis: Furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of four (4) representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
2. Report suitability of tested soil for turf growth.

a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. Yd. (0.76 cu. M)

b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

3. Notify Landscape Architect of sources of planting materials minimum seven (10) days in advance of delivery to site.

1.11 SELECTION AND OBSERVATION OF PLANTS

A. The Landscape Architect may review all plants subject to approval of size, health, quality, character, etc. Review or approval of any plant during the process of selection, delivery, installation and establishment period shall not prevent that plant from later rejection in the event that the plant quality changes or previously existing defects become apparent that were not observed.

B. Plant Selection: The Landscape Architect reserves the right to select and observe all plants at the nursery prior to delivery and to reject plants that do not meet specifications as set forth in this specification. If a particular defect or substandard element can be corrected at the nursery, as determined by the Landscape Architect, the agreed upon remedy may be applied by the nursery or the Contractor provided that the correction allows the plant to meet the requirements set forth in this specification. Any work to correct plant defects shall be at the contractor's expense.
1. The Landscape Architect may make invasive observation of the plant's root system in the area of the root collar and the top of the root ball in general in order to determine that the plant meets the quality requirements for depth of the root collar and presence of roots above the root collar. Such observations will not harm the plant.
2. Corrections are to be undertaken at the nursery prior to shipping.

C. The Contractor shall bear all cost related to plant corrections.

D. All plants that are rejected shall be immediately removed from the site and acceptable replacement plants provided at no cost to the Owner.

E. Submit to the Landscape Architect, for approval, plant sources including the names and locations of nurseries proposed as sources of acceptable plants, and a list of the plants they will provide. The plant list shall include the botanical and common name and the size at the time of selection. Observe all nursery materials to determine that the materials meet the requirements of this section.

F. Trees shall be purchased from the growing nursery. Re-wholesale plant suppliers shall not be used as sources unless the Contractor can certify that the required trees are not directly available from a growing nursery. When Re-wholesale suppliers are utilized, the Contractor shall submit the name and location of the growing nursery from where the trees were obtained by the re-wholesale seller. The re-wholesale nursery shall be responsible for any required plant quality certifications.

G. The Contractor shall require the grower or re-wholesale supplier to permit the Landscape Architect to observe the root system of all plants at the nursery or job site prior to planting including random removal of soil or substrate around the base of the plant. Observation may be as frequent and as extensive as needed to verify that the plants meet the requirements of the specifications and conform to requirements.

H. Where requested by the Owner's Representative, submit photographs of plants or representative samples of plants. Photographs shall be legible and clearly depict the plant specimen. Each submitted image shall contain a height reference, such as a measuring stick. The approval of plants by the Landscape Architect via photograph does not preclude the Landscape Architect's right to reject material while on site.

1.12 PLANT SUBSTITUTIONS FOR PLANTS NOT AVAILABLE

A. Submit all requests for substitutions of plant species, or size to the Landscape Architect, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each de livery of bulk organic fertilizers, lime and soil amendments with appropriate certificates.

C. Deliver plants freshly dug. Do not prune trees and shrubs before delivery, except as approved by Landscape Architect. Protect bark, branches, and root systems from sunscald, drying, sweating, whipping, and other handling and tying damage. Do not bend or tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering during delivery.

D. Handle planting stock by root ball and do not drop during delivery.

E. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed for more than six hours after delivery, store plants as follows:

   1. Store plants in shade, protect from weather and damage, and keep roots moist.
   2. Set balled stock on ground and heel in with soil, mulch, or other acceptable material.

3. Do not remove container-grown stock from containers before time of planting.
4. Water roots of plants stored on-site. Water as necessary to maintain moist conditions.

1.14 SITE CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Landscape Architect, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.

1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Landscape Architect in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Landscape Architect of such conditions, he/she shall remain responsible for plant material under the warranty clause of the specifications.

B. It is the responsibility of the Contractor to be familiar with the local growing conditions, and if any specified plants will be in conflict with these conditions. Report any potential conflicts, in writing, to the Landscape Architect.

C. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

D. Interruption of Existing Services or Utilities: Do not interrupt services or utilities t o facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than three days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Construction Manager's or Owner's written permission.

E. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: between March 15 – May 1
2. Fall Planting: between August 15 – November 1

F. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

G. Coordination with Turf Areas (Lawns) and Seed Mix Areas: Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.15 WARRANTY

A. Special Warranty: Warrant exterior plants and workmanship, for the warranty period indicated, against defects, poor health, unsatisfactory growth, and death, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.

1. Warranty Period from date of Substantial Completion.
   a. Trees, Shrubs, Vines, and Ornamental Grasses: **twelve (12) months**.
   b. Ground Covers, Biennials, Perennials, and Other Plants: **twelve (12) months**.

2. Include the following remedial actions as a minimum:
   a. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
   b. At end of warranty period: Replace plants that are more than 25 percent dead or in an unhealthy condition.
   c. A limit of one replacement of each plant will be required, except for losses due to failure to comply with requirements.
   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.16 MAINTENANCE

A. Maintain landscaping by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: 60 days from date of substantial completion.

PART 2 - PRODUCTS

2.01 PLANTS: GENERAL

A. Standards and measurement: Provide plants of quantity, size, genus, species, and variety or cultivars as shown and scheduled in contract documents.

1. All plants including the root ball dimensions or container size to trunk caliper ratio shall conform to ANSI Z60.1 "American Standard for Nursery Stock" latest edition, unless modified by provisions in this specification. When there is a conflict between this specification and ANSI Z60.1, this specification section shall be considered correct.

2. Plants larger than specified may be used if acceptable to the Owner's Representative. Use of such plants shall not increase the contract price. If larger plants are accepted the root ball size shall be in accordance with ANSI Z-60.1. Larger plants may not be acceptable if the resulting root ball cannot be fit into the required planting space.

3. If a range of size is given, no plant shall be less than the minimum size and not less than 50 percent of the plants shall be as large as the maximum size specified. The measurements specified are the minimum and maximum size acceptable and are the measurements after pruning, where pruning is required.

B. Proper Identification: All trees shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by genus, species, variety and cultivar.

C. Compliance: All trees shall comply with federal and state laws and regulations requiring observation for plant disease, pests, and weeds. Observation certificates required by law shall accompany each shipment of plants.

D. Plant Quality:

1. General: Provide healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability and health for the expected life of the plant

2. Plant quality above the soil line:

a. Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified. Tree quality above the soil line shall comply with the project Crown Acceptance details and the following:

1) Crown: The form and density of the crown shall be typical for a young specimen of the species or cultivar pruned to a central and dominant leader.
   a) Crown specifications do not apply to plants that have been specifically trained in the nursery as topiary, espalier, multi-stem, clump, or unique selections such as contorted or weeping cultivars.
2) Leaves: The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress or over watering as indicated by wilted, shriveled, or dead leaves.
3) Branches: Shoot growth (length and diameter) throughout the crown should be appropriate for the age and size of the species or cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.
   a) Main branches shall be distributed along the central leader not clustered together. They shall form a balanced crown appropriate for the cultivar/species.
   b) Branch diameter shall be no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 1 inch above the branch union.
   c) The attachment of the largest branches (scaffold branches) shall be free of included bark.
4) Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds that penetrate to the wood (properly made pruning cuts, closed or not, are acceptable and are not considered wounds), sunburned areas, conks

(fungal fruiting bodies), wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties, or lesions (mechanical injury).

b. All graft unions, where applicable, shall be completely closed without visible sign of graft rejection. All grafts shall be visible above the soil line.

c. Trunk caliper and taper shall be sufficient so that the lower five feet of the trunk remains vertical without a stake. Auxiliary stake may be used to maintain a straight leader in the upper half of the tree.

3. Plant quality at or below the soil line:
   a. Plant roots shall be normal to the plant type specified. Root observations shall take place without impacting tree health. Root quality at or below the soil line shall comply with the project Root Acceptance details and the following:

      1) The roots shall be reasonably free of scrapes, broken or split wood.
      2) The root system shall be reasonably free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Wounds resulting from root pruning used to produce a high quality root system are not considered injuries.
      3) A minimum of three structural roots reasonably distributed around the trunk (not clustered on one side) shall be found in each plant. Root distribution shall be uniform throughout the root ball, and growth shall be appropriate for the species.
         a) Plants with structural roots on only one side of the trunk (J roots) shall be rejected.
      4) The root collar shall be exposed.
      5) Two structural roots shall reach the side of the root ball near the top surface of the root ball. The grower may request a modification to this requirement for species with roots that rapidly descend, provided that the grower removes all stem girdling roots above the structural roots across the top of the root ball.
      6) The root system shall be reasonably free of stem girdling roots over the root collar or kinked roots from nursery production practices.
         a) Plant Grower Certification: The final plant grower shall be responsible to have determined that the plants have been root pruned at each step in the plant production process to remove stem girdling roots and kinked roots, or that the previous production system used practices that produce a root system throughout the root ball that meets these specifications. Regardless of the work of previous growers, the plant's root system shall be modified at the final production stage, if needed, to produce the required plant root quality. The final grower shall certify in writing that all plants are reasonably free of stem girdling and kinked roots as defined in this specification, and that the tree has been grown and harvested to produce a plant that meets these specifications.
      7) At time of observations and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

E. Submittals: Submit for approval the required plant quality certifications from the grower where plants are to be purchased, for each plant type. The certification must state that each plant meets all the above plant quality requirements.

1. The grower's certification of plant quality does not prohibit the Owner's Representative from observing any plant or rejecting the plant if it is found to not meet the specification requirements.

2.02 ROOT BALL PACKAGE OPTIONS:

The following root ball packages are permitted. Specific root ball packages shall be required where indicated on the plant list or in this specification. Any type of root ball packages that is not specifically defined in this specification shall not be permitted.

A. BALLED AND BURLAPPED PLANTS

1. All Balled and Burlapped Plants shall be field grown, and the root ball packaged in a burlap and twine and/or burlap and wire basket package.

2. Plants shall be harvested with the following modifications to standard nursery practices.

a. Prior to digging any tree that fails to meet the requirement for maximum soil and roots above the root collar, carefully removed the soil from the top of the root ball of each plant, using hand tools, water or an air spade, to locate the root collar and attain the soil depth over the structural roots requirements. Remove all stem girdling roots above the root collar. Care must be exercised not to damage the surface of the root collar and the top of the structural roots.

b. Trees shall be dug for a minimum of 4 weeks and a maximum of 52 weeks prior to shipping. Trees dug 4 to 52 weeks prior to shipping are defined as hardened-off. Digging is defined as cutting all roots and lifting the tree out of the ground and either moving it to a new location in the nursery or placing it back into the same hole. Tress that are stored out of the ground shall be placed in a holding area protected from extremes of wind and sun with the root ball protected by covering with mulch or straw and irrigated sufficiently to keep moisture in the root ball above wilt point and below saturation.

c. Twine and burlap used for wrapping the root ball package shall be natural, biodegradable material. If the burlap decomposes after digging the tree, then the root ball shall be re-wrapped prior to shipping if roots have not yet grown to keep root ball intact during shipping.

B. SPADE HARVESTED AND TRANSPLANTED

1. Spade Harvested and Transplanted Plants shall meet all the requirements for field grown trees. Root ball diameters shall be of similar size as the ANSI Z60.1 requirements for Balled and Burlapped plants.

2. Trees shall be harvested prior to leafing out (bud break) in the spring or during the fall planting period except for plants know to be considered as fall planting hazards. Plants

that are fall planting hazards shall only be harvested prior to leafing out in the spring.

3. Trees shall be moved and planted within 48 hours of the initial harvesting and shall remain in the spade machine until planted.

C. CONTAINER (INCLUDING ABOVE-GROUND FABRIC CONTAINERS AND BOXES) PLANTS

1. Container plants may be permitted only when indicated on the drawing, in this specification, or approved by the Owner's Representative.

2. Provide plants shall be established and well rooted in removable containers.

3. Container class size shall conform to ANSI Z60.1 for container plants for each size and type of plant.

2.03 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

1. Class: T, with a minimum of 99 percent passing through No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
2. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve. Iron Sulfate: Granulated ferrous sulfate containing min. of 20 percent iron and 10 percent sulfur.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 1 0 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.04 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. Organic matter content 50 to 60 percent of dry weight.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 l b/cu. F t. (2.4 k g/cu. M) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. Ft. (4 kg/cu. M) of loose sawdust or ground bark.

2.05 FERTILIZER

Fertilizers should only be used if the specific plant species requires it. Prior to amending the soil, Contractor shall test for deficiencies.

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram tablets.
2. Nutrient Composition: 2 0 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

F. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody pl ants, and commercial- grade FeDTPA for ornamental grasses and monocots.

2.06 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of:

1. Type: Native Shredded hardwood mulch; and as follows:
    a. From recycled fresh green tree and brush material.
    b. Biolobical based mulch.

2.07 PLANTING SOILS

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of **6** percent organic material content. All topsoil, regardless of source, shall be fertile, friable, natural loam surface soil free of subsoil, clay lumps, brush, weeds, weed seed, litter, roots, stumps, stones larger than one (1) inch in any dimension and any other extraneous or toxic matter harmful to human, animal, or plant life. Contractor shall provide required sample and soil analysis to Landscape Architect prior to delivery of any soil materials to site.

1. Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets o f coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix surface soil with the following soil amendments and organic fertilizers- as applicable – in the following quantities to produce planting soil.

    a. Ratio of Loose Compost to Surface Soil by Volume: 1:4
    b. Ratio of Loose Wood Derivatives to Surface Soil by Volume: 1:4

2. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources only after all existing soils for reuse has been consumed. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep and within 100 miles of the project site; soil characteristics need to match the project site; do not obtain from greenfields, agricultural land, bogs, or marshes.

    a. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch (25 mm) or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, pl aster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nut sedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes; grubs; or other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled pore space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

b. Mix imported topsoil or manufactured topsoil with the following soil amendments and organic fertilizers in the following quantities to produce planting soil:

1) Ratio of Loose Compost to Topsoil by Volume: 1:4 or until achieved desired results
2) Ratio of Loose Wood Derivatives to Topsoil by Volume: 1:4

2.08 TREE STABILIZATION MATERIALS

A. Stakes and Guys:
1. Upright and Guy Stakes: Rough-sawn, sound, new metal "T-post" stakes, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
2. Wood Deadmen: Timbers measuring 8 inches (200 mm) in diameter and 48 inches (1200 mm) long, treated with specified wood pressure-preservative treatment.
3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.
4. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch (2.7 mm) in diameter.
5. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
6. Guy Cables: Five-strand, 3/16-inch- (4.8-mm-) diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches (75 mm) long, with two 3/8-inch (10-mm) galvanized eyebolts.
7. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.
8. Proprietary Staking-and-Guying Devices: Proprietary stake and adjustable tie systems to secure each new planting by plant stem; sized as indicated and per manufacturer's written recommendations.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Arborbrace; ArborBrace Tree Guying System.
2) Or approved equal

B. Root-Ball Stabilization Materials:
1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38- by-38-mm actual) by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.
3. Proprietary Root-Ball Stabilization Devices: Proprietary at-or below-grade stabilization systems to secure each new planting by rootball; sized per manufacturer's written recommendations unless otherwise indicated.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Border Concepts, Inc.; Tomahawk Tree Stabilizers.
2) Foresight Products, LLC; Duckbill Rootball Fixing System.
3) Tree Staple, Inc.; Tree Staples.

4) Tree Stake Solutions, Root Anchor.
5) Approved equal.

2.09 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

C. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.

D. Planter Filter Fabric: Woven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

E. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

2.10 WATERING BAGS

A. Plastic tree watering bags holding a minimum of 15 gallons of water and with a slow drip hole(s) water release system, specifically designed to water establishing trees. Water should release over a several day period, not within a few hours

B. Watering bags shall be:
1. Treegator Irrigation Bags sized to the appropriate model for the requirements of the plant, manufactured by Spectrum Products, Inc., Youngsville, NC 27596.
2. Or approved equal.

C. Submit manufacturer's product data for approval.

PART 3 - EXECUTION

3.01 SITE EXAMINATION

A. Examine the surface grades and soil conditions to confirm that the requirements of the Specification Section – Planting Soil – and the soil and drainage modifications indicated on the Planting Soil Plan and Details (if applicable) have been completed. Notify the Owner's Representative in writing of any unsatisfactory conditions.

3.02 DELIVERY, STORAGE AND HANDLING

A. Protect materials from deterioration during delivery and storage. Adequately protect plants from drying out, exposure of roots to sun, wind or extremes of heat and cold temperatures. If planting is delayed more than 24 hours after delivery, set plants in a location protected from sun and wind. Provide adequate water to the root ball package during the shipping and storage period.

1. All plant materials must be available for observation prior to planting.
2. Using a soil moisture meter, periodically check the soil moisture in the root balls of all plants to assure that the plants are being adequately watered. Volumetric soil moisture shall be maintained above wilting point and below field capacity for the root ball substrate or soil.

B. Do not deliver more plants to the site than there is space with adequate storage conditions. Provide a suitable remote staging area for plants and other supplies.

1. The Owner's Representative or Contractor shall approve the duration, method and location of storage of plants.

C. Provide protective covering over all plants during transporting.

3.03 PLANTING SEASON

A. Planting shall only be performed when weather and soil conditions are suitable for planting the materials specified in accordance with locally accepted practices.

B. No planting shall take place during extremely hot, dry, windy or freezing weather.

3.04 COORDINATION WITH PROJECT WORK

A. The Contractor shall coordinate with all other work that may impact the completion of the work.

B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.

C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.05 LAYOUT AND PLANTING SEQUENCE

A. Relative positions of all plants and trees are subject to approval of the Owner's Representative.

B. Notify the Owner's Representative, one (1) week prior to layout. Layout all individual tree and shrub locations. Place plants above surface at planting location or place a labeled stake at planting location. Layout bed lines with paint for the Owner's Representative's approval. Secure the Owner's Representative's acceptance before digging and start of planting work.

C. When applicable, plant trees before other plants are installed.

D. It is understood that plants are not precise objects and that minor adjustments in the layout will be required as the planting plan is constructed. These adjustments may not be apparent until some or all of the plants are installed. Make adjustments as required by the Owner's Representative including relocating previously installed plants.

3.06 SOIL PROTECTION DURING PLANT DELIVERY AND INSTALLATION

A. Protect soil from compaction during the delivery of plants to the planting locations, digging of planting holes and installing plants.

1. Where possible deliver and plant trees that require the use of heavy mechanized equipment prior to final soil preparation and tilling. Where possible, restrict the driving lanes to one area instead of driving over and compacting a large area of soil.

3.07 SOIL MOISTURE

A. Volumetric soil moisture level, in both the planting soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilting point and below field capacity for each type of soil texture within the following ranges.

B.

Soil type	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

1. Volumetric soil moisture shall be measured with a digital moisture meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent.

C. The Contractor shall confirm the soil moisture levels with a moisture meter. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.08 INSTALLATION OF PLANTS: GENERAL

A. Observe each plant after delivery and prior to installation for damage of other characteristics that may cause rejection of the plant. Notify the Owner's Representative of any condition observed.

B. No more plants shall be distributed about the planting bed area than can be planted and watered on the same day.

C. The root system of each plant, regardless of root ball package type, shall be observed by the Contractor, at the time of planting to confirm that the roots meet the requirements for plant root quality in Part 2 Products: Plants General: Plant Quality. The Contractor shall undertake at the time of planting, all modifications to the root system required by the Owner's Representative to meet these quality standards.

1. Modifications, at the time of planting, to meet the specifications for the depth of the root collar and removal of stem girdling roots and circling roots may make the plant unstable or stress the plant to the point that the Owner's Representative may choose to reject the plant rather than permitting the modification.
2. Any modifications required by the Owner's Representative to make the root system conform to the plant quality standards outlined in Part 2 Products: Plants General: Quality, or other requirements related to the permitted root ball package, shall not be considered as grounds to modify or void the plant warranty.
3. The resulting root ball may need additional staking and water after planting. The Owner's Representative may reject the plant if the root modification process makes the tree unstable or if the tree is not healthy at the end of the warranty period. Such plants shall still be covered under the warranty
4. The Contractor remains responsible to confirm that the grower has made all required root modifications noted during any nursery observations.

D. Container and Boxed Root Ball Shaving: The outer surfaces of ALL plants in containers and boxes, including the top, sides and bottom of the root ball shall be shaved to remove all circling, descending, and matted roots. Shaving shall be performed using saws, knives, sharp shovels or other suitable equipment that is capable of making clean cuts on the roots. Shaving shall remove a minimum of one inch of root mat or up to 2 inches as required to remove all root segments that are not growing reasonably radial to the trunk.

E. Exposed Stem Tissue after Modification: The required root ball modifications may result in stem tissue that has not formed trunk bark being exposed above the soil line. If such condition occurs, wrap the exposed portion of the stem in a protective wrapping with a white filter fabric. Secure the fabric with biodegradable masking tape. DO NOT USE string, twine, green nursery ties or any other material that may girdle the trunk if not removed.

F. Excavation of the Planting Space: Using hand tools or tracked mini-excavator, excavate the planting hole into the Planting Soil to the depth of the root ball measured after any root ball modification to correct root problems, and wide enough for working room around the root ball or to the size indicated on the drawing or as noted below.

1. For trees and shrubs planted in soil areas that are NOT tilled or otherwise modified to a depth of at least 12 inches over a distance of more than 10 feet radius from each tree, or 5 feet radius from each shrub, the soil around the root ball shall be loosened as defined below or as indicated on the drawings.

    a. The area of loosening shall be a minimum of 3 times the diameter of the root ball at the surface sloping to 2 times the diameter of the root ball at the depth of the root ball.

    b. Loosening is defined as digging into the soil and turning the soil to reduce the compaction. The soil does not have to be removed from the hole, just dug, lifted

and turned. Lifting and turning may be accomplished with a tracked mini excavator, or hand shovels.

2. The measuring point for root ball depth shall be the average height of the outer edge of the root ball after any required root ball modification.

3. If motorized equipment is used to deliver plants to the planting area over exposed planting beds or used to loosen the soil or dig the planting holes, all soil that has been driven over shall be tilled to a depth of 6 inches.

G. For trees to be planted in prepared Planting Soil that is deeper than the root ball depth, compact the soil under the root ball using a mechanical tamper to assure a firm bedding for the root ball. If there is more than 12 inches of planting soil under the root ball excavate and tamp the planting soil in lifts not to exceed 12 inches.

H. Set top outer edge of the root ball at the average elevation of the proposed finish. Set the plant plumb and upright in the center of the planting hole. The tree graft, if applicable, shall be visible above the grade. Do not place soil on top of the root ball.

I. The Owner's Representative may request that plants orientation be rotated when planted based on the form of the plant.

J. Backfill the space around the root ball with the same planting soil or existing soil that was excavated for the planting space. See Specification Section Planting Soil, for requirements to modify the soil within the planting bed.

K. Brace root ball by tamping Planting Soil around the lower portion of the root ball. Place additional Planting Soil around base and sides of ball in six-inch (6") lifts. Lightly tamp each lift using foot pressure or hand tools to settle backfill, support the tree and eliminate voids. DO NOT over compact the backfill or use mechanical or pneumatic tamping equipment. Over compaction shall be defined as greater than 85% of maximum dry density, standard proctor or greater than 250 psi as measured by a cone penetrometer when the volumetric soil moisture is lower than field capacity.

1. When the planting hole has been backfilled to three quarters of its depth, water shall be poured around the root ball and allowed to soak into the soil to settle the soil. Do not flood the planting space. If the soil is above field capacity, allow the soil to drain to below field capacity before finishing the planting. Air pockets shall be eliminated and backfill continued until the planting soil is brought to grade level.

L. Where indicated on the drawings, build a 2 inch high, level berm of Planting Soil around the outside of the root ball to retain water. Tamp the berm to reduce leaking and erosion of the saucer.

M. Thoroughly water the Planting Soil and root ball immediately after planting.

N. Remove all nursery plant identification tags and ribbons as per Owner's Representative instructions. The Owner's Representative's seals are to remain on plants until the end of the warranty period.

O. Remove corrugated cardboard trunk protection after planting.

P. Follow additional requirements for the permitted root ball packages.

3.09 PERMITTED ROOT BALL PACKAGES AND SPECIAL PLANTING REQUIREMENTS

A. The following are permitted root ball packages and special planting requirements that shall be followed during the planting process in addition to the above General planting requirements.

B. BALLED AND BURLAPPED PLANTS
1. After the root ball has been backfilled, remove all twine and burlap from the top of the root ball. Cut the burlap away and remove; do not fold down onto the Planting Soil.
2. Earth root balls shall be kept intact except for any modifications required by the Owner's Representative to make root package comply with the requirement in Part 2 Products.

C. SPADE HARVESTED AND TRANSPLANTED PLANTS
1. After installing the tree, loosen the soil along the seam between the root ball and the surrounding soil out to a radius from the root ball edge equal to the diameter of the root ball to a depth of 8 – 10 inches by hand digging to disturb the soil interface.
2. Fill any gaps below this level with loose soil.

D. CONTAINER (INCLUDES BOXED AND ABOVE-GROUND FABRIC CONTAINERS) PLANTS
1. This specification assumes that most container plants have significant stem girdling and circling roots, and that the root collar is too low in the root ball.
2. Remove the container.
3. Perform root ball shaving as defined in Installation of Plants: General above.
4. Remove all roots and substrate above the root collar and the main structural roots according to root correction details so root system conforms to root observations detail.
5. Remove all substrate at the bottom of the root ball that does not contain roots.
6. Using a hose, power washer or air excavation device, wash out the substrate from around the trunk and top of the remaining root ball and find and remove all stem girdling roots within the root ball above the top of the structural roots.

3.10 GROUND COVER, PERENNIAL AND ANNUAL PLANTS

A. Assure that soil moisture is within the required levels prior to planting. Irrigation, if required, shall be applied at least 12 hours prior to planting to avoid planting in muddy soils.

B. Assure that soil grades in the beds are smooth and as shown on the plans.

C. Plants shall be planted in even, triangularly spaced rows, at the intervals called out for on the drawings, unless otherwise noted. The first row of Annual flower plants shall be 6 inches from the bed edge unless otherwise directed.

D. Dig planting holes sufficiently large enough to insert the root system without deforming the roots. Set the top of the root system at the grade of the soil.

E. Schedule the planting to occur prior to application of the mulch. If the bed is already mulched, pull the mulch from around the hole and plant into the soil. Do not plant the root system in the mulch. Pull mulch back so it is not on the root ball surface.

F. Press soil to bring the root system in contact with the soil.

G. Spread any excess soil around in the spaces between plants.

H. Apply mulch to the bed being sure not to cover the tops of the plants with or the tops of the root ball with mulch.

I. Water each planting area as soon as the planting is completed. Apply additional water to keep the soil moisture at the required levels. Do not over water.

3.11 STAKING AND GUYING

A. Trees that are guyed shall have their guys and stakes removed after one full growing season or at other times as required by the Owner's Representative.

B. Tree guying shall utilize the tree staking and guying materials specified. Guying to be tied in such a manner as to create a minimum 12-inch loop to prevent girdling. Refer to manufacturer's recommendations and the planting detail for installation.
   1. Plants shall stand plumb after staking or guying.
   2. Stakes shall be driven to sufficient depth to hold the tree rigid.

C. For trees planted in planting mix over waterproofed membrane, use dead men buried 24 inches to the top of the dead man, in the soil. Tie the guy to the dead man with a double wrap of line around the dead man followed by a double half hitch. When guys are removed, leave the dead men in place and cut the guy tape 12 inches above the ground, leaving the tape end covered in mulch.

3.12 STRAIGHTENING PLANTS

A. Maintain all plants in a plumb position throughout the warranty period. Straighten all trees that move out of plumb including those not staked. Plants to be straightened shall be excavated and the root ball moved to a plumb position, and then re-backfilled.

B. Do not straighten plants by pulling the trunk with guys.

3.13 INSTALLATION OF FERTILIZER AND OTHER CHEMICAL ADDITIVES

A. Do not apply any soluble fertilizer to plantings during the first year after transplanting unless soil test determines that fertilizer or other chemical additives is required. Apply chemical additives only upon the approval of the Owner's Representative.

B. Controlled release fertilizers shall be applied according to the manufacturer's instructions and standard horticultural practices.

3.14 PRUNING OF TREES AND SHRUBS

A. Prune plants as directed by the Owner's Representative. Pruning trees shall be limited to addressing structural defects as shown in details; follow recommendations in "Structural Pruning: A Guide For The Green Industry" published by Urban Tree Foundation, Visalia CA.

B. All pruning shall be performed by a person experienced in structural tree pruning.

C. Except for plants specified as multi-stemmed or as otherwise instructed by the Owner's Representative, preserve or create a central leader.

D. Pruning of large trees shall be done using pole pruners or if needed, from a ladder or hydraulic lift to gain access to the top of the tree. Do not climb in newly planted trees. Small trees can be structurally pruned by laying them over before planting. Pruning may also be performed at the nursery prior to shipping.

E. Remove and replace excessively pruned or malformed stock resulting from improper pruning that occurred in the nursery or after.

F. Pruning shall be done with clean, sharp tools.

G. No tree paint or sealants shall be used.

3.15 MULCHING OF PLANTS

A. Apply 2 inches of mulch before settlement, covering the entire planting bed area. Install no more than 1 inch of mulch over the top of the root balls of all plants. Taper to 2 inches when abutting pavement.

B. For trees planted in lawn areas the mulch shall extend to a 5 foot radius around the tree or to the extent indicated on the plans.

C. Lift all leaves, low hanging stems and other green portions of small plants out of the mulch if covered.

3.16 PLANTING BED FINISHING

A. After planting, smooth out all grades between plants before mulching.

B. Separate the edges of planting beds and lawn areas with a smooth, formed edge cut into the turf with the bed mulch level slightly lower, 1 and 2 inches, than the adjacent turf sod or as directed by the Owner's Representative. Bed edge lines shall be a depicted on the drawings.

3.17 WATERING

A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants from the point of installation until the date of Substantial Completion Acceptance. The

Contractor shall adjust the automatic irrigation system, if available, and apply additional or adjust for less water using hoses as required.

B. Hand water root balls of all plants to assure that the root balls have moisture above wilt point and below field capacity. Test the moisture content in each root ball and the soil outside the root ball to determine the water content.

C. The Contractor shall install 25 gallon watering bag for each tree to be maintained and used for tree watering during the warranty period.

1. The watering bags shall remain the property of the Owner at the completion of the work.
2. Contractor shall be responsible for re-filling watering bags during construction and maintenance period.

3.18 CLEAN-UP

A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.

1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative's seals are to remain on the trees and removed at the end of the warranty period.

C. Make all repairs to grades, ruts, and damage by the plant installer to the work or other work at the site.

D. Remove and dispose of all excess planting soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.19 PROTECTION DURING CONSTRUCTION

A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers. Maintain protection during installation until Substantial Completion Acceptance. Treat, repair or replace damaged work immediately.

B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including roots, trunk or branches of large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory.

3.20 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION ACCEPTANCE

A. During the project work period and prior to Substantial Completion Acceptance, the Contractor shall maintain all plants.

B. Maintenance during the period prior to Substantial Completion Acceptance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, repairing and replacing of damaged tree wrap material, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings reasonably free of damaging insects and disease, and in healthy condition. The threshold for applying insecticides and herbicide shall follow established Integrated Pest Management (IPM) procedures. Mulch areas shall be kept reasonably free of weeds, grass.

3.21 SUBSTANTIAL COMPLETION ACCEPTANCE

A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.

1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.

B. The date of substantial completion of the planting shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

C. The Plant Warranty period begins at date of written notification of substantial completion from the Owner's Representative. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

3.22 CLEANUP AND PROTECTION

A. During planting operations, keep adjacent paving and construction clean and work area in an orderly condition on a daily basis. Thoroughly clean any surface marred or stained by installation activities. Protect plants from damage due to landscape operations. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged planting. Remove excess materials, debris, and equipment from site.

3.23 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

3.24 MAINTENANCE DURING THE WARRANTY PERIOD

A. During the warranty period, provide all maintenance for all plantings to keep the plants in a healthy state and the planting areas clean and neat.

B. General requirements:

1. All work shall be undertaken by trained, uniformed landscape maintenance crews under the supervision of a foreman with a minimum of 5 years experience supervising commercial plant maintenance crews.

2. All chemical and fertilizer applications shall be made by licensed applicators for the type of chemicals to be used. All work and chemical use shall comply with all applicable local, provincial and federal requirements.

3. Assure that hoses and watering equipment and other maintenance equipment does not block paths or be placed in a manner that may create tripping hazards. Use standard safety warning barriers and other procedures to maintain the site in a safe manner for visitors at all times.

4. All workers shall wear required safety equipment and apparel appropriate for the tasks being undertaken.

5. The Contractor shall not store maintenance equipment at the site at times when they are not in use unless authorized in writing by the Owner's Representative.

6. Maintenance vehicles shall not park on the site including walks and lawn areas at any time without the Owner's Representative's written permission.

7. Maintain a detailed log of all maintenance activities including types of tasks, date of task, types and quantities of materials and products used, watering times and amounts, and number of each crew. Periodically review the logs with the Owner's Representative, and submit a copy of the logs at the end of each year of the maintenance agreement.

8. Meet with the Owner's Representative a minimum of three times a year to review the progress and discuss any changes that are needed in the maintenance program. At the end of the warranty period attend a hand over meeting to formally transfer the responsibilities of maintenance to the Owner's Representative. Provide all information on past maintenance activities and provide a list of critical tasks that will be needed over the next 12 months. Provide all maintenance logs and soil test data. Make the Contractor's supervisor available for a minimum of one year after the end of the warranty period to answer questions about past maintenance.

C. Provide the following maintenance tasks:

1. Watering; Owner will provide all water required. Contractor is to manage the distribution of water to keep soil within and around the root balls at optimum moisture content for plant growth.
   a. Maintain all watering systems and equipment and keep them operational.
   b. Monitor soil moisture to provide sufficient water. Check soil moisture and root ball moisture with a soil moisture meter on a regular basis and record moisture readings. Do not over water.
   c. Make seasonal adjustments to irrigation program as necessary to maintain healthy plants.

2. Soil nutrient levels: Take a minimum of 4 soil samples from around the site in the spring and fall and have them tested by an accredited agricultural soil testing lab for chemical composition of plant required nutrients, pH, salt and % organic matter. Test results shall include laboratory recommendations for nutrient applications. Apply fertilizers at rates recommended by the soil test.
    a. Make any other soil test and/or plant tissue test that may be indicated by plant conditions that may not be related to soil nutrient levels such as soil contaminated by other chemicals or lack of chemical uptake by the plant.

3. Plant pruning: Remove cross over branching, shorten or remove developing co dominant leaders, dead wood and winter-damaged branches. Unless directed by the Owner's Representative, do not shear plants or make heading cuts.

4. Restore plants: Reset any plants that have settled or are leaning as soon as the condition is noticed.

5. Guying and staking: Maintain plant guys in a taught position. Remove tree guys and staking after the first full growing season unless directed by Owner's Representative.

6. Weed control: Keep all beds free of weeds. Hand-remove all weeds and any plants that do not appear on the planting plan. Chemical weed control is permitted only with the approval of the Owner's Representative. Schedule weeding as needed but not less 12 times per year.

7. Trash removal: Remove all trash and debris from all planting beds and maintain the beds in a neat and tidy appearance. The number of trash and debris removal visits shall be no less than 12 times per year and may coincide with other maintenance visits.

8. Plant pest control: Maintain disease, insects and other pests at manageable levels. Manageable levels shall be defined as damage to plants that may be noticeable to a professional but not to the average person. Use least invasive methods to control plant disease and insect outbreaks.
    a. Submit product information and recommendations to Owners Representative for approval at least 48 hours in advance.
    b. Contractor to use a licensed chemical applicator.

9. Plant replacement: Replace all plants that are defective as defined in the warranty provisions, as soon as the plant decline is obvious and in suitable weather and season for planting as outlined in above sections. Plants that become defective during the maintenance period shall be covered and replaced under the warranty provisions.

10. Mulch: Refresh mulch once a year to maintain complete coverage but do not over mulch. At no time shall the overall mulch thickness be greater than 2 inches. Do not apply mulch within 6 inches of the trunks or stems of any plants. Replacement mulch shall meet the requirements of the original approved material. Mulch shall be no more than one inch on top of the root ball surface.

11. Leaf, fruit and other plant debris removal: Remove fall leaf, spent flowers, fruit and plant part accumulations from beds and paved surfaces. Maintain all surface water drains free of debris. Debris removal shall be undertaken at each visit to weed or pick up trash in

beds.

12. Damage from site use: Repair of damage by site visitors and events, beyond normal wear, are not part of this maintenance. The Owner's Representative may request that the Contractor repair damage beds or plantings for an additional cost. All additional work shall be approved in advance by the Owner's Representative.

3.25 END OF WARRANTY FINAL ACCEPTANCE / MAINTENANCE OBSERVATION

A. At the end of the Warranty and Maintenance period the Owner's Representative shall observe the work and establish that all provisions of the contract are complete and the work is satisfactory.

1. If the work is satisfactory, the maintenance period will end on the date of the final observation.
2. If the work is deemed unsatisfactory, the maintenance period will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Owner's Representative.

B. FAILURE TO PASS OBSERVATION: If the work fails to pass final observation, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owners Representative.

END OF SECTION 329300

TECHNICAL SPECIFICATIONS FOR CONSTRUCTION

SECTION 1: NOTICE OF SITE WORK

NOTICE:

1. The Proposers shall make themselves familiar with the General Conditions and the Special Conditions as they are part of SECTIONS.

2. The work under these Sections consist of furnishing all labor, materials and equipment required to completely execute the excavation, grading, aggregate base, subsurface drainage, channel drain, synthetic grass surface in areas designated, bituminous paving, seeding, concrete work, general clean up and all work herein stated.

3. The Proposers shall visit the site before submitting proposals and fully inform themselves as to the job and site conditions and other conditions under which the work of this section must be conducted. Verify themselves with the soil conditions at the site and familiarize themselves with the existing conditions that may be adjusted for this project. Submission of proposals implies that the Proposer has visited the site and is fully aware of these conditions.

4. A pre-construction conference shall be held on the job site with all intended Sub-contractors prior to the start of any work.

5. Site limits are as shown on the drawings.

SURVEY REQUIREMENTS:

1. The Contractor shall provide all survey work required to locate lines and grades for the construction of this project as herein specified and shown on drawings. The Contractor shall employ a competent engineer or surveyor for this layout.

2. The Contractor upon entering the site and before any other work is underway, shall establish and set control points as indicated on the drawings and verify all finish grades.

3. Existing survey as shown on the drawings is for information only and accurate at time taken. Contractor shall verify field conditions and notify the Owner of any discrepancies found in the survey or site conditions.

4. The Contractor shall provide a complete "as built" survey of the site within the site limits, noting all grades, locations, etc.

1. All work under this section shall be coordinated with the Owner so as to verify their understanding of the plans and intended layout.

END OF SECTION 1: NOTICE

SECTION 2: SITE GRADING, EXCAVATION AND BACKFILL

I. GENERAL

A. Work Included;

1. Remove topsoil and stock pile on site until removal operation.
   Removal of all irrigation systems and cap.
2. Excavate and compact sub-soil to grades, contours and levels, as shown on drawings.
3. Excavate grade and compact subgrade for synthetic area and new track areas, landscaped areas, play areas, additional areas, culver ditch drain and storm system.
4. Respread topsoil and fine grade in the areas outside the playing area where the existing conditions have been altered.
5. Blend topsoil/sand medium for repairs to playfield.
6. Repair playfield area within playing area including sub-drainage system.

B. Related Work

1. Unknown ground surface and aerial utility lines, and buried objects are indicated on the drawings.
2. Existing topographical survey was obtained from a survey furnished by the Contractor.
3. The Contractor will, upon becoming aware of subsurface of latent physical changed conditions differing from those directly disclosed by the original soil investigation work, promptly notify the Owner verbally to permit verification of the conditions, and in writing, as to the nature and extent of the differing conditions. No claim by the Contractor. for any conditions differing from those anticipated in the plans and specifications and disclosed by the soil studies will be allowed, unless the Contractor has so notified the Owner, verbally and in writing, as required above, of such changed conditions.

D. Protection

1. Protect trees, shrubs and lawns and other features remaining as part of completed site work.
2. Protect bench marks, and existing structures, fences, roads, sidewalks, paving and curbs against damage from equipment and vehicular traffic.
3. Protect aerial, surface, or underground utility lines or appurtenances which are to remain.
4. Repair damage to items requiring protection, at no cost to the Owner.

II. PRODUCTS

Materials

A. Excavated fill material: On-site, soil free from roots, rocks larger than 3", and building debris.

B. Additional fill material: Soil gradation and quality equal to State of Arkansas Class 2. Additional fill material, if required, shall be included in base RFP and no extra compensation will be made.

III. EXECUTION

A. Preparation

1. Establish and identify required lines, levels, contours and datum.
2. Maintain bench marks, monuments, and other reference points. Re-establish same if disturbed or destroyed, at no cost to the Owner.
3. Before start of grading, establish the location and extent of utilities in the work areas. Notify utilities to remove and relocate lines which interfere with construction.
4. Maintain, protect, reroute or extend as required existing utilities to remain which pass through work areas.
5. Pay costs for the above work, except those covered by utility companies.
6. Protect utility services uncovered during excavation.
7. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.
8. Accurately locate and record abandoned and active utility lines rerouted or extended, on Project Record Documents.

B. Removal of Topsoil

1. Remove topsoil of horticulture value from areas to be excavated, paved and regraded. Stockpile in areas approved by the Owner.
2. Do not permit topsoil to be mixed with subsoil.
3. Do not stockpile topsoil when wet.
4. Do not stockpile topsoil to depths exceeding 12 feet.
5. Remove all unused topsoil and dispose of this material legally off-site at no additional cost to the Owner.

C. Rough Grading

Rough grade site to the required subgrade levels, profiles, contours and elevations ± 0.10 feet, ready for finish grading and surface treatment as shown on drawings. Maintain the following elevations:

1. Seeded areas, other than inside playing area, 6 inches below finished grade elevations.
2. Playing field playing area, refer to drawings.
3. Bituminous areas, refer to details on drawings.
4. 4 inches below finished grade elevations.

D. Placing Fill

1. Preparation of ground before placing fill shall be accomplished by striping topsoil as specified, proof-rolling the subsoil surface, and replacing any soft areas which appear, and compacting the existing subsoil surface to a depth of 12 inches to the density specified.
2. Fill shall be spread in uniform layers not over 10 inches thick before compaction. Each layer shall be bladed smooth before completion so that compacting equipment operates over a uniform layer.

3. If a mechanical analysis of the soil being placed shows a marked difference from one location to another, the fill being placed shall not be made of a mixture of these materials. Each different type of material shall be handled continuously so that field control of moisture and density may be based upon a known type of material.
4. No fill shall be placed following a heavy rain without first making certain on an isolated test area that compaction can be obtained without damage to the already compacted area.

E. Compaction

1. Compacting equipment shall be heavy duty, rolling drum, vibrating compactors if soils is predominately granular. Pneumatic tried, wobble wheel rollers, loaded to not less than 325 lbs. per rated inch of tire width, may be used if fill layer is reduced to 8 inches thick. For clay fills, each layer shall be compacted with sheep's fool roller. Roller shall have staggered rows of feet projecting not less than 7 inches from drum, and shall be loaded to produce at least 200 lbs. per square inch of tamping area in contact with ground. Other compacting equipment may be used with approval of the Engineer.
2. Compacting equipment shall not require more than 6 passed to obtain specified density. If compaction cannot be attained the height of the lift shall be reduced, and/or other suitable methods shall be used.
3. The above methods or other suitable methods capable of producing equivalent results with the available material may to be used with the approval of the testing laboratory and the engineer.
4. Density of compacted fill shall be at least 95% Modified Proctor Density (ASTM D 1557) under all building areas, areas noted as future expansion, bituminous paving, playing area area, walks and as noted on drawings. Fill under all other areas shall be at least 90% Modified Proctor Density. Granular soils of relatively uniform grain size and very small amounts of fine binder material may have their density established by the relative density (ASTM D 2049) method. Compaction of all cohesionless soil fill shall be at least 75% relative density.

F. Moisture

1. All fills shall be compacted within 25% of the percentage at optimum moisture content. (For example, it optimum moisture content is 10%, fill can be compacted at from 7.5% to 12.5& moisture). If fill material is too wet, the Contractor shall provide and operate approved means to add moisture to the fill layers.
2. The moisture content shall be checked by the testing laboratory and operations concerning placing fill shall be under their control.

G. Scheduling

1. Proper timing of the filling operation, and direction in which work progresses should be planned to take advantage of weather and also to relieve whatever difficulties ground water condition might impose.
2. The order of work should be planned to permit the rapid commencement of work of other building trades.
3. As much as possible, filling work should be coordinated with Sections 4 and 5 so that buried facilities may be installed without having to re-excavate.

H. Quality Control

1. When work of this section or portions of work are completed notify the testing laboratory to perform density tests. Do not proceed with additional portions of work until results have been verified.
2. If, during progress of work, tests indicate that compacted materials do not meet specified requirements, remove, replace and retest defective work at no cost to the Owner.
3. Ensure compacted fills are tested before proceeding with placement of surface materials.
4. The Representatives of the Testing Laboratory will make all tests of materials to determine their suitability for compaction and will supervise the placing of fill as directed by the Engineer.
5. The Representatives of the Testing Laboratory and the Architect shall have the power of rejection of materials, equipment or operating procedures of the backfilling operation. The Contractor shall replace, rework or correct work which does not meet the specifications as directed by the Testing Laboratory and/or the Engineer.

I. Surplus Material

Place surplus excavated subsoil in areas where directed by the Architect. All excess materials shall be removed from the site and legally disposed

J. Finish Grading

1. Sub-Soil Preparation
    a. Fine grade sub-soil systematically to eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc., in excess of 2 inches in size. Remove sub-soil which has been contaminated with petroleum products.
    b. Cut out areas, to sub-grade elevation, which are to receive paving.
    c. Bring sub-soil to required levels, profiles and contours suitable for receiving the required finish surfaces. Make changes in grade gradual. Blend slopes into level areas. Maximum scope 4:1 unless otherwise indicated.
    d. Cultivate sub-grade to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.
    e. Compact sub-soil to the following percentages to a depth of 12 inches:
        1. 90% Modified Proctor where topsoil is to be placed.
        2. 95% Modified Proctor where paving is to be placed.
        3. 95% Modified Proctor where concrete sidewalks and slabs are to be placed.

K. Structure Excavation and Backfill

1. Fill Materials
    a. Subsoil: Existing site material, free from roots, rocks larger than 2 inches in size and building debris.
    b. Texas Department of Transportation Class 2, Granular Material.
2. Excavation
    a. Excavate subsoil in accordance with lines and levels shown on the drawings for construction of the work, including space for forms, bracing and shoring to permit inspection.
    b. Hand trim excavations and leave free from loose or organic matter.

c. When complete, verify soil bearing capacities, depths and dimensions.
d. Correct unauthorized excavation as directed, at no cost to the Owner.
e. Fill over-excavated areas under structure beating surfaces with concrete as specified for foundation, soil, free from clay, shale and organic matter and compacted to 95% Modified Proctor.
f. Excavations shall not interfere with normal 45 degree bearing splay of any foundation, unless said foundations have been underpinned.
g. Stockpile excavated sub-soil for reuse where directed. Place excess or unsuitable excavated sub-soil as directed by the Architect.
h. Do not disturb soil within branch spread of existing trees of shrubs that are to remain.

3. Backfilling
   a. Ensure areas to be backfilled are free from debris, snow, ice and water, and that ground surfaces are not in a frozen condition.
   b. Do not backfill over existing sub-grade surfaces which are porous, wet or spongy.
   c. Compact existing sub-grade surfaces to a depth of 12 inches to the densities specified.
   d. Cut out soft areas of existing sub-grade. Backfill with sub-soil and compact to the density specified.
   e. Backfill areas to grades, contours, levels and elevations shown on the drawings.
   f. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.
   g. Place and compact fill materials in continuous layers not exceeding 10 inches loose depth.
   h. Wherever possible, backfilling shall be done simultaneously on both sides of walls to equalize lateral pressures. Do not backfill on only one side of vertically spanning walls unless walls are adequately shored or permanent construction is in place to furnish lateral support at both top and bottom of wall.

4. Fill Types and Compaction
   a. Exterior side of foundation walls
      1. Sub-soil, gravel fill to top of sub-grade elevation.
      2. Compact to 95% Modified Proctor.
   b. Within building area
      1. Sub-soil fill to underside of stabilizing base course for floor slabs.
      2. Compact to 95% Modified Proctor.
   c. Stabilizing base course under concrete slabs
      1. 4 inches of sand fill to underside of slabs.
      2. Compact to 95% Modified Proctor.
   d. Retaining walls
      1. Granular fill to top of sub-grade elevation.
      2. Compact to 95% Modified Proctor.
   e. Fill under landscaped areas
      1. Sub-soil to top of sub-grade elevation.
      2. Compact to 90% Modified Proctor.

L. Trenching Backfilling and Compacting

1. Work Included
    a. Excavate for utilities from connection to existing utilities and/or outlet to 5 feet from the building wall.
    b. Cap off and seal discontinued utility services and remove from the site portions of discontinued lines within trench areas.
    c. Place and compact granular beds and fills over utilities to rough grade elevations.
    d. Dewater excavations as required.

2. Related Work
    a. Manholes, Catch Basins and Similar Structures
    b. Water System
    c. Storm Sewer System
    d. Sanitary Sewer System

. Trenching
    a. Excavate for utilities in accordance with lines and grades from connection to existing utilities and/or outlet from building wall. Ensure trenching does not interfere with normal 45 degree bearing splay of any foundation. All trench wall need to be smooth and free of any caving or collapsing of the walls. No void space behind the fabric/liners of the trench walls.
    b. The maximum width of trench shall be 36 inches for pipe 6 inches to 12 inches inclusive in diameter; for larger sizes of pipe, the maximum width of trench shall be not more than 2 feet greater than the inside diameter of the pipe, except as otherwise specified or directed. The above limiting restrictions on trench width apply from the outside bottom of pipe to 12 inches above the outside top of pipe.
    c. When the bottom uncovered at sewer foundation grade is soft and in the opinion of the Engineer, and/or testing laboratory cannot support the pipe or monolithic sewer, a further depth shall be excavated and refilled to sewer foundation grade with approved materials compacted in layers, or other approved means shall be employed to assure a firm foundation for the sewer, with extra compensation allowed therefore. The quantity of unstable foundation removed and replaced with approved materials shall be determined in cubic yards. The maximum allowable width to be used for computing the volume, shall not exceed the width specified. Do, said "Extra Work" only upon written order from the Architect, approved in writing by the Owner.
    d. The excavation shall at all times be finished to grade for a safe distance in advance of completed structures, but unless otherwise specifically directed or permitted by the Engineer, not more than 400 feet of trench shall be open at one time in advance of the built structure. The excavated earth along the line of the trench shall be confined to the approved limits. Pedestrian crossing and vehicle bridges for fire protection shall be erected and maintained by the Contractor where designated by the Engineer. All open trenches shall be protected in accordance with OSHA regulations.
    e. Cut trenches sufficiently wide to enable proper installation of services and to allow for inspection. Trim and shape trench bottoms and leave free of irregularities, lumps and projections.
    f. Correct unauthorized excavation as directed, at no cost to the Owner.

g. Place excess or unsuitable excavated sub-soil where directed by Architect.

4. Dewatering
   a. Keep trenches dry. Provide and operate necessary equipment including pumps, piping, and temporary drains on a 24 hour basis to keep excavations free of water until services have been placed and backfilling is completed.
   b. Do not discharge drainage water lines into municipal sewers without municipal approval. Ensure water discharge does not contain silt held in suspension.
   c. Direct surface drainage away from excavated areas.
   d. Control the grading in and adjacent to excavations to prevents water running into excavated areas or onto adjacent properties or public thoroughfares.
5. Bedding
   a. Provide Class B, first class bedding. ASTM-C-33 granular material gradation No. 67, achieved by either of the following methods.
      1. Shaped bottom with tamped backfill:
         a. The bottom of the trench shall be shaped to conform to a cylindrical surface with a radius of at least 12 inches (5 cm) greater than the radius to the outside of the pipe barrel to be bedded in fine granular fill placed in the shaped excavation.
         b. Backfill compacted to 95% Modified Proctor shall be placed at the sides of the pipe to a thickness of at least 12 inches (30 cm) above the top of the pipe.
      2. Compacted granular bedding with tamped backfill:
         a. The pipe shall be bedded in a granular material placed on a flat trench bottom and compacted to 95% Modified Proctor.
         b. The granular bedding shall have a minimum thickness of 1/4 the outside pipe diameter and shall extend halfway up the pipe barrel at the sides.
         c. The remainder of the side fills and a minimum depth of 12 inches (30 cm) over the top of the pipe shall be filled with material compacted to 95% Modified Proctor.
6. Backfilling
   a. Do not start backfilling until services have been inspected and bedding is installed.
   b. Ensure trenches are free of building debris, snow, ice and water and that ground surfaces are not in a frozen condition.
   c. Under no conditions shall rock excavation, boulders over 1 cubic foot in size, broken structures of any kind, frozen material, tree roots, organic material, debris or refuse of any kind, be used as backfill.
   d. Above the bedding, the balance of the backfill, including that around manholes, catch basins, and other structures, shall be of sound earth, of granular nature, free from large stones and lumps and shall be placed in layers not more than 12 inches thick, each layer being fully compacted to 95% Modified Proctor, using vibrators or other mechanical means as approved by the Owner. Flooding of trenches as a method of compaction will not be permitted, however, addition of water may be required to reach desired moisture content of backfill materials.
   e. All fills shall be compacted within 25% of the percentage at optimum moisture content.
   f. The moisture shall be checked by the testing laboratory and operations shall be

under their control.

7. Bearing Conditions in Trench:
   a. When soil encountered at the required grade is clay, the Contractor shall excavate the clay to a depth of 6 inches below the bottom of the pipe and replace it with material specified.
   b. Whenever a sewer is to be built in clay soil, or other soil which is unsuitable, after bedding is installed, the trench shall be backfilled with a granular material to a depth of 2 feet below the sub-grade in lawn areas. Backfill material for the remaining 2 vertical feet of trench in lawn areas shall be the same soil as that which is adjacent to the trench between these elevations. Granular material shall be placed to sub-grade under all pavements and building areas.
   c. Removal of clay or unsuitable material and placement of granular backfills in sewer and lateral trenches shall be incidental to the price RFP for furnishing and laying of pipe and no extra compensation will be allowed.

END OF SECTION 2: SITE GRADING AND EXCAVATION

SECTION 3: DEMOLITION AND REMOVALS

1. **SCOPE**

The work covered by this section consists of furnishing all labor, materials and equipment required to remove and dispose of TOPSOIL, brush, pavement, curbing, clay drain tile, fencing and other debris on the site for grading and utilities areas.

2. **DEFINITIONS**

A. The following definitions shall apply to terms used in these specifications, on the Plans and in other Contract Documents.

1. "Tree"
   shall be defined as any plant material having a single stem or truck exceeding four (4) inches in diameter at a point 1'-0" above ground. Multi-stemmed trees, such as birch clumps shall be considered as one tree.
2. "Brush"
   shall be defined as any plant materials having stem or truck less than four (4) inches in diameter at a point 1'-0" above the ground.
3. "Clearing"
   shall mean removal of the trunk and branches at existing grade level or slightly above, without the stump.
4. "Grubbing"
   shall mean the removal of stumps only where trees have previously been cleared.
5. "Removal"
   shall mean complete removal of the entire tree and stump.
6. "Debris"
   shall be defined as solid material which cannot be burned such as concrete, bricks, metal, culvert, fencing, etc.
7. Pavement removal consists of asphalt surfacing and black base material.
8. Curb removal consists of the wood curb and gutter removal at the nearest designated joint and disposal off site.
9. "Clay Draintile"
   shall be defined as the existing drainage system for the interior of the playing area.
10. "Topsoil"
    shall be defined as the existing top six inches (6") of material including the grass and/or vegetation.
11. "Fencing"
    shall be defined as the existing 4 foot fence located in the playing area infield area. This fence will be removed and disposed of for the Owner.
12. "Irrigation"
    shall be defined as the existing heads, lines and valves that are within 12" of the finished subbase. This will be removed and disposed of.
13. "Goals"

shall be defined as the football goals that are permanently installed at each field. These Goals shall be carefully removed and returned to the Township.

B. **AREA OF THE WORK**

Unless otherwise shown on the Plans or directed by the Architect, clearings operations shall be confined to areas of utility installations, excavation, filling or grading only.

4. **TREES AND SHRUBS TO BE SAVED**

The Contractor shall note trees within the construction area which are to be retained and are shown on the plans or as directed by the Architect. The Contractor shall adequately protect these trees during the construction work by placing snow fence around the perimeter of tree's crown.

5. CLEARING BRUSH

All brush shall be cut even with the ground surface and removed from the site, or may be buried under fill upon specific approval and under the direction of the Owner.

6. TREE CLEARING

Existing trees in any are of more than 7 feet fill on the site, except under a building or other structure including sewers and paving of any kind, may be cleared by cutting at a point no more than 1 foot above existing grade.

7. PAVEMENT REMOVAL

A. Remove bituminous pavement and base course from the areas indicated on the plans. Where such removal meets pavement that is to remain, chalkline and jackhammer to ensure a straight edge on remaining pavement, unless the plans require a saw cut. In that case, the cut shall also be made along a chalked line to ensure straightness of cut.
B. All disposal of pavement should be off Owner's property.

9. CONCRETE REMOVAL

A. Remove curb and gutter, sidewalk, and aprons from the areas indicated on the plans.
B. All disposal of pavement should be off the Owner's property.

10. DEBRIS

A. All debris is to be disposed off the Owner's property unless specifically noted on plans
B. Debris may not be buried over existing sewers or water mains.
C. All debris shall be removed on a daily basis.

11. REMOVE AND RELOCATE SIGNS

Remove and relocate signs as indicated on the plans.

12. REMOVE AND RELOCATE

Remove and relocate utilities (poles, lines, cables, sewers, water lines, storm sewers) as indicated on the plans. Where such removals and relocations are to be done by others, the Contractor shall coordinate the work with the utility company.

13. MEASUREMENT AND PAYMENT

A. Removal items shall be paid by lump sum as indicated on the proposal form. The Contractor must determine the nature and extent of the work described in removal of items paid by lump sum.

B. Off site hauling and disposal of removal items shall be incidental with no additional compensation.

14. REMOVALS TO BE SALVAGED

Fencing mesh, fence posts, irrigation equipment, goals and any as deemed reusable material will remain the property of the Owner to be stored on site by the Owner after removal. All concrete from the post footings will be removed and disposed of off site.

END OF SECTION 3: DEMOLISION AND REMOVALS

SECTION 4: STABLIZED BASE AND STONE LEVELING COURSE

PART I - GENERAL

1.01 DESCRIPTION OF WORK

1. Extent: It shall be the responsibility of Contractor to provide all labor, materials, equipment and tools necessary for the complete installation of a cement dust stabilized sub-grade in the specified area as shown on the Drawings.

    1. Break-up and or pulverize, similar to lime treatment, existing soil as necessary to re-grade the treated area as shown on the Drawings, minimum depth of 12 inches.
    2. Cement treat those areas no deeper than 12".
    3. Rough grade and compact the mixed material to achieve 98% compaction.
    4. Fine grade to specified tolerance.

2. Related Work
    1. Stabilized Leveling Course

1.02 QUALITY ASSURANCE

A. Comply with the following:

    1. The Contractor shall demonstrate experience on at least two (2) sub-grade stabilization projects of the type herein specified.

1.03 SUBMITTALS

A. Submit the following for review within two days following the Notice to Proceed:
    1. Equipment to perform breaking up of existing sub-grade and pulverizing machine
    2. Portland Cement dust shall be used.

PART II - PRODUCTS

2.01 MATERIALS

A. Portland Cement Dust: Type-II cement shall conform to the requirements of ASTM C150.

PART III – EXECUTION

3.01 BASE CONSTRUCTION

A. The Contractor shall approve, in writing, the cross-sectional design, as well as the ratio and volume of cement dust prior to the installation. See Section-Stabilized Leveling Course for fine tuning of sub-grade planarity.

3.02 STABILIZATION OF SUB-GRADE:

A. Apply 11% by volume Portland Cement dust to treatment area and mix in with pulverizing machine. Water shall be as needed to allow setting up of soil cement.
   - Cement shall be 350 pounds per cubic yard
   - Material shall be mixed thoroughly into the existing top 12" of soil using a Bomag pulverization machine or a high speed tiller. Disc method will be accepted.

B. All work in a designated portion of the field area shall be completed, including fine grading, within 24 hours. Cure time of the material is 24 to 72 hours without rain. Do not apply if temperature is below 40 degrees F, including cure process time.

3. Rough grade area to +/- 1” tolerance. Compact area with 8-10 ton vibrator double drum roller.

4. Fine grade to 3/8-1/2’” in ten foot tolerance maintaining existing cross slope. Compact with double drum roller.

END OF SECTION 4: SUBBASE STABILIZATION

SECTION 5: DRAIN MAT AND STORM DRAINAGE

PART I - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to the work of this Section.

B. Geotechnical Report by Associated Testing Laboratories.
- Supplied at time of RFP.

1.02 DESCRIPTION OF WORK

A. Extent: Work in this section includes, but is not limited to, providing all labor, materials, and equipment necessary for the complete installation of a vertical-to-horizontal drainage-mat system (referred to herein as drain-mat).

1. Install drain-mat over entire base and beyond, terminating at the perimeter of the synthetic grass field. Install an impermeable liner / geotextile fabric under the entire drain-mat, terminating at the perimeter of the synthetic grass field and the collector drain trenches.

B. Related Work

1. Field Earthwork and Grading
2. Base Stabilization
3. Synthetic Grass System
4. Synthetic Grass System Warranty and Guarantee

1.03 DEFINITIONS

A. Relative compaction or compaction: is defined as the in-place dry density of the compacted soil divided by the laboratory compacted maximum dry density as determined by ASTM Test D1557 (Modified Proctor), latest edition, expressed as a percentage.

1.04 QUALITY ASSURANCE

A. Prospective RFPders and/or installers of the drain-mat shall be required to comply with the following:

1. The Contractor shall provide competent workmen skilled in drain-mat installation. Sub-contract supervisory installation personnel are permitted as approved by the Architect.
2. The designated supervisory personnel on the project shall be certified by the manufacturers of the products as competent in the installation of these materials.
3. The manufacturers shall have these representatives on site to certify that the installation meets their specifications and standards.

B. The drain-mat shall be capable of accepting a compressive load of 30,000 psf and shall be capable of evacuating a minimum of 2.5 in/hr of rainfall from the entire field area.

1.05 SUBMITTALS

A. The successful RFPder must submit to the owner's representative, for the owner's approval, the following items before the contract can be awarded.

1. Prior to the installation, the Contractor shall submit product data and a sample of all components of the drainage mat system.
2. The Contractor shall provide, with the RFP, a list of prior synthetic grass installations of similar types with drain-mat, providing specific contacts and phone numbers.

B. If a hot-melt welding method is used, submission of all hot melts shall be 10 calendar days prior to installation.

PART II - PRODUCTS

2.01 DRAIN-MAT

A. Acceptable manufacturers / systems of drain-mat, or approved equal:

1. Schmitz Foam 20D Proplay installed over an impermeable liner.
2. Softeria Max installed over an impermeable liner.
3. Brock Systems, YSR System installed over an impermeable liner.
4. Substitutions only approved prior to RFP per addendum.

2.02 GLUE

A. If a hot melt welding method is used, the glue shall have an application temperature of 325 degrees F. with a melting point of 180 degrees F. Material shall be National Adhesive #34-5372 or equal.

2.03 LEVELING COURSE FINES

A. Gradation: Shall be the final two inch layer of the base stone specifications

2.04 GEOTEXTILE FABRIC/IMPERABLE LINER

A. See section Geotextile Fabric for product and installation.

PART III – EXECUTION

3.01 JOB CONDITIONS

A. Contractor shall use an electronic or staked grade grid, of not more than 25' separation, to establish finished grade of stabilized base, before installing the drain-mat and impermeable liner / geotextile fabric if required. Sub-grade shall be completed as specified in Section Earthwork and Grading.

B. Timing of drain-mat installation shall coincide with synthetic grass installation. No more than 20 yards of field coverage shall be installed of the drainage mat product prior to installing synthetic grass.

3.02 LEVELING COURSE FINES INSTALLATION

A. Leveling course fines shall be installed and compacted per the specifications to 95%.

3.04 GEOTEXTILE FABRIC

A. Fabric to be run over finished leveling stone that meets planarity requirements. The material must be ship lapped in the direction running down the slope of the field to discharge into the perimeter trenches.
B. Fabric shall NOT be the same material for both the trenches and under the drainage matt.
C. See Section for Geotextile Fabric/Impermeable Liner.

STORM SEWERAGE SYSTEM

I. General

A. Work Included
   1. Furnish and place storm system as shown on the drawings.
   2. Excavation and backfill.

B. Related Work
   1. Manholes, catch basins, and similar structures.
   2. Subsurface Drainage.
   3. Site grading.
   4. Asphaltic concrete paving.

II. Products

A. Materials
   1. ADS system
   2. Multiflow

B. Joints
   1. Joints for the 18” and 24" pipe shall be of Tylox Type CR rubber gasket or equal using bell and spigot design and shall conform to current specification ASTM C-443.

   2. Joints for 8" shall be round rubber gasket, using a modified bell and spigot design.

      a. The spigot shall have an external groove accurately sized to receive the gasket,

so that when the pipe is laid and the joint completed, the gasket shall be enclosed on all four surfaces.

b. Joints and gaskets shall conform to the current ASTM specifications C-443.

c. The durometer hardness of rubber gaskets shall be 45 plus or minus 5 and the gaskets shall have a circular cross-section.

C. End Sections

1. End sections shall be precast or prefabricated units equal to the size, strength and material of the pipe to which it is joined.

2. Sizes and locations are shown on the plans.

D. Pipe Marking

1. Pipe shall have the markings which are required by the governing standard specification.

2. Additionally, each pipe fitting and special section shall have plainly and permanently marked thereon:
   a. Pipe class.
   b. Date of manufacture.
   c. Manufacturer's name or trademark.
   d. On bends the angle turned thereby.
   e. Markings shall be indented in the pipe or painted thereon with waterproof paint.

III. Execution

A. Sewer Installation

1. Laying Sewer Pipe

   a. The construction shall begin at the outlet end and proceed toward the upper end..
   b. The pipe shall be carefully laid in the prepared trench to the line and grade shown on the plans with the spigot and downstream.
   c. The bottom of the trench shall be so shaped to permit a firm and even bearing along the barrel of the pipe in accordance with Subsurface Drainage.
   d. The pipe shall be fitted close and tight and with smooth inverts.
   e. Unless otherwise shown on the plans, all pipe shall be laid straight between changes in alignment and at a uniform grade between changes in grade.
   f. Except where bends are installed adjacent to manholes, all lines shall be laid so that each section between manholes will lamp.
   g. Pipe shall be protected from lateral displacement by means of pipe

embedment.

h. Under no circumstances shall pipe be laid in water and no pipe shall be laid under unsuitable weather or trench conditions.

i. When jointed in the trench, the pipe shall form a true and smooth line. The pipe trench shall be 24" in depth and 48" wide. The trench will be backfilled with ¾" – 100% crushed and washed stone having a 4" pipe bed of stone.

j. Pipe shall not be trimmed, except for closures, and pipe not making a good fit shall be removed.

k. While pipe laying is in progress not less than three unfilled joints shall be in place ahead of any joint filling or sealing work so that the sealed joints will not be disturbed by pipe laying operations.

2. Pipe Handling

a. Pipe, fittings and accessories shall be handled in a manner that will insure their installation in the work in sound, undamaged condition.

b. Equipment, tools and methods used in unloading, reloading, hauling and laying pipe and fitting shall have broad, well-padded contact surfaces.

c. Care shall be taken to avoid dragging the spigot ring on the ground or allowing fit to come in contact with hard objects.

d. Joint rings which have been damaged in any way will not be accepted and shall not be incorporated in the work.

g. Concrete pipe and fittings shall be handled with suitable slings and lifting hooks.

1. No hooks shall be permitted to come in contact with joint surfaces.
2. Pipe units shall be kept from contact with adjacent units during handling and storage.

3. Pipe Cleaning

a. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter before being installed and shall be kept clean until the work has been accepted.

b. All joint contact surfaces shall be kept clean until the joining is completed.

c. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed.

d. No debris, tools, clothing or other materials shall be placed in the pipe.

e. Whenever pipe laying is stopped the end of the pipe shall be closed with an end board closely fitting the end of the pipe and having a number of small holes drilled near the center, to prevent the trench from filling with water and to keep sand and earth out of the pipe.

4. Pipe Inspection

a. Each piece of sewer pipe shall be tested for soundness after its delivery.

b. All pipe shall be subject to rejection on account of failure to conform to any

requirements of the governing ASTM Standard Specification.

c. All broken or surplus material shall be removed from both sewers.
d. A T-saddle or other approved connection shall be installed.
e. The cut-in pipe shall not extend beyond the inner wall of the existing pipe.
f. The joint shall be sealed with 1:2 mortar, and with a sufficient bead or fillet of such mortar to insure a solid connection.
g. When so directed by the Consultant, the Contractor shall place such a bead or fillet on the inside as well as on the outside of the larger sewer.

5. Manholes/Catch Basins
   a. Materials:
      1. Each new Catch Basin shall be constructed with prefabricated 48" square or round structures.
      2. Each CB shall have a solid 4" min. concrete base.
      3. Each CB shall have a ring and cover as manufactured by PARK or equal.

III. Execution

A. Excavation

1. Excavation shall be of sufficient dimensions to provide ample space for sheathing and bracing is required, and ample space for the workmen to perform their work in a satisfactory manner.

B. Adjusting Existing Structures

1. Whenever existing manholes, catch basins, valve chambers, or similar structures occur, the tops of such structures shall be adjusted or rebuilt so that the top of the casting will fit the crown and/or grade of the finished surface.
2. Raising castings shall be accomplished by use of precast adjusting rings and/or brick set in a full mortar bed with the casting re-set in accordance with preceding requirements for new construction.
3. Lowering castings shall be accomplished by removing a sufficient amount of the existing structure to allow for reconstruction of the taper section and resetting the casting in accordance with the preceding requirements for new construction.
   a. All manholes shall be constructed to conform to the requirements of Section
4. Catch Basins
   a. All catch basins shall be constructed to conform to the requirements of this Section.
5. Rip-Rap
   a. Rip-Rap and Zip-rap shall be laid on geotextile membrane
   b. Each piece of Rip-Rap shall be laid individually by hand and shall be bedded with gravel between pieces.
   c. Rip-rap shall be thoroughly compacted as it is installed and shall be bedded with gravel between pieces.
   d. Rip-rap shall be thoroughly compacted as it is installed and the finished surface shall be even and tight.

e. Voids between the Rip-Rap shall be filled with mortar grout.

C. Acceptance Tests

1. Acceptance tests will be conducted by the Engineer to determine the acceptability of the sewers as constructed. The Contractor shall furnish suitable assistants to help the Engineer during the conduction of the tests.
2. Each section of sewer line between manholes is required to be straight and uniformly graded. Each section shall be lamped.
3. All defects in the sewers shall be repaired to the satisfaction of the OWNER.

SUBDRAINAGE SYSTEMS

I. General

A. Work Included:

Drainage tile system with filter wrap, complete with required couplings and accessories

B. Related Work:

1. Site Grading
2. Trenching, backfilling and compacting

C. Reference Standards:

ASTM F-405-W

D. Materials

1. Drainage Tile

ASTM F-405 perforated corrugated polyurethane tubing by Advanced Drainage System, Chagrin Falls, Ohio complete with required couplings and fittings

2. The Tubing shall be wrapped with the nylon filter sock.

II. Installation

A. Hand trim excavating to required elevations. Do not over excavate. Remove large stones or other hard matter which could damage drain tile.
B. Have drain tile ready for installation.
C. Place a four inch(4") thick bed of filter aggregate.
D. Install the drainage tile on the filter aggregate bed.
E. Ensure complete connection to storm sewer using perforated pipe.
F. Cover the pipe with filter aggregate to top of trench and compact to 90% Modified Proctor.

END OF SECTION 5: DRAIN MAT AND STORM DRAINIAGE

SECTION 6: EROSION CONTROL

I. Scope of Work

A. Installation and maintenance of temporary erosion controls.
B. Prevent siltation of water courses, sewers, streams and/or lakes.
C. Confinement of fuels, oils, bituminous materials, chemicals and other harmful materials.
D. Prevention of dust and airborne materials.
E. Permits will be obtained by Owner.

II. Project Requirements

A. All applicable state and local statutes, relating to the prevention and abatement of pollution, shall be complied with during the performance of the contract.

B. No separate measurement or payment will be made for work covered by this section. All payment, therefore, shall be included in the contract price.

C. Construction operations shall be conducted in such manner as to provide permanent and temporary erosion controls and to prevent damaging siltation of watercourses, streams or lakes. Further, the Contractor shall conduct his work in a manner such that all soil, fuels, oils bituminous materials, chemicals, sanitary sewage, and other harmful materials, resulting from the construction of the project are confined within project limits, properly disposed of, and prevented from entering watercourses, rivers, lakes, or entering onto or causing damage to adjoining or other properties. A schedule of soil erosion activities shall be submitted prior to any earth-change activity.

D. Should any requirement for protecting against soil erosion and sedimentation be neglected or not adequately followed, the Owner may, upon written notice, require the Contractor to immediately cease construction operations and to apply his efforts to meet the omitted requirements before proceeding further with the project. Should the Contractor, upon such written notice, neglect, refuse, or fail to adequately correct matters causing or contributing to uncontrolled erosion or sedimentation, the Owner may, and without prejudice to any other recourse, on three days written notice, execute the required work in the most expedient manner and shall deduct all related costs from the contract amount. No extension of the completion date will be allowed relating to such defaulted work.

E. During any filling and grading operations where siltation is likely to be a problem, the Contractor's operation shall be scheduled and performed such that required permanent soil stabilization can follow immediately thereafter if the project conditions permit; otherwise, temporary approved erosion and siltation control measure will be required between successive construction stages.

F. The Contractor shall control dust from his operation, in a manner approved by the local enforcing agency.

G. The Contractor shall be responsible for disposing of excess excavation in a lawful manner. Before any spoil material is taken from the site, the Contractor shall identify, in writing, the proposed spoil areas. Where such area is other than property owned by the Contractor or a licensed landfill operation, the Contractor shall also submit, with such identification, a written certification from the local enforcing agency that the proposed disposition of such material will not result in violation of applicable local ordinances or state laws. Any cost of such certification and/or related erosion or sedimentation control measures shall be the responsibility of the Contractor.

H. If the borrow areas are required on this project, the Contractor shall be responsible for securing necessary borrow or fill materials. Before any borrow or fill is placed on the site, the Contractor shall identify, in writing, the source of all borrow or fill to be used on the project. Where such material is not taken from property owned by the Contractor or a commercial operation, the Contractor shall also submit, with such identification, a written certification from the local enforcing agency that removal of such material will not result in violation of applicable local ordinances or state laws. Any cost of such certification and/or related erosion or sedimentation control measure shall be the responsibility of the Contractor.

III. Materials

A. Seed
   1. Temporary seed shall be cereal rye.
   2. Permanent seed shall conform to the requirements of Lawn Work Section.

B. Straw
   1. Clean straw, tightly wrapped in standard bale form.

C. Burlap

D. Geotextile (Silt Fence)
   1. Fabric shall have uniform fiber distribution and shall be non woven, needle punched polyester material, inert to typical soil chemicals and resistant to sunlight. The material shall have a specific gravity greater than 1.0 and possesses excellent resistance to creep.
   2. Edges of the fabric shall be bonded or sealed to prevent raveling.
   3. Fabric shall be equal to Terra Bond 1115 as manufactured by the Hoechst Corporation.

IV. Execution

A. Temporary Controls
   1. Prior to, or as the first step in construction, a perimeter defense around the boundaries of this site against erosion and sediment will be initiated.
   2. Temporary controls include, but are not limited to ; straw bales, silt fences, burlap

or geotextile filters on catch basins and manholes and seeding of stockpiled erodible materials and borrow areas.

3. In addition to temporary measures required by the drawings, the Contractor shall be responsible for providing any additional measures required to properly control erosion and sedimentation as may become necessary or may arise from conditions which may develop during construction. Except for emergencies, proposed additional temporary controls shall be approved by the Engineer.
4. Where seasonal limitations or construction delays prevent scheduled installation of permanent control facilities, approved temporary measures shall be installed within 30 calendar days and maintained until replaced by the permanent facility.
5. All temporary erosion control facilities shall be removed at the completion of construction, unless ordered by the Engineer to remain in place. Care shall be taken during removal to minimize siltation in any drainage course.

6. Erosive or sediment producing areas exposed for up to 12 months shall be protected by seeding or as specified by seeding in conjunction with other measures.
7. As much as possible, grading work shall be coordinated with work specified in Lawn Work to minimize the duration of soil exposure to erosive elements.

8. All mud/dirt playing areas onto existing city/county roads from this site, due to construction, shall be promptly removed by the General Contractor.
9. All mud/dirt playing area or spilled on paved roads/surfaces within this site shall be promptly removed by the General Contractor.
10. Catch Basins
    a. Protection shall be as detailed on drawings. Additional protection shall be provided for others if necessary, during construction. Inlets shall be protected before paving by sealing the inlet with plastic weighted by sandbags or by other suitable means. One inch diameter holes shall be made in the supporting cone approximately one foot below the sub-base elevation and a pea stone filter material placed in the area of the holes. Such holes shall be sealed and pea stone replaced with compacted earth prior to paving.
11. Straw Bale and/or Silt Fences
    a. Construction shall be as shown on the drawings. Berms shall be placed as shown on the drawings and as required as temporary control measures determined necessary during construction.
    b. A minimum of two hold-down stakes shall be used per bale. Wood stakes shall be at least 2 inches by 2 inches. All stakes shall be sufficient in length to penetrate a minimum of one foot into the ground.
    c. A six inch (minimum) ridge of pea stone or compacted earth shall be placed along the base of the bale on the side from which flow will come. This area shall be periodically inspected and maintained to prevent piping.
    d. Geotextile material shall be anchored into the subsoil as detailed and supported by 2 x 2 x 4 foot stakes placed at 4 foot centers and driven at

least 18 inches into the subsoil.

e. Construction shall be as shown on the drawings. Silt fences and straw bale berms may be used interchangeably unless otherwise noted.

B. Permanent Controls

1. Permanent soil erosion control measures, plantings, and mulching for all slopes, channels, ditches or any disturbed land area shall be completed within 15 calendar days after final grading or the final earth change has been completed.
   a. When it is not possible to permanently stabilize disturbed area after an earth change has been completed or where significant earth change activity ceases, temporary soil erosion control measures shall be implemented within 30 calendar days.
   b. All temporary soil erosion control measures shall be maintained until permanent soil erosion control measures are implemented.
   c. All permanent soil erosion control measures will be implemented and established before a Certificate of compliance is issued.
2. Installation of permanent controls shall include, but is not limited to: finish seeding, asphaltic concrete paving, concrete paving, storm sewers, ditches, ground cover and plantings.
3. Placement of permanent controls shall be as specified in related sections.

END OF SECTION 6: EROSION CONTROL

SECTION 7: LEVELING COURSE, GEOTEXTILE MEMBRANE, IMPERABLE LINER

PART I - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Conditions of Contract, Special Provisions, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. Site excavation.

B. Excavation of a perimeter drainage collector network and installation of drainage grid system.

C. Construction of a stable and impermeable aggregate layer primarily for impermeable badse installation. See also Section 9 -Synthetic Grass System for explanation of Method installation.

D. Related Work:

a. Demolition
b. Earthwork and Grading
c. Drainage Facilities
d. Synthetic Grass System
e. Geotextile Membrane

1.03 SITE EVALUATION

A. Verifying cleaning operations of organic material was sufficient to prepare for subgrade preparation.

1.04 SUBMITTALS

A. Contractor shall submit sieve analyses of the rock courses specified to verify conformance to these specifications. Submittals shall include permeability testing as specified below, at compaction percentages specified.

1.05 QUALITY ASSURANCE

A. Testing:

1. The permeability of the aggregate shall be checked by a registered geotechnical engineer from a sampling of the aggregate sieve prior to shipping the rock to the site. In addition, testing shall occur during installation at 800 ton intervals. The rock shall have an impermeable rate no more than 1/4” per hour and shall be per Din 8035 Part 7, ASTM 2434 (constant head), or ASTM

D3385 (double-ring) testing methods. In addition to the lab testing, after installation of any aggregate base cross-section, designed to conduct rainfall from the turf to the sub-soils and/or under-drain system, the finished aggregate base shall be tested, *in situ* for infiltration rate, using a double-ring infiltrometer (ASTM D-3385-94). The test shall be performed by a registered P.E. or certified agronomist, in at least 12 critical areas of the field, as determined by the Owner's representative. The average infiltration rate of all locations shall not be more than 1/4" per hour, with no one location having a rate more than 1/2" per hour. The Contractor is responsible to meet this performance specification, **before** proceeding with installation of the synthetic turf, and shall bear the cost of the on-site testing and the cost of any additional work necessary to achieve compliance with the specification.

2. All test results shall be logged and documented by the Owner's Technical Representative or Geotechnical Engineer. If at any time the processed stone base does not meet specifications, it shall be the Contractor's responsibility to restore, at his expense, the processed stone base to the required grade, cross-section and density.

3. After the contractor has independently confirmed compliance with all the above tolerances (planarity and elevation verified by a licensed surveyor and compaction, gradation, & permeability verified by Geotechnical Engineer), he shall notify the appropriate party and schedule a final inspection for approval. The contractor shall make available an orbital laser system to the Inspection Team for the inspection process.

4. All testing fees shall be paid for by the Contractor.

B. Standard Specifications: Shall mean the Texas Department of Transportation Standard Specifications, latest active edition.

PART II - PRODUCTS

B. MATERIALS

1. Liner: Shall be as specified in Section - Geotextile Membrane for Method A installation only.

2. Impermeable Base Rock: Shall be a 100% fractured, by mechanical means, with elongated characters on each individual particle larger than 1/4". Materials shall be devoid of mineral fines. All particles smaller than 1/4" shall be produced by manufactured means only. Rounded sands or aggregates are prohibited.

3. Aggregate or Aggregate blends shall conform to the following gradation:

TOP 2" LEVELING COURSE

SIEVE	Sieve Size Metric	(mm)	Percent Passing by Weight (AASHTO Test Method T-27)
1/4"		mm	95-100
No. 4	4.75	mm	75-85

No. 8	2.38	mm	40-65
No. 30		mm	25-30
No. 50		mm	20-30
No. 100		mm	15-20
No. 200	75	mm	15-20

4. Collector Trench Rock: Shall be 3/4” clean and washed crushed drain rock for and may allow 3/8” clean crushed gravel as a topping over the 3/4” drain rock to make a smoother grade for the drain mat.

PART III - EXECUTION

A. EXCAVATION

1. A single benchmark shall be established prior to any excavation and maintained by a licensed surveyor of record during the entire construction process. The site shall be excavated to subgrade depth as indicated on the Plans and specified in Section Earthwork and Grading.

2. In the event of over-excavation, select-fill material shall be used to achieve design subgrade elevations. Select materials shall be as specified in Section Earthwork and Grading.

3. Proof roll and mark "soft spots" for additional compaction or correction. Use static tandem drum-type roller of not less than five (5) tons weight. Proof rolling operations shall be performed in the presence of the Engineer.

4. Excavate perimeter drainage collector trenches as shown on the Plans. The trenches shall be excavated with a minimum of 0.75% slope starting from the low point of the drainage system at the outlet extending toward the high point(s). Design of the collector trenches shall incorporate the following:

    a. All loose debris shall be removed from the trenches.
    b. The trenches shall be backfilled using base materials specified in this Section.

B. UNDER DRAIN SYSTEM

5. Membrane: Verify subgrade elevations of the finished subgrade. The elevations shall conform to the elevations shown on Drawings.

6. Prior to under drain system construction, the subgrade surface shall be uniform and free of rocks, depressions, voids, and irregularities.

7. Membrane: Install geotextile collector trenches as specified in Section -Geotextile Membrane.

8. Perimeter Collector Drains: Install perforated pipe in the perimeter collector trenches. The centerline of the pipe shall coincide with the centerline of trench. The pipes shall be strong and capable of withstanding the anticipated loading without deformation.

9. A minimum of 4” of the collector trench drain rock shall be placed in the bottom of collector trenches, on top of the membrane. The crushed stone shall be compacted suitably.
10. Fill the remainder of the collector trenches with the specified 3/4” drain rock to top of subgrade; compact suitably. 3/8” fractured rock can be utilized to blend in the ¾” only at the top of the trench and no more than 1” of material is allowed of the 3/8”. All ¾” and 3/8” rock must be 100% fractured and washed prior to installation. All round rock will be rejected and contractor will remove from the trenches at their cost.

3.03 AGGREGATE LAYER

A. Install the impermeable base over the entire stabilized subbase and the composite drain system. The aggregate shall comprise of a minimum 2" compacted, stable, impermeable, processed, stone. Care shall be taken to maintain the grade designed for the subbase. The capability of the processed stone drainage layer to meet the stability and permeability requirement shall be determined by a certified laboratory prior to construction of the course. The processed stone base layers shall be compacted to a minimum density of 95%. Nuclear density tests shall be performed during aggregate placement and rolling to ensure specified compaction.

3.04 PROPERTIES AND INSTALLATION OF IMPERMEABLE STONE

A. Delivery Moisture Content: Processed stone shall contain 90% to 110% of the optimum moisture content to ensure that fines do not migrate in transit or during placement and to facilitate proper compaction. This is critical. The contractor shall ensure that aggregate leaving the source plant meet this requirement. The contractor is required to apply water to the processed stone on site to attain and maintain this minimum moisture content. Stone base materials shall not be stockpiled on site. Stone base materials shall be 100% crushed.

B. Handling and Placement:

C. Prior to aggregate placement, remove any excess or contaminated backfill from the drainage trenches.
D. Should any separation of the materials occur, during any stage of the spreading or stockpiling, the Contractor shall immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further separation. Double handling of materials shall not be allowed.
E. The Contractor shall utilize laser control equipment for the grading of the processed stone to ensure accuracy in the grade tolerances of +0" to -1/4".
F. Install processed stone base, from sideline toward center-line, parallel to the composite drain network, to the lines and grades shown on the drawings. Under no circumstance shall the material be pushed more than 30' from the point of discharge.
G. The Contractor shall shape the complete surface of the processed stone and continue until the deviation from the required elevation does not exceed a maximum deviation from grade of +0" to -1/4" in ten feet (10'), when measured in any direction using a 10' straight-edge.

H. Each layer shall be spread uniformly with equipment that will not cause perceptible separation in gradation (segregation of the aggregates), preferably a self-propelled paving machine or small laser controlled low ground pressure (LPG) dozer.

C. Compaction and Planarity:

1. The processed stone shall be compacted to a minimum density of not less than 95% of maximum density as determined by ASTM D698 and measured using a nuclear method.
2. Proof roll wherever possible and mark "soft spots" for additional compaction or correction. Use static tandem drum-type roller of not less than five (5) tons weight. Proof rolling operations shall be preformed in the presence of the Engineer.
3. The finished surface shall not deviate (tolerance-to-grade) from designated compacted grade. This means that the surface shall not deviate more than 1/4" in 10' (any direction) when placed under a10 foot straight edge. This tolerance is required over the entire field.

D. Areas that deviate shall be marked with spray paint and corrected with 1/4” to 3/8” crushed stone or granite chips (limestone will not be acceptable) and rolled tight to achieve proper density. Such remedial actions shall be done by hand and rechecked by means of test procedures described above.

E. Testing:

1. The surface of the processed stone course shall be well drained at all times. No standing water shall be permitted at any time. The permeability of the aggregate shall be checked per Din 8035 Part 7, ASTM 2434 (constant head), or ASTM D3385 (double-ring) testing methods. Test samples shall be taken (at a minimum of) one sample per every 5,000 square feet or as otherwise directed by the Owner’s Representative.

2. All test results will be logged and documented by the Owner's Technical Representative or Geotechnical Engineer. If at any time the processed stone base does not meet specifications, it shall be the Contractor's responsibility to restore, at his expense, the processed stone base to the required grade, cross-section and density.

3. After the contractor has independently confirmed compliance with all the above tolerances (planarity and elevation verified by a licensed surveyor and compaction, gradation, & permeability verified by Geotechnical Engineer), he shall notify the appropriate party and schedule a final inspection for approval. The contractor shall make available an orbital laser system to the Inspection Team for the inspection process.

GEOTEXTILE MEMBRANE
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. Provide all labor, material and equipment necessary to treat the compacted subgrade of the new synthetic grass area with a vegetation sterilant.

1.03 SUBMITTALS

A. The Contractor shall submit a sample of the proposed impermeable geotextile membrane prior to installation of the product. This is to be submitted at the time of contract award so as to assure the delivery of this product in time to meet installation schedules.
   1. liner shall be a minimum of 15 mils.
   2. liner shall have no open seams.
   3. liner shall have all seams completely sealed using manufacturers recommended procedures.

B. The material shall be installed in 12-foot wide rolls. Geotextile filter fabric shall be used to line the new drainage trench on three sides (not covering the top).
   1. Filter fabric for the drainage trenches shall not be less than 6 oz.

C. The material shall be overlapped at all edges and head seams and taped with a 2" duct type tape.

D. All overlapped material shall be overlapped by 12".

PART 2 – PRODUCTS

2.01 SOIL STERILANT MATERIALS

A. Soil Sterilant: The materials for this work shall consist of Casoron as manufactured by UniRoyal, Finale, Roundup or Primitrol. A letter from the state DEP indicating that this material is registered with them and is suitable for this application is required before use. No fuel oils or petro chemicals shall be used.

DESCRIPTION:

Provide all labor, material and equipment necessary to treat the compacted subgrade of the synthetic turf and areas indicated with a vegetation sterilant.

MATERIALS:

The materials for this work shall consist **Finale** as manufactured by Monsanto, or **Roundup**. A letter from the state DEP indicating that this material is registered with them and is suitable for this application is required before use.

CONSTRUCTION METHODS:

The method and rate of application shall be per the manufacturer's instructions for a total kill of vegetation, a copy of which will be provided the Engineer for approval prior to use. The individual applying this material must be licensed with the State DEP.

The applications shall not exceed the limits of this contract. The amount of sterilant required for this work is one gallon per 5,000 square feet of undiluted material. The sterilant shall be applied in a diluted form of 20 parts water to 1 part sterilant (or as recommended by the manufacturer).

Care must be taken to avoid all lawn and planted areas from receiving this material. Any damage caused to these areas by this material shall be corrected by the contractor at no additional cost to the Owner.

BASIS OF PAYMENT:

There shall be no separate payment for this work. All labor, materials and equipment shall be included in the lump sum price for the Contract.

A. IMPERMEABLE LINER

1. Materials:

Properties	***Test Method***	***Average Roll Values***
Color-Black PVC		
Thickness, mils	ASTM D5199	20
Density, gram/cm	ASTM D1505	.75
Tensile Properties – Each Direction Tensile Strength at Break, lbs/in width (N/mm) Elongation at Break, %	ASTM D638 ASTM D638	76 (13) 750
Tear Resistance, lbs (N)	ASTM D1004	11 (49)
Puncture Resistance, lbs (N)	ASTM D4833	31 (137)
Carbon Black, %	ASTM D1603	2
Carbon Black Dispersion	ASTM D5596	100% opacity

B. The filter fabric geotextile shall be:

- Mirafi, by Royal Ten Cate
- Typar, by DuPont Chemical Corp.
- Supac 5NP, by Phillips Fibers Corporation
- Amoco 4553, by Amoco Fabrics Company
- Trevira 1120, by Hoechst Celanese Corporation
- or approved equal.

1. Other geotextiles may be submitted by a Contractor for approval. The submittal must

include a sample of the proposed geotextile measuring no less than 3 square yards in area and the manufacturer's certification that the proposed geotextile meets or exceeds all requirements below. All submissions must be made no later than 10 working days prior to the RFP date. Geotextiles submitted after this deadline will not be accepted. Equivalency will be determined on the basis of the following:

2. The geotextile shall be of a 6 oz. non-woven, mechanically bonded construction and consist of long-chain polymeric fibers composed of polypropylene or polyester. The fibers shall be oriented into a multi-directional stable network. The geotextile shall be free of any chemical treatment or coating which reduces permeability and shall be inert to chemicals commonly found in soil. The geotextile shall conform to the mechanical and hydraulic property requirements listed below:

3. Required

Property	Value*	Test Pressure
Tensile Strength	230 lbs.	ASTM D-1682
Tensile Elongation	50%	ASTM D-1682
Mullen Burst	465 psi	ASTM D-3786
Trapezoidal Tear Strength	95 lbs.	ASTM D-4533
Puncture Strength	120 lbs.	ASTM D-751_
Apparent Opening Size	<=0.210 mm	COE CW-02215
Permeability	0.001 gal/sec/sy	ASTM D-4491

*The Required Value refers to the minimum value, determined from any on test performed on any one sample, associated with the geotextile's weaker principal direction. Therefore, the Required Values are absolute minimum values not statistically derived "minimum average" or "average" values.

Tension testing machine with ring clamp; steel ball replaced with a 5/16" diameter solid steel cylinder with flat tip centered within the ring clamp.

The geotextile shall be furnished in a protective wrapping which will protect the fabric from ultraviolet radiation and abrasion. The geotextile shall be covered with the appropriate soil cover within two weeks of its placement.

PART 3 – EXECUTION

3.01 GENERAL

A. The method and rate of application shall be per the manufacturer's instructions for a total kill of vegetation, a copy of which will be provided the Township for approval prior to use. The individual applying this material must be licensed with the State DEP. Care must be taken to avoid all lawn and planted areas from receiving this material. Any damage caused to these areas by this material shall be corrected by the contractor at no additional cost to the Township.

B. The impermeable liner and geotextile shall be placed in the manner and at the locations shown on the plans. Should the geotextile be damaged during construction, the torn or punctured section shall be repaired by placing a piece of fabric that is sufficiently large to cover the damaged area plus two feet of adjacent undamaged geotextile in all directions.

END OF SECTION 7:
LEVELING COURSE, GEOTEXTILE MEMBRANE AND IMPERMEABLE LINER

SECTION 8 - CAST-IN-PLACE CONCRETE

GENERAL

A. SUMMARY

This Section includes cast-in-place concrete, including reinforcement, concrete materials; mix design, placement procedures, and finishes.

B. SUBMITTALS

Product Data: For each manufactured material and product indicated.

Design Mixes: For each concrete mix indicated.

Shop Drawings: Include details of steel reinforcement placement including material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports.

Material: test reports.

C. QUALITY ASSURANCE

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

Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.

General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
Formwork and form accessories.
Steel reinforcement and supports.
Concrete mixtures.
Handling, placing, and constructing concrete.

Pre-installation Conference: Conduct conference at Project site with Engineer.

D. PRODUCTS

MATERIALS

Formwork: Furnish formwork and form accessories according to ACI 301.

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

Concrete Materials:

Portland Cement: ASTM C 150, Type I or II**.**
Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-1/2-inch nominal size.
Lightweight Aggregate: ASTM C 330.
Water: Complying with ASTM C 94.

Admixtures:

Air-Entraining Admixture: ASTM C 260.
Water-Reducing Admixture: ASTM C 494, Type A.

Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber

Curing Materials:

Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
Water: Potable.
Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

Comply with ACI 301 requirements for concrete mixtures.

Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:

Compressive Strength (28 Days): 3500 psi
Slump: 4 inches

Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

For mixer capacity larger than 1 cu. yd increase mixing time by 15 seconds for each additional 1 cu. yd.

Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

E. EXECUTION

INSTALLATION, GENERAL

Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.

Vapor Retarder: Install, protect, and repair vapor-retarder sheets according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

Lap joints 6 inches and seal with manufacturer's recommended tape.

Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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

Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.

Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

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 the concrete thickness, as follows:

Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

CONCRETE PLACEMENT

Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

Consolidate concrete with mechanical vibrating equipment.

FINISHING FORMED SURFACES

Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

Apply to concrete surfaces not exposed to public view.

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 defective areas. Completely remove fins and other projections.

Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

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.

FINISHING UNFORMED SURFACES

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

Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.

Do not further disturb surfaces before starting finishing operations.

Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

CONCRETE PROTECTION AND CURING

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.

Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur 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.

Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

Cure formed and unformed concrete for at least seven days as follows:

Moisture Curing: Keep surfaces continuously moist with absorptive cover, water saturated and kept continuously wet.

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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

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.

FIELD QUALITY CONTROL

Testing Frequency: At least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

TERMINATION/ATTACHMENT BOARD:

After the concrete has set for 7 days minimum, the termination or attachment board shall be installed.

A. Material:

1. 2"x4" (nominal) pressure treated ground contact pine wood or untreated cedar.
2. Board can be set with a ramset anchor spaced not less than 4 feet apart.
3. Board shall be set at exactly 1-3/4" from the top of the curb.
4. In lieu of the wood board, the concrete can be notched with a 2-1/2" wide x 1-3/4" deep formed ledge to accept the turf, drain mat and liner.

END OF SECTION 8:
CAST IN PLACE CONCRETE

SECTION 9: SYNTHETIC GRASS SYSTEM

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. The work under this section includes but is not limited to the installation of the geotextile membrane, new synthetic grass system, in-fill materials, in-laid markings, perimeter termination and maintenance equipment.

B. **FIELD MAINTENANCE EQUIPMENT**

- The Contractor shall supply at the end of the Project one new and unused SMG TCA 1400 grooming unit.

- If the Contractor fails to deliver any of the equipment listed above, the Owner shall receive a total credit from the contract, the corresponding amounts for each equipment item noted above.

C. ADDITIONAL FIELD MATERIALS

- The Contractor shall supply and deliver an additional 100 lineal feet of standard width material, for each field in the Project.

- The Contractor shall supply and deliver an additional 2,000 lbs of rubber and 2,000 lbs of sand infill material as specified for the field.

- The Contractor shall supply an additional 200 lineal feet of nylon or Mylar seaming tape (12” width). In addition, supply calking tubes for Township repair. Minimum 100 tubes and equipment to operate the glue tubes.

1.03 SUBMITTALS

A. Installation Qualifications: The synthetic grass sub/contractor shall demonstrate experience on at least five (5) installations of the proposed material in the last year. The synthetic grass manufacturer shall certify the designated supervisory personnel on the project. A letter on the manufacturer’s letterhead shall be submitted affirming the sub/contractor as competent in the installation of the material, including seaming methods, in-laid markings, termination and proper installation of the product.

B. Synthetic Grass Sample: The Contractor shall submit an 6”X9” sample of the synthetic grass and in-fill system proposed for this contract for approval of colors, in-fill, seaming materials and layout of the system prior to ordering the materials.

C. Warranty: The Contractor shall submit a manufacturer's warranty listing a TEN (10) year (3rd Party Insured 8 years, 2 years company backed) guarantee against Ultra-violent ray fading, degradation, or defects, such as excessive wear of defibrillation. The guarantee shall include and cover that the product will not decrease in pile height by more than 15%, decrease in face weight (without in-fill) by more than 20% and not exceed a G-max (force reduction) of 110 G's initially and not exceed 130 G's over the guarantee period. The Contractor is required to perform the necessary testing during a scheduled time at least one time per year during the guarantee period. The results of the testing shall be submitted to the Township within 30 days of each test. Failure to submit the results will serve as notice to perform such testing by the Township to determine the extent of the needs under this guarantee.

   The Contractor is required under this guarantee to supply and install all in-fill materials and synthetic grass to maintain the performance levels of this guarantee.

B. Testing and Quality Control: Submit to the Project Manager a copy of the results certified by an independent testing laboratory for the following tests performed on the synthetic grass system.

C. Fiber shall be monofilament (spinneret, extruded bi-color (mix of Field Green – three ends, and Olive Green – three ends) multifilament polyethylene.

D. All material shall be constructed using the C-8 resin technology.

Pile Yarn Type	Monofilament Film 100% Polyethylene Fiber and Slit Film Fibers
Yarn Denier	ASTM D-1577
Yarn Breaking Strength	ASTM D-2256
Yarn Melting Point	ASTM D-789
Pile Height	ASTM D-418
Pile Weight	ASTM D-418
Total Weight	ASTM D-418
Backing Perforations	ASTM D-418
Tuft Bind (Without in-fill)	ASTM D-1335
Tuft Bind (With in-fill)	ASTM D-1335
Grab Tear Strength	ASTM D-1682
Impact Attenuation	ASTM D-355
Pill Burn Test	ASTM D-2859

E. Maintenance and Operating Data: Submit to the Project Manager a copy of maintenance and operating data for the synthetic grass system. Provide descriptions of all equipment recommended for the maintenance, repair, citing turf and activities not recommended relative to the warranty. Include maintenance recommendations including coverings for special events, small repair procedures, minor seam repair, discussion of the precautions to be practiced, general maintenance and uses to avoid to protect the turf system.

F. Site Acceptance: As apart of this contract, this contractor shall be responsible to oversee the

installation of the base and drainage and to comment on any problems or conflicts that may be discovered. Upon completion of the base work, submit a letter confirming the site inspection has been performed, noting any discrepancies, problems and/or conflicts. A summary of certification of the acceptance of the base and drainage shall be submitted.

1.04 STANDARD SPECIFICATIONS FOR LAYOUT AND RULES

A. All markings shall be performed using selected colors of turf materials.

1.05 FIELD SLOPE

A. Each field shall be installed with a SLOPED surface. The slope of the field may not exceed a finish profile of 0.75% grade for the Base RFP. This will be maintained throughout. Any modification to this slope shall be submitted in advance to the Project Manager for final review and approval.

1.06 DELIVERY, STORAGE AND HANDLING

Packing and Shipping: Deliver products in original unopened packaging with legible manufacturers' identification. All materials shall be stored in a dry place out of the direct sunlight.

A. Bulk Materials: Deliver materials in clean, washed and covered trucks to eliminate contamination during transportation. On site stockpiling locations to be coordinated with the Township. Stockpile only in areas free of debris and away from drainage routes. Cover all materials with plastic or geotextile if materials are to be stockpiled more than 48 hours.

1.07 FIELD SYSTEM HOLD HARMLESS

The contractor shall hold the Township, Project Manager and Field Consultant harmless from infringement of any current or future patent issued for the synthetic grass system, fibers, backings, including shock pad (if required), installation methods and vertical draining characteristics. The successful Proposer will be required to submit a letter for consent from their surety. Surety will indemnify the requirements.

1.08 FIELD DIMENSIONS AND LAYOUT

The Contractor will be responsible for furnishing, setting and marking all lines, seams and markings for the field. The Contractor shall at all times maintain all necessary benchmarks and control points to locate all events and markings.

1.09 PROTECTION OF UTILITIES AND STRUCTURES

This Contractor shall take special care to protect all field and stadium structures and utilities.

1.10 WARRANTY OF SYNTHETIC GRASS SYSTEM

A. The Warranty/Guarantee shall cover, in general, the usability of the turf system (and pad if required); accessories use characteristics and suitability of the installation. All items covered by the warranty are to be replaced or repaired with new materials, including installation at the sole expense of the warranting contractor for a period of ten (10) years (3rd Party Insured 8 years, 2 years company backed) to the Township from the date of substantial completion. The field materials shall be guaranteed for the designated uses as follows:

1. Marching Band
2. Football
3. Soccer
4. Physical Trustees exercises
5. Physical Trustees activities
6. Lacrosse
7. Field Hockey
8. Rugby
9. Pneumatic rubber tired maintenance and service equipment
10. Pedestrian traffic and other similar uses

B. A principal of the applicable firm, duly authorized to make contracts, shall sign the turf contractor warranty. The term "contractor" contained herein means the firm furnishing the warranty. "Owner" is the Mountain Home Board of Trustees. If the turf manufacturer of the synthetic grass system is not the same entity as the contractor, the warranty shall be co-signed by the manufacturer and the installation contractor.

1.11 FORM OF WARRANTY OF THE SYNTHETIC GRASS SYSTEM

A. Contractor hereby warrants to the Township, subject to the limitations and conditions set forth below, that its synthetic grass system consisting of the synthetic turf described as _____, the shock-absorbing under-pad (if necessary) described as _____, and the adhesives used in the installation, are free from defects in material and workmanship and shall, for a period of ten (10) years (3rd Party Insured 8 years, 2 years company backed) from the date of acceptance by the Township, remain serviceable for the activities as listed above.

B. Contractor warrants to the Township that it's synthetic grass materials shall not fade, fail, shrink, wrinkle or reflect excessive wear. Contractor shall, at their sole expense and cost, replace such areas of the synthetic grass system not performing to these standards for the life of the warranty.

E. Definitions:
   1. The term "not fade" in the context of this warranty shall mean that the synthetic grass material remain a uniform shade of green or the other colors installed with no significant loss of color as defined by not greater than 20% loss or shade reduction.
   2. The term "not fail" or "excessive wear" as used in the context of this warranty shall mean that the length and weight of the face yarn or pile material in the synthetic turf surface shall not have been decreased by more than 8% per year according to ASTM D418, nor exceed 20% during the warranty period. In the event that the synthetic turf materials do not retain its fiber height or shock absorbency and is consequently no longer serviceable during the warranty period, the Contractor shall, at their sole expense, replace such portions of the system that are no longer serviceable.
   3. The term "serviceable" in the context of this warranty shall mean that the synthetic turf material shall have a maximum '"G" force value according to Procedure A, B, or C of ASTM D355, not exceed 110 G's at any location upon installation and shall not exceed 130 G's thereafter throughout the life of the warranty period. This shall be determined by conducting dynamic cushioning tests at the 10 field locations as required per ASTM D355

procedures. “G” force factor values to be determined at 70 degrees F. Any increase from 110 G’s to allowable 130 G’s maximum shall be at a relatively uniform rate not to exceed 10 G’s in any single year.

D. Where applicable, the fabric shall adhere firmly and completely to the underpad or seaming tape over the entire warranty period.

E. Contractor warrants to the Township that the permeable synthetic turf system shall drain vertically a minimum of 20 inches precipitation per hour for a maximum of 24 hours continuously, without visible surface ponding.

F. Contractor shall replace with new materials, at their sole expense, any damage to the synthetic grass system, which extends more than one meter beyond the location of foreign combustibles, which may ignite, and fire-damage the synthetic grass system. The Contractor shall not be held responsible for any incidental or consequential damages. These warranties and the Contractor’s obligations here-under are expressly conditioned upon;

1. The Township making all minor repairs to the synthetic grass system upon the discovery of the need for such repairs.
2. The Township maintaining and properly caring for the synthetic grass system in accordance wit the Contractor’s maintenance manual and instructions.
3. The Township complying with the dynamic and static load specifications established by the Contractor.

G. The warranty is not to cover any defect, failure, damage or undue wear in or to the synthetic grass system caused by or connected with abuse, neglect, deliberate acts, acts of God, casualty, static or dynamic loads exceeding Contractor’s recommendations.

H. Contractor shall examine the synthetic turf system at least once per year or in regards to any claim that the Township makes to be present at any time, to analyze the results of all tests conducted by the Township or others, and to conduct such tests of their own. Contractor shall not be responsible for any costs or expenses incurred by the Township or others with respect to such tests, except the Contractor shall pay for costs of all tests and analysis conducted or directed by their representative. The annual testing will be at the expense of the Contractor and the results delivered to the Township within 60 days of the testing.

I. In the event the Contractor does not respond to the Township’s written notice within 10 days of receipt of the notice or does not submit, schedule and execute corrective work within 60 days (weather permitting), the Township has the option of having the work performed at the expense of the Contractor.

J. The Contractor will be given 7 days notice in the form of a certified letter notifying the Contractor of the end of the 60 day scheduling period.

G. Sample form of warranty herein set forth is a suggested for use for the work under this section. Manufacturers’ standard form of warranty may be used provided conditions specified herein are

incorporated. All claims by the Township under this warranty must be made in writing to the Contractor's address.

Within 30 days after the Township learns of the defect, giving rise to the claim. This warranty shall constitute a contract made in the State of Texas and shall be governed by the laws of that State.

PART 2 – MATERIALS

2.01 GENERAL

A. The field surfacing system shall be a vertically draining permeable synthetic grass system consisting of a synthetic grass like pile that shall be tufted into a triple layer synthetic backing. The final coating shall be a polyurethane based material.

B. The suppliers listed are capable vendors for the specified material. This specification will supersede any references to the vendors specifications or product literature. The specification is meant to identify the quality and quantity of the specific components and performance results. Any material exceeding the specifications shall be consider as an equal. Any material with variations from the specifications shall be approved by the Owner prior to acceptance under this specification and contract.

The Synthetic Grass Suppliers:

- Sprinturf, Charleston SC
- FieldTurf, Fieldturf-Tarkett, Peachtree City, GA
- Shaw Sports Turf, by Shaw Industries, Dalton, GA
- Astroturf, Dalton, GA
- Equal Products Approved by the Township

C. The entire system shall be resistant to weather, insects, rot, mildew, fungus growth and be non-allergenic and non-toxic. The entire system shall be constructed to maximize dimensional stability, to resist damage and normal wear and tear from its designated uses and to minimize the ultra-violet degradation.

D. All adhesives used in bonding the system together shall be resistant to moisture, bacterial and fungus attacks, and resistant to ultra-violet rays at any location upon installation.

E. Include all labor, materials, equipment, transportation and services to install complete all-weather synthetic grass system.

2.02 DYNAMIC CUSHIONING REQUIREMENTS OF THE SYNTHETIC GRASS SYSTEM

A. The dynamic cushioning of the combined turf and in-fill system (and pad if required) shall not exceed a maximum of 110 G's at 70 degrees F. per ASTM 1936-98, F355, Procedure A at any location within 30 days of the installation. The system shall not exceed 130 G's over the warranty period.

B. Packing and Shipping: Deliver products in original unopened packaging with legible manufacturers' identification. All materials shall be stored in a dry place out of the direct sunlight.

C. Rubber infill shall be ambient ground and produced of 100% recycled automobile tires. No other rubber granules will be accepted. The material shall have a size not to exceed 14 mesh nor smaller than 20 mesh. The fine particles shall not exceed 10% by volume.

D. The in-fill system shall have not less than 5.0 pounds of silica sand and 2.5 pounds rubber per square foot installed. Any system that requires less rubber as in-fill shall be required to use an in-situ shock pad system as a force reduction vehicle. The pad shall be designed and tested by the Contractor to show compliance with the shock attenuation requirements.

E. If a combination of sand and rubber are used as the in-fill system, the rubber content shall be not less than 5 pounds per square foot and the sand shall not be less than 3 pounds per square foot.

2.03 PERMEABILITY REQUIREMENTS OF THE SYNTHETIC GRASS SYSTEM

A. After the subgrade is compacted and before the stone base and stone screenings leveling course is fine graded, compacted and made ready for the turf, the per section for Sterilant and Geotextile. Geotextile membrane (filter type fabric) is installed under stone base.

B. The combined turf and in-fill system (and pad if required) shall drain vertically at a minimum of 10 inches of precipitation per hour for 24 hours continuously, without visible surface ponding.

2.04 ADHESIVE MATERIAL PROPERTIES

A. Mapei Adhesive.

B. The adhesive shall have the same warranty period as the synthetic grass system.

2.05 SYNTHETIC TURF PILE SURFACE

A. The pile surface shall provide good traction in all types of weather with the use of conventional "sneaker type shoes" and composition, molded sole athletic shoes. The pile surface shall be suitable for both temporary and permanent line. Markings and permanent markings using a rubber base paint where applicable.

B. The pile height shall be constructed to allow a total of 1/2" of free fiber after the in-fill materials are installed.

2.06 SYNTHETIC TURF SYSTEM MATERIAL COMPONENTS

A. Pile fibers shall resemble freshly grown natural grass in appearance, texture and color (except for the color turf for markings).

B. Fibers shall be monofilament film 100% Polyethylene fiber having a denier of not less than 330 Microns. Slit Film shall be no less than 100 micron. Total fiber weight shall be not less than 56 ounces per square yard. Thatched products are not allowed.

C. Pile surface shall be nominally uniform in length not less than 24".

D. The fibers are tufted through K29 backing synthetic backing material.

E. The final coating or secondary backing shall be a moisture cure polyurethane. This backing shall be not less than 22 ounces. Latex backing material is not acceptable. The secondary backing or polyurethane coating shall be uniform and monolithic when cured.

F. If sewn, all turf seams shall be constructed of reinforced backing material or sewn with high strength polyester fiber cord. Sewn seams shall be a "bagger" type seam with a double sewn line. Seams shall lay flat after in-fill.

G. All glued seams shall have a 12" wide seaming tape of nylon or Mylar, fully coated with adhesive. All seams shall not have any adhesive applied to any exposed fibers. All graphics or markings can be in-laid or cut-in.

H. All turf shall be perforated for drainage after the final backing coating. The perforations shall be not less than 1/4" in diameter and have a uniform spacing of not less than 4" on center. Perforations shall be complete and full diameter for a minimum of 95% of the each roll.

I. On-site perforations are to be inspected prior to installation of the product.

J. Fabric surface shall be constructed and installed in minimum widths of 15 feet with no longitudinal or transverse seams, except for inlaid lines with a finished roll assembly. The seams shall be 15'-0" apart and shall have the white 5-yard line tufted into each panel for the full width of the field. Rolls that do not comply with the proper length or conform to the seaming diagram as submitted prior to the installation, shall be rejected from the site. No fitted pieces will be allowed to true alignment.

2.07 PERFORMANCE AND TEST REQUIREMENTS

A.	Melting Point	ASTM D789	135 degrees F.
B.	Specific Gravity	ASTM D792	.950 to .960
C.	Breaking Strength	ASTM D5034	Length 283 lbs./ft. Width 208 lbs. /ft.
D.	Coefficient of Friction	ASTM D5034	Dry 1.15 Wet 1.00
E.	Pill Burn Test	ASTM D2859	8 Passed/0 Failed

F.	Tuft Bind (without in-fill)	ASTM D1335	11 lbs./sq.ft.
	Tuft Bind (with in-fill)	ASTM D1335	22 lbs./sq.ft.
G.	Pile Height	ASTM D418	2” minimum
H.	Fiber Face Weight	ASTM D418	56 oz./sq. yard
I.	Fiber Construction	ASTM D418	Monofilament 100% Polyethylene Slit Film 100 micron min.
	Gauge Width	ASTM D418	Not more than 0.75”
J.	Fiber Denier	ASTM D418	12,000 Denier
	Fiber Thickness	ASTM D418	330 microns (minimum thickness)

K. Fiber Manufacturers: All yarn suppliers must be based in Europe or N. America. Any manufacture utilizing yarns produced in any country not stated above are not allowed. Proof of extrusion and documentation of the creole origin is part of the submittal process. No raw materials utilized in the extrusion process are allowed from any other country than stated above.

*****Note: No other fiber manufacturer shall be considered at this time.**

L.	Secondary Backing	ASTM D418	Non-filled Polyurethane or Black Latex

M. Post Installation Testing Requirements:

1. After the installation the Contractor shall have the field tested for performance within two weeks of completion.
2. The testing requirements shall be according to the below parameters.
3. TESTS:
   a. Ball Roll: 6 to 10 meters
   b. Ball Bounce: 60 to 100 centimeters
   c. Force Reduction: 55 to 70
   d. Deformation: 4 to 9 mm
   e. Torque: 25 to 50 kg/
   f. Traction: 120 to 180
   g. Ball Angle: Dry 45 to 60 degrees Wet 45 to 80 degrees
   h. Ball Speed: 35 to 50 km
   i. Evenness: 9mm within 3m straightedge

j. Gmax: 95 to 109
k. Seams: All Seams are checked for completeness
l. Infill Depth: 78% of pile height

4. Testing Laboratories:

- All in-situ field performance testing shall be performed by
  a. Labosport Inc, Montreal, Canada +1 (514) 277-9111
  b. FireFly Sports Testing, NH

2.08 MARKINGS

A complete field lining, marking and field boundary system with team areas limits, etc. shall be provided with the initial installation. Layouts shall be accurately surveyed and marked prior to installation.

All lines, numbers and field markings except one-yard marks are to be tufted or inlaid with the specific colored turf. All markings shall be uniform in color, providing a sharp contrast with the turf color and shall have sharp and distinct edging. Markings shall be true and shall not vary more than 1/2" from specified width and location.

Manufacturer is to guarantee that the synthetic fiber is adaptable to painted lines.

Minimum Lining and Markings: All Green Field area with white, red and yellow soccer markings.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Perform all work in strict accordance to the drawings, shop drawings and manufacturer's specifications and instructions.

B. Verification: The Contractor is responsible for the inspecting, verifying and completing all installed work of this section.

C. Weather Permitted Conditions: The Contractor will not perform any work if the condition for working are;

1. Ambient air temperatures are below 45 degrees F.
2. Material temperature falls below 45 degrees F.
3. Rain is forecast or falling
4. Conditions exist or are pending that will be unsuitable to the installation of the system.

3.02 CERTIFICATION OF THE BASE INSTALLATION

A. THE BASE AND DRAINAGE, The Contractor is responsible for the review and acceptance of the base and drainage.

B. Upon completion of the base, this contractor will submit in written form the acceptance of the base noting any deficiencies.

3.03 DELIVERY AND INSPECTION OF MATERIALS

A. Prior to the installation of any materials and immediately upon delivery of the synthetic turf system and components to the project site, the Contractor shall inspect materials as follows:

1. For damaged or defective items
2. Measure turf pile height and roll lengths
3. Inspect the perforations and uniformity
4. Adhesives shall arrive in sealed dry containers.
5. Rubber in-fill shall arrive in large sacks or bags without tears and loose material about.
6. Rubber in-fill shall arrive dry and loose. No Rubber shall be accepted that is bulked or solid.

3.04 TOWNSHIP TESTING

A. The Township reserves the right to submit any material, either before or after installation to any testing it deems necessary to satisfy the conditions of this contract.

B. Any material tested and found not in compliance with the contract will be rejected and replaced with material conforming to the specifications. This will be done at the sole expense of the contractor.

C. Any testing performed by the Township will be at the Township's expense. The contractor is responsible for the cost of all testing the fails.

3.05 TURF INSTALLATION

A. During the installation of the turf the contractor of the turf and pad contractor is not allowed to nail anything thru the liner. At no time are nails allowed in the turf or pad. Any damage done to the underlying linear will be required to be repaired or replaced based upon the Owner's discretion.

B. Seams:

1. All panel seams shall be securely sewn using a double stitch bagger seam and/or glued to a backing material of nylon or Mylar.
2. All panel seams spacing are to be held to a minimum of 15 feet unless prior approval of seaming diagram indicates a lesser panel.
3. All inlaid areas shall have full fastenings and no loose areas. At no time can pulling on the section separate the material.
4. All seams and inlaid areas shall be brushed thoroughly before infill materials are installed.

C. Turf Edges and Termination

All edges and ends of the turf shall be secured to a termination area. This termination shall be as detailed in the drawings. The contractor shall submit a shop drawing of this termination detail prior to any work on the site.

3.06 LINES, MARKINGS AND IN-LAID TURF

A. There are inlays for Two sports for this project.
Main Field Soccer (White Turf)
   - All line colors will be selected by Owner post RFP from manufactures standard color line.
   - Soccer Fields – 2 Total
   - Cricket pitch – wicket area turf system will be determined with selected contractor to determine best product for the wicket area indicated on the plans.

3.07 INSTALLATION OF RUBBER IN-FILL

A. All in-fill materials shall be produced of 100% recycled used automobile tires. There will be no evidence of steel fibers or strands in the material.
   1. The fine particles shall not exceed 10% by volume. Rubber shall have no visible evidence of steel particles present in the final grass infill. The bulk density of the rubber materials shall not be less than **29.75 lbs/cubic feet**.

B. The in-fill material shall be installed at not less than 5.0 pounds of silica sand and 2.5 pounds per square foot allowing an exposed fiber of not less than 3/4” after finish brushing.

C. This contractor is responsible for the supply and installation of all in-fill materials and shall be required to return to the site after not less than 30 days to inspect and add in-fill materials as needed.

D. No in-fill materials shall be installed until the turf system is fully installed with all lines and markings.

E. The synthetic turf shall be thoroughly brushed prior to any in-fill materials to remove any wrinkles and defibrillated the slit film.

F. The synthetic turf shall be brushed a minimum of 10 passes over each area prior to any in-fill areas.

G. The in-fill materials shall be installed in layers not to exceed 0.375 pound per square foot per layer. If sand is added this will be performed as a mixture with the rubber prior to installation at the manufacturer’s recommendations.

H. The turf shall remain free draining at all times before, during and after the in-fill materials are installed.

3.08 GENERAL CLEANUP

A. The site shall be kept clean and free of debris throughout the installation. Empty barrels, sacks, bags and remnant materials shall be stored or disposed daily in a proper container or legal manner.

B. After completion of the entire project, the site shall have a general cleanup removing all debris remaining on the site that is not apart of the final project.

C. The cost of each unit supplied to each project shall be apart of the total proposal cost and become the sole expense of the Synthetic Turf Contractor.

END OF SECTION 9: SYNTHETIC GRASS

SECTION 10: WARRANTY AND GUARANTEE

A: SYNTHETIC TURF SYSTEM: PROPOSAL A

GENERAL

- The Contractor shall be required to issue a non-prorated guarantee for 100% of all labor, materials, workmanship and services for the Synthetic Surface and Markings for:

- Synthetic Grass System for a period of TEN (10) years (3rd Party Insured 8 years, 2 years company backed). This warranty will be not be subject to pro-rating of the surface for any failure due to installation or materials. The surface wear will be determined by an independent consultant acceptable to all parties.

- The guarantee for the surface systems shall remain in force for a period of not less than TEN (10) Years (3rd Party Insured 8 years, 2 years company backed) specified from the date of written acceptance of the work.

    a. The Owner will notify the contractor in writing of any issues that require remedial work on the field area.
    b. The Contractor shall respond to the notification within 48 hours of receipt and schedule any major defect or repair within 72 hours or as weather permits.
    c. The warranty requires that the contractor shall be required to perform all required repairs in a permanent and suitable manner as deemed necessary to maintain a safe playing condition at all times.
    d. The warranty requires that in case of any major repair or replacement, the contractor is to schedule such work as to not interfere with the Owner's primary use or schedule.
    e. Any replacement or repair area shall match (as close as possible) the appearance of the existing turf.
    f. Failure to service the requirements of this warranty will be charge to the contractor.

- Any defects caused by delamination, peeling, normal abrasion or raveling that is not in original conformance with the testing specifications shall be repaired or replaced at no cost to the Woodlands Township Board of Trustees during this guarantee period.

    a. In addition to the Contractor's warranty, the contractor shall be required to submit the following documents in regard to the guarantee:

        - Provide a TEN (10) year warranty for the turf product from the manufacturer for all work performed under this contract.

        - Provide a TEN (10) year warranty for the fibers from the fiber manufacturer for all work performed under this contract.

- Provide a TEN (10) year surfacing manufacturer and installer written guarantee for the synthetic grass.
- Provide a TEN (10) year third party insured warranty issued by a company licensed to do business in the State of Texas. This company shall have a Best rating of A- or more. The limits of the policy shall not be less than $5,000,000.00 per year with a single limit of not less than $500,000.00 per field (not site).
- The Woodlands Township shall be listed as additionally insured.
- There will be no a deductible allowance for this policy.
- Documents shall be submitted to the Woodlands Township District Board of Trustees prior to final payment.

- The Contractor will be responsible for all tests that fail the specification. The Township reserves the right to submit the surface to the above tests at any time during the length of the guarantee. Consideration will be given to the time and use of the surface.

- This warranty does not cover excessive wear of the surface caused by misuse. The Township will be given an instructions and caretaking procedures before final acceptance. This is to follow the maintenance guidelines as specified by the surfacing manufacturer.

END OF SECTION 10: WARRANTY

END OF TECHNICAL SPECIFICATIONS

SPECIFICATIONS

Project #:	11851A	Date:	6/23/2025
Project Name:	Alden Bridge Sports Complex	Bldg Size:	See Drawings
Site Address:	4751 Tx-242	Type of Bldg:	SS-396-DF-BF
City, State, Zip:	The Woodlands, TX 77384		Restroom

TYPE OF BUILDING

Construction Type

MVR WOOD	Wood Framed walls above cap beam, and wood framed rafters [ceiling & vents same as MVR]

FLOOR SYSTEM

ROOM/ITEM	FINISH
Entire Building	Exposed Concrete with Light Broom Finish with Integral Additive for Stain/Moisture Resistance
Entire Building	Floor Coating with Skid Resistant Additive - Flakes

WALL SYSTEM

BUILDING WALLS HEIGHT

Building Walls Height	7'4"

EXTERIOR WALLS - CMU	BLOCK TYPE AND COLOR	ROWS
Precision Exterior 4" CMU	Precision Gray	All

CAP BEAM

Cap Beam	Cap Beam, Steel Tube, Painted

WALL FINISHES - EXTERIOR

TYPE	FINISH	HEIGHT
CMU	Uncoated	To Cap Beam
Wainscot	Cultured El Dorado Stone With Water Sill	To 32" AFF
FRC Siding -Below- Cap Beam	Allura Cedarmill Board & Batt Siding Vertical - Painted	Above Wainscot To Cap Beam
FRC Siding -Above- Cap Beam	Allura Cedarmill Board & Batt Siding Vertical - Painted	Above Cap Beam
Alcove	Precision CMU Painted	To Cap Beam
Exterior Paint	PPG Exterior Gloss - Colors TBD by client	

WALL FINISHES - INTERIOR

ROOM	FINISH	HEIGHT
Restrooms Below Cap Beam	Block filler & paint	To Cap Beam
Restrooms - Above Cap Beam	Stucco Pattern FRC - Painted	Above Cap Beam
Mechanical - To Cap Beam	Block filler & paint	To Cap Beam
Mechanical - Above Cap Beam	Painted OSB	Above Cap Beam
Behind Mop Sink	PVC Panels	To Cap Beam

ROOF SYSTEM

ITEM	DESCRIPTION
Metal Sales Image II 26 GA	26 GA SSM, Metal Sales Image II Standing Seam With 16" Striations W/Ice & Water
Entire Building Ceiling	(MVR) 5/16" Cement Board Stucco Pattern Over 5/8" OSB
Fascia	14/16 Ga Formed Galvanized Steel W/1" Return At Top (MVR)
Vents SS Wire Mesh	Stainless Steel Wire Mesh - Provide Lexan Cover for Vents

DOORS - HARDWARE

ITEM	DESCRIPTION
Hollow Metal Doors	Hollow Metal: Galvanized 14 GA. Door w/ 14 GA Frame Continuos Hinge

Deadbolt	SCHLAGE B600 series temporary large format core (std)

ITEM	DESCRIPTION	LOCATION
Pull Plates	Rockwood-VRT24 "Z" (Standard w/Anti-Microbial) (Std)	
Door Closer	LCN Closer, Model # 4211 Cush Arm (for Out Swing Door)	Restroom
Weather Strip	Pemko Perimeter Gasketing (3' x 7' Door) # 303-C-S-3684	Chase
Door Sweeps	NGP Door Sweep 200NA36	Chase
Door Threshold (No Tile)	Threshold Fluted Saddle Mill Finish Alum, 4" Wide #270A36	All
Door Stop/Bumper	Door Stop/Bumper, Floor Mounted, Brass, Item # DSF444U26D	Chase

Magnetic Locks (SAM)	SAM Securitron System	SDC-463U Emergency Exit Button

RESTROOM ACCESSORIES

ITEM	MANUFACTURER/DESCRIPTION	FINISH
Signage	Door/Wall Signs	Polished Aluminum & Blue
Grab Bars	Grab Bars	Stainless Steel
Aluminum Louvers (Chase Std)	Louver Sunvent Industries Model #157	Polished Aluminum
3-roll Toilet Paper Holders	Royce Rolls TP-3	Stainless Steel
Baby Changing Station	Foundations Horizontal #5410339	Stainless Steel
Hand Dryer Std	Dyson Airblade V, Low Voltage 120V, Model # HU02,	Spray Nickel

ITEM	MANUFACTURER/DESCRIPTION
Utility Hook (Standard)	Utility Hook, Bright Finish, Bobrick # B-670-PRC or Franklin Brass 5501 for Blazer
Soap Dispenser	PRC Proprietary Tank
W/Thru Wall Valve	Thru Wall Valve ASI #353

PRIVACY SCREENS (PARTITION WALLS)

Paper Stone Partition & Doors	Paper Stone Partition Walls & Doors, Continuos Hinges, Pilasters

PLUMBING

FIXTURE/PART	DESCRIPTION
Toilets - Stainless Steel	Acorn # 1675 W-1-HET 1.28 GPF-FVBO-ADA-PFS-316SS
Urinals - Stainless Steel	Acorn # 1709 HEU-W-1-0.125-FVBO-316SS
Lavs - Stainless Steel	Rear Connect Acorn # 1652LRB-1-DMS-03-M-316SS
Drinking Fountain	Wall Mounted Drinking Fountain, 14 Gauge, Type 304 Stainless Steel, Haws Model # 1109.14
Remote Water Chiller	Haws - Remote Drinking Fountain Water chiller - Model #HCR8 w/ Shelf Model #7149MS
Bottle Filler	Wall Mounted Bottle Filler, Lead Free, Type 304 Stainless Steel, Haws Model # 1920
Lever (Std) - Toilet Flush Valve	Zurn W.C. Flush Valve 1.28 Ga Zurn # Z6143AV-HET-7L-BG
Lever - Urinal Flush Valve	Zurn Urinal Flush Valve .125 GPM Zurn # Z6195AV-ULF-7L-BG
Metering Faucet	Single Hole Metering Faucet, Chicago Model # 333-E2805-665PSHABCP - Tempered
Floor Drains: W/Trap Primer	Floor Drain Zurn # ZN460-2NH-5B W/Strainer / With Trap Primer

PLUMBING GENERAL

FIXTURE/PART	DESCRIPTION	
Water Heater	Stiebel DHC-E12	3+ lavorities
Tempered Water to Lavs	Thermostatic Mixing Valve, Acorn Model # ST70-12	
Valve Combo (PRV)	Valve Combo with Pressure Reducing Valve	

Water Line Material	Copper (Std)
Bladder Tank	ProFlo PFXT5, (PRC)/ Amtrol 2 gal (Blazer) - no elect required
Pressure Booster	Amtrol RP-25 PRO (requires elect)
Hose Bibb- Interior	Acorn #8121-LF - in the Chase
Hose Reel & Hose	Hose Reel With 5/8"x75' Garden Hose

ELECTRICAL

ITEM	DESCRIPTION	
Electrical Panel	200 amp Single Phase - 120/240 v	30 Circuits
Breakers	Plug on (QOD)	

LIGHTING

ITEM	DESCRIPTION (W=WALL, C=CEILING)	
Lighting Control -Interior-	Light Fixture Integraded Occupancy Sensor (OCC)	
OCC Sensor Switch for St&CN	Occupancy Sensor Wall Switch with Dimming	
Interior Lights	W/C) Luminaire, Swoop Series SWP1212-OP-BRZ-OCC	15 Watts
Lighting Control -Exterior-	Photo Cell Intermatic Photo Control #EK4336S	
Exterior Light	ORBIT LWP4-30W-CW	10 Watts
Chase Lights	C) Green AL-42L (large Chase)Waterproof	30 Watts

RECEPTACLES/SWITCHES, HEATERS, FANS, HVAC, LIGHTED SIGNS

ITEM	DESCRIPTION	LOCATION
Receptacles	GFCI (Adjacent to Panel)	
Switches By Pass	By Pass (To By Pass OCC Sensors)	Chase
Fan	Broan Model # L100MG 120 VAC with 6" Round Duct Connector #1106466	
Emergency Light	Lithonia ELM2L Led 2 Head Led Emergency Light (Mechanical Room)	