

Project Manual

Bid Package 01

(NORTH PARKING & ACCESS)



Cherokee Nation Replacement Hospital

Tahlequah, Oklahoma

Project Number 21-08.21

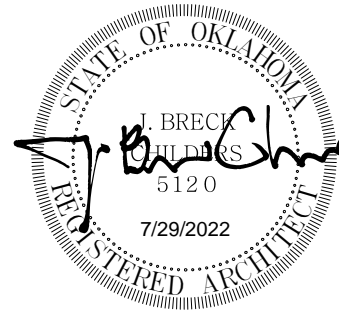
July 29, 2022



SECTION 00 0105

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July 29, 2022
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AVAILABLE PROJECT INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: References other information relevant to the construction of this Project that is available project information.
- B. At the request of the Owner, the information identified below represents services that have been provided by others, not as an Architect's Consultant, regarding conditions that affect this Project that are beyond the responsibilities of the Architect and Architect's Consultants. Reference to such information herein is solely for the convenience of the Owner. Architect makes no representation, express or implied, as to the accuracy or validity of the information.
- C. Bidders are expected to examine the site and the information available from the Owner to determine for themselves the conditions to be encountered.
- D. If conditions other than those indicated in the information available from the Owner are encountered before or during construction, notify the Owner before work continues.

1.2 GEOTECHNICAL REPORT

- A. Owner's Geotechnical Consultant has made subsurface borings at the Project site, has performed investigations of the geotechnical conditions, and has prepared reports of the investigation:
 - 1. North Parking Lot: Palmerton & Parrish, Inc., Project Number 281188, dated July 12, 2022.
- B. Information was obtained for use in preparing the foundation design, but is indicative only of the soil conditions where the borings are taken.
- C. Copies follow this Section,

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

GEOTECHNICAL ENGINEERING REPORT
W.W. HASTINGS SURFACE PARKING
TAHLEQUAH, OKLAHOMA

Prepared for:

CHILDERS ARCHITECT
142 Howell Street, Suite 170
Dallas, Texas 75207

Prepared by:



PPI PROJECT NUMBER: 281188

July 12, 2022

July 12, 2022
(Revised)

Childers Architect
142 Howell Street, Suite 170
Dallas, Texas 75207

Attn: Mr. Matthew Thomas, Associate AIA
Email: mthomas@childersarchitect.com

RE: Geotechnical Engineering Report
W.W. Hastings Replacement Surface Parking
Tahlequah, Oklahoma
PPI Project Number: 281188

Dear Mr. Thomas:

Attached, please find the report summarizing the results of the Geotechnical Investigation conducted for the above referenced project. We appreciate this opportunity to be of service and if you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC.
By:



R. Todd Hercules, P.E.
Geotechnical Engineer

PALMERTON & PARRISH, INC.
By:



Brandon R. Parrish, P.E.
Vice President



July 12, 2022

Submitted: One (1) Electronic .pdf Copy

BRP/SMR/RTH/cl

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APPENDIX II	–	GENERAL NOTES
APPENDIX III	–	GRAIN SIZE ANALYSIS RESULTS
APPENDIX IV	–	IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

EXECUTIVE SUMMARY

A Geotechnical Investigation was performed at the site planned for construction of the new Cherokee Nation W.W. Hastings Surface Parking located directly north of the recently constructed Cherokee Nation Outpatient Health Center in Tahlequah, Oklahoma. This project is anticipated to include construction of a new surface parking area, three (3) detention basins, and a bus shelter. The parking area will extend south of E. Downing Street to the existing Cherokee Nation Outpatient Health Center's existing parking area.

A total of twenty-five (25) geotechnical borings were drilled within the proposed development footprint. Twenty-one (21) borings were located within the proposed pavement area footprint, while four (4) borings were located within the proposed detention basins. Pavement borings were proposed to depths of 5 to 7.5 ft. below the ground surface, while the detention basin borings were to extend to proposed depths of 10 ft. All borings were extended to the depths specified above or auger refusal, whichever was shallower.

Based upon the information obtained from the borings and subsequent laboratory testing, the site is suitable for construction of the proposed new W.W. Surface Parking, detention basins, and bus shelter. Important geotechnical considerations for the project are summarized below. However, users of the information contained in the report must review the entire report for specific details pertinent to geotechnical design considerations.

- The project site primarily consists of grass-covered lawn or field with some areas of mature trees and existing structures. The existing structures are anticipated to be demolished prior to parking lot construction;
- A layer of topsoil (approximately 4 to 6 inches) was encountered within all borings. This material is not suitable in areas of new fill, pavement sections and building areas;

EXECUTIVE SUMMARY (CONTINUED)

- Existing structures including all building components, old pavements, and terminated utilities should be removed and replaced prior to the construction of pavements;
- Overburden soils generally consisted of clayey gravels and sands, gravelly clays, or lean clay with sand and gravel as is typical in the Tahlequah area. These soils were primarily logged as medium dense to very dense or stiff to very hard and sometimes exhibited significant drilling difficulty when using standard drilling methods;
- Foundation loads for the new bus shelter may be supported upon shallow foundations bearing upon stiff to very hard or medium dense to dense natural overburden soils, or controlled fill. Foundations bearing on native soils may be designed for an allowable bearing capacity of 3,500 psf for column footings and 3,000 psf for continuous footings. Foundations bearing on newly placed controlled fill may be designed for allowable bearing capacities of 2,500 psf for column footings and 2,000 psf for continuous footings;
- Due to the stiffness and density of the existing subgrade soils, sufficient support is anticipated to be provided for pavements if subgrades are prepared in accordance with Section 7.0;
- In order to provide temporary parking as well as a staging area for the upcoming Hospital project, the parking lot is understood to be initially asphalt paved, followed by a concrete overlay, i.e. white topping, once Hospital construction is complete. Refer to Section 10.0 for additional details regarding concrete white topping;
- The project site classifies as a Site Class C in accordance with Section 1613 of the 2018 International Building Code (IBC), as determined by on-site standard penetration resistance testing;

EXECUTIVE SUMMARY (CONTINUED)

- Excavation and mass earth moving at this project site is anticipated to generally be somewhat difficult and variable. Excavation difficulty and rippability of the existing overburden soils at the site is further discussed in Section 7.7 of this report; and
- Palmerton & Parrish, Inc. should be retained for construction observation and construction materials testing. Close monitoring of subgrade preparation work is considered critical to achieve adequate foundation and subgrade performance.

GEOTECHNICAL ENGINEERING REPORT

W.W. HASTINGS SURFACE PARKING

TAHLEQUAH, OKLAHOMA

1.0 INTRODUCTION

This is the report of the Geotechnical Investigation performed at the site planned for construction of the new Cherokee Nation W.W. Hastings Surface Parking in Tahlequah, Oklahoma. This investigation was authorized by Mr. J. Breck Childers, Managing Principal, representing Childers Architect. The approximate site location is shown below for reference.



The purpose of the Geotechnical Investigation was to provide recommendations for foundation design and construction planning, and to aid in site development. Palmerton & Parrish Inc.'s (PPI) scope of services included field and laboratory investigation of the subsurface conditions in the vicinity of the proposed project site, engineering analysis of

the collected data, development of recommendations for foundation design and construction planning, and preparation of this engineering report.

2.0 PROJECT DESCRIPTION

Item	Description
Site Layout	See <u>Figure 1</u> : Boring Location Plan
Pavements	The lot is anticipated to be asphalt paved initially and used for temporary parking and a construction staging area for the upcoming Hospital project. Once construction of the Hospital is complete, a concrete overlay, i.e. white topping, will be constructed for the final wearing surface.
Detention Basins	A total of three (3) detention basins are planned at the project site on the west side of the proposed parking area.
Retaining Walls	None anticipated.
Foundation Loading	Light foundation loads for the bus shelter are anticipated.
Existing Structure	Based on aerial imagery, the subject site contains an existing residential house and several shed buildings. Demolition of the existing structures is anticipated prior to project construction.
Anticipated Grading	Site grading plans were not provided at the time of this report. It is PPI's understanding that approximately 2 to 3 feet of cut will be performed on the east side of the proposed new surface parking area and 1 to 2 feet of cut and/or fill will be performed across the remaining parking areas.

3.0 SITE DESCRIPTION

Item	Description
Township/Range/Section	T17N R22E S34
Location	The site is located in Cherokee County and will be located south of East Downing Street near its intersection with Old River Road in Tahlequah, Oklahoma.
Latitude: Longitude: (± Center of Project Site)	35.913336° -94.945408°
Available Historic Aerial Photography	Based on available historic aerial imagery from Google Earth Pro, the project site has not visibly been altered since the year 1985.
Current Ground Cover	The project site is primarily covered in grass covered topsoil with some trees and existing buildings/pavements on the north half of the subject site.
Existing Topography	The project site ranges in elevation from approximately 920 feet to 930 feet based on information from Google Earth Pro.
Drainage Characteristics	The project site drains to the northwest, with poor to moderate drainage.

4.0 SUBSURFACE INVESTIGATION

Subsurface conditions were investigated through completion of subsurface borings and subsequent laboratory testing.

4.1 Subsurface Borings

As requested by the Design Team, a total of twenty-five (25) borings were drilled at the project site. A site plan of the boring locations is attached as Figure 1: Boring Location Plan. Boring locations were selected by the Design Team and staked in the field by PPI. Boring identifications were assigned to the borings according to the table below:

Borings	Location	Proposed Boring Depths (ft)
DB1 thru DB4	Detention Basin	10
EP1 thru EP5	Eastern Parking	7.5
P1 thru P16	Primary Parking Area	5

Borings were discontinued in natural overburden soils or upon auger refusal at depths ranging from 3.8 ft. to 10 ft. below the existing ground surface. The Oklahoma One-Call System, as well as hospital maintenance personnel, were notified prior to the investigation to assist in locating buried public and private utilities, respectively. Logs of the borings showing descriptions of soil and rock units encountered, as well as results of field and laboratory tests and a “Key to Symbols” are presented in Appendix I.

Borings were drilled between June 8 and 10, 2022 using 4.5-inch outside diameter (O.D.) continuous flight augers (CFA) or a 3-inch O.D. carbide tricone with wash rotary methods. Boring DB2 encountered a chert layer that was not penetrable with CFA’s; however, drilling was continued using a 3-inch O.D. carbide tricone.

All borings were advanced utilizing a track-mounted Dietrich D-50 drill-rig. Soil samples were collected at 2.5 ft. centers during drilling using a split spoon sampler while performing the Standard Penetration Test (SPT) in general accordance with ASTM D1586.

Auger refusal occurred in Borings DB1, DB2, DB3, EP1, EP2, EP5, P1, P2, P6, P11, P13, P15, and P16. The refusal was either a result of the auger itself or the split spoon sampler failing to penetrate the chert-laden soils.

4.2 Laboratory Testing

Collected samples from the borings were sealed and transported to the laboratory for further evaluation and visual examination. Laboratory soil testing included the following:

- Atterberg Limits (ASTM D4318);
- Grain Size (ASTM D6913);
- Moisture Content (ASTM D2216); and
- Pocket Penetrometer Strength.

Laboratory soil test results are shown on each boring log in Appendix I and are summarized in the following table. Grain size analysis results are attached as Appendix III.

Soil Laboratory Testing Results							
Boring	Depth (ft.)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Moisture Content (%)	USCS Symbol	% Passing No. 200 Sieve
DB2	8.5	22	14	8	11.0	SC	-
DB3	6.0	-	-	-	11.3	SC	38
EP2	3.5	33	18	15	13.5	GC	-
EP5	6.0	-	-	-	10.3	SC	33
P3	1.0	26	17	9	18.5	CL	-
P3	3.5	-	-	-	11.3	GC	28
P9	1.0	33	16	17	17.1	CL	-
P16	1.0	33	20	13	21.2	CL	-

5.0 SITE GEOLOGY

According to the United States Geologic Survey's Geological Map of Oklahoma, the general site is underlain at depth by the Keokuk and Reeds Spring formation and the St. Joe Group. Within the site area, the primary rock type is chert with other rock types consisting of limestone, shale, and marlstone. Overburden soils at the site are typically

residual having developed through chemical and physical weathering of the underlying parent bedrock, consisting primarily of chert fragments, boulders and clay layers. The boundary between overburden soils and relatively unweathered limestone is usually abrupt.

6.0 GENERAL SITE & SUBSURFACE CONDITIONS

Based upon subsurface conditions encountered within the borings drilled at the project site, generalized subsurface conditions are fairly consistent across the project site, and similar to typical overburden soils found within the Tahlequah area. Surficial materials primarily consist of topsoil, overlying lean clays with varying amounts of gravel and sand or clayey gravels/sands. Gravels and sands were generally noted to consist of chert. Zones of relatively chert free lean clays were sometimes encountered and were generally noted to be within the upper 3 feet were present in isolated areas.

These conditions are presented on each boring log attached in Appendix I. Soil stratification lines on the boring logs indicate approximate boundary lines between different types of soil units based upon observations made during drilling. In-situ transitions between soil and some rock types are typically gradual.

6.1 Detention Basins

The overburden soils encountered within Borings DB1, DB2, DB3, and DB4 were consistent with soils containing large amounts of chert gravels. Chert cobbles and boulders may also be found within this material that are not distinguishable with a 2-inch split-spoon sampler. Therefore, special attention must be made to the rippability of the soils in the detention basin areas, as explained in Section 7.7.

6.2 Groundwater

Shallow groundwater was not observed within the borings on the date drilled, except within Boring EP1. Perched groundwater was encountered within Boring EP1 at a depth of 1 ft. It is anticipated that perched water had collected over a relatively impermeable layer of fat clay, causing the water to be locally isolated within the

boring location. The free-water encountered within this boring is not anticipated to reflect the depth of a more stable layer of groundwater at the subject site.

It should be noted that water-based drilling fluid was used during field drilling in Boring DB2. As a result, obtaining groundwater levels was not possible once tricone rotary methods were initiated. Based upon previous borings drilled within the general site area, groundwater is not anticipated to be encountered. It should be noted that during wet periods, perched groundwater may be encountered at the limestone/shale/chert and overburden soil contact, if present. Groundwater levels should be expected to fluctuate with changes in site grading, precipitation, and regional groundwater levels. Groundwater may be encountered at shallower depths during wetter periods.

7.0 EARTHWORK

7.1 Site Preparation

The initial phase of site preparation should include the following:

- Topsoil and all vegetative matter including trees/root bulbs should be removed from all pavement locations, building locations, and areas scheduled to receive new fill. Removal should include tree roots of 6-inches or greater; and
- Areas scheduled to receive controlled fill should be proof-rolled and approved in accordance with the following section of this report.

After the initial phase is complete, it is recommended that all building, pavement and undercut bottoms be proof-rolled to assure a stable subgrade. Proof-rolling consists essentially of rolling the ground surface with a loaded tandem axle dump truck or similar heavy rubber-tired construction equipment and noting any areas which rut or deflect during rolling. All soft subgrade areas, if any, identified during proof-rolling should be undercut and replaced with compacted fill as outlined below. Proof-rolling, undercutting, and replacement should be monitored by a representative of PPI. **The depth and areal extent of undercutting soft subgrade areas will be largely**

dependent upon the time of year and related soil moisture conditions. If construction is initiated during or immediately following wetter months, the requirement for undercutting areas of isolated soft surficial soils below planned cut depths should be anticipated and reflected in the contract documents, but anticipated to be minimal.

After evaluation by proof-rolling and approval, the subgrade should be scarified to a depth of at least 8 inches, adjusted to within the optimum moisture content ranges and compacted to specified density, provided below (See Section 7.3). Placement of controlled fill may then proceed.

7.2 Fill Material Types

Fill Type¹	USCS Classification	Acceptable Location for Placement
On-Site Soils / Imported Fill	GC, SC, SW or GW	Acceptable for all areas/elevations.
Low Volume Change (LVC) Engineered Fill & Onsite Soils ²	CL, GC, or SC (LL < 50)	Acceptable for all areas/elevations; however, CL soils containing less than 30 percent gravels may be difficult to establish proper compaction with and it may be advisable to limit these materials to non-pavement and building areas.
Non-LVC Imported Fill	CH with less than 30% gravel content	Should <u>not</u> be placed within the upper 2 ft. beneath foundations and pavements.
^{1.} Controlled, compacted fill should consist of approved materials that are free of organic matter and debris and contain maximum rock size of 12 inches, or the lift thickness, whichever is less. Frozen material should not be used and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to its use. ^{2.} Low plasticity cohesive soil or granular soil having a liquid limit of less than 50%, containing at least 15% fines retained on the No. 200 sieve, and preapproved by the Geotechnical Engineer.		

7.3 Compaction Requirements

Item	Description
Subgrade Scarification Depth	At least 8 inches
Fill Lift Thickness	8-inch (loose)
Compaction Requirements ¹	<ul style="list-style-type: none"> • <u>Coarse Grained Material</u>: 70% Relative Density, or compacted by a minimum of three (3) passes of a large diameter self-propelled vibratory compactor. • <u>Fine Grained Material</u>: 95% Standard Proctor Density (ASTM D-698)
Moisture Content	<ul style="list-style-type: none"> • \pm 2% optimum moisture for CL, SC, or GC soil types; or • 0 to 4% above optimum for CL-CH or CH soil types.
Recommended Testing Frequency	<ul style="list-style-type: none"> • One (1) Field Density (compaction) test for each 2,500 sq. ft. of fill within bus shelter areas; • One (1) Field Density (compaction) test for each 5,000 sq. ft. of fill within paving areas; and • A minimum of three (3) tests per lift.
¹ . We recommend that engineered fill (including scarified compacted subgrade) be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.	

7.4 Landscaping & Site Drainage

Discharge from roof downspouts, if any, should be collected and diverted well away from the parking area perimeter and incorporated into the design plans. Rapid, efficient runoff away from the project site should also be provided.

In addition, provisions should be implemented to reduce the potential for large fluctuations in moisture within the subgrade soils adjacent to the structure. Ponding of surface water immediately adjacent to the structures and pavements can significantly increase subgrade moisture and may result in undesirable subgrade movement. As previously mentioned, careful consideration should be given to the landscaping and drainage elements to be installed at the project site adjacent to bus shelter and pavement areas. **Trees and some large bushes can draw significant moisture from the subgrade soils, resulting in shrinkage and subsequent foundation/pavement movement.**

7.5 Earthwork Construction Considerations

Once grading and filling operations have been completed, the moisture within the subgrade should be maintained, and soils not be allowed to dry and desiccate prior to construction of footings. Grading of the site should be performed in such a manner so that ponding of surface water on prepared subgrade or in excavations is avoided. During construction, if the prepared subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be scarified or removed, moisture conditioned, and recompact prior to construction.

7.6 Excavations

Based upon the subsurface conditions encountered during this investigation, the on-site soils typically classify as Type B in accordance with OSHA regulations. Temporary excavations in soils classifying as Type B with a total height of less than 20 ft. should be cut no steeper than 1H:1V in accordance with OSHA guidelines. **Confirmation of soil classification during construction, as well as construction safety (including shoring, if required), is the responsibility of the contractor.**

7.7 Rippability

As mentioned throughout this report, the overburden soils at the project site primarily consist of dense to very dense clayey gravels with possible chert cobbles and boulders. Sometimes significant difficulty was experienced when drilling the geotechnical borings within this chert-laden material. Based upon this information, the overburden soils are anticipated to be rippable with dozers, but with difficulty. **In addition, areas resistant to ripping consisting of large chert boulders, requiring other removal methods (pneumatic breakers or blasting, if allowed) should be anticipated.** The Earthwork Contractor should review the attached boring logs when assessing excavation difficulty at this site. Mass grading at this site is anticipated to occur at a slower rate as compared to sites where overburden soils are primarily fine grained (silts and clays).

8.0 FOUNDATIONS

8.1 Shallow Foundation Design Recommendations

The table below contains recommendations regarding shallow foundations for the bus shelter structure.

Description	Column (Spread Footing)	Wall (Continuous Footing)
Net allowable bearing pressure ¹	<ul style="list-style-type: none"> Native Soil: 3,500 psf Controlled Fill: 2,500 psf 	<ul style="list-style-type: none"> Native Soil: 3,000 psf Controlled Fill: 2,000 psf
Minimum dimensions	2.5 feet	1.5 feet
Minimum embedment below finished grade for frost protection and variation in soil moisture ² (footings on soil)	2 feet	2 feet
Estimated total settlement ³	1 inch or less	1 inch or less
Allowable passive pressure ⁴	600 psf	600 psf
Coefficient of sliding friction ⁵	0.4 (natural soils/controlled fill)	0.4 (natural soils/controlled fill)
<ol style="list-style-type: none"> The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended pressure considers all unsuitable and/or soft or loose soils, if encountered, are undercut and replaced with tested and approved new engineered fill. Footing excavations should be free of loose and disturbed material, debris, and water when concrete is placed. A factor of safety value of 3 has been applied to these values. For perimeter footings and footings beneath unheated areas. The foundation movement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. Allowable passive pressure value considers a factor of safety of about 2. Passive pressure value applies to undisturbed native clay or properly compacted fill. If formed footings are constructed, the space between the formed side of a footing and excavation sidewall should be cleaned of all loose material, debris, and water and backfilled with tested and approved fill compacted to at least 95% of the material's Standard Proctor dry density. Passive resistance should be neglected for the upper 2.5 feet of the soil below the final adjacent grade due to strength loss from freeze/thaw and shrink/swell. Coefficient of friction value is an ultimate value and does not contain a factor of safety. 		

8.2 Uplift

Resistance of shallow spread footings to uplift (Up) may be based upon the dead weight of the concrete footing structure (W_c) and the weight of soil backfill contained in an inverted cone or pyramid directly above the footings (W_s). The following parameters may be used in design:

Description	Weights
Weight of Concrete (W_c)	150 pcf
Weight of Soil Resistance (W_s)	100 pcf
Weight for on-site soils placed in accordance with <u>Section 7.0</u>	

The base of the cone or pyramid should be the top of the footing and the pyramid or cone sides should form an angle of 30 degrees with the vertical. Allowable uplift capacity (U_p) should be computed as the lesser of the two (2) equations listed below:

$$U_P = (W_s/2.0) + (W_c/1.25) \text{ or } U_P = (W_s + W_c)/1.5$$

8.3 Construction Considerations for Shallow Foundations

It is essential that footing bottoms should not be allowed to become dry and desiccate prior to concrete placement to help reduce the potential for shrink/swell behavior. Footings should be clean and free of standing water, debris, and loose soil at the time of concrete placement. Footing/mat excavations should be observed by a representative of PPI prior to placement of reinforcing steel and concrete placement.

9.0 SEISMIC CONSIDERATIONS

Code Used	Site Classification
2018 International Building Code (IBC) ¹	C
1. In general accordance with the <i>2018 International Building Code</i> , Section 1613	

10.0 PAVEMENT

The parking lot is anticipated to be asphalt paved initially and used for temporary parking and a construction staging area for the upcoming Hospital project. Once construction of the Hospital is complete, a concrete overlay, i.e. white topping, will be constructed for the final wearing surface. Prior to initial asphalt pavement placement, preparation of the pavement subgrade should be performed in accordance with Section 7.0 of this report.

10.1 Flexible Pavement

As mentioned above, asphalt is anticipated to be placed as the temporary driving surface to be used for parking and a construction staging area. Below the asphaltic paving, the aggregate base may be a granular compacted crushed limestone with a gradation and quality conforming to the requirements of the Oklahoma Department of Transportation (ODOT), Standard Specification 703.01 for Type A aggregate. The maximum lift thickness for the granular base is 4 in. Granular base thicknesses in excess of 4 inches should be placed in multiple lifts with each lift being of approximately equal thickness. The granular base should be compacted to at least 100% of Standard Proctor Compaction (ASTM D-698).

Asphaltic concrete, both base and surface, should conform to the applicable requirements of ODOT Standard Specification 708. Asphaltic concrete should be compacted to 92 to 96% of Maximum Theoretical Specific Gravity (ASTM D-2041). Substitution of an appropriate Superpave Mix Design, SP 190C or SP 250C, can be used in place of the bituminous base. SP 190C or SP 125C may be used for the surface. All bituminous mix designs should have been prepared or verified within 6 months of the date of placement on the project.

10.2 Concrete White Topping

Following temporary use of the asphalt driving surface, it is understood that a thin concrete white topping will be placed on top of the asphalt as the final driving surface. A bonded overlay is considered the most appropriate overlay due to the anticipated relatively good condition of the previously placed asphalt. In a bonded overlay, preparation of the underlying asphalt is key to the satisfactory performance of the white topping. **A bonded white topping is not recommended to be placed over new asphalt.** However, the asphalt is anticipated to be in place at least 1 year prior to white topping placement. The following steps should be performed prior to white topping placement:

- Mill asphalt surface 0.5-inch, minimum, maintaining at least a 4-inch underlying asphalt thickness to promote satisfactory bonding;
- Mill deeper, or completely remove, where the asphalt is heavily damaged, if any by construction equipment; and
- The milled asphalt surface should be swept multiple times, air blasted to remove remaining debris and dust and wetted prior to concrete placement.

Following surface asphalt preparation, installation of the concrete white topping is anticipated. Construction of a concrete white topping is similar to standard concrete pavement, although it does require some additional requirements, including:

- Concrete panel size of 6-ft by 6-ft. to aid in concrete crack control;
- Joints sawed as soon as concrete has gained sufficient strength to allow sawing without raveling;
- Due to the increased number of saw joints, a gang of concrete saws spaced along a guide bar is often used for the longitudinal joints, with the transverse joints sawed first. Regardless, the paving contractor should have sufficient equipment and manpower available for the saw jointing process, as this requirement is greater than conventional concrete pavement jointing and curing occurs at a faster pace due to the thinner concrete section. If jointing is not performed in a timely manner, undesirable cracking may occur; and
- Refer to “Tech Brief, Thin Concrete Overlays, FHWA-HIF-17-012, October 2017” found at <https://www.fhwa.dot.gov/pavement/pubs/hif17012.pdf> for additional information.

The Portland Cement Concrete (PCC) mix should have a minimum 28-day compressive strength of 4000 pounds per square inch (psi). Concrete should be placed at a low slump (1 to 3 inches) and have an entrained air content of 5 to 7%. If an increased slump is desired, use of Super Plasticizer is recommended.

10.3 Pavement Subgrade CBR

Based upon relatively high SPT-N values obtained during drilling, the natural soil deposits should exhibit stiff to hard subgrades for pavement construction. A CBR value equal to 5.0 for the natural subgrade soils or natural overburden soils that have been properly recompacted is recommended to be used in pavement design.

10.4 Pavement Thickness

Typical pavement design for this type of development would generally generate a Structural Number of 3.0 to 3.5 within heavy duty areas and 2.4 to 2.6 within light duty areas, depending on the subgrade conditions. The lower table presents corresponding typical flexible and rigid pavement thickness using the general Structural Numbers where conventional pavement placement is anticipated, i.e. standard thickness concrete or asphalt only. However, the upper table below presents recommended thickness if a temporary asphalt layer is placed, utilized during hospital construction, followed by placement of a concrete white topping once Hospital construction is complete.

Recommended Temporary Asphalt Placement Followed by Concrete White Topping Thicknesses (If utilized)					
Pavement Type	Anticipated Traffic Frequency	Asphaltic Surface (in.)	Asphaltic Base (in.)	Concrete Thickness (in.)	Aggregate Base (in.)
Initial Flexible (Asphalt) Pavement Layer	Medium Duty	*2.0	3.0	-	6.0
Concrete White Topping	Medium Duty	-	-	5.0	N/A
*This layer will be milled 0.5-inches and thoroughly cleaned prior to concrete white topping placement, and repaired (if required) in areas where construction traffic damages the asphalt pavement.					

Conventional Pavement Thicknesses (If utilized)					
Pavement Type	Anticipated Traffic Frequency	Asphaltic Surface (in.)	Asphaltic Base (in.)	Concrete Thickness (in.)	Aggregate Base (in.)
Flexible Pavement	Heavy Duty	3.0	4.0	-	6.0
	Medium Duty	2.0	3.0	-	6.0
	Light Duty	2.0	2.0	-	6.0
Rigid Pavement	Heavy Duty	-	-	7.0	4.0
	Medium Duty	-	-	6.0	4.0
	Light Duty	-	-	5.0	4.0

11.0 CONSTRUCTION OBSERVATION & TESTING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Since geotechnical engineering is influenced by variable depositional and weathering processes and because we sample only a small portion of the soils affecting the performance of the proposed structures, unanticipated or changed conditions can be disclosed during grading. Proper geotechnical observation and testing during construction is imperative to allow the Geotechnical Engineer the opportunity to evaluate assumptions made during the design process. Therefore, we recommend that PPI be kept apprised of design modifications and construction schedule of the proposed project to observe compliance with the design concepts and geotechnical recommendations, and to allow design changes in the event that subsurface conditions or methods of construction differ from those assumed while completing this study. We recommend that during construction all earthwork be monitored by a representative of PPI, including site preparation, placement of all engineered fill and trench backfill, and all foundation excavations as outlined below.

- An experienced Geotechnical Engineer or Engineering Technician of PPI should observe the subgrade throughout the proposed project site immediately following stripping to evaluate the native clay, identify areas requiring additional undercutting, and evaluate the suitability of the exposed surface for fill placement;
- An experienced Engineering Technician of PPI should monitor and test all fill placed within the building and pavement areas to determine whether the type of

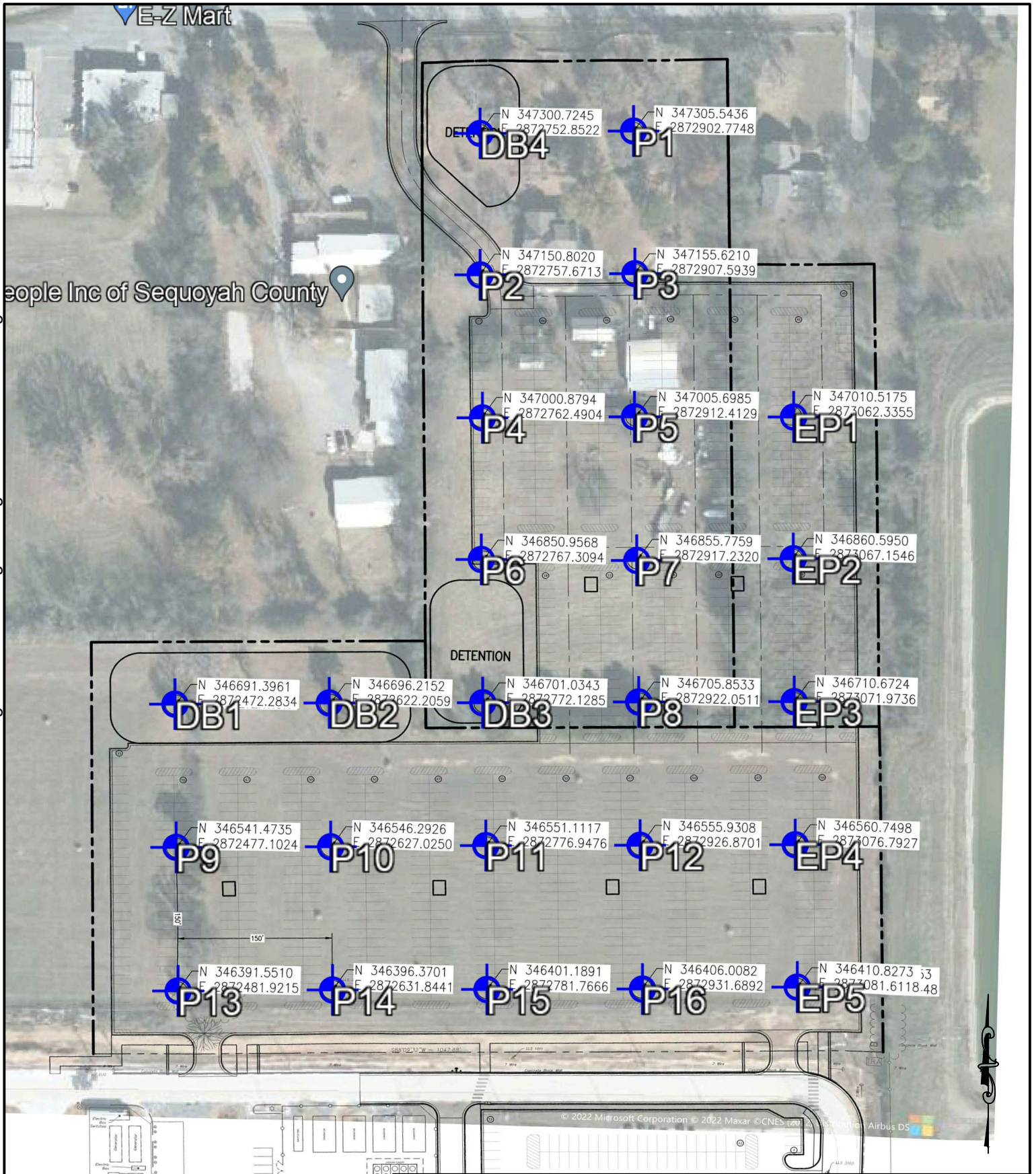
material, moisture content, and degree of compaction are within recommended limits. **Refer to Section 7.3 for recommendations regarding Field Density (compaction) testing frequency;**

- An experienced Technician or Engineer of PPI should observe and test all footing excavations. Where unsuitable bearing conditions are observed, remedial procedures can be established in the field to avoid construction delays; and
- An experienced Technician or Engineer of PPI should observe and test all footing excavations. Where unsuitable bearing conditions are observed, remedial procedures can be established in the field to avoid construction delays.

12.0 REPORT LIMITATIONS

This report has been prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Palmerton & Parrish, Inc. observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. Palmerton & Parrish's findings and conclusions must be considered not as scientific certainties, but as opinions based on our professional judgment concerning the significance of the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.

FIGURES



SCALE: 1" = 125'

LEGEND

Boring Location

Project: W.W. Hastings Surface Parking - Tahlequah, Oklahoma
Client: Childers Architect

Boring Location Plan

DATE: June 24, 2022

Project Number: 281188



PALMERTON & PARRISH, INC.
GEOTECHNICAL AND MATERIALS ENGINEERS/MATERIALS TESTING LABORATORIES/ENVIRONMENTAL SERVICES

FIGURE 1

APPENDIX I
BORING LOGS & KEY TO SYMBOLS

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GEOTECHNICAL BORING LOG

BORING NUMBER

DB1

PAGE 1 OF 1

CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/9/22

COMPLETED 6/9/22

SURFACE ELEVATION _____ **BENCHMARK EL.** _____

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf)				ELEVATION (ft)
								N VALUE				
								SHEAR STRENGTH (ksf)				
								PL MC LL				
								20 40 60 80 100				
0.0	CFA - 4.5" O.D.		TOPSOIL (5") 0.4 ft									
			CLAYEY GRAVEL, With Sand, Reddish Brown to Red, Dense to Very Dense, Moist (GC)			5-21-24 (45)	0					
2.5												
						28-48-46 (94)	1.75					
5.0												
			CHERT LAYER 5.5 ft									
			GRAVELLY LEAN CLAY, With Sand, Red, Very Hard, Moist (CL) 6.4 ft			59-66/3"	1.75					
7.5												
			CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC) 7.7 ft									
						66-66/1"	3.25					
			9.1 ft									
Refusal at 9.1 feet. Bottom of borehole at 9.1 feet.												



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PAGE 1 OF 1

CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/9/22	COMPLETED	6/9/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆				ELEVATION (ft)
								20 40 60 80 100				
								▲ N VALUE ▲				
								20 40 60 80				
								PL MC LL				
20 40 60 80												
■ SHEAR STRENGTH (ksf) ■												
1 2 3 4												
0.0	CFA - 4.5" O.D.		TOPSOIL (5") 0.4 ft			12-21-30 (51)	0					
2.5			CLAYEY GRAVEL, With Sand, Brown, Very Dense, Moist (GC)									
3.0	ROTARY - 3" O.D.		CLAYEY SAND, With Gravel, Red, Very Dense, Moist (SC)			20-52-66/5"	2.75					
5.0												
6.6												
7.5												
9.3			SPT 4		47-66/3"	2.75						

Refusal at 9.3 feet.
Bottom of borehole at 9.3 feet.



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PAGE 1 OF 1

CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/9/22	COMPLETED	6/9/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆				ELEVATION (ft)	
								20	40	60	80		100
								▲ N VALUE ▲					
								20	40	60	80		
								PL	MC	LL			
								■ SHEAR STRENGTH (ksf) ■					
1	2	3	4										

0.0	CFA - 4.5" O.D.		TOPSOIL (5")	0.4 ft									
			CLAYEY SAND, With Gravel, Red With Gray, Dense to Very Dense, Moist (SC)			SPT 1	5-17-29 (46)	1.5					
2.5						SPT 2	21-66/3"	2.25					
5.0						SPT 3	30-63-66/5"	2.25					
7.5						SPT 4	12-66/3"	2.75					

Refusal at 9.3 feet.
Bottom of borehole at 9.3 feet.



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GEOTECHNICAL BORING LOG

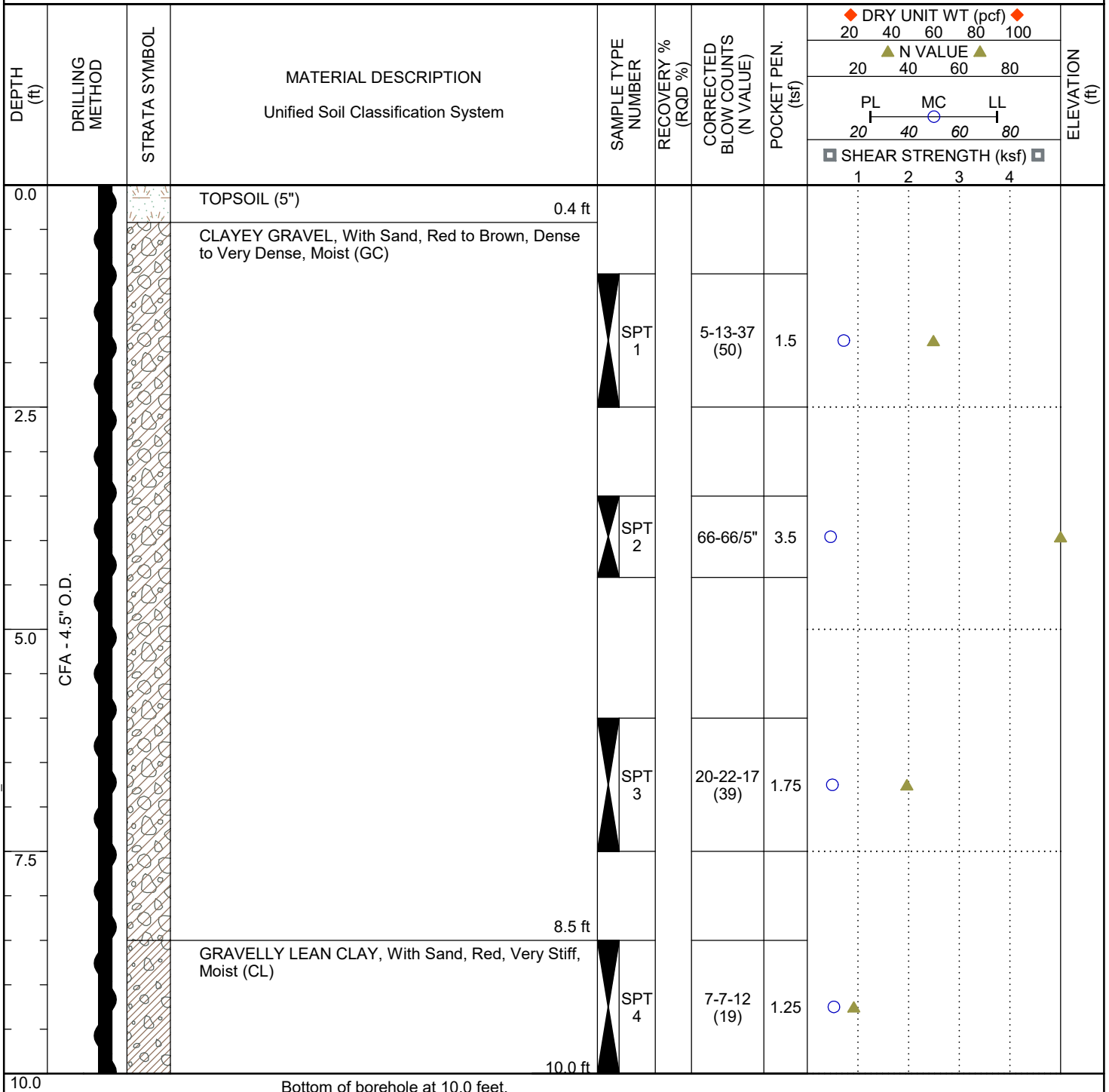
BORING NUMBER

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PAGE 1 OF 1

CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/10/22	COMPLETED	6/10/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ





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GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/10/22	COMPLETED	6/10/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	1 ft
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	♦ DRY UNIT WT (pcf) ♦	▲ N VALUE ▲	PL MC LL	■ SHEAR STRENGTH (ksf) ■	ELEVATION (ft)
								20 40 60 80 100	20 40 60 80	20 40 60 80		
0.0			TOPSOIL (5")									
			0.4 ft									
			GRAVELLY LEAN CLAY, With Sand, Red to Brown, Very Stiff, Moist (CL)	SPT 1		1-4-17 (21)	0.75					
2.5			3.0 ft									
			CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC)	SPT 2		39-66-59 (125)	0.5					
5.0												
				SPT 3		30-66/4"	1.5					
6.8 ft												

Refusal at 6.8 feet.
Bottom of borehole at 6.8 feet.



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CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/10/22	COMPLETED	6/10/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	♦ DRY UNIT WT (pcf) ♦	▲ N VALUE ▲	PL MC LL	■ SHEAR STRENGTH (ksf) ■	ELEVATION (ft)
								20 40 60 80 100	20 40 60 80	20 40 60 80		
0.0			TOPSOIL (5")									
			0.4 ft									
			LEAN CLAY, With Gravel and Sand, Red to Brown, Very Stiff, Moist (CL)	SPT 1		1-3-13 (16)	0.5					
2.5			3.0 ft									
			CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC)	SPT 2		24-45-64 (109)	1.5					
5.0												
			6.3 ft	SPT 3		66/3"	1.5					

Refusal at 6.3 feet.
Bottom of borehole at 6.3 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ



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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/8/22

COMPLETED 6/8/22

SURFACE ELEVATION _____

BENCHMARK EL. _____

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING _____

NOTES _____

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆	▲ N VALUE ▲	PL MC LL	■ SHEAR STRENGTH (ksf) ■	ELEVATION (ft)
								20 40 60 80 100	20 40 60 80	20 40 60 80		
0.0			TOPSOIL (5") 0.4 ft									
			LEAN CLAY, Trace Sand & Gravel, Red to Brown, Stiff, Moist (CL)	SPT 1		3-4-5 (9)	0.75	▲	○			
2.5			- With Gravel, Red, Very Stiff Below 3.5'	SPT 2		5-7-9 (16)	2	▲	○			
5.0				SPT 3		16-29-16 (45)	3.25	○		▲		
7.5			CLAYEY GRAVEL, With Sand, Red, Dense, Moist (GC)									

Bottom of borehole at 7.5 feet.

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GEOTECHNICAL BORING LOG

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EP4

PAGE 1 OF 1

CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/8/22

COMPLETED 6/8/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

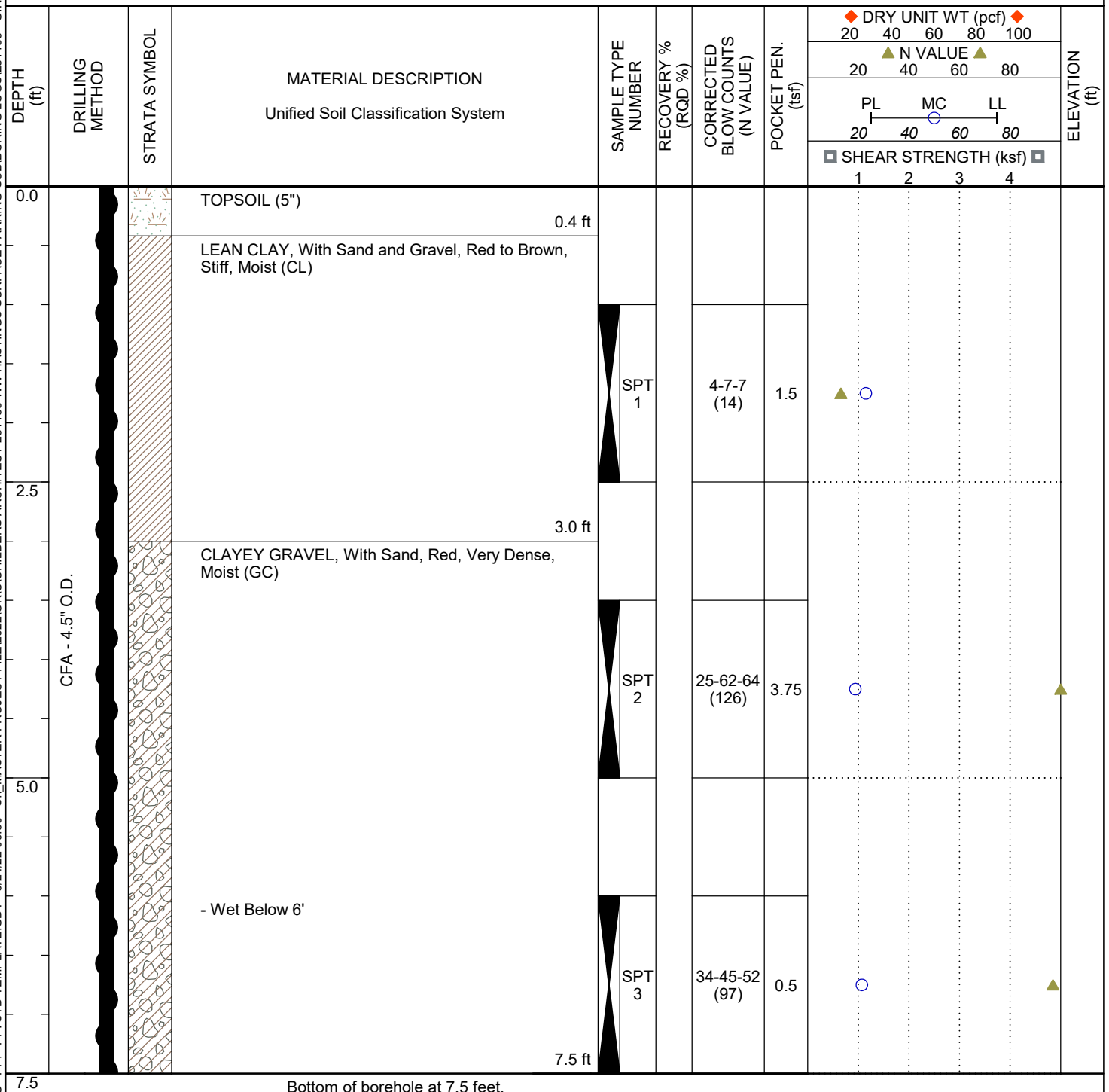
AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES



Bottom of borehole at 7.5 feet.

BOHRING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\ MASTER PROJECT FILE\2022\K/C\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUB\BORING LOGS\281188 - GINT.GPJ



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GEOTECHNICAL BORING LOG

BORING NUMBER

EP5

PAGE 1 OF 1

CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/8/22	COMPLETED	6/8/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆				ELEVATION (ft)
								20 40 60 80 100				
								▲ N VALUE ▲				
								20 40 60 80				
								PL MC LL				
								■ SHEAR STRENGTH (ksf) ■				
								1 2 3 4				
0.0	CFA - 4.5" O.D.		TOPSOIL (5")									
			0.4 ft									
			LEAN CLAY, Trace Gravel, Gray to Brown, Stiff, Moist (CL)			3-4-10 (14)	2.5					
2.5												
			3.0 ft									
			CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC)			39-47-66/5"	2.25					
5.0												
			5.5 ft									
			CLAYEY SAND, With Gravel, Red, Very Dense, Moist (SC)			47-66/5"	2.5					
6.9 ft												

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ

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GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/9/22

COMPLETED 6/9/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 100 ▲ N VALUE ▲ 20 40 60 80 PL MC LL 20 40 60 80 ■ SHEAR STRENGTH (ksf) ■ 1 2 3 4				ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (5")									
			0.4 ft	CLAYEY GRAVEL, With Sand, Brown, Dense, Moist (GC)								
1					SPT 1	7-16-24 (40)	1.5					
2												
3			CLAYEY SAND, With Gravel, Red, Very Dense, Moist (SC)									
4			4.4 ft	SPT 2	35-66/5"	1.5						

Refusal at 4.4 feet.
Bottom of borehole at 4.4 feet.

BOHRING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\ MASTER PROJECT FILE\2022\K/C\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUB\BORING LOGS\281188 - GINT.GPJ

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GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/10/22

COMPLETED 6/10/22

SURFACE ELEVATION _____ **BENCHMARK EL.** _____

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆				ELEVATION (ft)
								▲ N VALUE ▲				
								PL MC LL				
								■ SHEAR STRENGTH (ksf) ■				
20	40	60	80	100								
20	40	60	80									
20	40	60	80									
1	2	3	4									

0	CFA - 4.5" O.D.		TOPSOIL (5")							
			CLAYEY GRAVEL, With Sand, Brown, Dense, Wet (GC)							
1										
2										
3				- Red, Very Dense, Moist Below 3.5'						
				Refusal at 3.8 feet. Bottom of borehole at 3.8 feet.						

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/9/22

COMPLETED 6/9/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP**DRILL RIG** Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto



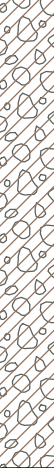
AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	<div> <div>◆ DRY UNIT WT (pcf) ◆</div> <div>20 40 60 80 100</div> <div>▲ N VALUE ▲</div> <div>20 40 60 80</div> <div>PL MC LL</div> <div>20 40 60 80</div> <div>■ SHEAR STRENGTH (ksf) ■</div> <div>1 2 3 4</div> </div>		ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (5")							
			0.4 ft							
1			LEAN CLAY, With Sand & Gravel, Red to Brown, Stiff, Moist (CL)							
2										
3			CLAYEY GRAVEL, With Sand, Red to Brown, Very Dense, Moist (GC)							
4										
5			5.0 ft							

Bottom of borehole at 5.0 feet.

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GEOTECHNICAL BORING LOG

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/10/22

COMPLETED 6/10/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 100 ▲ N VALUE ▲ 20 40 60 80 PL MC LL 20 40 60 80 ■ SHEAR STRENGTH (ksf) ■ 1 2 3 4				ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (5")									
			CLAYEY GRAVEL, With Sand, Red, Medium Dense, Moist (GC)									
1												
2												
3												
4			- Very Dense Below 3.5'									
5			Bottom of borehole at 5.0 feet.									

Bottom of borehole at 5.0 feet.

BOHRING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\ MASTER PROJECT FILE\2022\K/C\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUB\BORING LOGS\281188 - GINT.GPJ



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GEOTECHNICAL BORING LOG

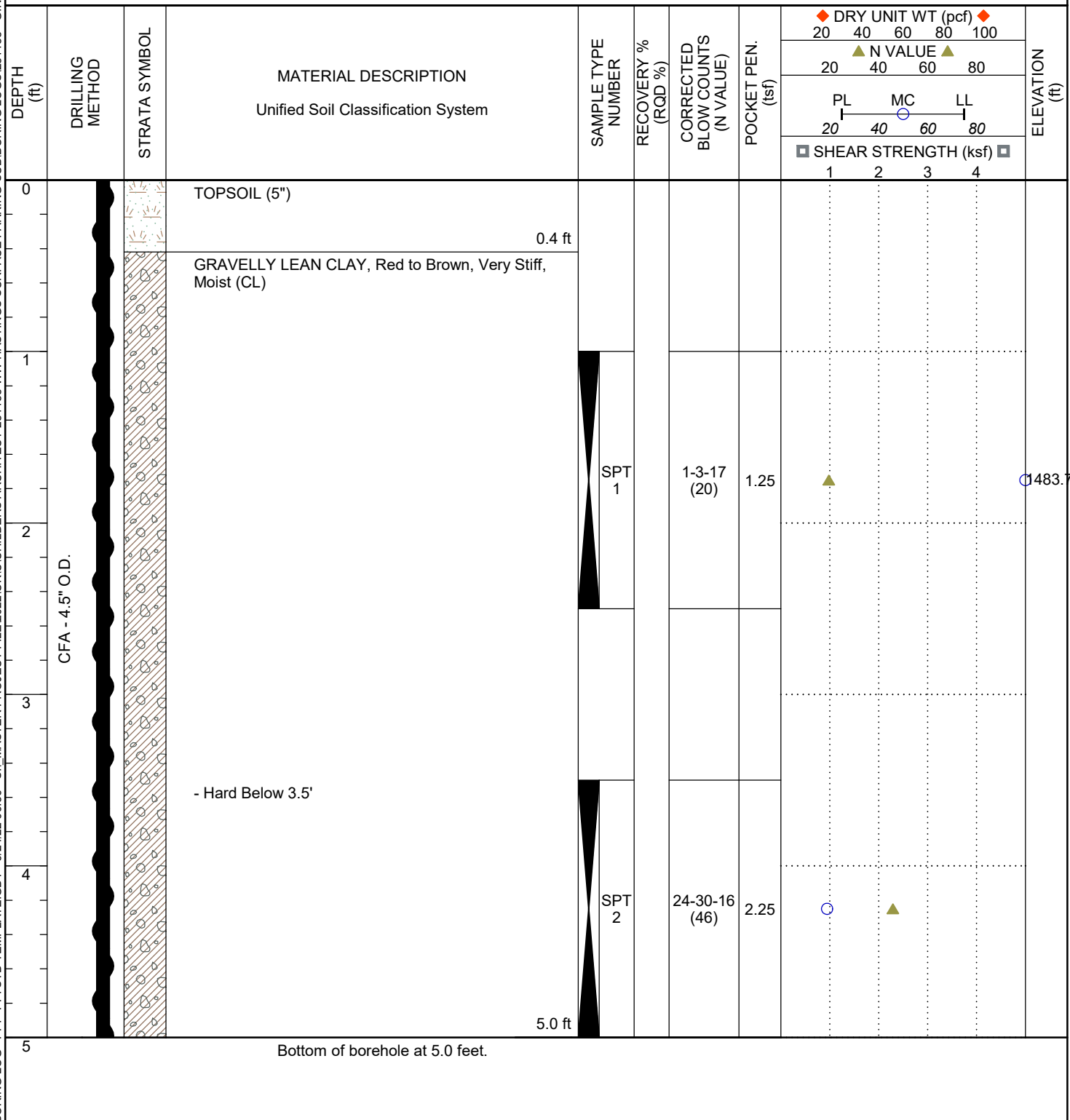
BORING NUMBER

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CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/10/22	COMPLETED	6/10/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ





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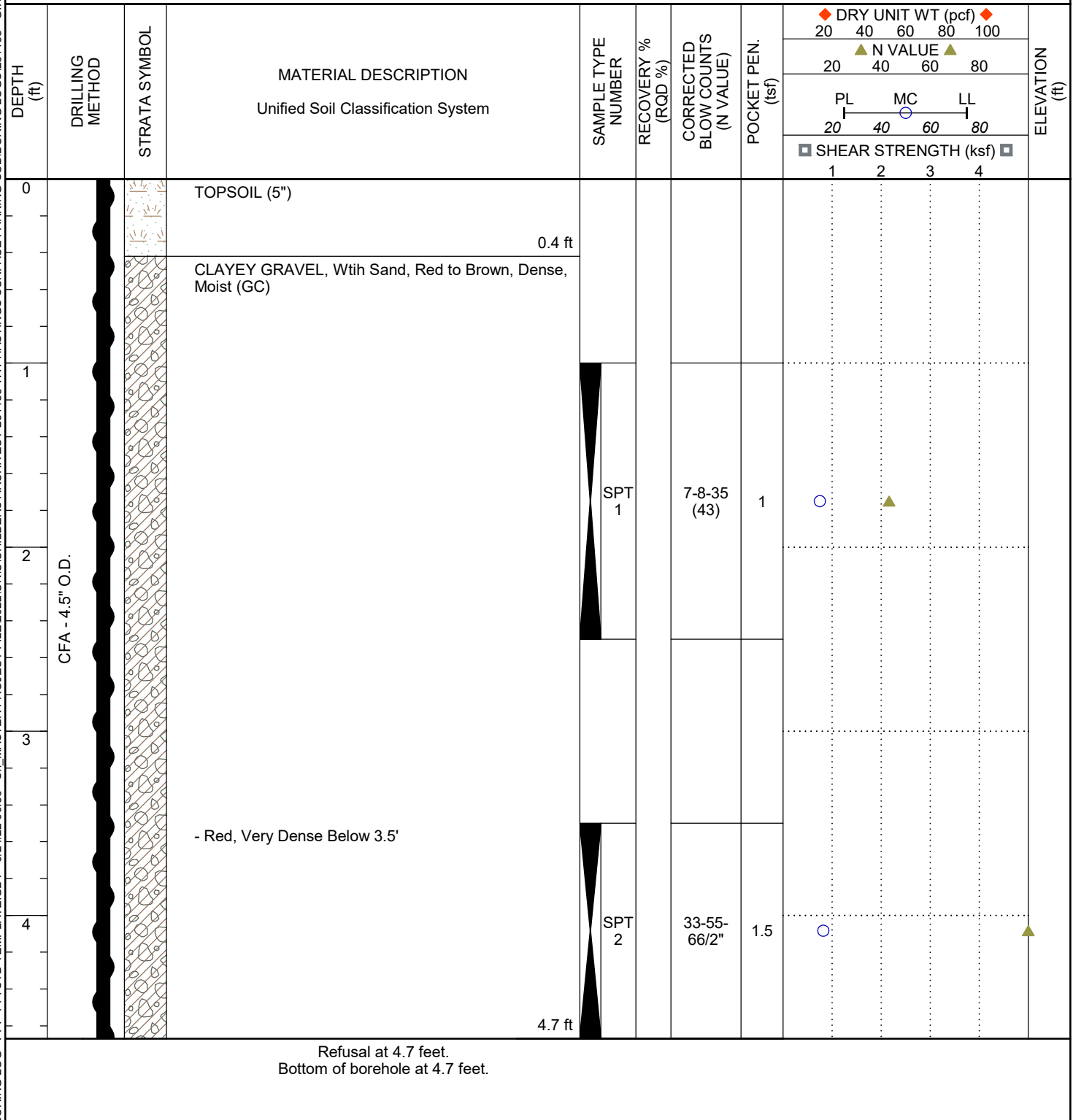
BORING NUMBER

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CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/10/22	COMPLETED	6/10/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

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BORING NUMBER

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/10/22

COMPLETED 6/10/22

SURFACE ELEVATION	BENCHMARK EL.
-------------------	---------------

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆				ELEVATION (ft)	
								▲ N VALUE ▲					
								PL MC LL					
								■ SHEAR STRENGTH (ksf) ■					
								20	40	60	80	100	
								20	40	60	80		
								20	40	60	80		
								1	2	3	4		
0	CFA - 4.5" O.D.		TOPSOIL (5")										
			0.4 ft										
			GRAVELLY LEAN CLAY, Red to Brown, Very Stiff, Moist (CL)										
1													
2													
3													
4													

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GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/8/22

COMPLETED 6/8/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

[illegible]



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GEOTECHNICAL BORING LOG

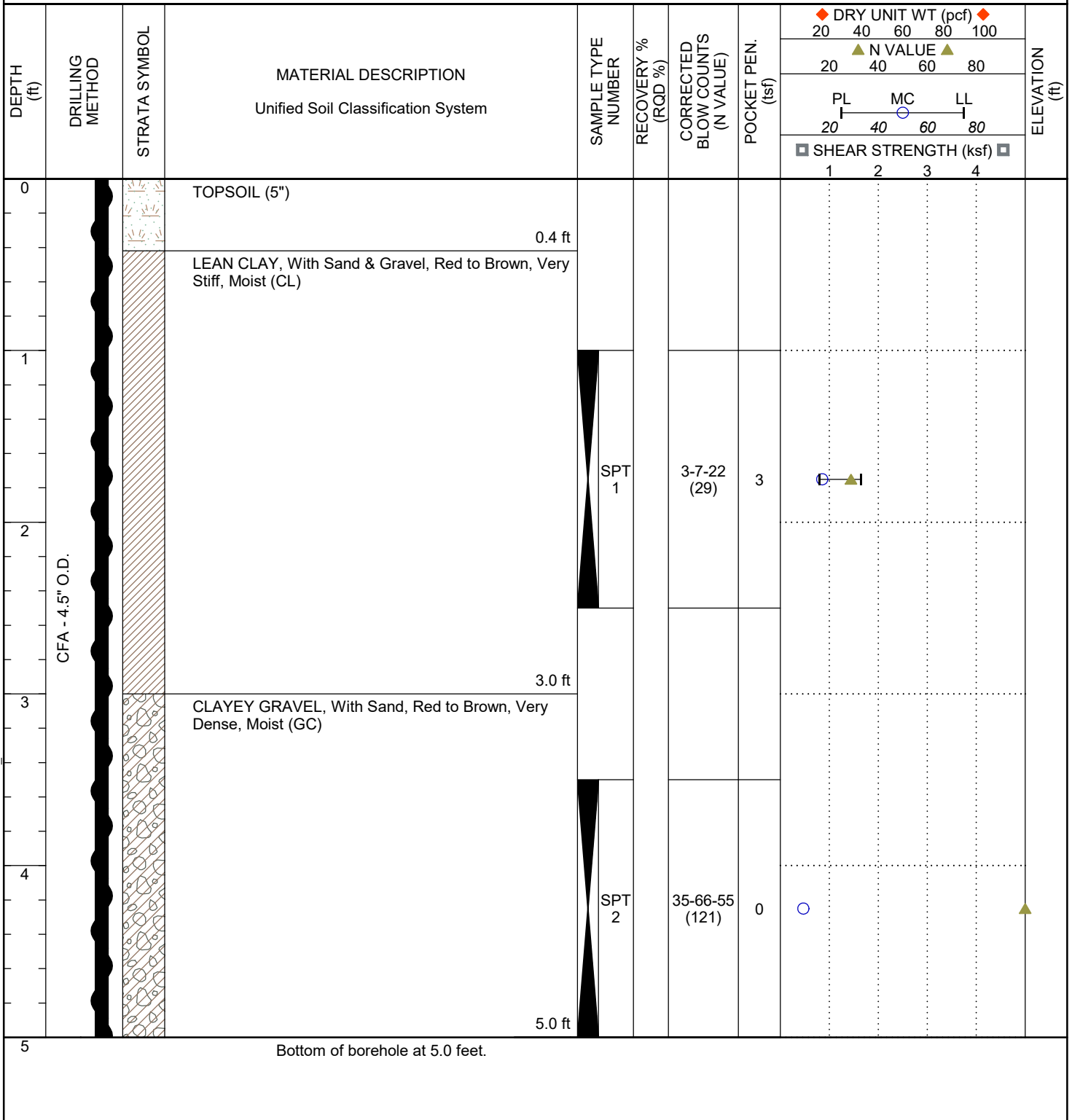
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CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/9/22	COMPLETED	6/9/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

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GEOTECHNICAL BORING LOG

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/8/22

COMPLETED 6/8/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto





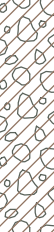


AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf) ◆			ELEVATION (ft)
								◆ N VALUE ◆			
								PL MC LL			
								SHEAR STRENGTH (ksf) ■			
								20 40 60 80 100	20 40 60 80	20 40 60 80	
								1 2 3 4			
0	CFA - 4.5" O.D.		TOPSOIL (5")								
			0.4 ft								
1			LEAN CLAY, With Sand, Trace Gravel, Red to Brown, Hard, Moist (CL)	SPT 1		3-4-28 (32)	1.25				
2											
3			CLAYEY GRAVEL, With Sand, Red to Brown, Very Dense, Moist (GC)								
4				SPT 2		22-35-39 (74)	2				
5			Bottom of borehole at 5.0 feet.								

Bottom of borehole at 5.0 feet.

BOHRING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\ MASTER PROJECT FILE\2022\K/C\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUB\BORING LOGS\281188 - GINT.GPJ

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/9/22

COMPLETED 6/9/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto


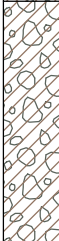
AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	Legend				ELEVATION (ft)	
								◆ DRY UNIT WT (pcf) ◆ 20 40 60 80 100					
								▲ N VALUE ▲ 20 40 60 80					
								PL MC LL 20 40 60 80 ■ SHEAR STRENGTH (ksf) ■					
								1	2	3	4		
0	CFA - 4.5" O.D.		TOPSOIL (5")										
			GRAVELLY LEAN CLAY, Red to Brown, Hard, Moist (CL)	SPT 1		1-12-28 (40)	2						
1													
2													
3			CLAYEY GRAVEL, With Sand, Red, Very Dense, Moist (GC)	SPT 2		66/4"	1.25						

Refusal at 3.8 feet.
Bottom of borehole at 3.8 feet.

BOHRING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\ MASTER PROJECT FILE\2022\K/C\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUB\BORING LOGS\281188 - GINT.GPJ

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GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/8/22

COMPLETED 6/8/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	<div> <div>◆ DRY UNIT WT (pcf) ◆</div> <div>20 40 60 80 100</div> <div>▲ N VALUE ▲</div> <div>20 40 60 80</div> <div>PL MC LL</div> <div>20 40 60 80</div> <div>■ SHEAR STRENGTH (ksf) ■</div> <div>1 2 3 4</div> </div>		ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (5")							
			LEAN CLAY, With Sand & Gravel, Red to Brown, Very Stiff, Moist (CL)							
1										
2										
3			CLAYEY SAND, With Gravel, Red to Tan, Very Dense, Moist (SC)							
4										
5	Bottom of borehole at 5.0 feet.									

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GEOTECHNICAL BORING LOG

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/9/22

COMPLETED 6/9/22

SURFACE ELEVATION

BENCHMARK EL.

DRILLER SP**DRILL RIG** Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT (pcf)				ELEVATION (ft)	
								20 40 60 80 100					
								N VALUE					
								20 40 60 80					
								PL	MC	LL			
								20	40	60	80		
								SHEAR STRENGTH (ksf)					
								1	2	3	4		
0	CFA - 4.5" O.D.		TOPSOIL (5")										
			0.4 ft										
1			GRAVELLY LEAN CLAY, With Sand, Red to Brown, Hard, Moist (CL)	SPT 1	5-17-30 (47)	2.25							
2													
3			CLAYEY SAND, With Gravel, Red to Tan, Very Dense, Moist (SC)	SPT 2	41-64-66/5"	2.75							
4													
	Refusal at 4.9 feet. Bottom of borehole at 4.9 feet.												

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GEOTECHNICAL BORING LOG

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/8/22

COMPLETED 6/8/22

SURFACE ELEVATION

BENCHMARK EL.

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)					ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (5")									
			LEAN CLAY, With Sand & Gravel, Red to Brown, Very Stiff, Moist (CL)									
1												
2												
3			GRAVELLY LEAN CLAY, With Sand, Red, Very Stiff, Moist (CL)									
4												
5	Bottom of borehole at 5.0 feet.											



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GEOTECHNICAL BORING LOG

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CLIENT	Childers Architect	PROJECT NAME	WW Hastings Surface Parking
PROJECT NO.	281188	PROJECT LOCATION	Tahlequah, OK
DATE STARTED	6/8/22	COMPLETED	6/8/22
DRILLER	SP	DRILL RIG	Dietrich D-50
HAMMER TYPE	Auto	GROUND WATER LEVELS	
LOGGED BY	MV	AT TIME OF DRILLING	None
CHECKED BY	CL	AT END OF DRILLING	
NOTES			

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆				ELEVATION (ft)
								20 40 60 80 100				
								▲ N VALUE ▲				
								20 40 60 80				
								PL MC LL				
■ SHEAR STRENGTH (ksf) ■								1 2 3 4				
0	CFA - 4.5" O.D.		TOPSOIL (5")									
			0.4 ft									
			GRAVELLY LEAN CLAY, With Sand, Red to Brown, Very Stiff, Moist (CL)									
1												
2												
3												
4												

Refusal at 4.6 feet.
Bottom of borehole at 4.6 feet.

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ

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GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

DATE STARTED 6/8/22

COMPLETED 6/8/22

SURFACE ELEVATION _____ **BENCHMARK EL.**

DRILLER SP

DRILL RIG Dietrich D-50

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY MV

CHECKED BY CL

AT END OF DRILLING

NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TEST RESULTS				ELEVATION (ft)
0	CFA - 4.5" O.D.		TOPSOIL (5")									
			0.4 ft									
			GRAVELLY LEAN CLAY, With Sand, Red to Brown, Hard, Moist (CL)									
1												
2												
3												
			- Red, Very Hard Below 3.5'	 SPT 2		66/3"	0.5					

Refusal at 3.8 feet.
Bottom of borehole at 3.8 feet.

BOHRING LOG - PPI - PPI STD TEMPLATE.GDT - 6/24/22 09:36 - S:\ MASTER PROJECT FILE\2022\K/C\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUB\BORING LOGS\281188 - GINT.GPJ



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KEY TO SYMBOLS

CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK

LITHOLOGIC SYMBOLS (Unified Soil Classification System)



CHERT: Chert



CL: USCS Low Plasticity Clay



CLG: USCS Low Plasticity Gravelly Clay



GC: USCS Clayey Gravel



SC: USCS Clayey Sand



TOPSOIL: Topsoil

SAMPLER SYMBOLS



Standard Penetration Test

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200 - PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION
▽ Water Level at Time
Drilling, or as Shown
▼ Water Level at End of
Drilling, or as Shown
▽ Water Level After 24
Hours, or as Shown

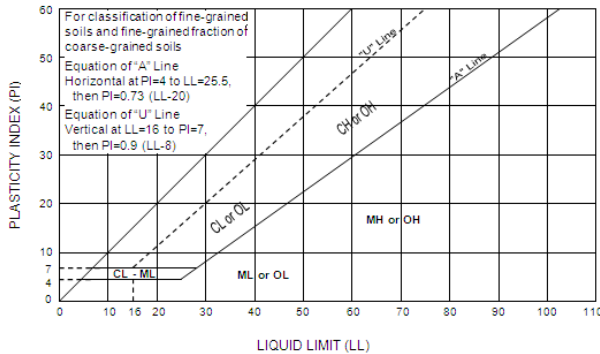
APPENDIX II
GENERAL NOTES

GENERAL NOTES

SOIL PROPERTIES & DESCRIPTIONS

COHESIVE SOILS

Consistency	Unconfined Compressive Strength (Qu)	Pocket Penetrometer Strength	N-Value
	(psf)	(tsf)	(blows/ft)
Very Soft	<500	<0.25	0-1
Soft	500-1000	0.25-0.50	2-4
Medium Stiff	1001-2000	0.50-1.00	5-8
Stiff	2001-4000	1.00-2.00	9-15
Very Stiff	4001-8000	2.00-4.00	16-30
Hard	>8000	>4.00	31-60
Very Hard			>60



Group Symbol	Group Name
CL	Lean Clay
ML	Silt
OL	Organic Clay or Silt
CH	Fat Clay
MH	Elastic Silt
OH	Organic Clay or Silt
PT	Peat
CL-CH	Lean to Fat Clay

Plasticity		Moisture	
Description	Liquid Limit (LL)	Descriptive Term	Guide
Lean	<45%	Dry	No indication of water
Lean to Fat	45-49%	Moist	Indication of water
Fat	≥50%	Wet	Visible water

Fine Grained Soil Subclassification	Percent (by weight) of Total Sample
Terms: SILT, LEAN CLAY, FAT CLAY, ELASTIC SILT	PRIMARY CONSTITUENT
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]
with sand, with gravel, with cobbles, with boulders	>15-30] – secondary coarse grained constituents
scattered sand, scattered gravel, scattered cobbles, scattered boulders	5-15]
a trace sand, a trace gravel, a few cobbles, a few boulders	<5]
The relationship of clay and silt constituents is based on plasticity and normally determined by performing index tests. Refined classifications are based on Atterberg Limits tests and the Plasticity Chart.	

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	N-VALUE
Very Loose	0-4
Loose	5-10
Medium Dense	11-24
Dense	25-50
Very Dense	≥51

MOISTURE CONDITION	
Descriptive Term	Guide
Dry	No indication of water
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table.

**GRAIN SIZE IDENTIFICATION		
Name	Size Limits	Familiar Example
Boulder	12 in. or more	Larger than basketball
Cobbles	3 in. to 12 in.	Grapefruit
Coarse Gravel	¾-in. to 3 in.	Orange or lemon
Fine Gravel	No. 4 sieve to ¾-in.	Grape or pea
Coarse Sand	No. 10 sieve to No. 4 sieve	Rock salt
Medium Sand	No. 40 sieve to No. 10 sieve	Sugar, table salt
Fine Sand*	No. 200 sieve to No. 40 sieve	Powdered sugar
Fines	Less than No. 200 sieve	
*Particles finer than fine sand cannot be discerned with the naked eye at a distance of 8 in.		

Coarse Grained Soil Subclassification	Percent (by weight) of Total Sample
Terms: GRAVEL, SAND, COBBLES, BOULDERS	PRIMARY CONSTITUENT
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]
with gravel, with sand, with cobbles, with boulders	>15-30] – secondary coarse grained constituents
scattered gravel, scattered sand, scattered cobbles, scattered boulders	5-15]
a trace gravel, a trace sand, a few cobbles, a few boulders	<5]
Silty (MH & ML)*, clayey (CL & CH)*	<15]
(with silt, with clay)*	5-15] – secondary fine grained constituents
(trace silt, trace clay)*	<5]
*Index tests and/or plasticity tests are performed to determine whether the term "silt" or "clay" is used.	

*Modified after Ref. ASTM D2487-93 & D2488-93

**Modified after Ref. Oregon DOT 1987 & FHWA 1997

***Modified after Ref. AASHTO 1988, DM 7.1 1982, and Oregon DOT 1987

GENERAL NOTES

BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION (RQD)	
Description of Rock Quality	*RQD (%)
Very Poor	< 25
Poor	25-50
Fair	50-75
Good	75-90
Excellent	90-100
*RQD is defined as the total length of sound core pieces 4 in. or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.	

SCALE OF RELATIVE ROCK HARDNESS		
Term	Field Identification	Approx. Unconfined Compressive Strength (tsf)
Extremely Soft	Can be indented by thumbnail	2.6-10
Very Soft	Can be peeled by pocket knife	10-50
Soft	Can be peeled with difficulty by pocket knife	50-260
Medium Hard	Can be grooved 2 mm deep by firm pressure of knife	260-520
Moderately Hard	Requires one hammer blow to fracture	520-1040
Hard	Can be scratched with knife or pick only with difficulty	1040-2610
Very Hard	Cannot be scratched by knife or sharp pick	>2610

DEGREE OF WEATHERING	
Slightly Weathered	Rock generally fresh, joints stained and discoloration extends into rock up to 25mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered	Rock mass is decomposed 50% or less, significant portions of rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

GRAIN SIZE (TYPICALLY FOR SEDIMENTARY ROCKS)		
Description	Diameter (mm)	Field Identification
Very Coarse Grained	>4.76	Individual grains can easily be distinguished by eye.
Coarse Grained	2.0-4.76	
Medium Grained	0.42-2.0	Individual grains can be distinguished by eye.
Fine Grained	0.074-0.42	Individual grains can be distinguished by eye with difficulty.
Very Fine Grained	<0.074	Individual grains cannot be distinguished by unaided eye.

VOIDS	
Pit	Voids barely seen with naked eye to 6mm (¼-in)
Vug	Voids 6 to 50mm (¼ to 2 in) in diameter
Cavity	50 to 600mm (2 to 24 in) in diameter
Cave	>600mm

BEDDING THICKNESS	
Very Thick Bedded	> 3' thick
Thick Bedded	1' to 3' thick
Medium Bedded	4" to 1' thick
Thin Bedded	1¼" to 4" thick
Very Thin Bedded	½" to 1¼" thick
Thickly Laminated	⅛" to ½" thick
Thinly Laminated	⅛" or less (paper thin)

DRILLING NOTES

Drilling and Sampling Symbols

NQ – Rock Core (2-in. diameter)
 HQ – Rock Core (3 in. diameter)
 HSA – Hollow Stem Auger

CFA – Continuous Flight (Solid Stem) Auger
 SS – Split Spoon Sampler
 ST – Shelby Tube

WB – Wash Bore or Mud Rotary
 TP – Test-Pit
 HA – Hand Auger

Soil Sample Types

Shelby Tube Samples: Relatively undisturbed soil samples were obtained from the borings using thin wall (Shelby) tube samplers pushed hydraulically into the soil in advance of drilling. This sampling, which is considered to be undisturbed, was performed in accordance with the requirements of ASTM D 1587. This type of sample is considered best for the testing of "in-situ" soil properties such as natural density and strength characteristics. The use of this sampling method is basically restricted to soil containing little to no chert fragments and to softer shale deposits.

Split Spoon Samples: The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot of an 18-in. long, 2-in. O.D. split-barrel sampler with a 140 lb. hammer falling a distance of 30 in. The Standard Penetration Test is carried out according to ASTM D-1586.

Water Level Measurements

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, shallow groundwater may indicate a perched condition. Caution is merited when interpreting short-term water level readings from open bore holes. Accurate water levels are best determined from piezometers.

Automatic Hammer

Palmerton and Parrish's CME's are equipped with automatic hammers. The conventional method used to obtain disturbed soil samples used a safety hammer operated by company personnel with a cat head and rope. However, use of an automatic hammer allows a greater mechanical efficiency to be achieved in the field while performing a Standard Penetration resistance test based upon automatic hammer efficiencies calibrated using dynamic testing techniques.

*Modified after Ref. ASTM D2487-93 & D2488-93

**Modified after Ref. Oregon DOT 1987 & FHWA 1997

***Modified after Ref. AASHTO 1988, DM 7.1 1982, and Oregon DOT 1987

APPENDIX III
GRAIN SIZE ANALYSIS RESULTS



4168 W Kearney St.
Springfield, MO 65803
Telephone: 417-864-6000

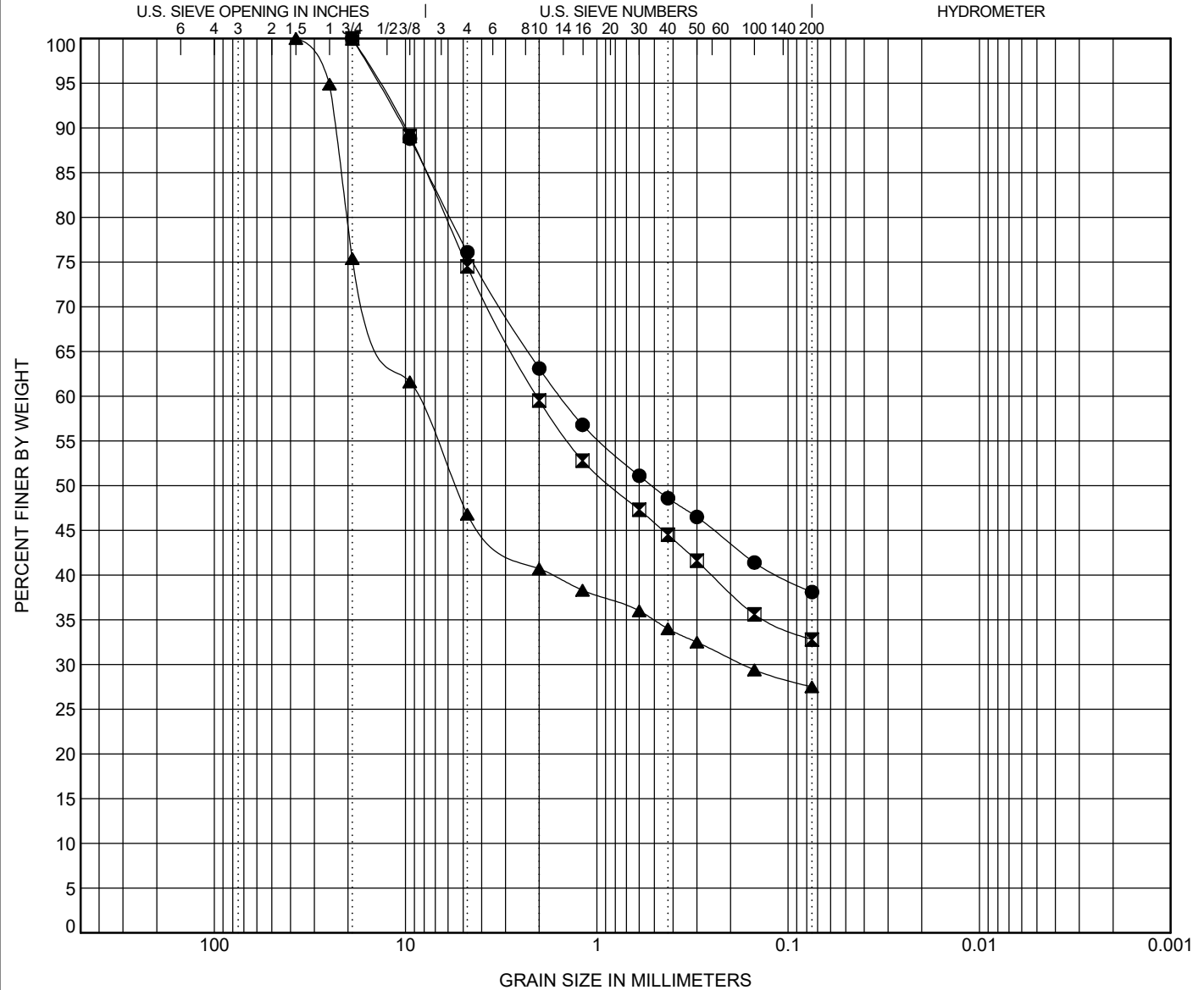
GRAIN SIZE DISTRIBUTION

CLIENT Childers Architect

PROJECT NAME WW Hastings Surface Parking

PROJECT NO. 281188

PROJECT LOCATION Tahlequah, OK



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● DB3	6.0	CLAYEY SAND with GRAVEL(SC)									
✕ EP5	6.0	CLAYEY SAND with GRAVEL(SC)									
▲ P3	3.5	CLAYEY GRAVEL with SAND(GC)									
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● DB3	6.0	19	1.548			23.9	38.0	38.1			
✕ EP5	6.0	19	2.059			25.5	41.7	32.8			
▲ P3	3.5	37.5	8.814	0.172		53.2	19.3	27.5			

GRAIN SIZE - PPI STD TEMPLATE.GDT - 6/22/22 15:37 - S:\MASTER PROJECT FILE\2022\OK\CHILDERS ARCHITECT-281188-WW HASTINGS SURFACE PARKING-SUBBORING LOGS\281188 - GINT.GPJ

APPENDIX IV

IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



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SECTION 00 72 00

GENERAL CONDITIONS

- A. The General Conditions of this Contract are the American Institute of Architects Document A201, "General Conditions of the Contract for Construction", 2017 Edition, hereinafter referred to as the "General Conditions."
- B. A copy of the Document follows this page and shall apply to each and every Section of the Work as though written in full therein.

END OF SECTION

DRAFT AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

«8th and Tryon»

« »

THE OWNER:

(Name, legal status and address)

« »« »

« »

THE ARCHITECT:

(Name, legal status and address)

« »« »

« »

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ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements for substitutions during construction. **Substitutions during the bidding process will not be reviewed or action taken.**

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Construction Manager.
 - 1. Substitutions for Cause: Changes proposed by Construction Manager that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Construction Manager or Owner that are not required in order to meet other Project requirements but may offer advantage to Construction Manager or Owner.

1.3 SUBMITTALS

- A. Substitution Requests: Submit electronic copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use scanned PDF electronic file of form provided at end of this section or annotated PDF electronic file of electronic form received from Architect matching form provided at end of this section.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Construction Manager's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Construction Manager's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Construction Manager's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, with reasonable promptness, Architect will request additional information or documentation for evaluation. Architect will notify Construction Manager of acceptance or rejection of proposed substitution with reasonable promptness. Acceptance of proposed substitution does not constitute approval or inclusion in Contract Documents. Pay applications certification, change orders, and certificate of substantial completion will contain such qualification.

1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Prior to starting Substitution Process, review proposed recommendations with Architect.
- B. Construction Manager's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples for construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.
- C. Construction Manager Representations: By making substitution request, Construction Manager:
 - 1. Recognizes burden of proof of equality for requested substitution rests with Construction Manager.
 - 2. Represents and warrants that Construction Manager has personally investigated requested substitution and determined that it is equal to or superior in all respects to specified Work.
 - 3. Represents and warrants that Contractor will provide same warranties for requested substitution that Construction Manager would for specified Work.

4. Certifies that cost data presented is complete and includes all related costs under this Contract except for Architect's redesign cost, and waives all claims for additional costs related to requested substitution which may subsequently become apparent.
 5. Will coordinate installation of accepted substitution, making such other changes as may be required to make Work complete in all respects.
 6. Represents and warrants that accepted substitution will perform same as specified Work would have performed. Should accepted substitution fail to perform as required, Construction Manager shall replace accepted substitution with specified Work at no additional cost to Owner.
- D. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.
1. Conditions: Architect will consider Construction Manager's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Construction Manager's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
- E. Substitutions for Convenience:
1. Conditions: Architect will consider Construction Manager's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Construction Manager's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SUBSTITUTION REQUEST FORM

Project Name

Specified Item

Section	Page	Paragraph	Description
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The undersigned Construction Manager requests consideration of the following:

Proposed Substitution _____

(Include all product data as indicated in Specification Section 01 2500 and any supplemental information as requested by the Architect.)

The undersigned Construction Manager warrants to the Architect and Owner that the following paragraphs, unless modified on attachments, are correct.

1. The Proposed Substitution does not affect dimensions shown on Drawings.
2. The cost reduction/increase indicated in item 5 below includes costs for changes to the building design, including engineering, design, detailing and construction costs caused by the requested Substitution. Any additional costs resulting from this substitution will be reimbursed from the cost savings in item 5 or, in it's absence, funded as a project cost.
3. The Proposed Substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the Proposed Substitution.

The Construction Manager further warrants to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item. The Construction Manager further warrants that the intent of specification section 01 25 00, paragraph 2.1.C has been met.

5. Total Cost Savings/Increase to the Owner: \$ _____
6. Compensation to the Architect / Consultant for related Additional Service fee: \$ _____

Manufacturer's Certification of Equal Quality

I _____ represent the manufacturer of the Proposed Substitution item and hereby certify and warrant to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item.

_____	_____	_____
Manufacturer's Representative	Date	Company
Acceptances		
1.		
_____	_____	_____
Construction Manager Acceptance	Date	Company
2.		
_____	_____	_____
Owner Acceptance	Date	Company
3.		
_____	_____	_____
Architect Acceptance	Date	Company
4.		
_____	_____	_____
Consultant Acceptance	Date	Company

Recommend Acceptance: ☐ Yes ☐ No

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect's Form 710 "Architect's Supplemental Instructions"; copy attached at the end of this Section.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposed Change: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time using Architect's Form 709 "Proposed Change"; copy attached at the end of this Section. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposed Changes issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposed Change or with reasonable promptness, when not otherwise specified, after receipt of Proposed Change, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Construction Manager's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Include updated Submittal Schedule showing effect of the change.
- B. Construction Manager-Initiated Proposed Change: If latent or changed conditions require modifications to the Contract, Construction Manager may initiate a claim by submitting a request for a change to Architect using Construction Manager's Standard Form.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Construction Manager's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Include updated Submittal Schedule showing effect of the change.
7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: If applicable, see Division 01 Section "Allowances" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: If applicable, see Division 01 Section "Unit Prices" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of unit-price work.
- C. Alternates: If applicable, see Division 01 Section "Alternates" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of alternate work.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposed Change, Architect will issue a Change Order for signatures of Owner and Construction Manager on Architects Form 701 "Change Order"; copy attached at the end of this Section.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on Architects Form 714 "Construction Change Directive"; copy attached at the end of this Section. Construction Change Directive instructs Construction Manager to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Construction Manager's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Accepted Alternates.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments; provide subschedules showing values coordinated with each phase of payment.
 - 4. Subschedules for Separate Elements of Work: Where the Construction Manager's construction schedule defines separate elements of the Work; provide subschedules showing values coordinated with each element.
 - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Division 01 Section "Summary."
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Construction Manager's name and address.
 - e. Date of submittal.
 - 2. Arrange the schedule of values in tabular form, in format accepted by Architect, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders.

- g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
- 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
- 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.
- 6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 7. Allowances (If Applicable): Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances (if applicable), as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- 8. Alternates (If Applicable): Provide a separate line item in the schedule of values for each accepted alternate.
- 9. Change Orders: Provide a separate line item in the schedule of values for each change order.
- 10. Separate Owner-Consultant Contracts: Provide a separate line item in the schedule of values for each separate Owner-Consultant related Work item.
- 11. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Construction Manager.
- 12. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Construction Manager's option.
- 13. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Construction Manager. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. If the Agreement does not state payment dates, establish dates at preconstruction conference.
 2. Submit draft, or pencil, copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Unless directed otherwise by Owner, use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Construction Manager. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Construction Manager's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: If accepted by Owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from Construction Manager, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Delays: Submit each Application for Payment with Construction Manager's waiver of mechanic's lien for construction period covered by the application.
 - a. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Construction Manager's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Construction Manager's staff assignments.
 8. List of Construction Manager's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. When applicable, this application shall reflect Certificate(s) of **Partial** Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. If applicable, final liquidated damages settlement statement.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project Web site.
 - 5. Project meetings.

1.2 DEFINITIONS

- A. Project communications documents shall be defined as the following:
 - 1. Letters.
 - 2. Memoranda.
 - 3. E-Mail Communications/Internet Communications/Project Management Software Communications.
 - 4. RFI (Request for Information - Construction Manager).
 - 5. RFI-A (Request for Information - Architect).

1.3 FORMAT

- A. Letters and Memoranda: Submit in formats acceptable to the Architect.
- B. E-Mail Communications/Internet Communications/Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.
- C. RFI (Request for Information - Construction Manager): Submit on forms furnished by the Architect, or on other forms as approved by the Architect. Unless otherwise approved use Architect's Form 750, "Request for Information"; copy attached at the end of this Section.
- D. RFI-A (Request for Information - Architect), will be submitted by Architect to Construction Manager on Architects standard form.

1.4 PROJECT COMMUNICATIONS DOCUMENTS

- A. Letters and Memoranda documents shall be submitted in a timely manner so as to facilitate project delivery and coordination. Routing of communications shall be as established in the Contract, the Contract Documents and the Pre-Construction Conference. Communications documents shall be transmitted or forwarded in a manner consistent with the schedule and progress of the work.

- B. E-Mail Communications, Internet Communications, and Project Management Software programs must be compatible with the Architect's and Owner's computer systems and equipment. The responsibility for all costs for management of these systems, including, but not limited to, licensing, onsite training or other training necessary for the proper operation of such systems, shall be by the Construction Manager. The Construction Manager shall keep written records and hard file copies of all electronic communications. Failure of the Construction Manager to keep such records shall waive the Construction Manager's right to rely on such communications and such communications shall be deemed to have not taken place.
- C. RFI (Request for Information - Construction Manager) shall be defined and limited to a request from the Construction Manager seeking interpretation or clarification of the requirements of the Contract Documents. Such requests shall comply with the following requirements:
1. RFI requests shall be submitted in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Construction Manager shall schedule the submission of RFI's so as to moderate and manage the flow of RFI requests. RFI's shall be submitted in a manner consistent with the schedule and progress of the work, and shall not be submitted in a sporadic and/or excessive manner.
 2. RFI requests shall be numbered in a sequential manner and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested.
 - a. The Construction Manager shall include a "Proposed Solution" to the issue requiring interpretation or clarification.
 3. RFI's submitted to the Construction Manager by Sub-Contractors, vendors, suppliers, or other parties to the work shall be reviewed by the Construction Manager prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Construction Manager, such requests will be returned to the Construction Manager for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
 4. RFI requests shall not contain submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other areas of the Contract Documents. RFI requests containing such information will be returned to the Construction Manager without action by the Architect.
 5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Construction Manager determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, the Construction Manager shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.
 6. If the Architect, after review, determines that any RFI has been submitted in an incomplete manner, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Construction Manager. The Construction Manager shall delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.
 7. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:
 - a. Project name.
 - b. Name and address of Construction Manager.
 - c. Name and address of Architect.

- d. RFI number including RFIs that were returned without action or withdrawn.
 - e. RFI description.
 - f. Date the RFI was submitted.
 - g. Date Architect's response was received.
- 8. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Construction Manager disagrees with response.
 - a. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- D. RFI-A (Request for Information - Architect) shall be defined as a request by the Architect for information relating to the obligations of the Construction Manager under the Contract.
 - 1. After receipt of an RFI-A the Construction Manager shall provide a written response to the Architect within 5 working days. Responses shall be thorough, complete and shall contain all information requested by the Architect.
 - 2. An RFI-A shall be limited to a request by the Architect for information related to the project. The RFI-A shall not be construed as authorizing or directing a change in the Contract or the Contract Documents.
- E. Revisions to Construction Documents: Responses to requests for information (RFI) shall not serve as construction documents; and the Construction Manager shall not incorporate RFI responses into construction of the Project, unless such answers bear the seal and signature of a licensed design professional.

1.5 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and Project Web site. Keep list current at all times.

1.6 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Construction Manager's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.7 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - e. Indicate required installation sequences.
 - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
 3. BIM File Incorporation: When applicable, develop coordination drawing files from Building Information Model (BIM) established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
 4. If approved by Owner, Architect will furnish Construction Manager one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in Autodesk Revit and/or Autocad; and compatible with Microsoft Windows operating system.
 - c. Distribution: Digital data files shall only be distributed via the Procore project website with acceptance of Architect's data licensing agreement.

1.8 PROJECT WEBSITE

- A. Use Procore project management software system for purposes of managing project communication and documentation until Final Completion.

1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
 4. Attendance: Document attendance of all participants.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Construction Manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, and coordination with adjacent activities. Prepare agenda appropriate to Work.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, at a time to be decided prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Construction Manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. If applicable, requirements for completing sustainable design documentation.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Construction Manager's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. If applicable, coordination of separate contracts.
 - l. If applicable, Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at regular intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

- a. Construction Manager's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Construction Manager's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following or as needed:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) If applicable, resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) If applicable, status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site utilization.
 - 10) Temporary facilities and controls.
 - 11) Work hours.
 - 12) Hazards and risks.
 - 13) Progress cleaning.
 - 14) Quality and work standards.
 - 15) Status of correction of deficient items.
 - 16) Field observations.
 - 17) Status of RFIs.
 - 18) Status of proposal requests.
 - 19) Pending changes.
 - 20) Status of Change Orders.
 - 21) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Construction Manager's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings on an as-needed basis. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.

- 3) If applicable, resolution of BIM component conflicts.
- 4) Status of submittals.
- 5) Deliveries.
- 6) Off-site fabrication.
- 7) Access.
- 8) Site utilization.
- 9) Temporary facilities and controls.
- 10) Work hours.
- 11) Hazards and risks.
- 12) Progress cleaning.
- 13) Quality and work standards.
- 14) Change Orders.

PART 2 - PRODUCTS

2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

- A. General: So as to expedite electronic review process, process all documents through a web-based software service. Sending documents via email, FTP or paper will not be accepted.
 1. Basis of Design (Product Standard): Procore.
- B. Performance Requirements:
 1. Project License:
 - a. Cloud based (no hardware required).
 - b. Unlimited user accounts.
 - c. Functionality to support subcontractors, contractors, architects and consultants.
 - d. Provide access to data for all project team members at no cost to the individual users.
 2. Training and Support:
 - a. Dedicated project training.
 - b. Phone support.
 3. Archive:
 - a. Export all data to an offline archive at the completion of the project.
 - b. Provide archive to architect, Construction Manager and owner.
 - c. Archive shall include all attachments, meta data, review comments and time stamp history.
 4. Submittals and RFIs:
 - a. Customizable logs and reporting accessible by all users.
 - b. Logs shall automatically update as submittals and RFIs are processed.
 - c. Automated routing of submittals and RFIs to design team based on trade.
 - d. Automated email notifications when submittal or RFI has been assigned or returned to a user.
 - e. Automated weekly email to design team users of overdue items.
 - f. Automatic sequential numbering per spec section for submittals.
 - g. Two sets of due dates - one overall due date and a consultant due date.
 - h. Built-in web-based markup tools to support a concurrent review of submittal and RFI.

5. Submittal Register:
 - a. Software vendor shall take specifications and build the required list of submittals and import into the software.
6. Drawing Management:
 - a. Provide current set of drawings and specifications through a centralized index.
 - b. Automated association of PDFs to the centralized index.
 - c. Manage drawing revisions with customizable review states.
 - d. Drawings shall be accessible offline via mobile devices.
7. File Sharing:
 - a. Integrated file sharing tool (FTP) to transfer any miscellaneous files such as BIM and CAD files.
 - b. Access permissions (view/edit) at a folder level.
8. Punch List and other Field Task Management:
 - a. Unlimited customizable field task types including punch list.
 - b. Locate and assign tasks from a mobile device.
 - c. No additional fees to individual users to access mobile apps.
 - d. Data shall be accessible offline on mobile devices.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

Form 750
Request for Information

Project	_____	RFI No.	_____
Project No.	_____	Receiver	_____
Sender	_____		
Date Sent	_____	Date Initiated	_____
Copies To	_____	Date Response Requested	_____

Subject _____

Request _____

Senders Proposed Answer/Solution _____

THE PROPOSED ANSWER/SOLUTION [] IS, [] IS NOT, INCLUDED IN THE CONTRACT.

Receivers Response _____

Response By _____ Company _____ Date _____

Distribution _____

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SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work.
- B. Related Section:
 - 1. Provide Construction Photographs in accordance with Division 01 Section "Photographic Documentation".

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Major Area: A story of construction, a separate building, or a similar significant construction element.
- C. Milestone: A key or critical point in time for reference or measurement.
- D. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- E. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- F. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- G. Event: The starting or ending point of an activity.
- H. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Construction Manager, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

- I. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

1.3 SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF electronic file.
- B. Startup construction schedule.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Construction Manager's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Construction Manager's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.

1.4 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Construction Manager's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Construction Manager's construction schedule with submittal schedule.
 - 3. Startup and Testing Time: Include no fewer than 7 days for startup and testing.
 - 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule (where applicable), and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 3. Products Ordered in Advance: Include a separate activity for each product.
 - 4. Owner-Furnished Products: Include a separate activity for each product.
 - 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 - 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.

- j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
8. Other Constraints include but are not limited to the following:
- a. Roads.
 - b. Parking.
 - c. Landscape.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, punch list activities, Substantial Completion, and final completion.
- E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Construction Manager intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within 14 days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. Startup Network Diagram may be submitted in lieu of Bar-Chart Schedule.

2.3 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE (BAR CHART/GANTT CHART)

- A. Bar Chart/Gantt Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Construction Manager's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Construction Manager's construction schedule using a time-scaled CPM network analysis diagram for the Work.
 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Construction Manager from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Purchase of materials.
 - c. Delivery.
 - d. Fabrication.
 - e. Installation.
 - f. Punch list and final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment, fragnet, to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Construction Manager or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. High and low temperatures and general weather conditions, including presence of rain or snow.
 5. Accidents.
 6. Meetings and significant decisions.

7. Unusual events (see special reports).
 8. Stoppages, delays, shortages, and losses.
 9. Meter readings and similar recordings.
 10. Emergency procedures.
 11. Orders and requests of authorities having jurisdiction.
 12. Change Orders received and implemented.
 13. Construction Change Directives received and implemented.
 14. Services connected and disconnected.
 15. Equipment or system tests and startups.
 16. Partial completions and occupancies.
 17. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Construction Manager's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. In-House Option: Owner may waive the requirement to retain a consultant if Construction Manager employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Construction Manager's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect–Owner, separate contractors, testing and inspecting agencies, and other parties identified by Construction Manager with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.2 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified professional commercial photographer to take electronic construction photographs.
- B. Minimum Digital Camera Resolution: 1800 x 1200 dpi (dots per inch) @ 72 dpi resolution.
- C. Acceptable Electronic File Format: .jpg, .tif, .tiff, .tga, .jpe, or .png.
- D. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- E. Image File Naming Convention (separate by an underscore _):
1. Project Job Number / Year-Month-Day / Image Number . file extension
- F. Print Format: 8 in (200 mm) by 10 in (250 mm) smooth surface matte prints on single-weight commercial-grade stock, mounted on linen or card stock to allow a 1 in (25 mm) wide margin and enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.
- G. Print Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
1. Name of Project.
 2. Name and address of photographer.
 3. Name of Architect.
 4. Name of Construction Manager.
 5. Date photograph was taken.
 6. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- H. Preconstruction Photographs: Before starting construction, take 4 photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property. Submit prints and JPEG electronic files as required under "Submittals" Article.
- I. Periodic Construction Photographs: Take 4 photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken. Submit prints and JPEG electronic files as required under "Submittals" Article.
1. Field Office Prints: In addition to prints required to be submitted under "Submittals" Article, make and retain in field office at Project site available at all times for reference, one set of prints of periodic construction photographs. Identify photographs the same as for those submitted to Architect.

- J. Final Completion Construction Photographs: Take 8 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points. Submit prints and JPEG electronic files as required under "Submittals" Article.

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.
4. Preconstruction video recordings.
5. Periodic construction video recordings.
6. Web-based construction photographic documentation.

1.2 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For photographer and Web-based photographic documentation service provider.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph or video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files within 3 days of taking photographs.
1. Digital Camera: Minimum sensor resolution of 12 megapixels.
 2. Format: Minimum 4288 by 2848 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 3. Image File Naming Convention (separate by an underscore _):
 - a. Project Job Number / Year-Month-Day / Image Number . file extension
 4. Identification: Provide the following information with each image description in file metadata tag:
 - a. Architect's Job Number.
 - b. Name of Project.
 - c. Name and contact information for photographer.
 - d. Name of Architect.
 - e. Name of Construction Manager.
 - f. Date photograph was taken.
 - g. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - h. Unique sequential identifier keyed to accompanying key plan.
- D. Video Recordings: Submit video recordings within 7 days of recording.
1. Video Recordings, General:
 - a. Submit in digital video disc format acceptable to Architect.
 - b. Submit by posting to Project Web site.

- c. Submit by posting to Web-based photographic documentation service provider's Web site.
 - 2. Identification: With each submittal, provide the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Weather conditions at time of recording.
 - 3. Transcript: Provide Portable Data (PDF) Electronic File. Include a cover page with same label information as corresponding video recording. Include name of Project and date of video recording on each page.
- E. Web-Based Photographic Documentation: Submit time-lapse sequence video recordings simultaneously with recording.
- 1. Real-time posting: Post in real-time, time-lapse sequence video recordings:
 - a. Post to Project Web site.
 - b. Post to Web-based photographic documentation service provider's Web site.
 - 2. Periodic Posting: Monthly on digital video disc.
 - 3. Identification: For each recording, provide the following information:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Date(s) and time(s) video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Weather conditions at time of recording.

1.3 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
- B. Web-Based Photographic Documentation Service Provider: A firm specializing in providing photographic equipment, Web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.4 USAGE RIGHTS

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

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of megapixels, and at an image resolution of not less than 4288 by 2848 pixels.
- B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to Architect.

2.2 WEB-BASED PHOTOGRAPHIC DOCUMENTATION

- A. Project Camera: Provide fixed exterior camera installation, mounted to provide unobstructed view of construction site from location approved by Architect.
 - 1. Provide 4 fixed-location camera(s), with the following characteristics:
 - a. Remotely controllable view with mouse-click user navigation for horizontal pan, vertical tilt, and optical zoom of 500 percent minimum.
 - b. Capable of producing minimum 3 megapixel pictures.
 - c. Provide power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.
- B. Web-Based Image Access: Password-protected access for Project team administered by Construction Manager, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
 - 1. Provide public viewer open access to most recent project camera image.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take a minimum of 20 photographs to show existing conditions adjacent to property before starting the Work.

3. Take a minimum of 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
1. Frequency: Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment.
 2. Vantage Points: Following suggestions by Architect and Construction Manager, photographer to select vantage points. During each of the following construction phases, take not less than 2 of the required shots from same vantage point each time to create a time-lapse sequence as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 - d. Interior Work, through date of Substantial Completion.
- G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
1. Do not include date stamp unless directed otherwise by Architect.
- H. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

3.2 CONSTRUCTION VIDEO RECORDINGS

- A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.
- B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.

- C. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
 - 1. Confirm date and time at beginning and end of recording.
 - 2. Begin each video recording with name of Project, Construction Manager's name, videographer's name, and Project location.
- D. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.
- E. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Architect.
 - 1. Flag construction limits before recording construction video recordings.
 - 2. Show existing conditions adjacent to Project site before starting the Work.
 - 3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of construction.
 - 4. Show protection efforts by Construction Manager.
- F. Periodic Construction Video Recordings: Record video recording monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).
- G. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.
 - 1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every 5 minutes, from same vantage point each time, to create a time-lapse sequence of 30 minutes in length as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 - 2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.
 - 3. Vantage Points: Following suggestions by Architect and Construction Manager, photographer shall select vantage points.

3.3 WEB-BASED CONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

- A. Live Streaming Construction Site Images: Provide Web-accessible image of current site image from viewer-controlled location camera(s), updated at 15 minute intervals during daytime operation.
- B. Time-Lapse Sequence Construction Site Recordings: Provide video recording from a fixed-location camera to show status of construction and progress.
 - 1. Frequency: Record one frame of video recording every 15 minutes, from same vantage point each time, to create a time-lapse sequence of construction activities.
 - 2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during daylight construction work hours.

- C. Maintain cameras and Web-based access in good working order according to Web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's review. Architect's responsive action is required.
- B. Digital Signature: A digital signature or digital signature scheme is a mathematical scheme for demonstrating the authenticity of a digital message or document.
- C. Electronic Signature: An electronic signature is any legally recognized electronic means that indicates that a person adopts the contents of an electronic message.
- D. Informational Submittals: Written and graphic information other than action submittals that require Architect's review. Architect's responsive action is required on informational submittals that do not comply with the information given and design concept expressed in the Drawings and Specifications.
- E. 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.

1.3 SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Construction Manager'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 Construction Manager's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 - 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 Architect's final release or approval.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: If approved by the by Owner, Architect will furnish Contractor one set of digital data files of Drawing files for use in preparing submittals. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
- 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 concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow sufficient and reasonable time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review.
- D. Paper Submittals: Architect reserves the right to require paper submittals.
- 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.
 - 2. Name file with submittal number, including revision identifier.
 - a. File Naming Convention (separate by dashes - or underscores _):
 - 1) Specification Number / Revision Number / Submittal Sequence (A, B, C, etc.).pdf
 - 3. Provide means for insertion to permanently record Construction Manager's review and approval markings and action taken by Architect.
 - 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
 - a. Project name.

- b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. Architect's Job Number.
 - b. Project name.
 - c. Number and title of appropriate Specification Section.
 - d. Manufacturer name.
 - e. Product name.
 - f. Submittal revision number.
6. Utilize electronic project management software program to process submittals when feasible with the type and extent of submittals. Refer to Division 01 Section "Project Management and Coordination" for description of electronic project management software.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On page, prepared on Construction Manager's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in file name and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with notation from Architect's action stamp not requiring additional submittals.
- I. Distribution: Furnish electronic 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 appropriate notation from Architect's action stamp indicating for construction. Retain a separate copy for Owner to be delivered to Owner with Project Closeout documents.

PART 2 - PRODUCTS

2.1 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. Submit electronic submittals as PDF electronic files directly to Architect's Project Web site specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. Provide PDF electronic files from scanned paper originals at 300 dpi, minimum.
 - 2. 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. When one or more individual Specification Sections includes requirements for notarized signature on certificates and certifications, provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's installation instructions.
 - c. Mill reports.
 - d. Standard product operating and maintenance manuals.
 - e. Certification that products are appropriate for installation indicated.
 - f. Manufacturer's catalog cuts.
 - g. Manufacturer's product specifications.
 - h. Standard color charts.
 - i. Statement of compliance with specified referenced standards.
 - j. Testing by recognized testing agency.
 - k. Application of testing agency labels and seals.
 - l. Notation of coordination requirements.
 - m. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in 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. Dimensions.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Design calculations.
 - i. Schedules.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship and attachment to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer.
 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (212 by 275 mm), but no larger than 30 by 42 inches (750 by 1050 mm).
 4. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 5. BIM File Incorporation: When applicable, 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 Division 01 Section "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. This is in addition to physical samples.
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 Construction Manager.
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 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 4 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 4 sets of paired units that show approximate limits of variations.
- E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- F. Construction Manager's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

- K. Sustainable Construction Submittals: Where applicable, comply with requirements specified in Division 01 sustainable construction requirements Section.
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-ENGINEERING SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Construction Manager by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Engineering Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Construction Manager 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: Where applicable, 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

3.1 CONSTRUCTION MANAGER'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. 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 Construction Manager's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp and mark submittal appropriately, as

follows:

1. Final but Restricted Release: When submittals are marked "Accepted as Noted," the Work covered by the submittal may proceed provided it complies with both the Architect's notations and corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
 2. Returned for Resubmittal: When submittal is marked "Revise Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Revise Resubmit" to be used at the Project site, or elsewhere where construction is in progress.
 3. Submittals Not Required: Where a submittal is primarily for other Construction Manager activity, the submittal will be returned, marked "Not Reviewed; Submittal not required by Contract Documents".
- B. Architect's acceptance of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.
- C. Informational Submittals: Architect will review submittal, and return it in accordance with submittal Processing Time indicated if it does not comply with requirements. Architect will stamp and mark submittal appropriately.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. Review shall not be final until complete submittal has been reviewed by Architect.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.
- G. Electronic File of Submittal Documents: Provide Architect with an independent electronic archive of project submittal documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination".

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Mockups establish the standard by which the Work will be judged.
 - 1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
 - 3. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL (Nationally Recognized Testing Laboratories), an NVLAP (National Voluntary Laboratory Accreditation Program), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Construction Manager or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- A. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction and with the qualification requirements of individual specification section governing their work.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 CONSTRUCTION MANAGER'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Construction Manager's quality-assurance and quality-control responsibilities. Coordinate with Construction Manager's construction schedule.

- B. **Quality-Control Personnel Qualifications:** Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may be the Project superintendent or be an individual with no other Project responsibilities, as accepted by the Architect.
- C. **Submittal Procedure:** Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. **Testing and Inspection:** In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Construction Manager-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Construction Manager-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority when Commissioning is included in the Project.
- E. **Continuous Inspection of Workmanship:** Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. **Monitoring and Documentation:** Maintain testing and inspection reports including log of approved and rejected results, including Owner acceptance of nonconforming work. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.5 REPORTS AND DOCUMENTS

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

- B. **Manufacturer's Technical Representative's Field Reports:** Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Statement whether conditions, products, and installation exceed manufacturer's statements.
 8. Other required items indicated in individual Specification Sections.
- C. **Factory-Authorized Service Representative's Reports:** Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. **Permits, Licenses, and Certificates:** For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. **General:** Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Construction Manager responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Construction Manager. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

- K. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Construction Manager shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 2. Clean exposed faces of mock-up.
 3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Protect accepted mock-up from the elements with weather-resistant membrane.
 6. Obtain Architect's acceptance of mock-ups before starting fabrication.
 7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
 8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Construction Manager, submitted to Architect in writing, and accepted by Architect in writing.
 9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.
- L. Integrated Exterior Mockups: See Division 01 Section "Visual Mock-Up Requirements".
- M. Room Mockups: See Division 01 Section "Visual Mock-Up Requirements".
- N. Laboratory Mockups: See Division 01 Section "Testing Mock-Up for Building Enclosure System".

1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Construction Manager with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Construction Manager.
- B. Construction Manager Responsibilities: Tests and inspections not explicitly assigned to Owner are Construction Manager's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Construction Manager by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Construction Manager's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Construction Manager shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Construction Manager's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Construction Manager and not required by the Contract Documents are Construction Manager's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Construction Manager's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. **Testing Agency Responsibilities:** Cooperate with Architect and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Construction Manager promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Construction Manager.
 4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 5. Do not perform any duties of Construction Manager.
- G. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Construction Manager's construction schedule.
 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
 - a. Prepare in tabular form and include the following:
 - 1) Specification Section number and title.
 - 2) Entity responsible for performing tests and inspections.
 - 3) Description of test and inspection.
 - 4) Identification of applicable standards.
 - 5) Identification of test and inspection methods.
 - 6) Number of tests and inspections required.
 - 7) Time schedule or time span for tests and inspections.
 - 8) Requirements for obtaining samples.
 - 9) Unique characteristics of each quality-control service.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner may engage a qualified to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
 1. Notifying Architect and Construction Manager promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Construction Manager and to authorities having jurisdiction.
 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Construction Manager's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Construction Manager's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. Submitted: The terms "submitted", "reported", "satisfactory" and similar words and phrases means submitted to Architect, reported to Architect and similar phrases.
- J. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
UBC	Uniform Building Code (See ICC)	

- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission	(888) 225-5322

www.fcc.gov

FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office	(866) 512-1800 (202) 512-1800

www.gpoaccess.gov/cfr/index.html

DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil Available from Defense Standardization Program www.dps.dla.mil Available from General Services Administration www.gsa.gov Available from National Institute of Building Sciences www.wbdg.org/ccb	(215) 697-2664 (202) 619-8925 (202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
 - 1. Cost or use charges for temporary facilities are not chargeable to Owner or Architect.
- B. Sewer Service: Arrange with utility company for sewer service for the project to be put in the Owner's name.
- C. Water Service: Arrange with utility company for water service for the project to be put in the Owner's name.
- D. Electric Power Service: Arrange with utility company for electrical power service for the project to be put in the Owner's name.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- C. Dust- and HVAC-Control Plan at Renovation Work: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.
 - 5. Other dust-control measures.

- D. Temporary Utility Reports: Make available on request, reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- E. Implementation and Termination Schedule: Make available on request a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6 "Requirements for Demolition Operations", NECA's "Temporary Electrical Facilities," and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".
 - 1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- D. Accessible Temporary Egress at Renovation Work: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department and Rescue Squad rules.
 - 5. Environmental protection regulations.
 - 6. City ordinances and regulations.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- C. Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum

2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top rails.

- D. Portable Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (40 mm) OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- E. Wood Enclosure Fence: Plywood, 8 feet (2.4 m) high, framed with four 2 by 4 inch (50 by 100 mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
- F. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil (0.25 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- G. Polyethylene Sheet: Reinforced, fire-resistive sheet, 6 mil (0.14 mm) minimum thickness, with Class A flame-spread rating per ASTM E 84 and passing NFPA 701 Test Method 2.
 - 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; SAFE-FLEX ICRA Awareness Barrier.
- H. Dust Containment Barrier for Doors: reinforced, fire-resistive polyethylene sheet, 10 mil (0.25 mm) minimum thickness with Class B flame-spread rating per ASTM E 84 and designed to be used for securing temporary construction doors so as to minimize and mitigate particle control during construction.
 - 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; Aire Guardian Door Guard Reusable Barrier.
- I. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (900 by 1500 mm).
- J. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site.
 - 2. Conference room of sufficient size to accommodate. Provide electrical power service and 120-V ac duplex receptacles. Furnish room with conference table, chairs, and tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor.
 - 5. Lighting fixtures capable of maintaining average illumination at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- D. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- E. Air-Filtration Units for Renovation Work: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. Locate temporary utilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required.
- B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent utilities.
- C. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.

3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- D. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to municipal system as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- E. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Sterilize temporary water piping before use in accordance with requirements of authorities having jurisdiction.
- F. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Existing Toilets in Occupied Facilities: Use of Owner's existing toilet facilities will not be permitted or allowed.
- G. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- H. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

- I. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Provide telephone line(s) for each field office.
- M. Electronic Communication Service: Provide internet access of not less than 15-Mbps download and 5-Mbps upload speed for use by Architect and Owner to access Project electronic documents and maintain electronic communications

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Provide dust-control that is nonpolluting and nontracking. Reapply as required to minimize dust.
- C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Coordinated parking with Owner's requirements.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar construction is completed.

3. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Coordinated signs with Owner's requirements and requirements of authorities having jurisdiction.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- H. Comply with progress cleaning requirements in Division 01 Section "Execution."
- I. Existing Elevator Use in Occupied Facilities: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 1. Do not load elevators beyond their rated weight capacity.
 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- J. Existing Stair Usage in Occupied Facilities: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 1. Comply with work restrictions specified in Division 01 Section "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
- K. Temporary Enclosures: Provide temporary, weathertight, enclosures for protection of construction, in progress and completed, including, but not limited to, vertical and horizontal openings, from exposure, foul weather, other construction operations, and similar activities.
- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (450 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1200 mm) between doors. Maintain walk-off mats in vestibule, for dust control.
 - 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 5. Protect air-handling equipment.
 - 6. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and authorities having jurisdiction; manage fire-prevention program.

3.5 MOISTURE CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of discoloration that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard, replace, or clean stored or installed material that begins to show discoloration.
 - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use permanent HVAC system to control humidity.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits. Refer to technical specification sections for additional and more stringent criteria.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may

have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Construction Manager. Refer to Division 01 Section "Substitution Procedures".
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers
- D. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.
- E. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Construction Manager's services are rendered, any amendments for Construction Manager's services rendered after the effective date of any such amendments.

1.3 SUBMITTALS

- A. Comparable Product: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.
- C. Construction Manager shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Construction Manager is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Compliance: Construction Manager shall take whatever measures deemed necessary to insure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Construction Manager of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product, required by the Contract Documents to provide specific rights for Owner, and specifically endorsed by manufacturer to Owner.
 - 2. Warranties: Prepare a written document, on manufacturer's standard form, modified to include Project-specific information, that contains appropriate terms and identification, properly executed.
- B. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 - 6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will not be considered.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will not be considered.

3. Products:
 - a. Restricted List (Acceptable Manufacturers/Fabricators and Products): Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List (Available Manufacturers/Fabricators and Products): Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
 - a. Restricted List (Acceptable Manufacturers/Fabricators): Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Construction Manager's convenience will be considered unless otherwise indicated.
 - b. Nonrestricted List (Available Manufacturers/Fabricators): Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product (Product Standard): Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers, or unnamed manufacturer's product.
- C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.
- D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.
 1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.
- F. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

- G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's color, gloss, pattern, density, or texture" or similar phrase, select a product (and manufacturer) that complies with other specified requirements.
1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
 3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.
- A. Allowances (If Applicable): Refer to provisions of individual Specification Sections and of Division 01 Section "Allowance" for allowances that control product selection and for procedures required for processing such selections.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Construction Manager's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents; that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION

3.1 RESTRICTION OF HAZARDOUS SUBSTANCES

- A. Construction Manager agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Construction Manager shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Construction Manager engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Construction Manager hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.

- B. In the event Construction Manager observes on the Project Site any substance which Construction Manager reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Construction Manager shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Construction Manager fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Construction Manager hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Construction Manager's failure to stop the Work.
- C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Construction Manager or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Construction Manager shall be responsible for the cost of such studies to the extent that Construction Manager or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 SUBMITTALS

- A. Qualification Data: For land surveyor or professional engineer.
- B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.
- D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.
- E. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.
- A. Retention System Certification: Submit a statement certified by the Construction Manager's registered structural engineer that the design of components of the excavation support system is in compliance with provisions of the Contract Documents and the local building code, and is in keeping with generally accepted engineering practice.
1. Submit, if requested, design calculations, specifications and erection drawings, bearing the Construction Manager's registered structural engineer's stamp, to the local building code official.
 2. Submit complete excavation support system shop drawings for information coordination purposes only.
 3. Architect/Engineer will neither review nor approve excavation support system shop drawings.

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Retention System Engineering: Each component of the excavation support system shall be designed by a registered structural engineer, in accordance with the local building code, and registered structural engineer shall be engaged by the Construction Manager.
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 3. Miscellaneous Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - a. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
- D. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential

interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

- E. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable construction requirements Section.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities; and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

- C. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. Respective manufacturer/fabricator's written installation instructions.
 2. Accepted submittals.
 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- A. Existing Utility Interruptions at Renovation Work: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Construction Manager, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.4 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.5 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

- C. Certified Survey: 30 days after completion of each work component/activity, including, but not limited to, foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- D. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.6 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated, unless indicated otherwise in the Contract Documents.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located, aligned, and coordinated with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.7 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.8 OWNER-INSTALLED PRODUCTS

- A. Site Access: As applicable, provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 1. Construction Schedule: Inform Owner of Construction Manager's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.9 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers specifically intended for holding types of waste materials identified where applicable, e.g. blue colored containers with labeling and symbols for bio-waste.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills immediately.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive.
- H. Remove construction markings not required and graffiti immediately, repairing or replacing damaged material.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 STARTING AND ADJUSTING

- A. As applicable, coordinate startup and adjusting of equipment and operating components with commissioning requirements in Division 01 specification sections.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.11 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Not used.

1.2 DEFINITIONS

- A. Alternative Daily Cover: Material other than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter and scavenging. Generally, these materials must be processed so they do not allow gaps in the exposed landfill face.
- B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- E. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- G. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- H. Trash: Any product or material unable to be recycled, salvaged, or reused.

1.3 PERFORMANCE REQUIREMENTS

- A. General Requirements
 - 1. Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 percent (1 point) or 75 percent (2 points) by weight or volume of total demolition and construction waste generated by the Work.
 - 2. Alternatively, practice efficient waste management in the use of materials in the course of the Work. Reduce waste by minimizing factors that contribute to waste and achieve the most efficient use of resources and materials; use prefabricated components, modular construction and designs the use industry standard sizes; use water efficiently; avoid practices such as over-packaging, improper storage, ordering errors, poor planning, breakage, mishandling and contamination. Do not generate more than or 15 pounds (1 point) or 10 pounds (2 points) of construction waste per square foot of the building's floor area.

1.4 SUBMITTALS

- A. Waste Management Plan: Submit one copy of plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner. Include the following information:
1. Project Name and Location
 2. Project Site Contact
 3. Establish waste diversion goals for the project by identifying materials (both structural and nonstructural) targeted for diversion.
 4. Specify whether materials will be separated or commingled and describe the diversion strategies planned for the project.
 5. Describe where the material will be taken and how the recycling facility will process the material including expected diversion rates for each material stream. Include the names, addresses, and telephone numbers for the locations of the landfill and recycling facilities.
 6. Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler. Materials sent to a commingled recycling facility for processing must take the facility average recycling rate, per month, and must include alternative daily cover as landfill waste.
 7. Include how soil, land clearing debris, hazardous materials, or other materials not contributing to diversion will be handled.
 8. Include how alternative daily cover will be addressed.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit an electronic copy of report. Include separate reports for demolition and construction waste. Include the following information:
1. Material category.
 2. Generation point of waste.
 3. Location of waste or recycling facility.
 4. Total quantity of waste in tons for at least five target categories.
 5. Quantity of waste salvaged, both estimated and actual in tons.
 6. Quantity of waste recycled, both estimated and actual in tons.
 7. Quantity of landfilled trash, both estimated and actual in tons.
 8. Total quantity of all waste generated (salvaged, recycled, and landfilled trash) in tons.
 9. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit an electronic copy of calculated end-of-Project rates for salvage, recycling, and landfill trash disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Qualification Data: For Waste Management Coordinator and refrigerant recovery technician.

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or person responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site supervisor, each trade contractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling and recycling, salvage, reuse and return methods to be used by all parties at the appropriate states of the project.

3.2 LEED DOCUMENTATION

- A. Complete necessary LEED Online forms.
- B. Upload the required supporting documentation within LEED Online.

END OF SECTION

**SECTION 02 4113
SELECTIVE SITE DEMOLITION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SELECTIVE SITE DEMOLITION as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SELECTIVE SITE DEMOLITION shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Demolition and removal of selected site improvements.
- B. Disconnecting, capping or sealing, and abandoning in-place and removing site utilities.
- C. Salvaging items for reuse by Owner.

1.4 RELATED SECTIONS

- A. 31 10 00 Site Clearing
- B. 31 23 00 Excavation and Fill
- C. 31 25 00 Erosion and Sedimentation Controls
- D. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah
- B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- C. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- D. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- E. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

1.6 INFORMATIONAL SUBMITTALS

- A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any finished surfaces that might be misconstrued as damage caused by demolition operations.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective site demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.

4. Coordination of Owner's continuing occupancy of portions of existing building and use of the site.

1.7 QUALITY ASSURANCE

A. PRE-DEMOLITION CONFERENCE

1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.
2. Inspect and discuss condition of construction to be demolished.
3. Review structural load limitations of existing structures.
4. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review areas where existing construction is to remain and requires protection.
6. Review and finalize protection requirements.
7. Review procedures for dust control.
8. Review procedures for protection of adjacent buildings.
9. Review items to be salvaged and returned to Owner.
10. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.8 CLOSEOUT SUBMITTALS

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

1.9 REGULATORY REQUIREMENTS

- A. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

- A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.
- B. CONSTRUCTION MANAGER shall make application, pay permit fees, and obtain any and all other demolition permits.

1.11 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of CONSTRUCTION MANAGER.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.12 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.

1.13 CONSTRUCTION CONTROL

1. Do not commence work until temporary erosion and sedimentation control measures are in place.
2. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
3. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to

construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.15 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.16 FIELD CONDITIONS

- A. Notify ARCHITECT of discrepancies between existing conditions and Drawings before proceeding with SELECTIVE SITE DEMOLITION.
- B. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
 - 1. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 2. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 3. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before building demolition, coordinate with the Owner of any items Owner will remove prior to demolition and any items Owner wants CONSTRUCTION MANAGER to salvage for Owner's reuse.
- D. On-site storage or sale of removed items or materials is not permitted.

1.17 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

1.18 PROJECT CONDITIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction.

- Provide enough lights, warning signs, and watchmen for the safety of the public.
3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
1. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.19 HAZARDOUS CONDITIONS

- A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify Owner and ARCHITECT (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with ARCHITECT concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with governing CITY, STATE, and FEDERAL notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 "Safety Requirements for Demolition Operations" from the American National Standard for Construction and Demolition Operations, and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".

2.2 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 31 2300 Excavation and Fill.

PART 3 - EXECUTION

3.1 PRE-DEMOLITION WORK

- A. Contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. Notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility. CONSTRUCTION MANAGER shall also

coordinate the construction activities with the utility companies to ensure compliance with the project schedule.

- C. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to demolition. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.
- E. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- F. Photograph, record on video, or both the existing conditions of the Project site and adjoining property.

3.2 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.3 TEMPORARY EROSION CONTROLS

- A. See 31 25 00 Erosion and Sedimentation Controls.
- B. Comply with the City, State, and Federal requirements for the minimization and control of sediment erosion and site run-off in storm water resulting from construction activities. Install temporary erosion controls prior to SELECTIVE SITE DEMOLITION. Comply with the requirements of the Storm Water Pollution Prevention Plan and the permit(s) issued by the City and State.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material. Cut off pipe or conduit a minimum of 36 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.

- d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.5 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 - a. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - 2. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.
 - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - 6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 - 7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- E. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- F. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.6 DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small

- power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least per NFPA 51B hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Pack or crate items after cleaning. Identify contents of containers.
 2. Transport items to Owner's storage area designated by Owner.
 3. Protect items from damage during transport and storage.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.
- E. Explosives: Use of explosives is not permitted.

3.7 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated below:
1. Coordinate with Owner prior to demolition.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
1. Remove below-grade construction, including basements, foundation walls, and footings, completely.
- E. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 8 feet outside footprint indicated for new construction. Abandon utilities outside this area.
1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 31 23 00 Excavation and Fill.
- F. Hydraulic Elevator Systems: Demolish and remove elevator system, including cylinder, plunger, well assembly, steel well casing and liner, oil supply lines, and tanks.
- G. Pavement: Demolish pavement in sections. Cut pavement full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove pavement between saw cuts. Pavement shall be saw cut in straight lines.

3.8 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

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

dimensions indicated.

- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.9 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.10 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.11 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.12 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
- B. Clean roadways of debris caused by debris transport.

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SECTION 260000

GENERAL ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals
 1. This project is pursuing LEED Healthcare v4: Silver Certification
 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 RELATED DOCUMENTS

- A. Requirements under Division 1 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 1, this section and division take precedence. Become thoroughly familiar with all their contents as to requirements that affect this division, section or both. The work required under this section includes material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate each system's functioning as implied by the design and the equipment specified.
- B. The specifications and drawings for the project are complementary, and portions of the work described in one, shall be provided as if described in both. In the event of discrepancies, notify the engineer and request clarification prior to proceeding with the work involved.
- C. Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of work, indicating the intended general arrangement of the equipment and other materials without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all contract documents. Correct errors that could have been avoided by proper checking and inspection, at no additional cost to the owner.
- D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the contract is based.

1.3 DEFINITIONS

- A. Whenever used in these specifications or drawings, the following terms shall have the indicated meanings:
 1. Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."
 2. Install: "to perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
 3. Provide: "to furnish and install complete, and ready for the intended use."
 4. Furnished by owner (or owner-furnished) or furnished by others: "an item furnished by the owner or under other divisions or contracts, and installed under the requirements of this division, complete, and ready for the intended use, including all items and services

incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division.

5. Engineer: where referenced in this division, "engineer" is the engineer of record and the design professional for the work under this division, and is a consultant to, and an authorized representative of, the architect, as defined in the general and/or supplementary conditions. When used in this division, it means increased involvement by, and obligations to, the engineer, in addition to involvement by, and obligations to, the "architect".
 6. AHJ: the local code and/or inspection agency (authority) having jurisdiction over the work.
 7. NRTL: nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, certified, or all three, by an NRTL, and acceptable to the AHJ over this project.

1.4 PRE-BID SITE VISIT

- A. Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to do so will not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

1.5 MATERIAL AND WORKMANSHIP

- A. Provide all material and equipment new and in first class condition. Provide markings or a nameplate for all material and equipment identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. In general, provide the following quality grade(s) for all materials and equipment:
- B. Work performed under this contract shall provide a neat and "workmanlike" appearance when completed, to the satisfaction of the architect and engineer. Workmanship shall be the finest possible by experienced mechanics of the proper trade.
- C. The complete installation shall function as designed and intended with respect to efficiency, capacity, noise level, etc. Abnormal or excessive noise from equipment, devices or other system components will not be acceptable.
- D. Remove from the premises waste material present as a result of work. Clean equipment installed under this contract to present a neat and clean installation at the termination of the work.
- E. Repair or replace public and private property damaged as a result of work performed under this contract to the satisfaction of authorities and regulations having jurisdiction.

1.6 MANUFACTURERS

- A. In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.
- B. Where a list is provided, manufacturers listed are not in accordance with any ranking or preference.
- C. Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

1.7 COORDINATION

- A. Coordinate all work with other divisions and trades so that the various components of the systems will be installed at the proper time, fit the available space, and will allow proper service access to those items requiring maintenance. Refer to all other division's drawings, and to relevant equipment submittals and shop drawings to determine the extent of clear spaces. Components which are installed without regard to the above shall be relocated at no additional cost to the owner.
- B. Unless otherwise indicated, the general contractor will provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the general contractor with information where chases and openings are required. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing system components in the manner anticipated in the design. Keep informed as to the work of other trades engaged in the construction of the project, and execute work in a manner as to not interfere with or delay the work of other trades.
- C. Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor will be held responsible for errors that could have been avoided by proper checking and inspection
- D. Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the construction documents are not necessarily intended to designate the required trim.

1.8 ORDINANCES, CODES, AND STANDARDS

- A. Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with current applicable codes adopted by the local AHJ including any amendments and standards as set forth by the National Fire Protection Association (NFPA), Underwriters Laboratories (UL), Occupational Safety and Health Administration (OSHA), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), American National Standards Institute (ANSI), American Society of Testing Materials (ASTM) and other national standards and codes where applicable. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services.
- B. Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence.
- C. Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the engineer's attention for final resolution. Contractor will be held responsible for any violation of the law.
- D. Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for and furnish certificates of inspection to owner. Contractor will be held responsible for violations of the law.

1.9 PROTECTION OF EQUIPMENT AND MATERIALS

- A. Store and protect from damage equipment and materials delivered to job site, in accordance with manufacturers' recommendations. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment and material that has been damaged by construction activities will be rejected, and contractor shall furnish new equipment and material as required at no additional cost to the owner.
- B. Keep premises broom clean from foreign material created during work performed under this contract. Piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.
- C. Plug or cap open ends of conduits while stored and installed during construction when not in use to prevent the entrance of debris into the systems.

1.10 SUBSTITUTIONS

- A. Include in the base bid the products specifically named in these specifications or on the drawings. Submit, in the form of alternates, with bid, products of any other manufacturers for similar use, provided the differences in cost, if any, are included for each proposed alternate.
- B. No substitutions will be considered with receipt of Bids, unless the Architect and Engineer have received from the Bidder a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids, and have approved the substitution request. Include, with each such request, the name of the material or equipment for which substitution is being requested, and a complete description of the proposed substitution, including drawings, cut sheets, performance and test data, and all other information necessary for an evaluation. Include also a statement setting forth changes in other materials, equipment or other work that would be required to incorporate the substitution. The burden of proof of the merit of the proposed substitute is upon the proposer. The proposer of any substitutions shall compensate the Engineer at a rate of \$150.00 per hour for time spent evaluating proposed substitutions and or the subsequent revisions to the design required to utilize the substitution.
- C. The Architect's or Engineer's decision to approve or disapprove a substitution in a Bid is final.
- D. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal.
- E. No substitutions will be considered after receipt of Bids and before award of the Contract.
- F. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.11 SUBMITTALS

- A. Assemble and submit to the architect, for engineer's review, manufacturers' product literature for material and equipment to be furnished, installed, or both, under this division, including shop drawings, manufacturers' product data and performance sheets, samples, and other submittals required by this division. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed. Provide the number of submittals required by division 1; however, at a minimum, submit two (2) sets. Before submitting, verify that all materials and equipment submitted are mutually compatible and suitable for the intended use, fit the available spaces, and allow ample and code-required room for access and maintenance. Submittals shall contain the following information. Submittals not so identified will be returned to the contractor without action:
 - 1. The project name.
 - 2. The applicable specification section and paragraph.
 - 3. The submittal date.
 - 4. The contractor's stamp, which shall certify that the stamped drawings have been checked by the contractor, comply with the drawings and specifications, and have been coordinated with other trades.
- B. Submittals and shop drawings shall not contain HP Engineering's firm name or logo, nor shall it contain the HP Engineering's engineers' seal and signature. They shall not be copies of HP Engineering's work product.
- C. Transmit submittals as early as required to support the project schedule. Allow for two weeks engineer review time, plus mailing time, plus a duplication of this time for re-submittals, if required. The engineer's submittal reviews will not relieve the contractor from responsibility for errors in dimensions, details, size of members, or quantities; or for omitting components or fittings; or for not coordinating items with actual building conditions.
- D. Refer to division 1 for acceptance of electronic submittals for this project. For electronic submittals,

contractor shall submit the documents in accordance with the procedures specified in division 1. Contractor shall notify the architect and engineer that the shop drawings have been posted. If electronic submittal procedures are not defined in division 1, contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, contractor shall copy the architect and engineer's designated representatives. Contractor shall allow the engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

1.12 ELECTRONIC DRAWING FILES

- A. In preparation of shop drawings or record drawings, contractor may, as an option, obtain electronic drawing files in Revit, AutoCAD, or DXF format from the engineer for a fee of \$300 for a drawing set up to 10 sheets plus \$25 per sheet in excess of 10 sheets. Contact the architect for written authorization; and, contact the engineer to obtain the necessary release agreement form and to indicate the desired shipping method and drawing format. In addition to payment, architect's written authorization and engineer's release agreement form must be received before electronic drawing files will be sent.

1.13 OPERATION AND MAINTENANCE MANUALS

- A. Submit to the architect, for engineer's review, copies each of operations and maintenance instruction manuals, appropriately bound into manual form including approved copies of the following, revised if necessary to show system and equipment as actually installed. Paper clips, staples, rubber bands, and mailing envelopes are not considered approved binders. Provide the number of submittals required by Division 1; however, at a minimum, submit two (2) sets, and include, at a minimum, the following information:
 - 1. Cover sheet that lists the project name, date, owner, architect, consulting engineer, general contractor, sub-contractor, and an index of contents.
 - 2. Manufacturers' catalogs and product data sheets
 - 3. Wiring diagrams
 - 4. Operation and Maintenance instructions
 - 5. Parts lists
 - 6. Approved shop drawings
 - 7. Test reports as defined in NETA ATS for the systems and equipment provided or furnished or installed under this contract.
 - 8. Names, addresses, telephone numbers, and e-mail addresses of local contacts for warranty services and spare parts.
- B. Submit manuals prior to requesting the final punch list and before any requests for substantial completion. Final approval of this division's systems installed under this contract will be withheld until this equipment brochure is received and deemed complete by the architect and engineer.
- C. Provide "as-built" drawings (see Division 1 and general conditions).

1.14 TRAINING

- A. At a time mutually agreed upon between the owner and contractor, provide the services of a factory trained and authorized representative to train owner's designated personnel on the operation and maintenance of the equipment provided for this project.

- B. Provide training to include but not be limited to an overview of the system and/or equipment as it relates to the facility as a whole; operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention; and review of data included in the operation and maintenance manuals.
- C. Submit a certification letter to the architect stating that the owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The contractor and the owner's representative shall sign the certification letter indicating agreement that the training has been provided.
- D. Schedule training with owner with at least 7 days advance notice.

1.15 WARRANTIES

- A. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of substantial completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds this duration. Warranties shall include labor and material. Remedy all defects, occurring within the warranty period(s), as stated in the general conditions and Division 1 without any additional costs to the owner.
- B. Perform any required remedial work promptly, upon written notice from the engineer or owner.
- C. At the time of substantial completion, deliver to the owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the required period, each warranty instrument being addressed to the owner and stating the commencement date and term.

1.16 MISCELLANEOUS REMODELING WORK

- A. Provide all demolition of existing electrical systems and new electrical system modifications required because of building remodeling, as noted on the drawings, or necessary for proper operation and new construction. Remove all abandoned cables and wiring above accessible ceilings and ventilation shafts.

PART 2 - ELECTRICAL WORK

2.1 BUILDING OPERATION

- A. Comply with the schedule of operations as outlined in the architectural portions of this specification. Building shall be in continuous operation. Accomplish work that requires interruption of building operation at a time when the building is not in operation, and only with written approval of building owner and/or tenant. Coordinate interruption of building operation with the owner and/or tenant a minimum of 7 days in advance of work.

2.2 EXCAVATION AND BACKFILLING

- A. Perform excavation and backfill required for installation of underground work under this contract. Trenches shall be of sufficient width. Crib or brace trenches to prevent cave-in or settlement. Do not excavate trenches close to columns and walls of building without prior consultation with the architect. Use pumping equipment if required to keep trenches free of water. Backfill trenches in maximum 6" layers of well-tamped dry earth in a manner to prevent future settlement.
- B. Excavation as herein specified shall be classified as common excavation. Common excavation shall comprise the satisfactory removal and disposition of material of whatever substances and of every description encountered, including rock, if any, within the limits of the work as specified and shown on the drawings. Excavation shall be performed to the lines and grades indicated on the drawings. Excavated materials which are considered unsuitable for backfill, and surplus of excavated material which is not required for backfill, shall be disposed of by the contractor at his own expense and responsibility, and to the satisfaction of the architect.

2.3 COINCIDENTAL DAMAGE

- A. Repair all streets, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of this work. Repair materials shall match existing construction. All backfilling and repairing shall meet all requirements of the owner, city and others having jurisdiction. Repair work shall be thoroughly first class. Conform to all requirements of Division 2 of these specifications.

2.4 CUTTING AND PATCHING

- A. Following the requirements in Division 1, cut walls, floors, ceilings, and other portions of the facility as required to perform work under this division. Obtain permission of the architect, owner, or both, before doing any cutting. Cut all holes as small as possible. Patch walls, floors, and other portions of the facility as required by work under this division. All patching shall be thoroughly first class and shall match the original material and construction, including fire ratings if applicable in a manner satisfactory to the architect.

2.5 ROUGH-IN

- A. Coordinate without delay all roughing-in with other divisions. Conceal all piping and rough-in except in unfinished areas and where otherwise indicated in the construction documents.

2.6 SUPPORT SYSTEMS

- A. Steel slotted support systems (slotted channel): comply with MFMA-3, factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch; Cooper B-Line, Erico International Corporation, Hilti, Inc., Power-Strut, Thomas & Betts Corporation, Unistrut.
- B. Finishes:
 - 1. Metallic coatings: hot-dip galvanized after fabrication and applied according to MFMA-3.
 - 2. Nonmetallic coatings: manufacturer's standard PVC, polyurethane or polyester coating applied according to MFMA-3.
 - 3. Painted coatings: manufacturer's standard painted coating applied according to MFMA-3
- C. Aluminum slotted support systems (slotted channel): comply with MFMA-3, type 6063-T6, per ASTM B221; factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch; Cooper B-Line, Erico International Corporation, Hilti, Inc., Power-Strut, Thomas & Betts Corporation, Unistrut.
- D. Field Fabrication:
 - 1. Where field cutting of standard lengths of channel are required, make cuts straight and perpendicular to manufactured surfaces.
 - 2. For field-cut or damaged surfaces of coated channels, dress cut ends, damaged surfaces, or both, with an abrasive material (e.g., file, grinding stone, or similar) and cleanser to remove oils, rust, sharp edges and shards.
 - 3. For channel with a factory-applied coating, re-finish cut edges with a coating compatible with the factory finish and as recommended by the manufacturer (e.g., manufacturer's touch-up paint or zinc-rich cold-galvanizing compound, as applicable).

2.7 PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 7 section "through-penetration firestop systems."
- B. Roofs:
 - 1. Coordinate all roof penetrations with engineer, owner, and as applicable, the roofing contractor providing a

roof warranty.

2. Keep all raceway penetrations within mechanical equipment curbs wherever possible. Coordinate with all other applicable Division's work.
3. Flash and counterflash all openings through roof, and/or provide pre-fabricated molded seals compatible with the roof construction installed, or as required by the engineer, owner, or roofing contractor. All roof penetrations shall be leak-tight at the termination of the work and shall not void any new or existing roof warranties.

C. Walls and Floors

1. Sleeves for raceways and cables
2. Steel pipe sleeves: ASTM A 53/A 53M, type E, grade B, schedule 40, galvanized steel, plain ends and drip rings.
3. Cast-iron pipe sleeves: cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Sleeves for rectangular openings: galvanized sheet steel with minimum 0.138 inch thickness and of width and length to suit application.

2.8 FIRE-STOPPING THROUGH PENETRATIONS

- A. Fire-resistant through penetration sealants: two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, raceways, and cable tray penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by underwriters' laboratories, inc., or other NRTL acceptable to AHJ.

B. Acceptable manufacturers:

1. Hilti, Inc.
2. 3m Corp.
3. Rectorseal.
4. Specify Technology Inc.
5. United States Gypsum Company.

C. Submittals

1. Submit product data, manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Division 1.
2. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment shall include both project name and contractor's name who will install firestop system as described in drawings.
3. Submit material safety data sheets provided with product delivered to job-site.

2.9 CONCRETE BASES

- A. Provide concrete bases (e.g., housekeeping pads) for equipment where indicated on the drawings and as specified herein. Concrete bases shall have chamfered edges. Size of base shall be a minimum of 2 inches greater than the footprint of the equipment that it is supporting.
- B. Construct equipment bases of a minimum 28-day, 4000-psi concrete conforming to American Concrete

Institute standard building code for reinforced concrete (ACI 318-99) and the latest applicable recommendations of the ACI standard practice manual. Concrete shall be composed of cement conforming to ASTM C 150 type I, aggregate conforming to ASTM C33, and potable water. Exposed exterior concrete shall contain 5 to 7 percent air entrainment.

- C. Unless otherwise specified or shown on the structural drawings, reinforce equipment bases with no. 4 reinforcing bars conforming to ASTM A 615 or 6x6 – w2.9 x w2.9 welded wire mesh conforming to ASTM A185. Place reinforcing bars 24 inches on center with a minimum of two bars each direction.
- D. Provide galvanized anchor bolts for equipment placed on concrete bases or on concrete slabs. Anchor bolts size, number and placement shall be as recommended by the manufacturer of the equipment.
- E. Concrete equipment bases shall have a minimum height of 4 inches and shall be poured-in-place.

2.10 ACCESS DOORS

- A. Provide access doors in ceilings and walls, where indicated or required for access or maintenance to concealed equipment installed under this section. Provide concealed hinges, screwdriver-type lock, and anchor straps.
- B. Manufactured by Milcor, Zurn, Titus, or equal. Obtain architect's approval of type, size, location and color before ordering.

2.11 EQUIPMENT FURNISHED BY OTHERS

- A. Provide necessary equipment and accessories that are not provided by the equipment supplier or owner to complete installation of equipment furnished by others, in locations as indicated on the drawings, specified herein, or both. Equipment and accessories not provided by the equipment supplier may include such items as flexible cords and plugs, as required for proper operation of the complete system, in accordance with the manufacturers' instructions.
- B. Be responsible for correct rough-in dimensions, and verify them with engineer, owner's representative, equipment supplier, or all three, prior to rough-in and service installations.

2.12 CLEANING

- A. In addition to the requirements of Division 1, remove from the premises dirt and refuse resulting from the performance of the electrical work, as required, to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from the work. Clean all material and equipment installed under this division. Remove dirt, dust, plaster, stains and foreign matter from all surfaces. Touch up and restore all damaged finishes to their original condition.

2.13 ADJUSTING, ALIGNING AND TESTING

- A. Adjust, align, and test all electrical equipment on this project provided under this division and all electrical equipment furnished by others for installation or wiring under this division, for proper operation.
- B. Test all systems and equipment according to the requirements in NETA ATS (latest edition) and all additional requirements specified in following sections.
- C. Maintain the following on the project premises at all times: a true RMS reading voltmeter, a true RMS reading ammeter, and a megohmmeter insulation resistance tester. Provide test data readings as requested or as required by the engineer.

2.14 EQUIPMENT IDENTIFICATION

- A. Provide equipment identification nameplates:

1. On all panelboards, switches, starters, dimmers, switches in distribution panelboards and switchboards and where indicated on the drawings.

B. Nameplates:

1. Engraved, contrasting color, three-layer, laminated plastic indicating the name of the equipment, load, or circuit as designated on the drawings and in the specifications:
 - A) Field-applied permanent epoxy adhesive, compatible with the equipment finish.
 - B) Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied.
2. Color: black background with white letters for normal power; red background with white letters for emergency power. Letter height: ½ inch minimum.

2.15 SYSTEM START UP

- A. Prior to starting up the electrical systems:
1. Check all components and devices.
 2. Lubricate items accordingly.
 3. Tighten screws and bolts for 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.
 4. Adjust taps on each transformer for rated secondary voltage when the transformer is at minimum load.
 5. Check and record building's service entrance voltage, grounding conditions, grounding resistance, and proper phasing.
 6. Replace all burned-out lamps and lamps used for temporary construction lighting in permanent light fixtures.
 7. Balance all single-phase loads at each panelboard, redistributing branch circuit connections until balance is achieved. Do not type up final panelboard directories until all re-balancing and redistribution of circuits are complete. Turn on all loads in an attempt to maximize the load on the panel and take ampere readings on each of the phases before redistributing circuits and balancing the panel.
 8. After all systems have been inspected and adjusted, confirm all operating features required by the drawings and specifications and make final adjustments as necessary.

PART 3 - EXISTING EQUIPMENT REUSE AND REMOVAL

- A. Remove all existing wiring, light fixtures, exposed conduits and other electrical installations not reused prior to substantial completion of the work.
- B. Existing raceways may be reused if their points of terminations are suitable; if they are clean inside with no evidence of rust or burrs; if free from cracks, flattened sections or sharp bends; and, if suitably located to avoid conflicts with other trades or installations. Carefully "fish" all existing conduits reused under this contract to remove all debris and obstructions, and swab until all moisture is removed.
- C. Cut, patch, and repair where required for new electrical installations, and patch and repair all surface damage resulting from this work. Cut flush with the floor and plug at both ends, raceways stubbed above the floor and not used at substantial completion of the work.
- D. Relocate all existing electrical systems required to be in operation at substantial completion of the contract, if required, as a result of work included under this contract, even if not specifically indicated in the drawings or specifications.

PART 4 - ALTERNATES

- A. Provide all work contemplated under the different alternates to include labor, materials, equipment and services necessary for and incidental to the completion of work under each particular alternate. Furnish separate bids for each alternate applicable to contractor's proposal, stating the amount to be added or deducted from the base bid in case the alternate is accepted. Comply with applicable sections of the base specifications for work required by the alternate unless otherwise specified. Refer to the architectural portion of the specification.

END OF SECTION

SECTION 26 0519

-LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals
 1. This project is pursuing LEED Healthcare v4: Silver Certification
 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

- A. Section Includes:
 1. Copper building wire rated 600 V or less.
 2. Metal-clad cable, Type MC, rated 600 V or less.
 3. Armored cable, Type AC, rated 600 V or less.
 4. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer's authorized service representative.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B496 for stranded conductors.
- D. Conductor Insulation:
 - 1. Type NM: Comply with UL 83 and UL 719.
 - 2. Type RHH and Type RHW-2: Comply with UL 44.
 - 3. Type USE-2 and Type SE: Comply with UL 854.
 - 4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
 - 5. Type THHN and Type THWN-2: Comply with UL 83.
 - 6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 7. Type UF: Comply with UL 83 and UL 493.
 - 8. Type XHHW-2: Comply with UL 44.
- E. Shield:
 - 1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 1569.
 - 3. RoHS compliant.
 - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Circuits:
 - 1. Single circuit and multi-circuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

- E. Ground Conductor: Bare.
- F. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.

- G. Armor: Aluminum, interlocked.
- H. Jacket: PVC applied over armor.

2.3 ARMORED CABLE, TYPE AC

- A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in an overall metallic sheath.
- B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Comply with UL 4.
 - 4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Circuits:
 - 1. Single circuit and multicircuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Ground Conductor: Bare.
- F. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.
- G. Armor: Aluminum, interlocked.

2.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

PART 3 - EXECUTION

3.1 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. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. MC cable shall not be used for home runs unless approved prior to bid in writing by the EOR. Contractor shall notify the EOR in writing their intent to use MC cable for any application in the building prior to bidding.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits in Cable Tray: Type THHN/THWN-2, single conductors in raceway.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- J. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. 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.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

- G. Complete cable tray systems installation according to Section 26 0536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Comply with requirements in Section 28 3111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.
- C. All conductor insulation shall be continuously colored to match phase types according to NFPA standards.

3.6 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 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Reference Division 7.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding critical equipment.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.

- c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- 3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals
 1. This project is pursuing LEED Healthcare v4: Silver Certification
 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency and testing agency's field supervisor.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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.

2.2 CONDUCTORS

- A. Insulated Conductors: 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 B3.
 - 2. Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch 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 wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch 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 apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 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. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- H. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- I. Straps: Solid copper, copper lugs. Rated for 600 A.
- J. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- L. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with zinc-plated bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 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 30 inches below grade.
- C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. 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.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 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 above to 6 inches 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.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

- A. 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.
- B. 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.
- C. 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.
- D. 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.

3.5 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 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. Use exothermic welds for connections.
- C. 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.
- D. 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.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- F. 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.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- H. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. 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.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. 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: 1 ohm(s).

5. Substations and Pad-Mounted Equipment: 5 ohms.
 6. Manhole Grounds: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals
 1. This project is pursuing LEED Healthcare v4: Silver Certification
 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

- A. Section Includes:
 1. Metal conduits and fittings.
 2. Nonmetallic conduits and fittings.
 3. Metal wireways and auxiliary gutters.
 4. Nonmetal wireways and auxiliary gutters.
 5. Surface raceways.
 6. Boxes, enclosures, and cabinets.
 7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Sustainable Design Submittals:

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. ARC: Comply with ANSI C80.5 and UL 6A.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch, minimum.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fiberglass:
 - a. Comply with NEMA TC 14.
 - b. Comply with UL 2515 for aboveground raceways.
 - c. Comply with UL 2420 for belowground raceways.
3. ENT: Comply with NEMA TC 13 and UL 1653.
4. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
5. LFNC: Comply with UL 1660.
6. Rigid HDPE: Comply with UL 651A.
7. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:

1. Fittings, General: Listed and labeled for type of conduit, location, and use.

2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 - a. Fittings for LFNC: Comply with UL 514B.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 3R unless otherwise indicated, and sized according to NFPA 70.
 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, 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.
- C. Wireway Covers: Hinged type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Prime coated, ready for field painting.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes:
 - 1. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
 - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- L. Gangable boxes are allowed.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R 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: Fiberglass.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. Cabinets:
 - 1. NEMA 250, Type 3R 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.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Standard: Comply with SCTE 77.

2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, "ELECTRIC".
 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 and Larger: Have inserts for cable racks and pulling-irons installed before concrete is poured.
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of reinforced concrete.
1. Standard: Comply with SCTE 77.
 2. Color of Frame and Cover: Gray.
 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "ELECTRIC".
 7. Conduit Entrance Provisions: Conduit-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: Have inserts for cable racks and pulling-irons installed before concrete is poured.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes 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

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-80-PVC,.
 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. Indoors: Apply raceway products as specified below 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: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.

d. Gymnasiums.

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: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. 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.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

I. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

J. Support conduit within 12 inches of enclosures to which attached.

K. 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. Secure raceways to reinforcement at maximum 10-foot intervals.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 5. Change from ENT to GRC before rising above floor.
- L. Stub-Ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. 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.
- N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- T. 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. Cap underground raceways designated as spare above grade alongside raceways in use.
- U. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- V. Install raceway sealing fittings at accessible locations according to NFPA 70 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 according to NFPA 70.
- W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Conduit extending from interior to exterior of building.
 4. Conduit extending into pressurized duct and equipment.
 5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 6. Where otherwise required by NFPA 70.
- X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Y. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - 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 Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 3. 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 for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semi-recessed luminaires, 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 or LFNC in damp or wet locations not subject to severe physical damage.
- AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- BB. 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. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- DD. Locate boxes so that cover or plate will not span different building finishes.
- EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

- GG. Set metal floor boxes level and flush with finished floor surface.
- HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 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 Section 31 2000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 31 2000 "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 Section 31 2000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

3.4 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 with bottom below frost line, below grade. Consult with civil engineer for frost line depth at site location.
- 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 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.

3.5 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 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 0544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals
 1. This project is pursuing LEED Healthcare v4: Silver Certification
 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 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. Section 07 8413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 1. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- 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.
- C. PVC-Pipe Sleeves: ASTM D1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, 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.

2.5 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

3.1 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 Section 07 9200 "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 or unless seismic criteria require different clearance.
 - 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.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. 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.

3.3 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 waterstop 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 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals

1. This project is pursuing LEED Healthcare v4: Silver Certification
2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- C. Comply with ANSI Z535.4 for safety signs and labels.
- D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be continuous colored insulation.
2. Colors for 208/120-V Circuits:

- a. Phase A: Black.
- b. Phase B: Red.
- c. Phase C: Blue.

3. Colors for 240-V Circuits:

- a. Phase A: Black.
- b. Phase B: Red.

4. Colors for 480/277-V Circuits:

- a. Phase A: Brown.
- b. Phase B: Orange.
- c. Phase C: Yellow.

5. Color for Neutral: White.
6. Color for Equipment Grounds: Green.

C. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

D. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

E. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

F. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
 - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 - 2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
 - 1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 2. Color and Printing:

- a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
- b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
- c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

3. Tag: Type II:

- a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
- b. Width: 3 inches.
- c. Thickness: 12 mils.
- d. Weight: 36.1 lb/1000 sq. ft..
- e. Tensile according to ASTM D882: 400 lbf and 11,500 psi.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

2.7 SIGNS

- A. Baked-Enamel Signs:
 - 1. Preprinted aluminum signs, high-intensity reflective, 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.
- B. Metal-Backed Butyrate Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal Size: 10 by 14 inches.
- C. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain 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

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- 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. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
1. "EMERGENCY POWER."
 2. "POWER."
 3. "UPS."
- M. Vinyl Wraparound Labels:
1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 2. 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.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

X. Metal Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using plenum-rated cable ties.

Y. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using plenum-rated cable ties.

Z. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using plenum-rated cable ties.

AA. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

BB. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

CC. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

DD. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 15 A and 100 V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 10-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
 2. Label shall include circuit number and panel of origin.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "POWER."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
1. Locate identification 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. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- K. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- L. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
1. Apply to exterior of door, cover, or other access.
 2. 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.
- N. Arc Flash Warning Labeling: Self-adhesive labels.
- O. Operating Instruction Signs: Self-adhesive labels.
- P. Emergency Operating Instruction Signs: Self-adhesive labels with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- Q. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Enclosed switches.
 - e. Enclosed circuit breakers.
 - f. Enclosed controllers.
 - g. Variable-speed controllers.
 - h. Contactors.
 - i. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION

SECTION 26 2213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals
 1. This project is pursuing LEED Healthcare v4: Silver Certification
 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- 4. Certification: Indicate that equipment meets Project seismic requirements.
- C. Source quality-control reports.
- D. Field quality-control reports.
- 1.6 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.
- 1.7 QUALITY ASSURANCE
 - A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- 1.8 DELIVERY, STORAGE, AND HANDLING
 - A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
 - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
 - B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.
 - C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
 - D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Source Limitations: Obtain each transformer type from single source from single manufacturer.
- 2.2 PERFORMANCE REQUIREMENTS
 - A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event.
- 2.3 GENERAL TRANSFORMER REQUIREMENTS
 - A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

- B. Comply with NFPA 70.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
 - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.4 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70 and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
- C. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 - 1. One leg per phase.
 - 2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
 - 3. Grounded to enclosure.
- D. Coils: Continuous winding except for taps.
 - 1. Coil Material: Copper.
 - 2. Internal Coil Connections: Brazed or pressure type.
 - 3. Terminal Connections: Bolted.
- E. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- F. Enclosure
 - 1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
 - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
 - 4. Finish: Comply with NEMA 250.
 - a. Finish Color: Gray weather-resistant enamel.
- G. Enclosure: Totally enclosed, nonventilated.
 - 1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
 - 2. Wiring Compartment: Sized for conduit entry and wiring installation.
 - 3. Finish: Comply with NEMA 250.
 - a. Finish Color: Gray weather-resistant enamel.
- H. Taps for Transformers 3 kVA and Smaller: None.

- I. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and two 5 percent taps below rated voltage.
- J. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- K. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- L. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of [150] [115] [80] deg C rise above 40 deg C ambient temperature.
- M. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- N. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding the indicated insulation class in a 40 deg C maximum ambient and a 24-hour average ambient of 30 deg C.
 - 2. Indicate value of K-factor on transformer nameplate.
 - 3. Unit shall comply with requirements of DOE 2016 efficiency levels when tested according to NEMA TP 2 with a K-factor equal to one.
- O. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.
- P. Neutral: Rated 200 percent of full load current for K-factor-rated transformers.
- Q. Wall Brackets: Manufacturer's standard brackets.
- R. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:
 - 1. 9.00 kVA and Less: 40 dBA.
 - 2. 9.01 to 30.00 kVA: 45 dBA.
 - 3. 30.01 to 50.00 kVA: 45 dBA for K-factors of 1, 4, and 9; 48 dBA for K-factors of 13 and 20.
 - 4. 50.01 to 150.00 kVA: 50 dBA for K-factors of 1, 4, and 9; 53 dBA for K-factors of 13 and 20.
 - 5. 150.01 to 300.00 kVA: 55 dBA for K-factors of 1, 4, and 9; 58 dBA for K-factors of 13 and 20.
 - 6. 300.01 to 500.00 kVA: 60 dBA for K-factors of 1, 4, and 9; 63 dBA for K-factors of 13 and 20.
 - 7. 500.01 to 700.00 kVA: 62 dBA for K-factors of 1, 4, and 9; 65 dBA for K-factors of 13 and 20.
 - 8. 700.01 to 1000.00kVA: 64 dBA for K-factors of 1, 4, and 9; 67 dBA for K-factors of 13 and 20.

2.5 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 26 0553 "Identification for Electrical Systems."
- B. Nameplates: Self-adhesive label for each distribution transformer. Self-adhesive labels are specified in Section 26 0553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
 - 1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
 - 2. Ratio tests at rated voltage connections and at all tap connections.
 - 3. Phase relation and polarity tests at rated voltage connections.
 - 4. No load losses, and excitation current and rated voltage at rated voltage connections.
 - 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
 - 6. Applied and induced tensile tests.
 - 7. Regulation and efficiency at rated load and voltage.
 - 8. Insulation-Resistance Tests:
 - a. High-voltage to ground.
 - b. Low-voltage to ground.
 - c. High-voltage to low-voltage.
 - 9. Temperature tests.
- B. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
 - 2. Brace wall-mounted transformers as specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
- B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

- C. Construct concrete bases according to Section 03 3000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 26 0529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure transformer to concrete base according to manufacturer's written instructions.
- E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
- C. 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-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and.
- E. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection.
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.

- c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- F. Large (Larger Than 167-kVA Single Phase or 500-kVA Three Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
 - c. Perform power-factor or dissipation-factor tests on all windings.
 - d. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - e. Perform an excitation-current test on each phase.
 - f. Perform an applied voltage test on all high- and low-voltage windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
 - g. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- G. Remove and replace units that do not pass tests or inspections and retest as specified above.
- H. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
 - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- I. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 -

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals
 1. This project is pursuing LEED Healthcare v4: Silver Certification
 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 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.

1.3 SUMMARY

- A. Section Includes:
 1. Fusible switches.
 2. Nonfusible switches.
 3. Receptacle switches.
 4. Shunt trip switches.
 5. Molded-case circuit breakers (MCCBs).
 6. Molded-case switches.
 7. Enclosures.

1.4 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, 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. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. 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. Provide in PDF format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. 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. Provide in PDF format.

1.8 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. 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.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.10 FIELD 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.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, 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 an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

- B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum 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, 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. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Three Pole, Single Throw, 600V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Type HD, Heavy Duty, Three Pole, Double Throw, 600V ac, 1200 A and Smaller: 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 and aluminum 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, 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. Lugs: Mechanical type, suitable for number, size, and conductor material.
 6. Service-Rated Switches: Labeled for use as service equipment.

2.5 RECEPTACLE SWITCHES

- A. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 600V ac, amperage rating as specified; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- B. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: Switch: 600V ac, amperage rating as specified; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- D. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).
- E. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum 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, 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. Lugs: Mechanical type, suitable for number, size, and conductor material.

6. Service-Rated Switches: Labeled for use as service equipment.

2.6 SHUNT TRIP SWITCHES

- A. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.
- B. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch Switch:600V ac, amperage rating as specified; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate **[specified]** **[indicated]** fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: Switch:600V ac, amperage rating as specified; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from source of control power with enough capacity to operate shunt trip, pilot, indicating and control devices.
- E. Accessories:
1. Oiltight key switch for key-to-test function.
 2. Oiltight red ON pilot light.
 3. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 4. Form C alarm contacts that change state when switch is tripped.
 5. Three-pole, double-throw, fire-safety and alarm relay; 24 V dc coil voltage.
 6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.
 7. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 8. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
 9. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 10. Lugs: **[Mechanical]** **[Compression]** type, suitable for number, size, and conductor material.
 11. Service-Rated Switches: Labeled for use as service equipment.

2.7 MOLDED-CASE CIRCUIT BREAKERS

- A. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- B. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- C. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be **[100 percent rated][series rated][100 percent rated or series rated as indicated on the Drawings]**. **[Circuit breaker/circuit breaker]** **[Fuse/circuit breaker]** combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."
- D. MCCBs shall be equipped with a device for locking in the isolated position.

- E. Lugs shall be suitable for 167 deg F (75 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
- F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal 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.
- H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I-squared t response.
- J. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- K. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- L. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- M. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- N. 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.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system, specified in Section 26 0913 "Electrical Power Monitoring and Control."
 - 6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 9. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
 - 10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 11. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - 12. Electrical Operator: Provide remote control for on, off, and reset operations.

2.8 MOLDED-CASE SWITCHES

- A. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- B. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- C. Features and Accessories:
 - 1. Standard frame sizes and number of poles.
 - 2. Lugs:
 - a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - b. Lugs shall be suitable for 167 deg F (75 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
 - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
 - 7. Alarm Switch: One NO contact that operates only when switch has tripped.
 - 8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
 - 9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
 - 10. Electrical Operator: Provide remote control for on, off, and reset operations.

2.9 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 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.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X.
 - 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.
 - 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

3.3 INSTALLATION

- 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.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.4 IDENTIFICATION

- A. Comply with requirements in Section 26 0553 "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.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
 - 2. Electrical Tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

F. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
- b. Inspect physical and mechanical condition.
- c. Inspect anchorage, alignment, grounding, and clearances.
- d. Verify that the unit is clean.
- e. Operate the circuit breaker to ensure smooth operation.
- f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- g. Inspect operating mechanism, contacts, and 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. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
- e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

- 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
- f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
 - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
 - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
 - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 4. 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 enclosed switch and circuit breaker. 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 enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- G. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- H. Prepare test and inspection reports.
1. Test procedures used.
 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 3. List deficiencies detected, remedial action taken, and observations after remedial action.
- 3.6 ADJUSTING
- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
 - B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 0573.16 Coordination Studies.

END OF SECTION

SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Section 01 8113 – Sustainable Design Requirements: Action and Informational Submittals
 1. This project is pursuing LEED Healthcare v4: Silver Certification
 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:
 1. Metal conduits and fittings.
 2. Metal wireways and auxiliary gutters.
 3. Metallic surface pathways.
 4. Boxes, enclosures, and cabinets.
 5. Polymer-concrete handholes and boxes for exterior underground cabling.
 6. Fiberglass handholes and boxes for exterior underground cabling.

1.4 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid conduit.
- C. IMC: Intermediate metal conduit.
- D. PVC: Polyvinyl chloride conduit.
- E. RTRC: Reinforced thermosetting resin conduit.

1.5 ACTION SUBMITTALS

- A. Product data for the following:
 1. Conduit and fittings.
 2. Boxes, enclosures, and cabinets.
 3. Underground handholes and boxes.

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1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. Underground ducts, piping, and structures in location of underground enclosures and handholes.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. General Requirements for Metal Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 - 2. Comply with TIA-569-E.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated [GRC] [IMC].
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: Set screw or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

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2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.
- B. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-E.
- C. RNC: [Type EPC-40-PVC] [Type EPC-80-PVC] <Insert type>, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.
- E. Continuous HDPE: Comply with UL 651A.
- F. RTRC: Comply with UL 2515A and NEMA TC 14.
- G. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- C. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
 - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 - 2. Comply with TIA-569-E.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman; nVent.

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2. MonoSystems, Inc.
 3. Quazite; Hubbell Incorporated, Power Systems.
 4. Wiremold; Legrand North America, LLC.
- C. General Requirements for Boxes, Enclosures, and Cabinets:
1. Comply with TIA-569-E.
 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
 5. Gangable boxes are [allowed] [prohibited].
- D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- E. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- F. Metal Floor Boxes:
1. Material: Cast metal.
 2. Type: Fully adjustable.
 3. Shape: Rectangular.
 4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.
1. Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4, 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:
 - a. Material: Plastic.
 - b. Finished inside with radio-frequency-resistant paint.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
1. NEMA 250, Type 3R 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.

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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.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 POLYMER-CONCRETE HANDHOLES

- A. Description: Molded of sand and aggregate; bound together with polymer resin; and reinforced with steel, fiberglass, or a combination of the two.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Oldcastle Infrastructure Inc.; CRH Americas.
 2. Quazite; Hubbell Incorporated, Power Systems.
 3. Martin Enterprises
- C. General Requirements for Polymer Concrete Handholes:
 1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 3. Comply with TIA-569-E and SCTE 77.
- D. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 1. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 2. Cover Legend: Molded lettering, "COMMUNICATIONS".
- F. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- G. Handholes 24 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 FIBERGLASS HANDHOLES AND BOXES

- A. Description: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete or fiberglass.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Oldcastle Infrastructure Inc.; CRH Americas.
 2. Quazite; Hubbell Incorporated, Power Systems.
 3. Martin Enterprises.
- C. General Requirements for Fiberglass Handholes and Boxes:

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1. Boxes and handholes for use in underground systems shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 3. Comply with TIA-569-E and SCTE 77.
- D. Color of Frame and Cover: Gray or Green.
- E. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
- F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
- G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- H. Cover Legend: Molded lettering, "COMMUNICATIONS".
- I. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- J. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes 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

3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed Conduit: RNC, Type EPC-40-PVC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-40-PVC.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
- B. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing

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conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

- C. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- D. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. ANSI/BICSI N1-2019.
 - 3. TIA-569-E.
 - 4. NECA 101
 - 5. NECA 102.
 - 6. NECA 105.
 - 7. NECA 111.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.
- F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Install conduit in the most direct path possible. Strive to keep conduit parallel and perpendicular as depicted.
- H. The conduit system shall be continuous. (i.e. conduit, pull boxes, etc.) between the point of origin and the destination. Daisy chaining of conduit is not allowed under any variance or circumstance.
- I. Conduit system shall contain no bends greater than 90 degrees and no more than 180 degrees total bends in the aggregate.
- J. If a bend greater than 90 degrees is required contractor shall install an appropriate sized pull box within 3 feet of the bend.
- K. Flexible conduit shall never be used for routes over 30 feet.
- L. All conduit bends shall be smooth and continuous. Conduit bend radius shall be at least 10 times the internal diameter of the conduit.
- M. "LB"s shall not be used.

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- N. A pull box shall not be used as a corner. All conduits shall enter and exit opposite sides of handholes and pull boxes.
- O. All conduits shall be reamed, swabbed and dried prior to any cable installation.
- P. Cap or plug all conduit after drying to prevent water and debris entering conduit.
- Q. Install plastic or nylon pull cord/s within all installed conduit, leaving 10' of slack at each handhole or pull box.
- R. Metallic conduit shall be bonded to a ground on one or both ends in accordance with local and national codes.
- S. Complete pathway installation before starting conductor installation.
- T. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- U. Conduit shall stub above slab/grade minimum 6".
- V. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- W. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- X. Support conduit within 12 inches of enclosures to which attached.
- Y. Pathways 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. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
 - 3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from nonmetallic conduit and fittings to GRC and fittings before rising above floor.
- Z. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- AA. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- BB. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- CC. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

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- DD. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- EE. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- FF. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- GG. Install pull wires in empty pathways. 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. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- HH. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, 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 pathway-sealing fittings according to NFPA 70.
- II. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- JJ. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

3.3 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.
- 2. Install backfill as specified.
- 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.
- 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
- 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete around conduit for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a

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minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning tape with trace wire: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align tape along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."

3.4 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 with bottom below frost line, 24" depth of 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 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.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

SECTION 31 1000 SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SITE CLEARING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SITE CLEARING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Clearing and Grubbing
- B. Soil Stripping and Stockpiling

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- B. 31 25 00 Erosion and Sedimentation Controls
- C. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah
 - 2. Oklahoma Department of Environmental Quality (ODEQ)
- B. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
- C. 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.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- E. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- F. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- G. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction
- H. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.6 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become CONSTRUCTION MANAGER's property and shall be removed from Project site.

1.7 INFORMATIONAL SUBMITTALS

- A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 PRECONSTRUCTION CONFERENCE

- A. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.

1.9 REGULATORY REQUIREMENTS

- A. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

- A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.

1.11 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.

1.12 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.13 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.14 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.15 PROJECT CONDITIONS

A. TRAFFIC

1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

1.16 UTILITY INTERRUPTIONS

- A. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.

1.17 HAZARDOUS CONDITIONS

- A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with governing CITY, STATE, and FEDERAL notification regulations before beginning SITE CLEARING. Comply with hauling and disposal regulations of authorities having jurisdiction.

2.2 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312300 "Excavation and Fill."
- B. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PRE-SITE CLEARING WORK

- A. Contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. Notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility. CONSTRUCTION MANAGER shall also coordinate the construction activities with the utility companies to ensure compliance with the project schedule.
- C. All existing structures, improvement and utilities designated to remain shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the OWNER of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible

unless noted on the plan.

- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to demolition. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.
- E. Verify that utilities have been disconnected and capped before starting SITE CLEARING operations.
- F. Protect and maintain benchmarks and survey control points from disturbance during construction.
- G. Locate and clearly identify trees, shrubs, and other vegetation to remain.
- H. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 CONSTRUCTION CONTROL

- A. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- B. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

3.3 TEMPORARY EROSION CONTROLS

- A. See 31 25 00 Erosion and Sedimentation Controls.
- B. Comply with the City, State, and Federal requirements for the minimization and control of sediment erosion and site run-off in storm water resulting from construction activities. Install temporary erosion controls prior to SITE CLEARING. Comply with the requirements of the Storm Water Pollution Prevention Plan and the permit(s) issued by the City and State.

3.4 CLEARING AND GRUBBING

- A. The limits of the area(s) to be cleared and grubbed shall be marked by stakes, flags, tree markings, or other suitable methods.
- B. Protect trees or groups of trees, designated to remain, from damage by all construction operations by erecting suitable barriers, or by other approved means. Clearing operations shall be conducted in a manner to prevent falling trees from damaging trees designated to remain.
- C. Except as otherwise directed, cut, grub, remove and dispose of all trees, stumps, brush, shrubs, roots and any other objectionable material within the limits defined on the Plans.
- D. All trees, stumps, brush, shrubs, roots and other objectionable material shall be cut, grubbed, removed and disposed of from areas to be occupied by buildings, structures, roads, pipelines and any other areas to be stripped. Trees and brush shall be removed to a depth at least three (5) feet below the existing grade.
- E. In addition, heavy growths of weeds or other plants shall be stripped from the surface in order to provide clear access to the work site and to prevent their inclusion in stockpiled soil which is to be reused later. Trees, stumps, surface plants and all debris removed from the site shall be disposed of off-site by the CONSTRUCTION MANAGER at his own expense.
- F. Areas outside the limits of clearing shall be protected from damage and no equipment or materials shall be stored in these areas.
- G. No stumps, trees, limbs, or brush shall be buried in any fills or embankments.

3.5 SOIL STRIPPING AND STOCKPILING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
 - 1. Limit height of topsoil stockpiles to 72 inches.

2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut a straight line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 BACKFILL

- A. Backfill any voids resulting from structures, vegetation, and objects removed according to 31 2300 Excavation and Fill.

3.8 DISPOSAL OF MATERIALS

- A. All tree trunks, limbs, roots, stumps, brush, foliage, other vegetation and objectionable material shall be removed from the site and disposed of in a permitted disposal site.
- B. Burning of cleared and grubbed materials will not be permitted.
- C. Suitable excavated materials may be stockpiled to be used for backfilling. Excess excavated materials and unsuitable backfill materials shall be disposed offsite by the CONSTRUCTION MANAGER according to City, State, and Federal regulations.

END OF SECTION

SECTION 31 2200 GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for GRADING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for GRADING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Grading

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- B. 31 25 00 Erosion and Sedimentation Controls
- C. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

1.7 INFORMATIONAL SUBMITTALS

- A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 DELIVERY, STORAGE, AND HANDLING

1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

- A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.

1.11 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.12 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements,

improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.13 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.14 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.15 PROJECT CONDITIONS

- A. Traffic
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - 1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any

interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.

C. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

1. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

E. HAZARDOUS CONDITIONS

1. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Subgrade Planer

1. An approved subgrade planer shall be provided, mounted on visible rollers riding on the forms, having adjustable cutting blades which shall trim the subgrade to exact sections shown on the plans. Planer frames shall be heavy enough to remain on the forms at all times and shall be of such strength and rigidity that, under a test made by changing the support from the wheels to the center for the type pavements as set out under "Subgrade Planer," they shall not develop a deflection of more than 1/8 inch. Tractive power equipment used on the subgrade to pull the planer shall not be such as to produce ruts or indentations in the subgrade.

B. Subgrade Template

1. The template for checking the contour of the subgrade shall be provided and operated by the CONSTRUCTION MANAGER. The template shall rest upon the side forms and shall be of such strength and rigidity that, under a test made by changing the support to the center, it shall not develop a deflection of more than 1/8 inch. It shall be provided with accurately adjustable rods projecting downward to the subgrade at 1-foot intervals, and these rods shall be adjusted to the required cross-section when the template is resting on the side forms.

C. Compacting Equipment

1. Compacting equipment shall be designed to produce the pavement density and surface smoothness herein specified and shall be maintained in first-class operating condition.

PART 3 - EXECUTION

3.1 SUBGRADE

- A. After the excavation and embankment has been substantially completed, the subgrade shall be brought to the proper alignment, cross section and elevation, so that after rolling and subsequent finishing operations, it shall conform to the correct alignment, cross section and elevation. Rolling and sprinkling shall be performed when and to the extent directed and the roadbed shall be completed to or above the

- plane of the typical section shown on the plans and the lines and grades established the by the OWNER.
- B. After completion of the compaction and immediately before the application of base or pavement, the subgrade planer shall be operated from approved forms in a manner to finish the subgrade to the required section. The subgrade shall then be tested with the approved template, operated and maintained by the CONSTRUCTION MANAGER. All irregularities which develop in excess of 1/2 inch in a length of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material; reshaping; and re-compacting by sprinkling and rolling.
 - C. The subgrade shall be maintained in a smooth, compacted condition, in conformity with the required section and established grade, until the base or pavement is placed, and shall be kept wetted down sufficiently in advance of placing any base or pavement to insure its being in a firm and moist condition for at least 2 inches below surface of the prepared subgrade. Only such subgrade as is necessary for the satisfactory prosecution of the work shall be completed ahead of the placement of base or pavement. Hauling or operating of unnecessary equipment on the completed subgrade shall be kept to a minimum. Complete drainage of the subgrade shall always be provided.
 - D. Finishing of the subgrade by hand shall be permitted on sections where the pavement width is not uniform, at intersections and elsewhere where the operation of the subgrade planer would not be practical. Subgrade finished by hand shall conform to the requirements above specified.
 - E. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
 - F. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
 - G. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

END OF SECTION

**SECTION 31 2300
EXCAVATION AND FILL**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for EXCAVATION AND FILL as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for EXCAVATION AND FILL shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Subgrade Preparation
- B. Excavation
 - 1. Trenching
- C. Dewatering
- D. Fill
 - 1. Backfill
 - 2. Compaction

1.4 RELATED SECTIONS

- A. 31 10 00 Site Clearing
- B. 31 22 00 Grading
- C. 31 25 00 Erosion and Sedimentation Controls
- D. 32 11 00 Base Courses
- E. 33 10 00 Water Utilities
- F. 33 30 00 Sanitary Sewerage Utilities
- A. 33 40 00 Storm Drainage Utilities
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – AUTHORITY HAVING JURISDICTION
 - 1. City of Tahlequah
 - 2. Oklahoma Department of Environmental Quality (ODEQ)
 - 3. Environmental Protection Agency (EPA).
- B. Backfill - Soil material or controlled low-strength material used to fill an excavation.
- C. Initial Backfill - Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- D. Final Backfill - Backfill placed over initial backfill to fill a trench.
- E. Borrow - Borrow shall consist of required excavation, removal, and proper utilization of materials obtained from designated or approved sources for use as fill or backfill.
- F. Excavation - Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- G. Authorized Additional Excavation - Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- H. Unauthorized Excavation - Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- I. Embankment - The placement and compaction of all suitable materials obtained from excavation or

borrow to raise existing grades.

- J. Structures - Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subgrade - Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- L. Utilities - Underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- M. Rock - Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or ripping.
 - 1. For classifying rock excavation in bulk or mass excavations, use a late model, well-maintained tractor-mounted hydraulic ripper equipped with one digging point of standard manufacturer's design sized for use with, and propelled by, a crawler-type tractor with a minimum net flywheel power rating of 370 hp (276 kW), operating in low gear.
 - 2. For classifying rock excavation in footing, trench, and pit excavations, use a late model, well-maintained, track-mounted hydraulic excavator; equipped with a 42-inch wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179s

1.6 ACTION SUBMITTALS

- A. For each type of the following:
 - 1. Material Test Reports: For each borrow material proposed for fill and backfill as follows:
 - a. Source of borrow material
 - b. Classification according to ASTM D-2487
 - c. Laboratory Compaction curve according to ASTM D-698
 - d. Liquid Limit (LL)
 - e. Plastic Limit (PI)
 - f. Gradation
- B. Geotextiles
- C. Controlled Low-Strength Material, including design mixture
- D. Warning tapes

1.7 INFORMATIONAL SUBMITTALS

- A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. See Execution.

1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

- A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.

1.11 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference

benchmark elevation.

1.12 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.13 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.14 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.15 PROJECT CONDITIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be

reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

B. UTILITY INTERRUPTIONS

1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.

C. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

1. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.16 HAZARDOUS CONDITIONS

- A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Excavating and grading equipment shall be approved types and designs and shall be maintained in first class condition. Equipment used for disposing of excavated materials outside of the limits of the work shall be such as will avoid scattering or wasting material along the line of haul.

2.2 MATERIALS

- A. Provide borrow materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils –
 1. On-Site Soils and Imported Fill -
 - a. Soil Classification Groups GC, SC, SW or GW according to ASTM D 2487. This soil type is required beneath building footprint (below foundation elements), extending outside perimeter walls a horizontal distance equal to the height of fill embankment. Also acceptable for all other areas/elevations not requiring LVC material.
 2. Low Volume Change (LVC) Engineered Fill –
 - a. Soil Classification Groups CL, GC, or SC according to ASTM D 2487, or a combination of these groups. This soil type is required beneath slabs for a depth of 2-ft. CL materials should be placed above foundation elements only. May be used below foundations if classifying as a GC or SC only. Acceptable for all other areas/elevations outside the building footprint as well. Topsoil strippings or material containing organics shall not be used as LVC material.
 - b. CL soils containing less than 30 percent gravels may be difficult to establish proper compaction and it may be necessary to limit these materials to non-pavement and non-building areas.
 3. On-Site Natural Soils –

- a. Soil Classification Groups CH according to ASTM D 2487. This soil type shall not be placed within the upper 2-ft beneath foundations, floor slabs and pavements.
- 4. Additional requirements for satisfactory soils –
 - a. Controlled, compacted fill shall consist of approved materials that are free of organic matter and debris and contain maximum rock size of 12 inches, or the lift thickness, whichever is less. Frozen material shall not be used and fill shall not be placed on a frozen subgrade. A sample of each material type shall be submitted to the Geotechnical Engineer for evaluation prior to its use.
 - b. Low plasticity cohesive soil or granular soil having a liquid limit of less than 50%, contain at least 15% fines retained on the No. 200 sieve, and preapproved by the Geotechnical Engineer.
 - c. Satisfactory soils shall be free of rock or gravel larger than 12 inches in any dimension or the lift thickness, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups not defined as Satisfactory Soils above, according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within the required optimum moisture content at the time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.3 GEOTEXTILES

- A. Geotextiles for Erosion Control
 - 1. Pervious fabric under riprap for slope protection and gabion separation shall meet the requirements of AASHTO M 288, "Permanent Erosion Control Geotextile Requirements." The fabric shall be a non-woven, needle-punched material constructed of long chain synthetic polymers composed of at least 85 percent polyester, polyolefins or polyamides.
 - 2. The fabric shall meet the following test requirements:
 - a. Weight: 6 oz. sq/yd, ASTM D 2646
 - b. Thickness: 70 mils, ASTM D 1777
 - c. Grab Strength: 180 lbs, ASTM D1682
 - d. Puncture Strength: 75 lbs, ASTM D 751
 - 1) Tension testing machine with ring clamp, steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.
 - e. Burst Strength: 290 psi, ASTM D 751, diaphragm test method
 - f. Trapezoidal Tear Strength, 50 lbs (either principal direction), ASTM D 1117
 - g. Ultraviolet Degradation at 150 hours: 70% retained strength, ASTM D 4355
 - h. E.O.S.: 50-100, USACE Method
- B. Geotextiles for Subsurface Drainage Purposes
 - 1. Geotextiles for pipe underdrain and drainage systems shall meet the requirements of AASHTO M

288, "Subsurface Drainage Geotextile Requirements." Geotextile shall be according to AASHTO M 288, Table 2, with from 15 to 50 percent of in-situ soil passing the No. 200 sieve.

C. Geotextiles for Subgrade Reinforcement

1. Geotextiles for subgrade reinforcement under pavement structures shall meet the requirements of AASHTO M 288, "Stabilization Geotextile Property Requirements."

D. Geotextiles for Bases

1. Geotextiles used for separation under base courses shall be a non-woven fabric for base course separation in accordance with AASHTO M 288, "Separation Geotextile Property Requirements" with a Class 2 Degree of Survivability.

2.4 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material (CLSM) shall be a self-compacting low strength material with a flowable consistency.

B. CLSM shall be produced from the following materials:

1. Portland Cement: ASTM C 150, Type I.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94.
6. Air-Entraining Admixture: ASTM C 260.

C. CLSM shall meet the following requirements:

1. Spread diameter of 8 inches or greater according to ASTM D 6103.
2. Minimum strength of 300 psi according to ASTM D 4832 at 28 days after placement.
3. Unit weight of 115 to 145 lb/cu.ft measured at the point of placement according to ASTM D 6023.

2.5 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXPLOSIVES

- A. Do not use explosives.

3.3 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Geotechnical Engineer.
 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is

earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Construction Methods

1. All excavation shall be in accordance with the lines, grades and typical sections as shown on the plans or as established by the OWNER. Unless otherwise shown on the plans or established by the OWNER, the excavation shall be made to the subgrade. Where excavation to grades established in the field by the OWNER would terminate in unstable soil, the CONSTRUCTION MANAGER shall remove the unstable soil and backfill to the required grade.
2. Where excavation to grade established in the field by the OWNER terminates in loose or solid rock, the CONSTRUCTION MANAGER shall extend the depth of excavation 6 inches and backfill with select material compacted as required.
3. The CONSTRUCTION MANAGER shall conduct his operation in such a manner that adequate measurements may be taken before any backfill, as required above, is placed.

C. Provisions for Drainage

1. If it is necessary in the execution of the work to interrupt the natural drainage of the surface or the flow of artificial drains, the CONSTRUCTION MANAGER shall provide temporary drainage facilities that shall prevent damage to public or private interest and shall restore the original drains as soon as the work shall permit.
2. The CONSTRUCTION MANAGER shall be held liable for all damages which may result from neglecting to provide for either natural or artificial drainage which his work may have interrupted.

D. Excess Excavation

1. Excavation in excess of that needed for construction shall be disposed of by the CONSTRUCTION MANAGER. In general, suitable excess excavation shall be used in construction of streets, drives, parking lots, widening of embankments, flattening of slopes, etc., but, if it becomes necessary to waste any material, it shall be disposed of in such a manner as to present a neat appearance and to not obstruct proper drainage or cause injury to any street improvements or abutting property. If necessary to haul off excess or unsuitable material, the CONSTRUCTION MANAGER should ask approval of the OWNER as to disposition site and method.

- E. The on-site soils typically classify as Type B in accordance with OSHA regulations. Temporary excavations in soils classifying as Type B with a total height of less than 20 ft. shall be cut no steeper than 1H:1V in accordance with OSHA guidelines. Confirmation of soil classification during construction, as well as construction safety (including shoring, if required), shall be the responsibility of the CONSTRUCTION MANAGER.

- F. Overburden soils on the site consist of very dense clayey gravels with chert cobbles and boulders with isolated areas consisting of clays with a reduced chert content. The overburden soils are anticipated to be rippable with dozers, but with difficulty. In addition, areas resistant to ripping consisting of large chert boulders, requiring other removal methods (pneumatic breakers or blasting, if allowed) should be anticipated. The Earthwork Contractor shall review the attached boring logs when assessing excavation difficulty at this site. Mass grading at this site is anticipated to occur at a slower rate as compared to sites where overburden soils are primarily fine grained (silts and clays).

- G. If relatively chert free fat clay zones are encountered at footing bottom and finish subgrade elevation, they shall be undercut 2 ft., or to gravelly clays/clayey gravels, whichever is shallower, and replaced with LVC fill material.

3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for

installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

- A. The length of trench excavated approximately to grade shall not exceed one hundred-fifty feet (150-ft) and no trench excavation whatsoever shall be made farther than three hundred feet (300-ft) in advance of completed backfill.
- B. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, joining, and embedment. Stipulated minimum trench widths are not minimum average widths but are minimum widths that shall be required. Stipulated maximum trench widths shall not be exceeded. Trench width shall be the width of the trench excavation measured from bank to bank at the top of the pipe. For rigid pipes, when the maximum trench width is exceeded, the CONSTRUCTION MANAGER shall be required to provide a higher strength pipe or higher bedding classification, singly or in combination as directed by the ARCHITECT, at the CONSTRUCTION MANAGER's expense. Any additional foundation material and/or embedment material required due to over excavation, beyond the maximum trench width shall be at the CONSTRUCTION MANAGER's expense.
- C. Where trenches are excavated in soil of such nature as to require sheeting and shoring to assure proper installation, and safety of the workmen and any adjacent structures or other objects, the CONSTRUCTION MANAGER shall provide the necessary sheeting and shoring. Where possible, shields designed to be portable and moved along as work progresses may be used. The contract pay widths shown in the above shall apply to all trenches with or without sheeting or shoring.
- D. Excavation shall be made in open-cut from the surface of the ground and shall be made no larger than necessary to permit proper construction of the work in accordance with the plans and specifications. The entire foundation area in the bottom of all excavations shall be firm, stable and of uniform density as nearly as practical, and unless necessary, materials shall not be disturbed below grade. Where trenches are excavated in soft, unsuitable materials, trench bottom may be stabilized by over-excavating unsuitable materials and replaced with engineered fill.
- E. Where depth of trenching and other excavations are greater than twenty feet (20'), and when not provided for in the plans, an engineer shall be retained by the CONSTRUCTION MANAGER to design bank protection as per OSHA rules and regulations. The bank protection design, signed and sealed by a Professional Engineer registered in the State of Oklahoma, shall be submitted to the ARCHITECT.
- F. The sides of all excavations shall be sufficiently sheeted, shored and braced so as to prevent slides, cave-ins, settlement or movement of the banks. In wet, saturated or flowing ground where it is necessary to install tight sheeting or cofferdams, wood or steel sheet piling of approved design and type shall be used. All sheeting, shoring and bracing shall have sufficient strength and rigidity to withstand the pressures exerted and maintain the walls of the excavation properly in place and protect all persons or property from injury or damage. When excavations are made adjacent to existing buildings or other structures, or in paved streets or alleys, particular care shall be taken to adequately sheet, shore, and brace the sides of the excavation to prevent any undermining of or settlement beneath the structures or the pavement. Underpinning of adjacent structures, when necessary, shall be done in an approved manner. The foundation material that is undermined shall be replaced and compacted in accordance with the requirements of this section. Sheeting, shoring, and bracing shall not be left in place unless otherwise shown on the plans or authorized by the ARCHITECT. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either the new structure or any existing structure or property, either private or public, and so as to avoid cave-ins or sliding of the banks. If for any reason the CONSTRUCTION MANAGER, with the approval of the ARCHITECT, leaves in place any sheeting, shoring or bracing, no payment will be allowed for such material left in place unless it is classified as a contract pay item. All holes or voids left by the removal of sheeting, shoring or bracing shall be

satisfactorily filled and compacted in accordance with the requirements of this section.

3.7 SUBGRADE PREPARATION AND INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's materials, testing, and inspections Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- D. Once the subgrade has passed proof-rolling, the exposed subgrade shall be scarified to a minimum depth of 8 inches, moisture conditioned, and compacted to the requirements within Compaction of Backfills and Fills.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 FILL

- A. Prior to the placing of any fill, all clearing and grubbing and site preparation shall have been completed. Stump holes or other small excavations within the limits of the embankment shall have been backfilled before commencing the embankment construction. The surface of the ground, including plowed or loosened ground or small ditches or washes, shall be restored to approximately its original slope.
- B. Embankments shall be constructed to the established grade and to the shape of the typical section shown on the, plans, and each section shall conform to the detailed sections of slopes. After completion of the embankment, it shall be continuously maintained to its finished section and grade until the project is accepted.
- C. Earth embankments shall be constructed in successive horizontal layers, for the full width of specified depth or cross sections; and in such lengths as are suitable for the sprinkling and compaction methods to be used. Each layer of earth embankment shall be uniform as to material, density, and moisture content before beginning compaction. Layers of embankment shall be brought up uniformly on each side of the structure, and special care shall be taken to prevent any wedging action against the structure. For such distances along embankments adjacent to structures where it is impracticable to obtain compaction by rolling, the embankment material shall be placed in layers not exceeding 12 inches in depth of loose material wetted uniformly to the moisture content directed; and shall then be compacted by methods approved by the OWNER, maintaining the required moisture content by additional sprinkling, if necessary, supplemented by such hand work as is necessary to secure a uniform and thoroughly compacted fill, until each layer has been uniformly compacted to the satisfaction of OWNER.
- D. Place backfill on subgrades free of mud, frost, snow, or ice.

3.10 UTILITY TRENCH BACKFILL

- A. Backfill is that portion of the total trench backfill down to but not including the pipe embedment material. The backfill shall be only material approved by the ARCHITECT consisting of loose earth, free of clods, stones, organic matter, debris or other objectionable materials.
- B. All backfilling shall be done in such a manner as not to disturb or injure the pipe or structures over or against which it is being placed. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be opened and repaired and then re-backfilled as herein specified.
- C. The top surface or slopes of all backfill shall be neatly graded off where select topsoil, sod or other material is removed and piled separately; such material shall be carefully replaced in a manner satisfactory to the ARCHITECT. The top twelve inches (12-inches) of backfill material shall be of as good quality as the original topsoil that was removed.
- D. A clay trench plug shall be constructed at the edge of the building and extend at least 5 feet out from the

face. The clay shall have a minimum plasticity index (PI) of 15 and be placed in controlled lifts not exceeding 9 inches in loose thickness. Each lift of clay backfill shall be compacted to at least 95 percent of the material's maximum standard Proctor dry density, ASTM 698, at a minimum moisture content that is above its optimum value.

- E. Place backfill on subgrades free of mud, frost, snow, or ice.
- F. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- G. Backfill voids with satisfactory soil while removing shoring and bracing.
- H. Utility trench backfill material shall be placed in layers not exceeding 6 inches in depth of loose material.
- I. Place and compact initial backfill, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
- J. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- K. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content for CL, SC, GW, and SW soil types; and to within 0 to 4 percent above optimum moisture content for CH soil types.
- B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content requirements and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact backfills and fills to not less than the following percentages of maximum dry unit weight according to ASTM D-698:
 - 1. Building Area – Below Foundation Bearing Elevation –
 - a. Six (6) passes (3 each direction) minimum using a self-propelled vibratory compactor with a minimum drum diameter of 48-inches, or 100% Standard Proctor Density (ASTM D698), whichever is applicable.
 - 2. Building Area – Above Foundation Bearing Elevation & Below Floor Slabs
 - a. Three (3) passes of the compactor referenced above, or 95% Standard Proctor Density (ASTM D698), whichever is applicable;
 - 3. Pavements, Sidewalks & Exterior Slabs –
 - a. Same as Building Area above foundations.
 - 4. Non-Structural Areas –
 - a. 90% Standard Proctor Density (ASTM D698).
 - 5. Utility Trenches –
 - a. Compact each layer according to the location of the utility, and no less than 95 percent Standard Proctor Density (ASTM D698).

3.13 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase course and base course to required crown elevations and cross-slope grades.
 4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 100 percent of maximum dry unit weight according to ASTM D-698.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D-698.

3.14 PROTECTION

- A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
- C. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

3.16 DEWATERING

- A. PERFORMANCE
 1. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 5. Remove dewatering system when no longer required for construction.
- B. PREPARATION
 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 2. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 3. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
 4. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 5. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 6. Provide temporary grading to facilitate dewatering and control of surface water.
 7. Monitor dewatering systems continuously.

8. Promptly repair damages to adjacent facilities caused by dewatering.
9. Protect and maintain temporary erosion and sedimentation controls during dewatering operations.

C. INSTALLATION

1. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
2. Space well points or wells at intervals required to provide sufficient dewatering.
3. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
4. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
5. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
6. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
7. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
8. Maintain piezometric water level a minimum of 60 inches below surface of excavation.
9. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
10. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
11. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
12. Promptly repair damages to adjacent facilities caused by dewatering operations.

3.17 FIELD QUALITY CONTROL

- A. OWNER will engage a soil/material's testing and inspection Geotechnical Engineer for the testing requirements within Excavation and Fill. CONSTRUCTION MANAGER shall coordinate and order all testing with OWNER's material's testing laboratory in conjunction with earthwork operations. The results of the tests shall be forwarded to ARCHITECT. The soils laboratory shall determine the suitability of existing site material prior to beginning fill operations.
- B. CONSTRUCTION MANAGER shall be responsible for the retesting cost of failed tests.
- C. CONSTRUCTION MANAGER shall be responsible for the cost of any and all of CONSTRUCTION MANAGER's internal quality control tests.
- D. The soils testing laboratory shall:
 1. Determine prior to placement of fill that site has been prepared in compliance with requirements and determine that fill material.
 2. Determine that maximum lift thickness comply with requirements.
 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- E. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- F. Testing agency shall test compaction of soils in place, as applicable. Tests will be performed at the following locations and frequencies:
 1. Building Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,500 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 3. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 4. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

- G. Engineered fill, including scarified compacted subgrade, shall be tested for moisture content and compaction during placement. If in-place density tests indicate the required moisture or compaction limits have not been met, the shall be reworked and retested as required until the required moisture and compaction requirements are met.
- H. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

END OF SECTION

SECTION 31 2500
EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for EROSION AND SEDIMENTATION CONTROLS as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for EROSION AND SEDIMENTATION CONTROLS shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

1.4 RELATED SECTIONS

- A. 31 1000 Site Clearing
- B. 31 2300 Excavation and Fill
- A. 01 50 00 Temporary Facilities and Controls
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah
 - 2. United States Environmental Protection Agency (USEPA)
 - 3. Oklahoma Department of Environmental Quality (ODEQ)

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Geotextiles for erosion control

1.7 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Silt Fence Posts
 - 2. Curb and drop Inlet sediment bags
 - 3. Silt socks

1.8 DELIVERY, STORAGE, AND HANDLING

1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PERMITS

- A. OWNER has or will make application and pay permit fees for the temporary stormwater erosion control permit(s) for construction activities required by the AHJ's.

1.11 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference

benchmark elevation.

1.12 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.13 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.14 CONSTRUCTION CONTROL

- A. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- B. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

PART 2 - PRODUCTS

2.1 GEOTEXTILES FOR EROSION CONTROL

- A. Pervious fabric under riprap for slope protection and gabion separation shall meet the requirements of AASHTO M 288, "Permanent Erosion Control Geotextile Requirements." The fabric shall be a non-woven, needle-punched material constructed of long chain synthetic polymers composed of at least 85 percent polyester, polyolefins or polyamides.
- B. The fabric shall meet the following test requirements:
 - 1. Weight: 6 oz. sq/yd, ASTM D 2646
 - 2. Thickness: 70 mils, ASTM D 1777
 - 3. Grab Strength: 180 lbs, ASTM D1682
 - 4. Puncture Strength: 75 lbs, ASTM D 751
 - a. Tension testing machine with ring clamp, steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.
 - 5. Burst Strength: 290 psi, ASTM D 751, diaphragm test method

6. Trapezoidal Tear Strength, 50 lbs (either principal direction), ASTM D 1117
7. Ultraviolet Degradation at 150 hours: 70% retained strength, ASTM D 4355
8. E.O.S.: 50-100, USACE Method

2.2 SILT FENCE POSTS

- A. Minimum 5 feet long:
- B. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.

2.3 TEMPORARY CONSTRUCTION FENCE

- A. See 01 50 00 Temporary Facilities and Controls.

PART 3 - EXECUTION

3.1 EROSION AND SEDIMENT CONTROLS, GENERAL

- A. Construction and placement of erosion and sediment control devices shall be performed in conjunction with the progress of general construction. CONSTRUCTION MANAGER shall install the erosion control devices shown and install additional erosion control devices as necessary to prevent silt runoff from the work area onto adjacent areas.
- B. The erosion and sediment controls to be used for this site are:
 1. Temporary construction entrance/exit - stabilized construction entrances shall be installed at all points where construction or employee vehicles enter or leave the construction or staging areas.
 2. Rock bag filter berms - rock bag filter berms shall be placed in small open channels. The berms shall be placed so that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
 3. Rock bag inlet barrier - rock bag inlet barriers shall be placed around all inlets proposed and existing that are receiving runoff from the site.
 4. Silt fences - silt fences shall be placed along the perimeter of the project where storm water will exit the site. Silt fences shall also be utilized along slope contours where vegetative cover is not sufficiently established to prevent erosion.
 5. Sodding/site seeding - sodding and seeding shall be used to establish final vegetative cover.
- C. The following are some other controls that may be used in the course of this project.
 1. Common vegetative practices
 - a. Temporary seeding, mulching, permanent seeding and planting, preservation of natural vegetation, dust control
 2. Structural erosion and sediment control practices
 - a. Silt fence, storm drain inlet protection, outlet protection, berms for fuel storage and dispensing areas
- D. Additional controls not listed above may also be considered for use.

3.2 OTHER CONTROLS

- A. The premises and the job site shall be maintained in a reasonably neat and orderly condition and kept free from accumulations of waste materials and rubbish during the entire construction period. Remove crates, cartons, and flammable waste materials or trash from the work areas at the end of each working day.
- B. Pavement on-site and on adjoining streets shall be kept free of any sediment or mud tracking from truck tires or from other equipment.
- C. Chemical toilets for the use of all construction personnel shall be provided at a location within the limits of the site. Chemical toilets shall be maintained in a sanitary condition.
- D. Any disposal of construction wastes, hazardous products, and contaminated soils shall be disposed of according to requirements of the City, County, ODEQ, and the U.S. Environmental Protection Agency.
- E. The wheels of vehicles leaving the construction areas shall be cleaned of mud prior to leaving the construction or staging areas. Wheel washing shall be performed in an area stabilized with stone that drains into an approved sediment trapping device.
- F. Adequate controls shall be made to prevent and/or control any release of pesticides, petroleum products, fertilizers and detergents, and hazardous products.
- G. Any spill of pesticides, petroleum products, fertilizers and detergents, and hazardous products shall be contained and removed according to state and federal requirements. Any spill of pesticides, petroleum products, fertilizers and detergents, and hazardous products shall be reported according to state and

federal requirements.

3.3 STORM WATER POLLUTION PREVENTION PLAN

- A. A Storm Water Pollution Prevention plan (SWP3) has been prepared for the work. CONSTRUCTION MANAGER shall implement the SWP3, and construct, inspect, and maintain the erosion controls to prevent runoff of silt and sediment from the site. A copy of the SWP3 shall be kept at the site at all times and be made available to inspectors upon request. Inspections reports shall be maintained in the swp3 and the swp3 shall be updated when necessary.

3.4 POSTING OF PUBLIC NOTICE

- A. CONSTRUCTION MANAGER shall be responsible for posting public notice. the notice shall be posted near the main entrance of the construction site that indicates the following information:
 - 1. The permit number for the project or a copy of the NOI if a permit number has not yet been assigned.
 - 2. The name and telephone number of a local contact person.
 - 3. A brief description of the project.
 - 4. The location of this SWP3 if the site is inactive or does not have an on-site location to store the plan.

3.5 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances:
 - 1. Width: As required; 20 feet, minimum.
 - 2. Length: 50 feet, minimum.
 - 3. Provide at each construction entrance from public right-of-way.
 - 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences.
 - 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
 - c. Along the toe of cut slopes and fill slopes.
 - d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
 - e. Across the entrances to culverts that receive runoff from disturbed areas.
 - 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet.
 - b. Slope between 2 and 5 Percent: 75 feet.
 - c. Slope between 5 and 10 Percent: 50 feet.
 - d. Slope between 10 and 20 Percent: 25 feet.
 - e. Slope over 20 Percent: 15 feet.
 - 3. Soil Stockpiles: Protect using one of the following measures:
 - a. Cover with polyethylene film, secured by placing soil on outer edges.
 - b. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.
 - 4. Temporary Seeding: Use where temporary vegetated cover is required.

3.6 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
 - 1. Excavate minimum of 6 inches.
 - 2. Place geotextile fabric full width and length, with minimum 12-inch overlap at joints.
 - 3. Place and compact at least 6 inches of 1.5-to-3.5-inch diameter stone.
- B. Temporary Construction Fences:

1. Space steel support posts to ensure mesh remains vertical and at proper height. Securely tie to posts.
- C. Silt Fences:
1. Store and handle fabric in accordance with ASTM D 4873.
 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16-inch-high barriers with minimum 36-inch-long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28-inch-high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32-inch-high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
 5. Install with top of fabric at nominal height and embedment as specified.
 6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
 7. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
 8. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.
- D. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
 3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
 4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
 5. Incorporate fertilizer into soil before seeding.
 6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
 7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
 8. Repeat irrigation as required until grass is established.

3.7 MAINTENANCE

- A. All erosion and sediment control measures and other protective measures shall be maintained in effective operating condition. If site inspections identify erosion controls that are not operating effectively, maintenance shall be performed before the next anticipated storm event, or as necessary to maintain the continued effectiveness of storm water controls. If maintenance prior to the next anticipated storm event is impracticable, maintenance must be scheduled and accomplished as soon as practicable.
- B. If sediment escapes the construction site, off-site accumulations of sediment shall be removed at a frequency sufficient to minimize offsite impacts (e.g., fugitive sediment in street could be washed into storm sewers by the next rain and/or pose a safety hazard to users of public streets).
- C. Sediment shall be removed from sediment traps or sedimentation ponds when the design capacity has been reduced by 50%.
- D. Litter, construction debris, and construction chemicals exposed to storm water shall be prevented from becoming a pollutant source for storm water discharges (e.g., screening outfalls, picked up daily).

3.8 INSPECTIONS

- A. CONSTRUCTION MANAGER shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, structural control measures, and locations where vehicles enter or exit the site, at least once every fourteen (14) calendar days and within 24 hours of the end of a storm event of 0.25 inches or greater.
- B. The following items, locations, and areas shall be inspected.
 1. Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system.
 2. Sediment and erosion control measures shall be observed to ensure that they are operating correctly.
 3. Where discharge locations or points are accessible, they shall be inspected to ascertain whether

- erosion control measures are effective in preventing significant impacts to receiving waters.
4. Where discharge locations are inaccessible, nearby downstream locations shall be inspected to the extent that such inspections are practicable.
 5. Locations where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking.

3.9 REPORTS

- A. A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, and major observations relating to the implementation of erosion controls shall be made.
- B. Major observations should include: the location(s) of discharges of sediment or other pollutants from the site; location(s) of erosion controls that need to be maintained; location(s) of erosion controls that failed to operate as designed or proved inadequate for a particular location; and location(s) where additional erosion controls are needed that did not exist at the time of inspection.
- C. Modifications made to erosion controls as a result of inspections shall be recorded.
- D. Reports shall identify any incidents of noncompliance.
- E. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The owner or CONSTRUCTION MANAGER shall sign the report.
- F. Any person signing the report shall make the following certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.
- G. Inspection reports shall be maintained on site.

3.10 MODIFICATIONS OR ADDITIONS TO EROSION CONTROLS

- A. Based on the results of the inspection, erosion controls shall be modified as necessary or additional control shall be provided to correct the problems identified. If existing erosion controls need to be modified or if additional controls are necessary, implementation shall be completed before the next anticipated storm event. If implementation before the next anticipated storm event is impracticable, they shall be implemented as soon as practicable.

3.11 STABILIZATION REQUIREMENTS

- A. Fine grading shall be performed according to the grading plan.
- B. All areas disturbed during the course of construction shall be revegetated according to the landscaping plan. If a landscaping plan is not provided, the disturbed areas shall be seeded or hydro-mulched.
- C. Except where the landscaping plan identifies other grasses, groundcover, plants, or shrubs to be planted, a 4 ft wide strip of Bermuda grass sod shall be placed behind all curbs.
- D. CONSTRUCTION MANAGER shall provide sufficient water and fertilizer to establish the sufficient growth of sod and seeds until final stabilization of the area is achieved.
- E. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
- F. where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently ceases is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable
- G. Where construction activity on a portion of the site is temporarily ceased, and earth-disturbing activities will be resumed within 21 days, temporary stabilization measures do not have to be initiated on that portion of site.
- H. in areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased is precluded by seasonal arid conditions, stabilization measures shall be initiated as soon as practicable.
- I. Temporary seeding or hydro-mulching may be used for temporary stabilization, if necessary.

3.12 CONSTRUCTION COMPLETION AND FINAL STABILIZATION

- A. CONSTRUCTION MANAGER shall remove all temporary erosion control structures upon completion of construction and the establishment of final stabilization.
- B. Final stabilization shall be complete when all soil disturbing activities at the site have been completed and

a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.

END OF SECTION

SECTION 31 3700 RIPRAP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for RIPRAP as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for RIPRAP shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- A. 31 25 00 Erosion and Sedimentation Controls
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

1.7 INFORMATIONAL SUBMITTALS

- A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. QUALITY ASSURANCE
 - 1. PRECONSTRUCTION CONFERENCE
 - a. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
 - 2. REGULATORY REQUIREMENTS
 - a. All materials and methods shall comply with the requirements of the AHJ.

1.9 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONSTRUCTION MANAGER shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONSTRUCTION MANAGER shall be done at his expense.

1.10 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans

are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.11 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDITIONS

A. TRAFFIC

- 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - a. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - b. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - c. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

B. UTILITY INTERRUPTIONS

- 1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed

interruption of utility.

C. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

1. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

- A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with the following subsections of the Oklahoma Department of Transportation's 2019 Specifications.
 1. 701.02 Portland Cement.
 2. 701.05 Fine Aggregates
 3. 712.02 Filter Fabric.
 4. 713.01 Stone for Riprap.
 5. 713.02 Filter Blanket.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

- A. The placement of RIPRAP shall comply with Section 601 "Riprap" of the Oklahoma Department of Transportation's 2019 Specifications.

END OF SECTION

SECTION 32 1100 BASE COURSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for BASE COURSES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for BASE COURSES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Subgrade Modification
- B. Aggregate Base Course
- C. Lime Treated Base Course
- D. Cement Treated Base Course

1.4 RELATED SECTIONS

- A. 31 22 00 Grading
- B. 31 23 00 Excavation and Fill
- A. 31 25 00 Erosion and Sedimentation Controls
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. For each type of the following manufactured products:
 - 1. Geotextiles
- B. Material Test Reports: For each base course material proposed as follows:
 - 1. Source of base course material.
 - 2. Classification according to ASTM D-2487.
 - 3. Laboratory Compaction curve according to ASTM D-698.

1.7 INFORMATIONAL SUBMITTALS

1.8 DELIVERY, STORAGE, AND HANDLING

- A. See Execution.

1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference

benchmark elevation.

1.11 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.12 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.13 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 PROJECT CONDITIONS

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with Section 703 Bases and Miscellaneous Aggregates of the Oklahoma Department of Transportation's 2019 Specifications.

2.2 AGGREGATE BASE FOR VEHICULAR PAVEMENTS

- A. General Requirements
 - 1. Provide aggregate base course material consisting of a mixture of coarse and fine graded aggregate that is free of vegetation and other deleterious materials.
 - 2. Coarse aggregate is the material retained on a No. 10 sieve. Provide coarse aggregate consisting of the following durable particles or fragments:
 - a. Gravel, Stone, Disintegrated granite, crushed concrete, or

- b. Provide fine aggregate made of sand, stone dust, or other inert, finely divided mineral.
 3. Ensure at least 40% of the completed Type A or Type B mixture retained on the No. 4 sieve contains uniformly graded, mechanically crushed particles with at least one fractured face.
 4. Ensure 100 percent of the completed Type C or Type D mixture retained on the No. 4 sieve contains uniformly graded, mechanically crushed particles with at least two fractured faces. Ensure the completed Type C mixture contains no more than 15 percent natural sand.
- B. Physical Properties
1. Ensure the coarse aggregate retained on the 3/8 in sieve of the completed mixture has no more than 50 percent wear in accordance with the Los Angeles Abrasion Test in accordance with AASHTO T 96. Ensure the aggregate has an Aggregate Durability Index of at least 40 in accordance with AASHTO T 210.
- C. Gradation and Other Requirements
1. Sample the uniform mixture from the project site before compacting. Ensure samples are in accordance with the following Table for Gradation, Plasticity Index, and Liquid Limit for the provided aggregate base types.

Aggregate Base Gradation				
Sieve Size	Percent Passing per Type			
	Type A	Type B	Type C	Type D
3 in	---	100	---	---
2 in	---	---	100	---
1-1/2 in	100	40 - 100	90 - 100	100
1 in	---	---	80 - 100	95 - 100
3/4 in	40 - 100	30 - 75	---	---
1/2 in	---	---	60 - 80	25 - 60
3/8 in	30 - 75	25 - 60	---	---
No. 4	25 - 60	20 - 50	40 - 60	0 - 10
No. 8	---	---	---	0 - 5
No. 10	20 - 43	15 - 35	25 - 45	---
No. 40	8 - 26	7 - 22	15 - 30	---
No. 200 ^a	40 - 12.0	3.0 - 10.0	0 - 5.0	0 - 2.0
Other Requirements				
Plasticity Index	≤ 6	≤ 6	≤ 6	---
Liquid Limit	≤ 25	≤ 25	≤ 25	---
^a Ensure the material passing the No. 200 sieve comprises no greater than two-thirds of the quantity of material passing the No. 40 sieve.				
^b When separate aggregates are blended to produce an aggregate mixture, no individual aggregate shall have a plasticity index higher than 8.				

2.3 SAND BASE FOR SIDEWALKS

- A. General Requirements
1. Sand base for sidewalks shall consist of sand, stone, rock, screenings, or select sandy soil free of organic material. Ensure there are no frozen lumps or moisture that may prevent the required compaction.
- B. Gradation Requirements

Sand Base Material Gradation	
Sieve Size	Percent Passing
3/8 in	100
No. 200	0 - 10

PART 3 - EXECUTION

3.1 PLACEMENT REQUIREMENTS

- A. The placement of BASE COURSES shall comply with 31 23 00 Excavation and Fill.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.3 STORAGE OF MATERIALS

- A. Stockpile base course materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile base course materials away from edge of excavations. Do not store within drip line of remaining trees.

3.4 SUBGRADE PREPARATION AND INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. After proof-rolling, scarify exposed subgrade to a minimum depth of 8 inches and compact to a least 95 percent of its maximum dry density as determined by the ASTM D-698 at a moisture content of optimum or above.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

3.5 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to between -1 and +3 percent of optimum moisture content.
- B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture by -1 and +3 percent is too wet to compact to specified dry unit weight.

3.6 COMPACTION OF SUBGRADE

- A. Compact subgrade to not less than the following percentages of maximum dry unit weight according to ASTM D-698:
 - 1. Under pavements, scarify and recompact top 8 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 8 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.

3.7 SUBGRADE TREATMENT

- A. The top 8 inches of subgrade shall be treated with hydrated lime. An estimated 5 to 7 percent hydrated lime is needed to adequately modify the on-site soils. The actual percentage of additive shall be determined at the time of construction by the geotechnical engineer. The lime shall be thoroughly blended into the subgrade and allowed to cure for 48 to 72 hours before being remixed and compacted. Before compaction, the treated soil zone shall be adjusted to within 2 percent of the material's optimum moisture as determined by the standard Proctor test method ASTM D-698. After conditioning the soil to the required moisture content, the treated subgrade shall be compacted to a least 98 percent of the material's maximum dry density.

3.8 BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase course and base course to required crown elevations and cross-slope grades.
 4. Place base course 6 inches or less in compacted thickness in a single layer.
 5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D-698.
- C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D-698.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus base course material and waste materials and legally dispose of them off Owner's property.

3.10 FIELD QUALITY CONTROL

- A. CONSTRUCTION MANAGER shall engage a qualified soil testing laboratory. CONSTRUCTION MANAGER shall coordinate and order all testing in conjunction with base course placement. The results of the tests shall be forwarded to ARCHITECT. The soils laboratory shall determine the suitability of existing site material prior to placement of base courses.
- B. The soils testing laboratory shall:
1. Determine prior to placement of fill that site has been prepared in compliance with requirements and determine that fill material.
 2. Determine that maximum lift thickness comply with requirements.
 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer.
- D. Testing agency shall test compaction of soils in place and base courses as applicable. Tests will be performed at the following locations and frequencies:
1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 sq. ft. or less of paved area, but in no case fewer than three tests.
- E. When testing agency reports that subgrades or base courses have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace materials to depth required; re-compact and retest until specified compaction is obtained.

END OF SECTION

**SECTION 32 1200
FLEXIBLE PAVING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for FLEXIBLE PAVING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for FLEXIBLE PAVING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Preparatory Coats
- B. Asphalt Paving
 - 1. Plant-Mix Asphalt Paving
- C. Asphalt Paving Wearing Course
- D. Flexible Paving Surface Treatments
- E. Seal Coats

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- B. 32 11 00 Base Courses
- A. 32 17 00 Paving Specialties
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 3. Job-Mix Designs: For each job mix proposed for the Work.

1.7 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each paving material.
- B. Material Test Reports: For each paving material, by a qualified testing agency.
- C. Field quality-control reports.

1.8 DELIVERY, STORAGE, AND HANDLING

1.9 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.11 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.12 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.13 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 PROJECT CONDITIONS

- A. TRAFFIC
 - 1. A Work Zone Permit must be obtained from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.

4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
1. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.15 ENVIRONMENTAL LIMITATIONS

- A. Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
1. Prime Coat: Minimum surface temperature of 60 deg F.
 2. Tack Coat: Minimum surface temperature of 60 deg F.
 3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.16 HAZARDOUS CONDITIONS

- A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with Section 708 Plant Mix Bituminous Bases and Surfaces of the Oklahoma Department of Transportation's 2019 Specifications.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

- A. The placement of FLEXIBLE PAVING shall comply with Section 411 Hot Mix Asphalt / Warm Mix Asphalt of the Oklahoma Department of Transportation's 2019 Specifications.

3.2 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.

- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
- D. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons.
- E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. OWNER will engage a soil/material's testing laboratory for the testing requirements and inspections within Flexible Paving. CONSTRUCTION MANAGER shall coordinate and order all testing with OWNER's material's testing laboratory in conjunction with Flexible Paving operations. The results of the tests shall be forwarded to ARCHITECT.
- B. CONSTRUCTION MANAGER shall be responsible for the retesting cost of failed tests.
- C. CONSTRUCTION MANAGER shall be responsible for the cost of any and all of CONSTRUCTION MANAGER's internal quality control tests.
- D. Thickness: In-place compacted thickness of hot-mix asphalt courses shall be determined according to ASTM D 3549.
- E. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- F. In-Place Density: Testing agency will take samples of un-compacted paving mixtures and compacted pavement according to ASTM D 979.
- G. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
- H. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - 1. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
 - 2. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- I. Replace and compact hot-mix asphalt where core tests were taken.
- J. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.5 WASTE HANDLING

- A. Remove waste materials and legally dispose of them off Owner's property.

END OF SECTION

**SECTION 32 13 00
RIGID PAVING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for RIGID PAVING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for RIGID PAVING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Concrete Paving

1.4 RELATED SECTIONS

- A. 31 22 00 Grading
- B. 31 23 00 Excavation and Fill
- C. 32 11 00 Base Courses
- D. 32 13 73 Concrete Paving Joint Sealants
- E. 32 16 13 Curbs and Gutters
- A. 32 17 00 Paving Specialties
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah
- B. Cementitious Materials - Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and slag cement.

1.6 ACTION SUBMITTALS

- A. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Paving Plan:
 - 1. Provide a paving plan that shows the proposed concrete placed each day.
 - 2. Provide a joint layout plan that shows isolation joints, longitudinal construction joints, longitudinal contraction joints, transverse contraction joints, and planned transverse construction joints.

1.7 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Applied finish materials.
 - 4. Bonding agent or epoxy adhesive.
 - 5. Joint fillers.
- B. Material Test Reports: For each of the following:
 - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

1.8 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- B. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- C. ACI Publications: Comply with ACI 301 unless otherwise indicated.
- D. Preconstruction Conference
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
 - 2. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 3. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. CONSTRUCTION MANAGER's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete paving subcontractor.
- E. Regulatory Requirements
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.9 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.10 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.11 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.

- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDITIONS

- A. TRAFFIC
 - 1. A Work Zone Permit must be obtained from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
 - 1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
 - 1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
 - 1. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

- A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION

MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with the following Section or Subsection of the Oklahoma Department of Transportation's 2019 Specifications.
 - 1. 701 Portland Cement Concrete.
 - 2. 702.01 Fly Ash.
 - 3. 702.02 Ground Granulated Blast Furnace Slag
 - 4. 702.03 Steel Reinforcement, Dowel Bars & Tie Bars.

2.2 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Class AA
 - a. Minimum 28 Day Compressive Strength: 4,000-psi
 - b. Minimum Cement Content: 564 lb/yd³
 - c. Air Content: 6.5% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.44 lb/lb
 - e. Slump: 2 inches, plus or minus 1 inch.
 - 2. Class A
 - a. Minimum 28 Day Compressive Strength: 3,000-psi
 - b. Minimum Cement Content: 517 lb/yd³
 - c. Air Content: 6% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
 - e. Slump: 2 inches, plus or minus 1 inch.
 - 3. Class A (vehicular pavement)
 - a. Minimum 28 Day Compressive Strength: 3,500-psi
 - b. Minimum Cement Content: 517 lb/yd³
 - c. Air Content: 6.5% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
 - e. Slump: 2 inches, plus or minus 1 inch.
 - 4. Class AP
 - a. Minimum 28 Day Compressive Strength: 3,000-psi
 - b. Minimum Cement Content: 470 lb/yd³
 - c. Air Content: 6% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
 - e. Slump: 2 inches, plus or minus 1 inch.
 - 5. Class C
 - a. Minimum 28 Day Compressive Strength: 2,400-psi
 - b. Minimum Cement Content: 395 lb/yd³
 - c. Air Content: 6% plus or minus 1.5%
 - d. Water/Cement Ratio: 0.25 to 0.62 lb/lb
 - e. Slump: 3 inches, plus or minus 1 inch.

- C. Cementitious Materials: Use fly ash, ground granulated blast-furnace slag, as needed to reduce the total amount of portland cement which would otherwise be used. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
- a. November through March: Fly ash meeting the requirements of this section may be substituted for up to 15% of the required cement. Ground granulated blast furnace slag meeting the requirements of AASHTO M 302 Grade 100 or Grade 120 may be substituted for up to 25% of the required cement. A combination of up to 25% ground granulated blast furnace slag and up to 15% fly ash may be substituted for up to 40% of the required cement.
 - b. April through October: A combination of up to 25% ground granulated blast furnace slag and up to 20% fly ash may be substituted for up to 45% of the required cement.
 - c. Substitution shall be by weight: 1.0 pound for each 1.0 pound of cement. The concrete mix design shall be appropriately adjusted. These substitutions will not be allowed for high early strength concrete, Class P concrete or concrete containing Type IP, Type I (PM), or Type I (SM) cement. If the specified minimum cement content is satisfied, additional fly ash or ground granulated blast furnace slag, or silica fume complying with ASTM C 1240, may be added to the mix when approved as part of the mix design.
- D. Water Cement Ratio. Using the weight in pounds of each material, calculate the water-cement ratio (W/C) by the following equation: $W/C = \text{Water} / (\text{Cement} + \text{Fly Ash} + \text{Blast Furnace Slag} + \text{Silica Fume})$ The water actually used is determined by the water measured into the batch plus the free water on wet aggregate minus the water absorbed by dry aggregate plus water in any admixture solutions and shall not exceed the limit specified.
- E. Slump. The slump shall be as shown, or as specified in the contract documents, or as approved by the ARCHITECT, and the consistency required shall be that which will provide satisfactory workability for the type work being done. Slump tests will be made during the progress of the work as a measure of uniformity of the consistency of the concrete. If using a high-range water reducing admixture, limit the slump to a maximum of 9 inches.
- F. Compressive Strength. Compressive strength is based on the average of three test cylinders. When the class of concrete is not expressly indicated on the Plans, the following requirements shall govern:
1. Class AA. Use Class AA concrete in superstructure items, such as bridge floors, approach slabs, reinforced concrete piles, drilled shaft foundations, parapet walls, concrete rail and handrails.
 2. Class A. Use Class A concrete for pavements and in substructures items, such as pier caps, columns, abutments, retaining walls, box culverts, and all reinforced concrete not requiring Class AA concrete.
 3. Class AP. Use Class AP concrete in shoulders, merge areas and gore areas for PCC pavements, unless otherwise directed by plan notes.
 4. Class C. Use Class C concrete for soil erosion control structures.

2.3 CONCRETE MIXING

- A. Design and produce concrete mixtures that conform to the Class of concrete specified in this section and base the mix design on absolute volume. Proportion the coarse and fine aggregate in accordance with ACI 211.1. Use the least amount of sand and mixing water which will ensure concrete of the required workability for placement conditions. Meet the minimum strength within 72 hours of placement for high early strength concrete. Submit the mix design at least 14 days before production to the ARCHITECT. Include at least the following information with each mix design:
1. Project identification
 2. Name and address of contractor and producer
 3. Mix design designation
 4. Intended use of the mix design
 5. Expected travel time from batch to placement
 6. If the concrete will be pumped or not
 7. Aggregate sources, gradation, moisture content, saturated surface dry batch mass, LA abrasion (AASHTO T 96), and freeze thaw durability (AASHTO T 103).
 8. Fineness modulus of fine aggregate.
 9. Cement type and source
 10. Type of cement replacement, if used, and source
 11. Type of admixtures and sources
 12. Material proportions
 13. Air content
 14. Slump
 15. Water / cement ratio

16. Strengths at 7 and 28 days
 17. Strengths at 72 hours for high early strength concrete.
- B. Do not place any concrete until the mix design is approved. Submit new mix designs if the mix design is rejected by the ARCHITECT, the source of any material changes, or the mix design produces unacceptable workability or production test results.

2.4 CONCRETE MATERIALS

- A. Portland cement: Shall conform to the requirements of AASHTO M 85 or AASHTO M 240. Type I, Type I (SM), Type I (PM), and Type IP shall be used in concrete for general concrete construction. Type II shall be used in concrete exposed to moderate sulphate action or moderate heat of hydration. Type III may be used when high early strength concrete is required. Unless otherwise approved by the ARCHITECT, the product of only one mill of any one brand and type of portland cement shall be used on any structure or adjacent structures. Provide suitable means of storing and protecting the cement against dampness.
1. Cement which for any reason has become partially set or which contains lumps of caked cement will be rejected. Cement salvaged from discarded or used bags shall not be used. All methods of sampling and testing shall be in accordance with the requirements of AASHTO M 85 or AASHTO M 240.
- B. Water
1. Provide water in accordance with AASHTO M 157, except as modified by the following:
 - a. Water quality testing is not required if obtained from an approved ODEQ public water source.
 - b. For other water sources, submit water quality test from the concrete producer showing compliance with AASHTO M 157 and the Chemical Limits for Mix Water listed below before use.
 - c. A blend of concrete wash water and other water sources may be used if the concrete producer submits certification that the water meets the requirements of AASHTO M 157 and Chemical Limits for Mix Water and Acceptance Criteria for Questionable Water Supplies listed below.
 - d. Test the blended water weekly for 4 weeks, or provide previous test reports. Test blended water monthly for compliance.
 - e. Chemical Limits for Mix Water
 - 1) Chloride (Cl) shall less than 1,000 ppm (ASTM D 512)
 - 2) Sulfate shall be less than 1,000 ppm (ASTM D 516)
 - 3) Alkalis shall be less than 600 ppm (ASTM D 4191 and ASTM D 4192)
 - 4) Total solids shall be less than 50,000 ppm (AASHTO T 26)
 2. Acceptance Criteria for Questionable Water Supplies
 - a. Compressive strength shall be a minimum 90% of the control at 7 days (AASHTO T 106)
 - b. The time of set shall not deviate from the control less than 1 or more than 1.5 (AASHTO T 131)
- C. Fine Aggregates
1. This specification applies to the quality and size of fine aggregates for Portland cement concrete pavements or bases, and incidental structures. Mortar sand shall meet the requirements of AASHTO M 45.
 2. General Requirements.
 - a. Provide fine aggregates that consists of a single source natural sand in accordance with AASHTO M 6, Class A, except as modified by the Gradation paragraph below.
 - b. Alternatively, provide a fine aggregate that consists of a combination of natural sands or a combination of natural and manufactured sands in accordance with AASHTO M 6, Class A, except as modified by the following:
 - 1) Mix the two materials under controlled conditions and stockpile as a finished aggregate. Alternatively, the two materials may be combined from separate stockpiles during batching operations at a hydraulic cement concrete plant.
 - 2) Ensure the combined fine aggregate meets the gradation requirements below.
 - 3) If a manufactured sand is used in combination with natural sand, ensure the fine aggregate blend has an acid insoluble residue of at least 60 percent by weight when tested in accordance with OHD L-25.
 - 4) Obtain crushed fine aggregate (manufactured sand) from a coarse aggregate source on ODOT Material Division's "Approved Products List" for use in hydraulic cement concrete.

3. Deleterious Substances

- a. The amount of deleterious substances shall not exceed the following limits: Clay lumps and friable particles 3%, Coal and Lignite 0.25%

4. Organic Impurities

- a. All fine aggregate shall be free from injurious amounts of organic impurities. Aggregates subjected to the colorimetric test for organic impurities and producing a color darker than the standard shall be rejected unless they pass the mortar strength test as specified below. Should the aggregate show a darker color than that of samples originally approved for the work, its use shall be withheld until tests satisfactory to the ARCHITECT have been made to determine whether the increased color is indicative of an injurious amount of deleterious substances. A fine aggregate failing in the test may be used provided that, when tested for the effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with Section 10 of AASHTO T 71 is not less than 95 percent.

5. Gradation

- a. Provide fine aggregate with a fineness modulus between 2.3 and 3.1, that is well graded from coarse to fine, and when tested in accordance with AASHTO T 27 and AASHTO T11 meets the following gradation requirements.
 - 1) Sieve size: 3/8-in, percent passing: 100%.
 - 2) Sieve size: No. 4, percent passing 95-100%.
 - 3) Sieve size: No. 8, percent passing 80-100%.
 - 4) Sieve size: No. 16, percent passing 50-85%.
 - 5) Sieve size: No. 30, percent passing 25-60%.
 - 6) Sieve size: No. 50, percent passing 5-30%.
 - 7) Sieve size: No. 100, percent passing 0-10%.
- b. The gradation requirements above represent the extreme limits of suitability. Ensure the gradation from one source does not have large changes in percentages of gradation.
- c. Use the average fineness modulus to determine the uniformity of the fine aggregate. The average fineness modulus is the average of the last 10 tests maintained by the ODOT Division Resident Engineer. Fine aggregates will be rejected from any one source having a variation in fineness modulus greater than 0.20 either way from the average. The fineness modulus of an aggregate is determined by adding the total percentages of material in the sample that are coarser than each of the following sieves (cumulative percentages retained), and dividing the sum by 100; No. 100, No. 50, No. 30, No. 16, No. 8, No. 4, 3/8 inch.

D. Coarse Aggregate

- 1. Provide coarse aggregate in accordance with AASHTO M 80, Class A, except as modified by the following:
 - a. Ensure coarse aggregate produces Class A concrete with a durability factor of at least 50. Determine the durability factor after 350 cycles of alternate freezing and thawing in accordance with AASHTO T 161, Procedure A.
 - b. The Los Angeles Abrasion percent wear shall be limited to a maximum of 40 percent after 500 revolutions when tested in accordance with AASHTO T 96.
 - c. The sodium sulfate soundness requirement shall not apply.
 - d. Ensure at least 70 percent of the coarse aggregate retained on the No. 4 sieve is crushed stone or mechanically crushed gravel with at least two fractured faces.
 - e. Limit the quantity of flat or elongated pieces to 15 percent or less, at a ratio of 1:5, when tested in accordance with ASTM D 4791.
- 2. Gradation
 - a. No. 357
 - 1) Sieve size 2-1/2-in., percent passing 100%.
 - 2) Sieve size 2-in., percent passing 95-100%.
 - 3) Sieve size 1-in., percent passing 35-70%.
 - 4) Sieve size 1/2-in., percent passing 10-30%.
 - 5) Sieve size No. 4, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-1.5%.

- b. No. 57
 - 1) Sieve size 1-1/2-in., percent passing 100%.
 - 2) Sieve size 1-in., percent passing 95-100%.
 - 3) Sieve size 1/2-in., percent passing 25-60%.
 - 4) Sieve size No. 4, percent passing 0-10%.
 - 5) Sieve size No. 8, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-2%.
- c. No. 67
 - 1) Sieve size 1-in., percent passing 100%.
 - 2) Sieve size 3/4-in., percent passing 90-100%.
 - 3) Sieve size 3/8-in., percent passing 20-55%.
 - 4) Sieve size No. 4, percent passing 0-10%.
 - 5) Sieve size No. 8, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-2%.
- d. No. 7
 - 1) Sieve size 3/4-in., percent passing 100%.
 - 2) Sieve size 1/2-in., percent passing 90-100%.
 - 3) Sieve size 3/8-in., percent passing 40-70%.
 - 4) Sieve size No. 4, percent passing 0-15%.
 - 5) Sieve size No. 8, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-2%.
- e. No. 8
 - 1) Sieve size 1/2-in., percent passing 100%.
 - 2) Sieve size 3/8-in., percent passing 85-100%.
 - 3) Sieve size No. 4, percent passing 10-30%.
 - 4) Sieve size No. 8, percent passing 0-10%.
 - 5) Sieve size No. 16, percent passing 0-5%.
 - 6) Sieve size No. 200, percent passing 0-2%.
- 3. Provide the specified sizes of coarse aggregate for the following types of concrete:
 - a. No. 57 for Class A and Class AP concrete;
 - b. No. 357 for massive Class A concrete;
 - c. No. 57, No. 67, or No. 357 for Class C concrete;
 - d. No. 57 or No. 67 for Class AA concrete.

2.5 ADMIXTURES

- A. Provide air entraining admixtures in accordance with AASHTO M 154 and ASTM C 260.
- B. Provide chemical admixtures in accordance with AASHTO M 194 for the type of admixture supplied.
Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
 - 1. Color: As indicated on Drawings.

2.6 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
- B. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or

adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.7 STEEL REINFORCEMENT

- A. Bar Steel Reinforcement – Billet Steel
 - 1. Provide plain or deformed billet steel bars for concrete reinforcement and dowels in accordance with AASHTO M 31, Grade 60, except provide deformed billet steel bars for bent tie bars used in concrete paving in accordance with AASHTO M 31, Grade 40.
- B. Welded Steel Wire Fabric
 - 1. Provide cold drawn steel wire fabric for concrete reinforcement in accordance with AASHTO M 55 or AASHTO M 221.
 - 2. Provide reinforcing fabric in flat sheets or rolls. Straighten bent or distorted materials before use. Ensure the fabric is free of excessive rust, scale, or coating that may impair the concrete bond.
- C. Cold Drawn Steel Wire
 - 1. Provide cold drawn steel wire, in accordance with AASHTO M 32, for spiral ties and other reinforcing shown on the Plans as "W" (Wire) sizes.
- D. Epoxy Coated Reinforcing Bars
 - 1. Provide epoxy coated (an electro-statically applied organic coating) reinforcing bars and epoxy coating material in accordance with AASHTO M 285, except the following:
 - a. Provide reinforcing steel bars in accordance with Bar Steel Reinforcement – Billet Steel.
 - b. Provide finished epoxy coating in a color and tone that easily gives visual indications of damage or corrosion staining.
- E. Tie Bars
 - 1. ASTM A 615, Grade 60, deformed.
- F. Hook Bolts
 - 1. ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- G. Bar Supports
 - 1. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.8 FIBER REINFORCEMENT

- A. Polypropylene fibers shall be 100 percent polypropylene, collated, fibrillated fibers manufactured to graduated lengths of equal proportions for secondary reinforcement. Polypropylene fibers shall be in accordance with ASTM C 1116 for Type III.
- B. Steel fibers shall be in accordance with ASTM A 820, for Type II, cut-sheet steel. Provide steel fibers with and aspect ratio of 30:60 and from 1-1/2 to 2 inches long.

2.9 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.10 RELATED MATERIALS

- A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 DETECTABLE WARNING MATERIALS

- A. Detectable Warning Stamp: Semi-rigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.
 - 1. Size of Stamp: One piece matching detectable warning area shown on Drawings.
- B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

- A. The placement of RIGID PAVING shall comply with Section 414 Portland Cement Concrete Pavement of the Oklahoma Department of Transportation's 2019 Specifications.

3.2 EXAMINATION AND PREPARATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
- D. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons.
- E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Joint Spacing Requirements
 - 1. Avoid odd-shaped slabs.
 - 2. In parking lots, longitudinal joints shall be parallel to the direction of vehicle travel, and can be made to delineate drive lanes and parking stalls. Transverse joints shall divide the paving lanes into panels.
 - 3. Longitudinal joint spacing shall not exceed 12.5 feet.
 - 4. The maximum transverse joint spacing for drives shall be 24 to 30 times the slab thickness or 15 ft, whichever is less. Divide the length between the concrete being placed into equally spaced joints.
 - 5. Slabs shall be as square as possible. The length of a panel shall not be more than 25% greater than its width.
 - 6. All transverse contraction joints shall be continuous through the curb and have a depth equal to $\frac{1}{4}$ to $\frac{1}{3}$ the pavement thickness.
 - 7. In isolation joints, the filler shall be full depth and extend through the curb. Isolation joints shall be used to isolate the pavement from light standard foundations, storm sewer inlets, manholes, and buildings.
 - 8. If there is no curb, longitudinal joints shall be tied with deformed tie bars.
 - 9. Offsets at radius points shall be at least 1.5 ft wide. Joint intersection angles less than 60 degrees shall be avoided.
 - 10. Minor adjustments in joint location made by shifting or skewing to meet inlets and manholes is allowable.
 - 11. Place joints to meet drainage structures, if possible.
- C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Provide tie bars at sides of paving strips where indicated.
 - 3. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- D. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- E. Contraction Joints: 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:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.
- L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- M. Hot-Weather Placement: Comply with ACI 305.1 and as follows when hot-weather conditions exist:
 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is CONSTRUCTION MANAGER's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand

floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8-inch-deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
 - a. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - b. Water.
 - c. Continuous water-fog spray.
 - d. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, 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 occurring during installation or curing period using cover material and waterproof tape.
- F. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

- A. Comply with tolerances in Oklahoma Department of Transportation's 2019 Specifications and as follows:
 1. Elevation: 1/2 inch.
 2. Thickness: Plus 3/8-inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot unleveled straightedge not to exceed 1/4 inch.
 4. Alignment of tie-bar end relative to line perpendicular to paving edge: 1/2 inch per 12 inches of tie bar.
 5. Lateral Alignment and Spacing of Dowels: 1 inch.
 6. Vertical alignment of dowels: 1/4 inch.
 7. Joint Spacing: 3 inches.
 8. Contraction Joint Depth: Plus 1/4 inch, no minus.
 9. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

- A. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.11 FIELD QUALITY CONTROL

- A. OWNER will engage a soil/material's testing laboratory for the testing requirements within Rigid Paving. CONSTRUCTION MANAGER shall coordinate and order all testing with OWNER's material's testing laboratory in conjunction with Rigid Paving operations. The results of the tests shall be forwarded to ARCHITECT.
- B. CONSTRUCTION MANAGER shall be responsible for the retesting cost of failed tests.
- C. CONSTRUCTION MANAGER shall be responsible for the cost of any and all of CONSTRUCTION MANAGER's internal quality control tests.

- D. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency:
 - a. Obtain at least one composite sample for each 100 cu.yd. or fraction thereof of each concrete mixture placed each day.
 - b. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 5. Concrete Density: ASTM C 138
 6. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three 6-inch diameter by 12-inch long standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days. Test specimens shall be 6-in diameter and 12-inch long cylinders. If testing agency uses 4-inch diameter by 8-in long cylinders, three specimens are required at 28-days.
 - a. A compressive-strength test shall be the average compressive strength from two 6-inch diameter by 12-inch long specimens obtained from same composite sample and tested at 28 days.
 - b. If 4-inch diameter by 8-in long cylinders are used, the compressive-strength test shall be the average compressive strength from three specimens obtained from the same composite sample and tested at 28 days.
- E. Strength of each concrete mixture will be satisfactory if average of the compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- F. Test results shall be reported in writing to ARCHITECT, concrete manufacturer, and CONSTRUCTION MANAGER within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by ARCHITECT but will not be used as sole basis for approval or rejection of concrete.
- H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by ARCHITECT.
- I. Concrete paving will be considered defective if it does not pass tests and inspections.
- J. Additional testing and inspecting, at CONSTRUCTION MANAGER's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- K. Prepare test and inspection reports.

3.12 ARCHITECT'S ACCEPTANCE OF PAVEMENT

- A. Pavement slabs with unsound concrete, uncontrolled cracking, malfunctioning sawed joints, spalling, honeycombing, surface irregularities, insufficient thickness, or other deficiencies associated with poor quality pavements may be rejected by ARCHITECT.
- B. Pavement rejected by ARCHITECT shall be removed and replaced at no additional cost to Owner.
- C. When replacing rejected slabs, remove a width of at least one lane and a length of at least 15 ft. If the removal is within 15 ft of any transverse joint, remove the slab to the joint.
- D. If a deficient unit does not warrant removal, as directed by ARCHITECT, the Owner will not pay for the deficient unit.

3.13 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by ARCHITECT.

- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

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SECTION 32 1373
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for CONCRETE PAVING JOINT SEALANTS as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for CONCRETE PAVING JOINT SEALANTS shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Cold-applied joint sealants
- B. Hot-applied joint sealants

1.4 RELATED SECTIONS

- A. 32 12 00 Flexible Paving
- A. 32 13 00 Rigid Paving
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: Joint-Sealants.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of joint sealant and accessory, from manufacturer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

1.8 DELIVERY, STORAGE, AND HANDLING

1.9 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.10 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with Subsection 701.08 "Joint Fillers and Sealer" of the Oklahoma

2.2 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
- C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.
- B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.6 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and

replace them with dry materials.

- D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place joint sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Non-sag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT JOINT SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within cement concrete pavement.
 - 1. Joint Location:
 - a. Expansion and isolation joints in cast-in-place concrete pavement.
 - b. Contraction joints in cast-in-place concrete slabs.
 - c. Other joints as indicated.
 - 2. Silicone Joint Sealant for Concrete: Single component, non-sag; Single component, self-leveling.
 - 3. Urethane Joint Sealant for Concrete: Multicomponent, pourable, traffic-grade.
 - 4. Hot-Applied Joint Sealant for Concrete: Single component.
- B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
 - 1. Joint Location:
 - a. Joints between concrete and asphalt pavement.
 - b. Joints between concrete curbs and asphalt pavement.
 - c. Other joints as indicated.
 - 2. Hot-Applied Joint Sealant for Concrete and Asphalt: Single component.

END OF SECTION

**SECTION 32 16 13
CURBS AND GUTTERS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for CURBS AND GUTTERS as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for CURBS AND GUTTERS shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Cast-In-Place Concrete Curb and Gutters

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- B. 32 12 00 Flexible Paving
- C. 32 13 00 Rigid Paving
- A. 32 13 73 Concrete Paving Joint Sealants
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Paving Plan:
 - 1. Provide a paving plan that shows the proposed concrete placed each day.
 - 2. Provide a joint layout plan that shows isolation joints, longitudinal construction joints, longitudinal contraction joints, transverse contraction joints, and planned transverse construction joints.

1.7 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Applied finish materials.
 - 4. Bonding agent or epoxy adhesive.
 - 5. Joint fillers.
- B. Material Test Reports: For each of the following:
 - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

1.8 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production

Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

- B. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- C. ACI Publications: Comply with ACI 301 unless otherwise indicated.
- D. Preconstruction Conference
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
 - 2. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 3. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Subcontractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete paving subcontractor.
- E. Regulatory Requirements
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.9 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.10 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.11 PROJECT CONDITIONS

- A. TRAFFIC
 - 1. A Work Zone Permit must be obtained from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with the following Section or Subsection of the Oklahoma Department of Transportation's 2019 Specifications.
 - 1. 701 Portland Cement Concrete.
 - 2. 702.01 Fly Ash.
 - 3. 702.02 Ground Granulated Blast Furnace Slag
 - 4. 702.03 Steel Reinforcement, Dowel Bars & Tie Bars.

2.2 CAST-IN-PLACE CONCRETE CURB AND GUTTERS

- A. Class A PC Concrete (3,500 psi at 28 days, air entrained) shall be used for concrete curbs and gutters.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

- A. The placement of CURBS AND GUTTERS shall comply with Section 414 "Portland Cement Concrete Pavement" of the Oklahoma Department of Transportation's 2019 Specifications.

3.2 EXAMINATION AND PREPARATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
- D. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons.
- E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.

3.3 JOINTS

- A. Expansion Joints - Set 1/2-inch expansion joints at maximum 100 ft spacing using 1/2 inch by 4-inch pre-molded expansion joint material.
- B. Contraction Joints – Set contraction joints at 15 ft to 20 ft spacing.
- C. Fill all joints to surface with silicone sealant.

3.4 TOLERANCES

- A. Comply with tolerances in Oklahoma Department of Transportation's 2019 Specifications and as follows:
 - 1. Elevation: 3/4 inch.
 - 2. Thickness: Plus 3/8-inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot unlevelled straightedge not to exceed 1/2 inch.
 - 4. Joint Spacing: 3 inches.
 - 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 6. Joint Width: Plus 1/8 inch, no minus.

3.5 FIELD QUALITY CONTROL

- A. OWNER will engage a soil/material's testing laboratory for the testing requirements within Rigid Paving. CONSTRUCTION MANAGER shall coordinate and order all testing with OWNER's material's testing laboratory in conjunction with Rigid Paving operations. The results of the tests shall be forwarded to ARCHITECT.
- B. CONSTRUCTION MANAGER shall be responsible for the retesting cost of failed tests.
- C. CONSTRUCTION MANAGER shall be responsible for the cost of any and all of CONSTRUCTION MANAGER's internal quality control tests.
- D. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu.yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or

from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- E. Strength of each concrete mixture will be satisfactory if average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- F. Test results shall be reported in writing to Architect, concrete manufacturer, and CONSTRUCTION MANAGER within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- I. Concrete paving will be considered defective if it does not pass tests and inspections.
- J. Additional testing and inspecting, at CONSTRUCTION MANAGER's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- K. Prepare test and inspection reports.

3.6 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

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**SECTION 32 1700
PAVING SPECIALTIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for PAVING SPECIALTIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for PAVING SPECIALTIES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Parking Bumpers
- B. Pavement Markings
- C. Preformed Traffic-Calming Devices

1.4 RELATED SECTIONS

- A. 32 12 00 Flexible Paving
- B. 32 13 00 Rigid Paving
- C. 32 13 73 Concrete Paving Joint Sealants
- A. 32 16 13 Concrete Curbs and Gutters
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For Pavement Markings.
 - 1. Indicate Pavement Markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.7 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.

1.8 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.

- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.9 PROJECT CONDITIONS

A. TRAFFIC

1. Obtain any Work Zone Permits required from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

B. ENVIRONMENTAL CONDITIONS

1. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 3000-psi (28-day) minimum compressive strength, 5-1/2 inches high by 8 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or drilled vertical holes through wheel stop for anchoring to substrate.
- B. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
- C. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch diameter, 10-inch minimum length or hardware as standard with wheel-stop manufacturer.

2.2 PAVEMENT MARKINGS

A. Performance Requirements

1. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

B. Pavement Marking Paint

1. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
 - a. Colors: White, Yellow, Blue, and Red.

2.3 PREFORMED TRAFFIC-CALMING DEVICES

- A. Speed Bumps: Solid, integrally colored, 96 percent postconsumer or commingled postconsumer and pre-consumer recycled rubber or plastic; UV stabilized. Provide factory-formed or -drilled vertical holes for anchoring to substrate.
 1. Size: 2 inches high by 10 inches wide by 72 inches long; with tapered, square, or rounded ends.
 2. Size: Modular assembly 3 inches high by 12 feet in overall width, with overall length as dimensioned on Drawings; and with tapered, square, or rounded ends.
 3. Color: Black.
 4. Embedded Markings: Molded-in, yellow reflective markings, permanently inset in exposed surface.

5. Mounting Hardware: Galvanized-steel lag screw, shield, and washers; 1/2-inch diameter, 8-inch minimum length or hardware as standard with device manufacturer.
6. Adhesive: As recommended by device manufacturer for adhesion to pavement.

PART 3 - EXECUTION

3.1 PARKING BUMPERS

A. EXAMINATION

1. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. INSTALLATION

1. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
2. Install wheel stops in bed of adhesive before anchoring.
3. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

3.2 PAVEMENT MARKINGS

A. EXAMINATION

1. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
2. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

B. APPLICATION

1. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
2. Allow paving to age for a minimum of 30 days before starting pavement marking.
3. Sweep and clean surface to eliminate loose material and dust.
4. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - a. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

C. FIRE LANES

1. Where fire lines are indicated, a 6-in wide red stripe with 4-inch high white letters with a 3/4-inch stroke stating, "FIRE LANE NO PARKING" shall be provided showing the boundary of the fire lane. The words "FIRE LANE NO PARKING" must be grouped together as a phrase. The phrase shall be painted a maximum distance of every 40 feet C-C along the length of the fire lane. When a curb is along the fire lane, the face and top of the curb shall be painted with the phrase painted on the face of the curb.

D. PROTECTING AND CLEANING

1. Protect pavement markings from damage and wear during remainder of construction period.
2. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.3 PREFORMED TRAFFIC-CALMING DEVICES

A. EXAMINATION

1. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. INSTALLATION

1. General: Install manufactured traffic-calming devices according to manufacturer's written instructions

unless otherwise indicated.

2. Install devices in bed of adhesive before anchoring.
3. Securely anchor devices to pavement with hardware spaced as recommended in writing by manufacturer for heavy traffic. Recess head of hardware beneath top surface of device.

END OF SECTION

**SECTION 32 9219
SEEDING (NATIVE DRILL)**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Temporary cover, seeding and maintenance.
- B. Maintenance.

1.2 RELATED SECTIONS

- A. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.3 DEFINITIONS

- A. Weeds: Includes but not limited to Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.4 MAINTENANCE DATA

- A. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, watering, and recommended coverage of herbicide and fertilizer.

1.5 QUALITY ASSURANCE

- A. General:
 - 1. Do not make substitutions for specified materials.
 - 2. Ship materials with certificates of inspection required by governing authorities.
- B. Analysis and Standards:
 - 1. Provide standard packaged products with manufacturer's certified analysis.
 - 2. For other materials provide analysis in accordance with methods established by the Association of Official Agricultural Chemists.

1.6 QUALIFICATIONS

- A. Seed Producer: Company specializing in seed production and harvesting with minimum five years of experience, and certified by the State of Oklahoma.
- B. Installer: Company approved by the seed producer.

1.7 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of herbicide mixture.

1.8 SUBMITTALS

- A. Seed: submit seed manufacturer's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for the each grass seed species.
 - 1. Submit to the Owner the empty bags which had the annual rye or native grass seed mix seed.
- B. Herbicide
- C. Temporary Irrigation System Method for non-automatic irrigation native grass seed areas.
- D. Agricultural Soils Test of On-site Topsoil with Recommendations

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Seeds shall be delivered in a waterproof, sealed and unopened package as shipped by the seed manufacturer.

1.10 COORDINATION

- A. Coordinate with installation of underground irrigation system piping.

1.11 JOB CONDITIONS

- A. Proceed with seeding operations after underground irrigation system or the temporary irrigation system has been approved.
- B. Work within seasonal limitations of grass specie.
- C. When detrimental conditions are encountered, notify the Owner's Representative.

1.12 MAINTENANCE SERVICE

- A. Maintain seeded areas immediately after applications until grass is well established and exhibits a vigorous growing condition and acceptance of all landscape work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Grass Seed:

- 1. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified.

- 2. Native Short Mix:

Common Name	Botanical Name	Pounds Per Live Seed / Acre
Western Wheatgrass	Agropyron smithii	3.00
Sideoats Grama	Bouteloua curtipendula	6.00
Blue Grama	Bouteloua gracilis	3.00
Buffalograss	Buchloe cadtyloides	8.00
Partridge Pea	Cassi fasciculate	3.00
Green Spragletop	Lepochloa dubia	3.00
Love Grass	Eragrostis curvula	2.00

- 3. Warm Season – Teff Grass (Eragrostis tef).
- 4. Cool Season - Annual Ryegrass (Lolium multiflorum lam.).
- 5. After arrival on the job site, seed containers will be kept in a weather protected, cool and dry.

- B. Erosion Control Measures:

- 1. Provide clean, seed-free, threshed straw of wheat.
- 2. Or Approved Equal

- C. Topsoil: Refer to SECTION: Landscape Grading.

- D. Water: Provided by the Owner.

- E. Temporary Irrigation System: Water the annual ryegrass for temporary cover and the native grass areas for growth and permanent establishment.

- F. Soil Amendments:

- 1. Provide as the soils test dictates the following:
 - a. Nitrogen: Furnish slow-release granular commercial product.
 - b. Lime: Furnish raw ground limestone containing not less than 95 percent carbonates, 98% passing a 20 mesh sieve and 50% passing a 100 mesh sieve.
 - c. Aluminum Sulfate
 - d. Bonemeal: Furnish commercial, raw, finely ground containing 4% nitrogen and 20% phosphoric acid.
 - e. Gypsum: furnish U.S. Grade Fine Gypsum.
 - f. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.

- G. Herbicide:

- 1. Plateau by BASF, approved by the seed manufacturer or approved equal.

PART 3 - EXECUTION

3.1 PLANTING SEASON

- A. Seed
 - 1. Cool Season Cover: Annual Ryegrass – Fall - Mid August to October and Spring - February to April.
 - 2. Warm Season Cover: Teff Grass – Summer - May to August
 - 3. Native Grass Seed Mix – Spring - March 15 and May 15.

3.2 EXAMINATION

- A. Verify that prepared on-site topsoil is ready to receive the work of this section including removal of hard pan areas, finish grading, etc.

3.3 PREPARATION OF SUBSTRATE

- A. Refer to SECTION: Landscape Grading
- B. Provide soil amendments and nutrients as per on site topsoil agricultural text.

3.4 APPLICATION

- A. Initial Application – Seeding Rate:
 - 1. Warm Season Annual Teff Grass Seed Mix Rate: Eight (8) pounds per acre.
 - 2. Cool Season Annual Rye Grass Seed Mix Rate: Twenty (25) pounds per acre.
 - 3. Native Grass Seed Mix: Seed weight rate of seventeen (17) pound per acre (equal to eleven (11) Pure Live Seed (PLS) pounds per acre.
- B. Drill Seeding:
 - 1. All seed is to be drilled one-quarter (1/4) inch into the soil with a mechanical grass drill with depth bands and an agitator in the seed box. Rows shall be spaced not more than seven (7) inches apart. Drill half of required seed in one compass direction and then drill the remaining half in a direction ninety degrees (90°) to the first half.
- C. Broadcast Seeding Small Areas
 - 1. Some portions of the project area is not accessible by the drill application. In these areas, uniformly apply seed at the same rate at cover with soil to a depth of one-quarter (1/4) inch to one-half (1/2) inch by hand raking the areas.
 - 2. Broadcast seeding shall be accomplished using a hand-operated "cyclone-type" seeder or rotary broadcast equipment attached to construction or revegetation machinery. All machinery shall be equipped with metering devices. Broadcasting by hand shall be acceptable on small, isolated areas. Prior to hand broadcast seeding, divide the seed required into two portions. Apply the first half of the seed and then follow up by applying the second portion to ensure complete coverage by seed. When broadcast seeding, passes shall be made over each site to be seeded in a manner to ensure an even distribution of seed. When using hopper type equipment, seed shall be frequently mixed with the hopper to discourage seed settling and even planting distribution of the seed.
- D. Cover Broadcast Seeding:
 - a. Following the drill seeding of all areas, the cover seed mix should be broadcast over areas as a temporary cover.
- E. Provide Erosion Control Measures:
 - 1. Apply straw mulch shall be applied immediately after seeding has been completed with a mechanical spreader at a rate not less than one and one-half (1-1/2) ton per acre and not more than two (2) tons per acre. Straw mulch shall then be anchored to the soil with a standard commercial crimper which shall crimp the mulch four (4) inches or more into the soil.
- F. Watering:
 - 1. Apply water with a fine spray immediately after each area has been mulched. Saturate to four (4)-inches of the soil without erosion.

3.5 MAINTENANCE

- A. The Contractor shall maintain the grass for a minimum of 90-days after installation or until completion and acceptance of all landscape work, whichever period is longer.

- B. Water to prevent grass and soil from drying out.
- C. Roll surface or topdress to remove irregularities.
- D. Control growth of weeds. The Contractor shall notify the Owner's Representative prior to herbicide spot application, favorable to the establishment of a Native Grass Short Mix. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- E. Immediately seed areas which show deterioration or bare spots.
- F. Protect seeded areas with warning signs during maintenance period.

3.6 ACCEPTANCE OF AREAS

- A. When seeding is substantially completed, including maintenance, Owner's Representative shall, upon request, make an inspection to determine acceptability.
- B. Seeded areas will be acceptable, provided requirements, including maintenance, have been complied with, and healthy, uniform, close stand of specified grass is established, free of weeds, bare spots, open joints and surface irregularities.
- C. Where inspected work does not comply with requirements, replace defected work, and continue specified maintenance until re-inspected by the Owner's Representative and found to be acceptable.
- D. Once the work is accepted as complete, the Contractor will maintain the seeded areas until final acceptance of all landscape work for the project.

END OF SECTION

SECTION 32 9223 SODDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fertilizing.
- B. Sod installation.
- C. Maintenance

1.2 RELATED SECTIONS

- A. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.3 REFERENCES

- A. ASPA (American Sod Producers Association) Guideline Specifications to Sodding.

1.4 SUBMITTALS

- A. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.
- B. Certification: Submit sod certification for grass species and location of sod source.

1.5 DEFINITIONS

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Grass Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.6 QUALITY ASSURANCE

- A. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
- B. Sod Producer: Company specializing in sod production and harvesting with minimum five-years' experience and certified by the State of Oklahoma.
- C. Installer: Shall have over five-years of documented experience in the scope of work specified.

1.7 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of fertilizer mixture and herbicide mixture.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sod on pallets. Protect exposed roots from dehydration.
- B. Do not deliver more sod than can be laid within 24 hours or sod will be rejected.

1.9 COORDINATION

- A. Where underground sprinkler systems are required, coordinate with installation of underground sprinkler system piping, spray heads, valves and quick coupler valves.

1.10 JOB CONDITIONS

- A. Proceed with sodding operations after underground sprinkler system has been approved by the Landscape Architect.
- B. Work within seasonal limitations of the grass species.
- C. When detrimental conditions are encountered, notify the Landscape Architect.

1.11 MAINTENANCE SERVICE

- A. Maintain sodded areas immediately after placement until final Acceptance of the project. The lawn shall be well established and exhibit a vigorous growing condition.

PART 2 - PRODUCT

2.1 MATERIALS

- A. Sod: ASPA Certified grade; "U-3" Bermuda Grass (or approved equal), a cultivated grass, Oklahoma grown, free of stones, burned or bare spots; containing no more than 10 weeds per 1,000 square feet.
- B. Imported Topsoil: Refer to SECTION ## #####.
- C. Fertilizer: Recommended for grass, with 50 percent of the elements derived from organic sources; controlled-release, granular or pellet form, uniform in composition, slow releasing, delivered in fully labeled sealed packages, and shall conform to applicable state or federal regulations, and a composition of the following: nitrogen 10 percent, phosphoric acid 20 percent, and soluble potash 10 percent.
- D. Water: During construction, the domestic water from the Project property will be provided to the Contractor by the Owner. The Contractor shall utilize the water in a conservative manner.
- E. Postemergent Herbicide: As manufactured by LESCO or GORDONS.

2.2 HARVESTING SOD

- A. Machine cut sod and load on pallets in accordance with ASPA Guidelines. Big rolls are preferred.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installation areas. Report unsatisfactory conditions in writing to Landscape Architect. Do not proceed until unsatisfactory conditions have been corrected.
- B. Verify that prepared topsoil is ready to receive the work of this section.
- C. Starting installation constitutes acceptance of condition or satisfactory for installation of sod by Contractor, who shall correct damage and defects or unsatisfactory work at no additional cost.

3.2 PREPARATION OF SUBSOIL

- A. Comply with SECTION ## #####: Landscape Grading

3.3 FERTILIZING

- A. Apply fertilizer (10-20-10) at a rate of 2.5 lbs. per 1,000 square feet.
- B. Apply after smooth raking of topsoil and prior to installation of sod.
- C. Apply fertilizer no more than 48 hours before laying sod.
- D. Mix thoroughly into upper 2-inches of imported topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.4 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod immediately (within 24 hours of harvesting) after delivery to site to prevent deterioration. Sod will be rejected if not installed within this time period.
- C. Place sod parallel with the adjacent street and building.
- D. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12-inches minimum. Do not stretch or overlap sod pieces.
- E. Lay smooth. Align with adjoining grass areas and flush with grade.
- F. Place top elevation of sod 1/2-inch below adjoining paving and curbs.
- G. Water sodded areas immediately after installation. Saturate sod to 4-inches of soil. Water by hand or by the irrigation system daily to prevent the root system from drying. Sod shall be kept moist. Dry sod will be rejected and replanted according to this specification.
- H. Once conditions are favorable, roll sodded areas to ensure a good bond between sod and soil and to remove minor depressions and irregularities. Roll sodded areas with a roller not exceeding 250 lbs.

3.5 MAINTENANCE

- A. Maintain the existing lawn and newly sodded grass areas between the street curb and the parking lot for a minimum of 30-days after installation or until Final Acceptance of the entire project, whichever period is longer. The grass shall be mowed a minimum of three times and maintained at a maximum height of 3 inches. Do not cut more than 1/3 of a grass blade at during one mowing.
- B. Neatly trim edges and hand clip where necessary.
- C. Water to prevent grass and soil from drying out.
- D. Roll surface and top-dress with imported topsoil to remove irregularities.
- E. Weed Control: Apply a weed control herbicide. Notify the Landscape Architect prior to herbicide application. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting

from improper use of herbicides.

- F. Immediately sod areas which show deterioration or bare spots.
- G. Protect sodded areas with warning signs during maintenance period.

3.6 ACCEPTANCE OF SODDED AREAS

- A. When sodding is substantially completed, including maintenance, the Landscape Architect will, upon request, make an inspection to determine acceptability.
- B. Sodded lawns will be acceptable, provided requirements, including maintenance, have been complied with, and healthy, uniform, close stand of specified grass is established, free of weeds, bare spots, open joints and surface irregularities.
- C. Where inspected work does not comply with requirements, replace defected work, and continue specified maintenance until reinspected by the Landscape Architect and found to be acceptable.
- D. Once the work is accepted as complete, the Contractor will maintain the sodded areas until Final Acceptance of the project.

END OF SECTION

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**SECTION 33 3123
SANITARY SEWERAGE FORCE MAIN PIPING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SANITARY SEWERAGE FORCE MAIN PIPING as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SANITARY SEWERAGE FORCE MAIN PIPING shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Sanitary Utility Sewerage Force Main Piping

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- A. 33 00 00 Sanitary Sewerage Utilities
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pipe
 - 2. Fittings
 - 3. Tracer Wire
- B. Field quality-control test reports.

1.7 INFORMATIONAL SUBMITTALS

- A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ENGINEER one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
 - 2. If the AHJ has not adopted specifications for materials and methods, the current edition of the AWWA and Oklahoma Department of Environmental Quality shall be used.

1.9 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.10 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.11 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ENGINEER and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ENGINEER and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ENGINEER and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ENGINEER before commencing work. The ENGINEER or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ENGINEER. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDITIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
 - 4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic

department.

B. UTILITY INTERRUPTIONS

1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ENGINEER one week (7 days) in advance of proposed interruption of utility.

C. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

1. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

- A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with the current edition of the AHJ's Standard Specifications.
- B. Polyethylene Pipe and Fittings shall meet the following standards:
 1. AWWA C 901-02, Standard for PE Pressure Pipe and Tubing, 0.5 in. through 3 in. for Water Service;
 2. AWWA C 906-99, Standard for PE Pressure Pipe and Fittings, 4-in. through 63 in. for Water Distribution and Transmission;
 3. ASTM D 3035-03a, Standard Specification for PE Plastic Pipe Based on Controlled Outside Diameter;
 4. ASTM D3350-02a, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials;
 5. NSF/ANSI 14-2003, Standard for Plastics Piping System Components and Related Material.

2.2 PIPE

A. PLASTIC PIPE

1. Polyethylene Pipe (PE)
 - a. Pipe
 - 1) Materials. Materials used for the manufacture of polyethylene pipe and fittings shall be PE 3608 (formerly PE 3408) high density polyethylene meeting cell classification 345464C for black or 345464E for stripes per ASTM D 3350; and shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade HDB rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.

- 2) Polyethylene pipe shall be manufactured in accordance with AWWA C901-02 for sizes 1-1/4" thru 3" IPS diameters and to the requirements of ASTM D3035. Pipe 4" and above DIPS and IPS sized shall be manufactured to the requirements of ASTM F714 and AWWA C906-07.
 - 3) Permanent identification of the piping service shall be provided by co-extruding color stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed on the pipe outside surface shall not be acceptable. IPS sized pipes shall have four equally spaced, longitudinal color stripes. DIPS sized pipes shall have three equally spaced pairs of longitudinal color stripes. The stripe color shall be green.
- b. Fittings
 - 1) All fittings and custom fabrications shall be pressure rated for the same internal pressure rating as the mating pipe.
 - 2) Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked.
 - 3) Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full-service pressure rating of the mating pipe.
 - c. Polyethylene Flange Adapters
 - 1) Flange adapters shall be made with enough through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing or restrain the gasket against blowout.
 - d. Back-up Rings and Flange Bolts
 - 1) Flange adapters shall be fitted with back-up rings pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.
2. PVC Pipe
 - a. PVC pipe shall SDR 21 PVC (Class 200) pipe and fittings shall conform to the latest revisions of ASTM D2241, CS 256-63 and the National Sanitation Foundation. Each pipe length shall be marked to include manufacturers name, nominal size, class pressure rating, PVC 1120, NSF Logo, and identification code. All pipe shall be of the same brand and manufacturer.
 - b. SDR 21 PVC pipe shall be Type 1, Grade 1, conforming to ASTM D1784 and having a working pressure as shown below at 73.4 °F based on a working fiber stress of 2,000 psi. Unless otherwise specified, all pipe shall conform to the following minimum requirements:

Table 1: IPS Pressure Pipe Specifications

Pipe Size (in)	Average O.D. (IN)	NOM I.D. (IN)	MIN T (IN)	MIN E (IN)	APPROX D ⁹ (IN)	APPROX WEIGHT (LBS/FT)
Rated 200 psi (SDR 21)* (G) (P)						
1.5	1.900	1.709	0.090	3.45	2.26	0.44
2	2.375	2.135	0.113	3.70	2.83	0.54
2.5	2.875	2.585	0.137	3.95	3.42	0.79
3	3.500	3.146	0.167	4.20	4.17	1.17
4	4.500	4.046	0.214	4.50	5.36	1.93
6	6.625	5.955	0.316	5.20	7.89	4.23
8	8.625	7.754	0.410	5.90	10.27	7.18
10	10.750	9.667	0.511	6.70	12.79	11.20
12	12.750	11.465	0.606	8.10	15.17	15.82

- c. Pipe markings shall include the following, marked continuously down the length: Manufacturer's Name; Nominal Size; Class Pressure Rating; PVC 1120; NSF Logo; and Identification Code.

2.3 GATE VALVES

- A. Gate Valves shall be AVK, non-rising stem, open left, resilient seat, designed for two hundred (200) pounds working pressure and shall conform to latest AWWA Specification No. C500-52, or latest revision. Valves shall be hub end, flange, mechanical joint, or inside pipe thread and cast-iron hand wheel, or operating nut, as specified on the plans or in the Form for bidders.

2.4 VALVE BOXES

- A. All valve boxes shall be standard slip joint 4-piece cast iron of the extension type suitable for a depth of cover over the pipeline as required by the backfill requirements at each valve. Each valve box shall be provided with a suitable cast iron base and cover. Covers shall have cast thereon an appropriate name designating the service for which the valve is to be used.

2.5 MJ ADAPTERS

- A. MJ Adapters 4" thru 16" may be provided with optional stainless-steel stiffener upon request. MJ Adapters 14" and above shall be provided with Heavy Duty Backup Ring Kits. All MJ adapters above 18" must be provided with stainless steel stiffeners.

2.6 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 ADOPTED PLACEMENT REQUIREMENTS

- A. The installation of SANITARY SEWERAGE FORCE MAIN PIPING shall comply with the current edition of the AHJ's Standard Specifications.

3.2 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 31 2300 Excavation and Fill.

3.3 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.4 PIPE JOINING

- A. ADOPTED JOINING REQUIREMENTS

- 1. Polyethylene Pipe fusion shall meet the following standards:
 - a. ASTM D 2657-03, Standard Practice for Heat Joining Polyolefin Pipe and Fittings;
 - b. ASTM D3261-03, Standard Specification for Butt Heat Fusion PE Plastic Fittings for PE Plastic Pipe and Tubing;
 - c. ASTM F1055-98e1, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

3.5 HEAT FUSION JOINING

- A. Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are in accordance with ASTM F2620. The CONSTRUCTION MANAGER shall ensure that persons making heat fusion joints have received training in the recommended procedure. The CONSTRUCTION MANAGER shall maintain records of trained personnel and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.
 - 1. Butt Fusion of Unlike Wall Thickness

- a. Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. SDR's for polyethylene pipe are 7.3, 9, 11, 13.5, 17, 21, 26, 32.5 and 41.
2. Heat Fusion Training Assistance
 - a. Upon request and at the requestor's expense, training personnel from the Distributor shall be made available.
- B. Joining by Other Means.
 1. Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.
 2. ID Stiffener and Restraint
 - a. A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.
- C. Branch Connections.
 1. Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe by heat fusion joining.

3.6 INSTALLATION

- A. General
 1. When delivered, a receiving inspection shall be performed, and any shipping damage shall be reported to the Manufacturer within 7 days. Installation shall be in accordance with ASTM D 2774, Manufacturer's recommendations, and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable safety codes and standards.
- B. Delivery and Handling of Materials
 1. All pipes shall be delivered in all respects sound and conformable to these specifications. Inspection by the Owner or its representative shall not relieve the CONSTRUCTION MANAGER or any of his obligations in this respect. Any defective pipe which may be passed by the Owner or its representatives at the work or elsewhere, shall always be liable to rejection when discovered until the final completion and adjustment of the contract. Care shall be taken in handling the pipe to avoid injury and no pipe or other material of any kind shall be placed in the pipes during transportation or at any other time.
 - a. Responsibility for Material Furnished by CONSTRUCTION MANAGER: The CONSTRUCTION MANAGER shall be responsible for all material furnished by him and he shall replace, at his own expense, all such material that is found to be defective in manufacture or that has become damaged in handling after delivery by the manufacturer.
 - b. Responsibility for Safe Storage: The CONSTRUCTION MANAGER shall be responsible for the safe storage of all materials intended for the work until such materials are incorporated in the completed project and accepted by the Owner.
 - c. Handling Pipe and Accessories: Pipe, fittings, specials, and other accessories shall be unloaded at the point of delivery hauled to and distributed at the site of the project by the CONSTRUCTION MANAGER and shall always be handled with extreme care to avoid damage thereto. The same to be hauled on equipment, equipped with pneumatic tires. Equipment, tools and methods used in unloading reloading, hauling, and laying pipe and accessories shall be such that no damage is done to the pipe. Hooks used for insertion in ends of pipe shall have broad, well-padded contact surfaces and shall be of such design and length that they will provide uniform support for a distance back from the end of the pipe of not less than one-third of the internal pipe diameter.
 - d. Where pipe is to be laid in front of or adjacent to business houses or manufacturing

establishments, or where homes have well-kept front yards, the pipe shall be delivered to the site of the work as the pipe is laid. Local storage of the pipe at the site of the work will not be permitted. By permission of the Engineer, twelve (12) joints of pipe may be allowed on the site of the work at any one time, but it is to be laid before stopping work at night, and all trench backfilling shall closely follow the pipe laying.

C. Placing Pipe in Trench

1. Proper equipment, implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the CONSTRUCTION MANAGER for the safe and convenient prosecution of the work. All pipe, fittings, hydrants and valves shall be carefully lowered into the pipe, or to the trench subgrade.

D. Alignment and Assembly of Pipe

1. Pipe shall be accurately installed to the alignment and profile indicated on the approved pipe installation drawings furnished for the purpose. Grades and elevations shall be determined by the pipe subgrade prepared as specified under Excavation and Backfill.
2. The maximum deflection in any pipe joint, made necessary by vertical and horizontal curves or offsets, shall not exceed the amount as recommended by the manufacturer of the pipe.
3. Laying all pipe shall be commenced as soon as possible after excavation is started and CONSTRUCTION MANAGER must use every means at his command to keep pipe laying up with the trenching. In no case shall more than 300 feet of ditch be opened at one time in advance of the pipe laid, without consent of the Engineer. Each joint of pipe shall be swabbed clean and lubricated before being lowered into the trench and must be so lowered and handled as to ensure the pipe is being placed in an undamaged condition. Pipe must be lowered and entered one joint at a time unless permission is given by the Engineer to join two or more pipes before same are laid. Valves, special casting, etc., shall be placed where shown on the plans unless their location is changed by the Engineer. Where necessary to cut pipes to place special castings, valves or for any other causes great care must be taken not to crack either piece of pipe and to mark out true and straight around the pipe. When pipe-laying is stopped at night or for any other causes or when special castings are left open for future connections, the CONSTRUCTION MANAGER shall close openings with iron or wood plug, lightly yarned into place to exclude dirt, water, small animals, etc. Pipe shall be so laid as to have a bearing for its entire length except at bells where holes shall be dug as specified. No pipe shall be laid when trench conditions or the weather are unsuitable, or laid in water, except by permission of the Engineer.

E. Separation of Water and Sewer Pipelines

1. Horizontal: Water and sewer mains shall be separated by at least ten (10) feet, measured inside edge to inside edge. In cases where this separation is unattainable, water and sewer mains may be closer if the sewer line is built equal to the water main and located in a separate trench or on an undisturbed earth shelf in accordance with DEQ Regulation 252:626-19-2.
2. Vertical: Water mains crossings sewer lines shall be laid at least twenty-four (24) inches above the top of the sewer, measured pipe to pipe. If water crossing above sewer is unattainable, the minimum vertical separation shall be twenty-four (24) inches and if the sewer main has non-resilient joints, lengths between joints less than ten (10) feet or shows evidence of damage or leakage, the sewer pipe shall be replaced with one full length of PVC or ductile water pipe with resilient joints sized to exactly match the existing pipe diameter in accordance with DEQ Regulation 252:626-19-2.
3. Crossings: In all cases where water and sewer mains or services cross, one full length of ductile iron water pipe [minimum 20-foot section] shall be centered on the crossing of the sanitary sewer line in accordance with DEQ Regulation 252:626-19-2.
4. Service Line Separation: Water and sewer services shall meet the horizontal separation requirements listed above, except where water and sewer services unavoidably must enter the building with less than 10-foot separation, the services shall diverge to achieve the required separation within 10 feet of the building wall. Water and sewer services crossing other services or mains shall meet the vertical separation requirements listed above, except PVC water pressure pipe (minimum 10-foot length) shall be used as encasement for sewer services crossing above water pipelines. Sewer services may also be laid between 18 inches and 12 inches below water mains or services if the sewer service is similarly encased in accordance with DEQ Regulation 252:626-19-2.

F. Bury Depth

1. Where the drawings do not show a profile grade the cover on the pipe shall be three (3-ft) feet below the top of the curb or where there is no curb three (3-ft) feet below the established grade of the center line of the surface. The minimum cover on the pipe shall be not less than three and one-half

(3½-ft) feet at ditch crossings.

G. Foundation & Bedding

1. Pipe shall be laid on grade and on a stable foundation. Unstable trench bottom soils shall be removed, and a 6-in foundation or bedding of compacted granular material shall be installed to pipe bottom grade. Excess groundwater shall be removed from the trench before laying the foundation or bedding for the pipe. A trench cut in rock or stony soil shall be excavated to 6-in below pipe bottom grade and brought back to grade with compacted granular bedding. All ledge rock, boulders and large stones shall be removed.

H. Pipe Handling

1. When lifting with slings, only wide fabric choker slings capable of safely carrying the load shall be used to lift, move, or lower pipe and fittings. Wire rope and chain are prohibited. Slings shall be of sufficient capacity for the load and shall be inspected before use. Worn or damaged equipment shall not be used.

I. Large Diameter Fabricated Fittings

1. One plain-end connection of 16-inch IPS and larger fabricated directional fittings (elbows, tees, etc.) shall be butt fused to the end of a pipe length. The remaining fitting connections shall be made in the trench using butt fusion, flange or other connection means in accordance with 3.2. Flange and other mechanical connections shall be assembled and tightened in accordance with the connection manufacturer's instructions and 4.4. Handling, lifting, moving or lowering a 16-inch IPS or larger fabricated fitting that is connected to more than one pipe length is prohibited. The installing contractor at his expense shall correct fitting damage caused by such improper handling.

J. Mechanical Joint & Flange Installation

1. Mechanical joint and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. MJ Adapters and flanges shall be centered and aligned to the mating component before assembling and tightening bolts. In no case shall MJ gland or flange bolts be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers should be used under the nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be as recommended by the Manufacturer.

K. Backfilling

1. Embedment material soil type and particle size shall be in accordance with ASTM D 2774. Embedment shall be placed and compacted to at least 90% Standard Proctor Density in 6-inch lifts to at least 6-inches above the pipe crown. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe spring line are filled and free of voids.

L. Protection against shear and bending loads

1. In accordance with ASTM D 2774, connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls. The area surrounding the connection shall be embedded in properly placed, compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads.

M. Warning Tape

1. Install warning tape directly above utilities, 12-in below finished grade, except 6-in below subgrade under pavements and slabs.

N. Final Backfilling

1. Final backfill shall be placed and compacted to finished grade. Native soils may be used provided the soil is free of debris, stones, boulders, clumps, frozen clods or the like larger than 8-in in their largest dimension.

3.7 TESTING

A. Fusion Quality

1. The CONSTRUCTION MANAGER shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the CONSTRUCTION MANAGER's fusion operator while on site. Upon request by the Owner, the CONSTRUCTION MANAGER shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps shall be cut out and bent strap tested in accordance with ASTM F2620. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The CONSTRUCTION MANAGER at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions. Testing of large diameter fusion (>12-in) may require special equipment and safety precautions.

B. Leak Testing

1. Hydrostatic testing of completed lines shall be performed in accordance with the current edition of AWWA C605.
2. Coordinate leak testing operations with Owner's construction inspector.
3. The hydrostatic test pressure shall not be less than 1.25 times the maximum anticipated sustained working pressure at the highest point along the test section unless the pressure exceeds the design pressure limit for any pipe, thrust restraint, valve fitting, or other appurtenance of the test section. In no case shall the test pressure exceed the design pressure limit for any pipe, thrust restraint, valve, fitting, or other appurtenance of the test section.
4. All pipelines shall be tested by means of hydrostatic pressure of not less than the pressure rating of the pipe. If test plugs are used, they shall be furnished and installed by the Contractor at his own expense, together with all necessary anchors, braces and other devices necessary to withstand the hydrostatic pressure on such plug or plugs without placing any hydraulic thrust on the pipeline or any part thereof. The Contractor shall be solely responsible for any and all damage to the pipeline and public and private property which might be caused by the failure of such test plugs or supports incidental thereto. The allowable leakage is 10 gallons per inch of pipe diameter per mile of pipe per 24 hours at 150 psi testing pressure.
5. After the section of line to be tested has been filled with water, the specified test pressure shall be applied by means of a force pump of such design and capacity that such pressure can be applied and maintained for the duration of the test period, which shall be not less than two (2) hours for 24" and smaller pipe; and not less than six (6) hours for 30" and larger diameter pipe.
6. All water supplied to the line after the initial filling thereof shall be metered by means of a tested water meter approved by the Engineer.
7. Any and all leaks on the line or lines constructed under this contract, which appear during the specified hydrostatic test or at any subsequent time before final acceptance of the whole works, shall be located and repaired by and at the expense of the CONSTRUCTION MANAGER.

END OF SECTION

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**SECTION 33 4000
STORM DRAINAGE UTILITIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for STORM DRAINAGE UTILITIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for STORM DRAINAGE UTILITIES shall be included in the bid prices for the work.

1.3 SECTION INCLUDES

- A. Storm Drainage Utility Piping
- B. Storm Drainage Manholes, Frames, and Covers
- C. Storm Drainage Inlets and Structures

1.4 RELATED SECTIONS

- A. 31 23 00 Excavation and Fill
- A. 32 13 00 Rigid Paving
- B. 01 81 13 Sustainable Design Requirements: Action and Informational Submittals
 - 1. This project is pursuing LEED Healthcare v4: Silver Certification.
 - 2. Refer to this section for additional, required LEED submittals not included in this specification section.

1.5 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
 - 1. City of Tahlequah

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pipe
 - 2. Manholes and Inlets
 - 3. Manholes Rings and Covers
 - 4. Fittings
 - 5. Clean-outs
- B. Field quality-control test reports.

1.7 INFORMATIONAL SUBMITTALS

- A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.8 QUALITY ASSURANCE

- A. PRECONSTRUCTION CONFERENCE
 - 1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ARCHITECT one week (7 days) prior to the date of the meeting.
- B. REGULATORY REQUIREMENTS
 - 1. All materials and methods shall comply with the requirements of the AHJ.
 - 2. If the AHJ has not adopted specifications for materials and methods, the current edition of the City of Oklahoma City's Standard Specifications for Construction of Public Improvements shall be used.

1.9 TOPOGRAPHIC SURVEY

- A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.10 EXISTING BUILDING, STRUCTURE, AND UTILITY PROTECTION

- A. All existing buildings, structures, pavements, improvements, and utilities designated to remain or not designated to be removed shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes near existing buildings, structures, pavements, improvements, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipelines or other obstructions, CONSTRUCTION MANAGER shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONSTRUCTION MANAGER shall be liable for damage to any buildings, structures, pavements, improvements, and utilities resulting from the CONSTRUCTION MANAGER's operations. During construction, all fire hydrants, valve boxes, traffic signals, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

1.11 UNDERGROUND UTILITIES

- A. CONSTRUCTION MANAGER shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ARCHITECT, ENGINEER, and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ARCHITECT, ENGINEER, and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ARCHITECT, ENGINEER, and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.
- C. CONSTRUCTION MANAGER shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.
- D. CONSTRUCTION MANAGER shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

- A. Do not commence work until temporary erosion and sedimentation control measures are in place.
- B. CONSTRUCTION MANAGER shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ARCHITECT before commencing work. The ARCHITECT or his representative will in no case assume the responsibility for laying out the work.
- C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ARCHITECT. If approval is secured, CONSTRUCTION MANAGER remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDITIONS

- A. TRAFFIC
 - 1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
 - 2. CONSTRUCTION MANAGER shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
 - 3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONSTRUCTION MANAGER shall establish all detour routes while streets are closed during construction. CONSTRUCTION MANAGER shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.

4. CONSTRUCTION MANAGER is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.
- B. UTILITY INTERRUPTIONS
1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ARCHITECT one week (7 days) in advance of proposed interruption of utility.
- C. SUBSURFACE CONDITIONS
1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
- D. EXCAVATION AND TRENCH SAFETY SYSTEMS
1. CONSTRUCTION MANAGER shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONSTRUCTION MANAGER is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONSTRUCTION MANAGER shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

- A. If CONSTRUCTION MANAGER encounters a Hazardous Environmental Condition or if CONSTRUCTION MANAGER or anyone for whom CONSTRUCTION MANAGER is responsible creates a Hazardous Environmental Condition, CONSTRUCTION MANAGER shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ARCHITECT (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.1 POLYPROPYLENE PIPE

- A. Pipe
1. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4, ASTM F2881, Section 5 and AASHTO M330, Section 6.1, for the respective diameters.
 2. 12-inch through 30-inch pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M330.
 3. 36-inch through 60-inch pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.
- B. Pipe Joints
1. Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.
 2. 12-inch through 60-inch shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
 3. 12-inch through 60-inch diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.

C. Fittings

1. Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

2.2 CORRUGATED POLYETHYLENE PIPE

A. Pipe

1. Virgin material for pipe and fitting production shall be high-density polyethylene conforming with the minimum requirements of cell classification 424420C for 4-inch through 10-inch diameters, and 435400C for 12-inch through 24-inch diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12-inch through 24-inch virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306 respectively. Bells shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified coupler. The pipe stock used to manufacture the bell-bell coupler shall meet the performance requirements for fabricated fittings as specified in ASTM D3034.
2. Pipe shall have a smooth interior and annular exterior corrugations.
3. 4-inch through 10-inch shall meet AASHTO M252.
4. 12-inch through 24-inch shall meet AASHTO M294, Type S or ASTM F2306.

B. Pipe Joints

1. Pipe joints shall meet the requirements of AASHTO M252, M294 or ASTM F2306. The 4-inch through 24-inch pipe shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. Bells shall be bell-bell couplers manufactured from PVC. Bell-bell couplers shall be installed on one side by the manufacturer.

C. Fittings

1. Fittings shall conform to AASHTO M252, M294 or ASTM F2306. Fabricated fittings shall be welded at all accessible interior and exterior junctions.

2.3 REINFORCED CONCRETE PIPE (RCP)

A. Pipe

1. Round pipe shall meet the requirements of ASTM C76/AASHTO M170, ASTM C361, and AWWA C302.
2. Arch pipe shall meet the requirements of ASTM C506/AASHTO M259.
3. Elliptical pipe shall meet the requirements of ASTM C507/AASHTO M207.

B. Pipe Joints

1. Joints for round pipe shall meet the requirements of ASTM C443/AASHTO M315.
2. Joints for arch pipe shall meet the requirements of ASTM C990.

2.4 CORRUGATED METAL PIPE (CMP)

A. Steel Pipe and Fittings (Type I Round, Type II Arch)

1. Metallic coated corrugated steel culverts: AASHTO M36, Type I Round, Type II Arch, with fittings of similar form and construction as pipe.
 - a. Zinc coated (galvanized) sheet steel: AASHTO M218
 - b. Aluminum coated (Type II) hot-dipped sheet steel: AASHTO M274
2. Externally coated or clad culverts
 - a. Bituminous coated corrugated metal culvert pipe and pipe arches: Type A per AASHTO M190
 - b. Pre-coated corrugated steel culverts: AASHTO M245
3. Connecting bands shall be corrugated steel with O-ring seals.

2.5 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. SOLID WALL PVC - All solid wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below or as modified herein.
1. ASTM D-3034
 - a. Standard Specification for "Type PSM Poly (Vinyl Chloride) (VC) Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from four (4") inches to fifteen (15") inches in diameter.
 - b. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C or 12364-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM D-1784.
 - c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212.
 2. ASTM F-679
 - a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from eighteen (18") inches to thirty-six (36") inches in diameter.
 - b. The pipe and fitting materials shall be made of PVC plastic having a minimum cell classification of 12364-C or 12454-C as defined in ASTM D-1784. Homopolymer PVC compounds must equal or exceed the requirements of the above listed minimum cell classification number.
 - c. Integral Bell Gasket Joint shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212.
 3. ASTM F-789
 - a. Standard Specification for "Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from four (4") inches to eighteen (18") inches in diameter.
 - b. The pipe shall be made of PVC plastic having a minimum cell classification of 12164-B as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-C or 13343-C as defined in ASTM D-1784.
 - c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212. Joints shall also be compatible to ASTM D-3034 joint dimensions.
- B. PROFILE WALL (PVC) - All profile (open or closed) wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below and modified herein. Regardless of size, open profile wall pipes will be allowed only on sections of pipe when there are no apparent service connections. Otherwise, open profile wall pipe will not be allowed.
1. ASTM F-794
 - a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from twelve (12") inches to forty-eight (48") inches in diameter.
 - b. The pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B or 12364-C as defined in ASTM D-1784.
 - c. Gasketed Joint Systems shall be used. The integral bell gasketed joint, coupling or fitting joints shall be designed so that when assembled, the gasket will be compressed radially on the pipe spigot or in the bell to form a watertight seal. The joints shall be designed to comply with and show no leakage when tested in accordance with ASTM D-3212.
 - d. Closed profile PVC pipes manufactured with a gasketed joint coupling system, with no bell and spigot, may be used for slip-lining installations.
 - e. Couplings shall form a watertight seal when assembled with plain end pipe and show no sign of leakage when tested in accordance with ASTM D-3212.
 2. ASTM F-949

- a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings". Pipe and fittings shall have a minimum stiffness of fifty (50 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from twelve (12") inches to thirty-six (36") inches in diameter.
 - b. The pipe shall be made of PVC plastic having a minimum cell classification 12454-B or 12454-C as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12464-B, 12464-C, or 13343-C as defined in ASTM D-1784.
 - c. Elastomeric Gasketed Joints shall be used to provide watertight seal and shall meet the requirements of ASTM D-3212.
- C. SPECIAL PVC PIPE - Special PVC pipe and fittings shall conform to the requirements of the appropriate standards listed below or as modified herein.
 - 1. ASTM D-2241
 - a. Standard Specifications for Polyvinyl Chloride (PVC) Pressure-rated Pipe (SDR Series). Pipe and fittings shall have a minimum SDR of thirty-two and one-half (32-1/2) and may be supplied in sizes ranging from four (4) inches to thirty-six (36) inches in diameter.
 - b. The pipe and fittings shall be made of PVC compounds having a cell classification of 12454-B, 12454-C, or 14333-D as defined in ASTM D-1784.
 - c. Elastomeric gasketed joints meeting the requirements of ASTM D-3212 shall be used to provide a watertight seal.
 - 2. AWWA C-900 and AWWA C-905
 - a. Standards for PVC Pressure Pipe from four (4") inches through twelve (12") inches, and fourteen (14") inches through thirty-six (36") inches, respectively. Pipes shall have a minimum DR rating of eighteen (18) for diameters four (4") inches through twelve (12") inches. For pipes greater than twelve (12") inches in diameter, the minimum DR shall be thirty-two and one-half (32 1/2).
 - b. The pipe and fittings shall be made of PVC compounds having a cell classification of 12454-A or 12454-B as defined in ASTM D-1784.
 - c. Elastomeric gasketed joints meeting the requirements of ASTM D-3139, when measured in accordance with ASTM-2122, shall be used to provide a watertight seal.

2.6 BACKWATER VALVES

- A. Cast-Iron Backwater Valves:
 - 1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
 - 2. Horizontal type; with swing check valve and hub-and-spigot ends.
 - 3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
 - 4. Terminal type; with bronze seat, swing check valve, and hub inlet.
- B. Plastic Backwater Valves:
 - 1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.7 CLEANOUTS

- A. Cast-iron Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements.
 - 2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 - 3. Top-Loading Classification(s): Heavy Duty.
 - 4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.8 PVC CLEANOUTS:

- A. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.9 MANHOLES AND JUNCTION BOXES

- A. Standard Precast Concrete Manholes:
 - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant

- joints.
2. All concrete for manhole and base shall be Class A concrete with a minimum compressive strength of 4,000 psi.
 3. Diameter: 48 inches minimum.
 4. Wall Thickness:
 - a. The minimum wall thickness shall not less than 5-in and shall not be less than one-twelfth (1/12) of the internal diameter of the largest cone or riser.
 - b. Manholes with 60-in and 48-in diameters shall have a 5-inch minimum thickness, and lengths to provide depth indicated.
 - c. Manholes with 72-in diameters shall have a 6-inch minimum thickness, and lengths to provide depth indicated.
 - d. Manholes with 84-in diameters shall have a 7-inch minimum thickness, and lengths to provide depth indicated.
 - e. Manholes with 96-in diameters shall have an 8-inch minimum thickness, and lengths to provide depth indicated.
 5. Base section shall have a 9-inch minimum floor slab thickness. Floor slab shall be integral with base section. Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
 6. Provided riser sections as needed to achieve the required manhole depth.
 7. Top section shall be eccentric-cone type unless flat-slab-top type is indicated, and top of cone of size that matches grade rings.
 8. Joint sealant shall meet ASTM C 990, bitumen or butyl rubber.
 9. Pipe connectors shall be resilient pipe connectors per ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 10. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 11. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
 12. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.
- B. Designed Precast Concrete Manholes:
1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
 2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
 3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 5. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
 7. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.
- C. Frames and Covers
1. Manhole frames and covers shall be to the dimensions and specifications of the jurisdictional utility standards.

2.10 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 2 percent through manhole.
 - 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 8 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 4000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

2.11 CONCRETE CHANNELS, SWALES, AND FLUMES

- A. The materials and execution for concrete channels, swales, and flumes shall per the requirements of 32 1300 Rigid Paving.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 31 2300 Excavation and Fill.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping with 36-inch minimum cover.
 - 2. Install corrugated steel piping according to ASTM A 798.
 - 3. Install corrugated aluminum piping according to ASTM B 788.
 - 4. Install PE corrugated sewer piping according to ASTM D 2321.
 - 5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 6. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join corrugated steel sewer piping according to ASTM A 798.
2. Join corrugated aluminum sewer piping according to ASTM B 788.
3. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
4. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
5. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
6. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
7. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.4 BACKWATER VALVE INSTALLATION

- A. Install horizontal-type backwater valves in piping where indicated.
- B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.
- C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 1. Use Light-Duty, top-loading classification cleanouts in earth areas.
 2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in cast-in-place concrete block, 18-inch by 18-inch by 12-inch deep.
- C. Set cleanout frames and covers in earth areas with tops 1-inch above surrounding earth grade.
- D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
 1. Use Light-Duty, top-loading classification drains in earth areas.
 2. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
- B. Embed drains in 4-inch minimum concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.

3.7 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3-inch above finished surface elsewhere unless otherwise indicated.

3.8 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.9 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

3.10 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.11 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains.
- B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured fittings for piping branch connections. Remove section of existing pipe; install fitting into existing piping; and encase entire fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 10. Remove section of existing pipe, install fitting into existing piping, and encase entire fitting with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections to manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.12 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Removing Piping
 1. Pipe indicated to be removed shall be excavated and removed from the project site and legally disposed according to City, State, and Federal regulations.
 2. Backfill trench and voids according to 31 2300 Excavation and Fill.
- B. Abandoned Piping
 1. Pipe indicated to be abandoned in place shall be filled with Portland Cement grout having a minimum twenty-eight (28) day compressive strength of five hundred pounds per square inch (500 psi).
- C. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 1. Remove manhole or structure and close open ends of remaining piping.
 2. Remove top of manhole or structure down to at least 48 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
 3. Backfill to grade according to 31 23 00 Excavation and Fill.

3.13 IDENTIFICATION

- A. Materials and their installation are specified in 31 23 00 Excavation and Fill. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.14 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect at completion of Project.
 1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 4. Re-inspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for

leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
 - b. Test plastic piping according to ASTM F 1417.
 - c. Test concrete piping according to ASTM C 924.
- C. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.15 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION