# SECTION 270640
# CATV DISTRIBUTION SYSTEM

## 1. SCOPE OF WORK

A. Furnishing of all labor, project management, materials, tools, equipment necessary for the complete installation of a CATV Distribution System as shown on the plans and as herein specified.

B. The Electrical Contractor shall provide conduit systems from box to cable tray and mount all boxes for the Systems wiring. The Systems supplier shall provide special boxes for installation by the Electrical Contractor.

C. It is the intent of these specifications and the accompanying plans that the Contractor furnishes and installs a system complete in every respect and ready to operate. All miscellaneous items and accessories required for such installation, whether or not each such item or accessory as shown on the plans or mentioned in these specifications, shall be furnished and installed.

D. It shall be the responsibility of each bidder to examine the site, plans and specifications carefully before submitting his bid, with particular attention to errors, omissions and conflicts between city ordinances, plans and specifications. Any such discrepancy discovered shall be brought to the attention of the Engineer and will be included in the Base Bid.

E. Intentional or unintentional painting of exposed low voltage or line voltage cabling is prohibited. The contractor shall ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades. The contractor shall review the painting requirements for all disciplines and shall provide cabling protection as required. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, the contractor shall provide alternate options for cable colors and shall provide submittals for such cabling to engineer for approval.

F. SUBMITTALS

(1) Provide complete brochure information on all components and accessory equipment with the bid documents. All information shall be clearly marked to indicate items provided.

(2) Contractors wishing to propose systems which differ in any features, functions or operating characteristics other than those outlined in these specifications must do so in writing to the specifying authority at least ten (10) days prior to bid opening. Proposals must include detailed information showing all deviations from the system as specified. Final approval of the alternate system shall be based on the decision of the Owner.

G. REGULATORY LISTING

(1) UL LISTING

All Material and equipment shall be listed, labeled, or certified by Underwriters Laboratories, Inc. The Intercom/paging system shall be UL813 listed as a complete system. All power supplied and computers shall be UL listed. Provide UL listing cards for all components specified herein.

H. MANUFACTURER

The equipment specified herein is that of Blonder Tongue, Peerless, Zenith and Precision Industries Incorporated. These manufacturers constitute the quality of design and construction, operational characteristics, appearance standards, space requirements and field service staffing levels required to comply with the requirements of the specification.

2. PRODUCTS, PERFORMANCE CRITERIA

A. The system shall comply with the radiation limitations as set forth under Part 15 as amended of the FCC Rules.

B. All equipment shall be designed and rated for 110 volt, 60 cp's AC operation and shall be UL rated for 24-hour day continuous operation.

C. The system shall have a signal to noise ratio of 43 dB or greater.

D. The overall system frequency response shall be flat to +/- 1 1/2 dB across the 6-megacycle bandwidth of any television channel.

E. The overall system shall have a voltage standing wave ratio of 1.2 to 1 or less.

F. The design and installation of the system shall be such that extensions, additions, or modifications will be possible without altering the system requirement of a voltage standing wave ratio of 1.2 or less.

G. The signal at any output shall not be less than 1000 microvolts or more than 10,000 microvolts into 75 ohms, except that in areas where direct pickup is possible, the signal shall not be less than 3000 microvolts. The signal at each outlet shall equal or exceed in quality the signal available from the Cable TV Company and shall be within 15 dB of same signal at any other outlet of the system.

H. Extraneous signal pickup shall be at least 50 dB down from desired normal minimum signal level.

I. Isolation between outputs and outlets shall not be less than 24 dB.

J. Upon completion of the system installation it shall be the responsibility of the Contractor to perform the necessary adjustments and balancing of all signals and amplifier level controls to insure proper system operation.

K. Each cable feeder line shall be inspected for proper termination.

L. Signal-to-noise test shall employ a Jerrold Model 727 field strength or equivalent. Measurements shall be made at the output of the last amplifier in the system. With the normal levels in the system the field strength meter shall be tuned to the picture carrier of each channel in turn and the reading obtained on the meter noted. The signal shall then be removed and the input of the head end amplifier shall be terminated in 75 ohms. With the field strength meter read the level of remaining noise in the absence of the signal and add a meter correction factor of 4 dB to the reading. The difference between the two readings will give the system's signal-to-noise ratio, and shall not be less than 43 dB.

M. No visible components of cross channel intermodulation ghosting or beat interference shall appear on the screen of a receiver turned to any normal signal.

N. Should such a demonstration of performance show that the Contractor has not properly balanced the system and that picture degradation is present or that output gain is not as specified, the Contractor shall make all necessary changes or adjustments and a second performance demonstration will be arranged at no cost to the Owner.

3. EQUIPMENT

A. DISTRIBUTION AMPLIFIERS

(1) The distribution amplifiers shall be a 19" rack mount, completely solid-state unit for the amplification of TV channels 2-61. Output level for each channel shall be +46dbmV minimum with no visible distortion.

(2) Amplifier gain controls shall be provided with minimum of 15db control range. Typical amplifier gain shall be 51db.

(3) The distribution system shall contain built-in regulated power supply to prevent change in output capability, and output level with changes in A-C line voltage of 117 VAC. Systems without regulated power supplies shall not be accepted.

(4) Amplifier shall be a Blonder-Tongue, RMDA 450-50.

B. SPLITTERS

(1) "2" way line splitters shall have a flat frequency response over the entire operating band from 500 to 600 MHz. The unit shall be of the hybrid design with a 75-ohm match of 17.0 dB RL minimum on all inputs and outputs. Output isolation shall be not less than 27.0 dB.

(2) "4" way line splitters shall have a flat frequency response over the entire operating band from 500-600 MHz minimum on all input and outputs. Output isolation shall be not less than 27.0 dB.

(3) Splitters shall be Blonder-Tongue Model CRS-2 and CRS-4.

C. CABLES

(1) Each reel of coaxial cable used in the system shall be sweep tested for transmission and structural return loss and be so certified in writing by the cable manufacturer. Transmission sweep tests shall establish conformance to guaranteed loss value from 20-108 MHz 174-216 MHz and 470-890 MHz. Structural return loss tests by sweep method shall show a minimum return loss of 26 dB RL VHF, 16 dB RL UHF, as compared to a fixed 75-ohm reference from 20-108 MHz 174-216 MHz and from 470-890 MHz.

(2) Coaxial cables shall be run in continuous lengths except for terminations and no splices shall be permitted in any conduit run. Cables shall be installed to avoid sharp bends or physical distortion.

(3) All cables terminating at amplifiers or splitters shall be tagged as to function and destination.

(4) The coax cable to rooms shall be plenum ratedRG-6/U coaxial cable with the following properties:

a. Nominal impedance: 75 ohms

b. Minimum center conductor size: 22 AWG solid
c. DC resistance maximum: 50 ohms/M
d. Nominal capacitance: 19 pF/ft + or 1 15%
e. Shield coverage minimum: 95%
f. Minimum number of shields: 2
g. Dielectric jacket type: plenum rated
h. Nominal velocity of propagation: greater than 70%
i. 100% sweep tested 5 - 500 MHz

(5) All trunk cable shall be plenum rated RG-11U type.

D. DIRECTION TAPOFFS

(1) All 1,2, or 4 tapoffs shall have a frequency range of 5 to 600 MHz.

(2) All tapoffs must meet all CATV and SMATV requirements for RF shielding.

(3) A variety of isolation valves shall be available to balance all signal levels.

(4) Tapoffs shall be equal to Blonder Tongue CRT series.

E. AGILE CHANNEL PROCESSORS

Provide agile heterodyne processors to convert any cable channel in the 50 to 80t MHz frequency range to any channel in the 50 to 550 MHz frequency range. Each unit shall have synthesized frequency control, with a tuning increment of 250 kHz. Frequency selection is accomplished via front panel DIP switches. The unit shall have an output level of +40dBmV. Channel selection shall be as directed by the Owner. The unit shall be equal to a Blonder Tongue model AP-40-550. Provide 12 units for this project.

F. CHANNEL MODULATORS

The channel modulators shall be part of modular headend system. The rack chassis shall have positions for up to 12 modulator or demodulator modules. The chassis shall be equal to Blonder Tongue MIRC-12 chassis with MIPS-12 power supply. The channelized, heterodyne audio/video modulator shall be able to provide an audio and video modulated RF carrier output on any single VHF channel in the 54 to 400 MHz range. The output level shall be +38 dBmV. Channel selection shall be as directed by the Owner. The unit shall be equal to Blonder Tongue model MICM. Provide 12 modules for this project.

G. PASSIVE COMBINERS

Provide passive combiners to combine the outputs of multiple modulators and Processors. These units shall feature high isolation between ports and a low net combining loss from each of the broadband inputs the unit shall be equivalent to Blonder Tongue model OC-12D. Provide units as required to accommodate the total number of channels for this project.

H. EQUIPMENT HOUSING

Provide all cable TV headend equipment in paging/intercom rack. Provide two 120VAC, 20 Amp power circuits in equipment housing for headend equipment.

I. SURGE PROTECTION

Provide a Ditek DT6F or equivalent surge protector and 1 3≅ conduit with coax as noted on drawings from headend to KET satellite dish location.

J. The Contractor shall provide three 4-head Hi-Fi Sony VCR's and three Sony DVD Players.

4. EXECUTION

A. INSTALLATION

(1) Install cable in conduit or cable tray, which is provided by the Electrical Contractor.

(2) All penetrations in smoke or firewalls shall be sealed with fire stop rated for this purpose.

(3) Provide for adequate ventilation in all equipment racks and take precautions to prevent electromagnetic or electrostatic hum. The installation of all work shall be neat and of professional quality. Cooperate with other trades in order to achieve well-coordinated progress and satisfactory final results. Execute without claim for extra payment minor moves or changes in equipment locations to accommodate equipment of other trades or the architectural symmetry of the facility.

B. WIRING

It shall be the responsibility of the Contractor to furnish and install all plenum rated cable as required to provide a complete and operable system. Cable shall be properly supported above ceilings.

C. TESTING

(1) Upon completion of the installation, the system must be tested by the manufacturer's representative and all necessary modifications and/or adjustments must be made to assure compliance with this specification.
(2) All final signal dB levels of TV outlets and amplifier inputs and outputs shall be shown on as built drawings.

D. CERTIFICATION

Upon completion of the testing, the manufacturer or representative shall issue to the Owner a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed and free of defects, and that the system is in compliance with this specification.

E. INSTRUCTION

The work shall include supplying the services of a field service representative who shall be a full-time employee. The field service representative shall have specialized experience in the operation and maintenance of the system and shall instruct the Owner's personnel in the techniques involved in the operation of the systems. A formal on-site training shall be provided by the Contractor to the owner's

representative/maintenance personnel and shall include instructions in the location, inspection, maintenance, testing and operation of all components. Provide a signed copy of the name of the personnel giving the instructions and the personnel of the Owner.

F. DIAGRAMS, DRAWINGS AND INSTRUCTION MANUALS

Furnish bound instruction manuals for the complete system for the Owner's use. Manuals shall include instructions, block and schematic diagrams, wiring diagrams, specification and technical data of the components and "as-built" drawings of the completed system.

G. WARRANTY, SERVICE AND MAINTENANCE

Provide a one-year warranty of the installed system, against defects in material and workmanship. If any defects are found within the warranty period, the defective equipment shall be replaced at no extra charge to Owner for parts or labor.

END OF SECTION

# SECTION 275100
# PAGING AND INTERCOM

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The General Provisions of a Contract, including conditions of the Contract and Division 1 of the Specifications, shall apply to the Work in this Section.

B. Drawings and general provisions of the Contract, including all portions of the Project Manual are hereby made a part of this Section. Refer to paragraph titled "Quality Assurance" in this section and to Division 1 for requirements for Communications Subcontractors. Throughout this and related Sections, "Subcontractor" shall not be limited to the singular and masculine and shall refer to one, or more than one, Communications Subcontractor. The Terms "Communications Subcontractor" and "Communications System Integrator " shall be used interchangeably and shall be understood to represent the bidder responsible for all work of this identified in this SECTION. The "Communications Subcontractor" or "Communications System Integrator", being one in the same shall be an authorized dealer of the product submitted for approval. Proof of authorization must be provided by the manufacturer and authorization must be shown to have been in place prior to the bid date of this project.

### 1.2 SUMMARY

A. Work Included. The scope of work of this Section consists of the designing, installation, and programming of all materials to be furnished under this SECTION, and without limiting the generality thereof, consists of providing all labor, materials, equipment, plant, transportation, appurtenances and services necessary and/or incidental to properly complete all work as shown on the drawings, as described in the specifications, or as reasonable inferred from either or, in the opinion of the Architect and Owner, as being required and in general, is as follows:

1. Public Address System, including but not limited to:

   a. Public address system amplifiers, zone controls, back boxes, and all equipment, cabling and support required to interface the Public Address System to the Owner's Telephone System (Not included in this contract).
   b. Public Address System Speakers, ceiling mounted, wall mounted horn, both interior and exterior.
   c. Cabling to support the Public Address System (NOTE: any category 5/6 cable must conform with owner guidelines. Coordinate with owner prior to submission for approval)
   d. Equipment rack or cabinet
   e. Volume attenuators where shown on the drawings to adjust the PA speaker sound level.
   f. Master and Secondary Clock System, clocks and cabling. Elapsed time indicator control panels where shown on the drawings.
   g. PA override signal to local sound systems. Coordinate with 27 40 00 contractor.
   h. Messaging calendar clock capable of receiving and scrolling up to 64 character custom messages without affecting or replacing display of time segments.
   i. Interactive Graphical User Interface (IGUI) to intercom functions including zone or all page, answering intercom call-ins, selecting and distributing program sources to

j. predefined zones or all zones and facilitating single action activation of multiple system interface e.g. access control and CCTV or other systems as directed by owner.

B. Actual control room and rack layouts will be based upon the specific designs submitted by the contractors. Needs for equipment, specific speakers, etc. will be dependent on actual product manufacturers. Contractors shall coordinate room layout, actual speaker and equipment placement and programming options with owner prior to installation.

1.3 SECTION INCLUDES

A. Central processor assembly

B. Administrative Control Console(s) with IGUI as shown on plans

C. 4" digital calendar clocks and 2.5" Digital clocks as noted on the drawings.

D. Digital Readout units

E. Bell/Class change signaling system.

F. Public Address/intercom System

G. Controls, Amplifiers, and Terminal Equipment

H. Power Supplies

I. Battery Backup for System Programming

J. Program Distribution System.

K. Master Clock System

L. Telephone controlled intercom system

M. Interactive Graphical User Interface (IGUI)

N. Programmable, individual control of inputs and outputs

O. Ceiling/Wall Mounted loudspeaker assemblies

P. Surface and flush clocks and clock and loudspeaker baffles

Q. Accessories

R. Wiring

S. Rack mounted networked PC/server and windows based PC for admin use.

T. Interior and Exterior Enclosed Horn Type PA Speakers

U. Speaker volume attenuators where shown on the drawings.

1.4 RELATED SECTIONS

A. Field Painting: DIVISION "FINISHES"

C. Electrical: DIVISION 26 00 00

D. All Communication Sections, 27 and 28.

1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00- SUBMITTAL PROCEDURES:

B. Product Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder. Ensure submittal is tabulated with index referencing the specification sections. Non tabulated and indexed submittal shall be returned without action.

C. Alternate systems being submitted for this bid shall provide a tabulation specification clearly comparing the submitted item with the specified item, being able to refer to all written expressed functions and capabilities. Specification sheets shall be submitted on all items including cable types.

D. Shop drawings, detailing the communications network system including, but not limited to, the following:

E. Built-in station arrangement.

F. Equipment cabinet arrangement

G. Wiring diagrams, detailing wiring for power, signal, and control, differentiating clearly between manufacturer's installed wiring and field installed wiring. Identify terminals to facilitate installation, operation and maintenance.

H. Submit wiring diagrams showing typical connections for all equipment.

I. Provide a riser diagram for the system showing in technically accurate detail all connections, interconnections, and all provisions available and made for adaptability of all specified future functions and including all calculations, charts, and test data necessary to demonstrate that all systems and system components deliver the specified signals, grades, and levels at all required points and locations.

J. Submit a valid certificate from the manufacturer indicating the distributed communications network system bidder is an authorized distributor for the system (or systems) being submitted.

K. Submit a valid certificate of completion of installation and service training from the communications network system (or systems) manufacturer by a present employee of the systems integrator/contractor.

L. As-built drawings: 3 sets. They should include up-to-date drawings that include any changes made to the system during installation. Circuit diagrams and other information necessary for the proper operation and maintenance of the system shall be included. Drawings must be provided on CD in AutoCAD 2000 format.

M. All material and/or equipment necessary for the proper operation of the system, even though not specifically mentioned in the contract documents, shall be deemed part of this contract.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section for "Closeout Submittals".

B. Include operator instructions for each required mode of operation, routine troubleshooting procedures, manufacturer's operation and maintenance manual for each item of equipment and accessory, and routine cleaning methods and materials.

1.7 DELIVERY, STORAGE AND HANDLING:

A. Deliver products in factory containers. Store in clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.8 QUALITY ASSURANCE

A. To establish continuity in manufacturer, system components shall be the standard product of one manufacturer when available. The combining of multiple manufacturer components in order to meet all the performance requirements outlined and described in these specifications which includes the internal communication, calendar clock messaging, interactive Graphical User Interface (IGUI) and multiple system interface is not acceptable. Further, an effort shall be made to establish common sources for equipment of all systems. The manufacturer shall have a minimum of fifteen (15) years experience in the manufacture of products specified in this Section.

B. The work to be provided under this Section consists of furnishing and installing all equipment, cabling, and labor required for complete, operable, new intercommunications systems. These systems shall be referred to as the Intercom System and their supplier as the CONTRACTOR.

C. All empty conduit and power required for the electronic systems shall be supplied by the electrical contractor as a complete raceway system.

D. The contractor must be a factory-authorized representative or distributor of all equipment used in the electronic systems. Further, this contractor must have a minimum of five years of experience in the specific application of the equipment proposed for these systems. Provide a letter signed by an officer of the manufacturer attesting to the contractor's direct affiliation with the manufacturer.

1.9 REGULATORY REQUIREMENTS

A. The entire installation shall comply with all applicable and safety codes. All central equipment and additional applicable equipment shall be Listed by Underwriters' Laboratories, per U.S. requirements Note: Furnish an original, dated specimen of the test agency's listing card with the submittal.

B. All equipment with digital apparatus (microprocessors) that generate and use timing signals at a rate in excess of 9,000 pulses per second to compute and operate must be Federal Communications Commission (FCC) and DOC CSA standards C108.8 (Electromagnetic Emissions) compliant. Any non-compliant equipment supplied or installed shall not be accepted and shall nullify the contract. Note: Provide documents supporting and verifying compliance.

C. Systems shall be considered non-compliant unless they completely meet the criteria as outlined in

this section. All supporting documentation shall be included as part of the initial submittal package. Letters regarding "future approval" or "approval pending" shall not be considered.

1.10 MAINTENANCE SERVICE

A. The bidder supplying the equipment shall show satisfactory evidence that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system, including replacement parts. The bidder shall be prepared to offer a service contract for the maintenance of the system after the guarantee period. The bidder shall produce evidence that they have had a fully experienced and established service organization for at least five years and proven satisfactory installations during that time.

B. Furnish service, maintenance, and labor of communications systems for three 3 years from Date of Substantial Completion.

C. Manufacturer shall provide factory, technical training directly to school district personnel if requested by the school district.

1.11 MANUFACTURERS

1. Any manufacturer that meets a convertible IP capable main-frame. Systems that do not meet this criteria include the Rauland Telecenter ICS (with or without the Rauland Telecenter U), Dukane by Carehawk, Carehawk.

2. It is the intent of this system to utilize the owner provided LAN with minimal impact on bandwidth or number of ports required to pass communications via the network. Any IP System requiring individual data drops for each station point shall provide within their quote all infrastructures cabling including fiber optic cable between closets, patch panels, data switches, and UPS power supplies for their network.

3. Any other manufacturer actively engaged in the manufacturing of systems specifically designed for K-12 internal communication and has done so for a period of no less than 15 years will be considered and deemed an equal to these specifications only after systems have been installed.

4. Upon completion of the installation, the owner will review the installed system and compare to the minimum performance standards as set forth in these specifications. Any installed system not meeting the minimum standards of performance as set forth in these specifications will be removed by the providing contractor and replaced with a system referred to in these specifications as the "standard system of reference" at the expense of the contractor responsible for this section of the specifications. Any additional expenses incurred to meet the owner's interpretation of the "standard system of reference" will be the sole responsibility of the contractor responsible for this section of the specifications. Any delays in the schedule shall also be subject to liquidated damages as described in other sections of these specifications.

PART 2- PRODUCTS

2.1 INTERNAL COMMUNICATIONS SYSTEM

The performance requirements for the Internal Communication System are the explicit requirements of the owner and based upon systems manufactured by Telecor. Internal Communication Systems as manufactured by Telecor shall be considered standard system of reference.

A. The Public Address System shall consist of a main and fully Central Control Unit, Consoles, interactive Graphical User Interface (IGUI) with interactive graphical representation of the school, separate web-based programming software utility for remote off-site programming and troubleshooting, rack equipment and all other necessary devices that are required to create a complete and operational system such as Speakers, Horns, Amplifiers, and Visual Message Devices, etc. All Public Address main equipment including card cages and all cards, program sources, etc., shall be rack mounted in the MDF room. IP-TBU units and any additional amplifiers required or large zone shall be located in the MDF and IDF closets as required to service the appropriate zones. Fully and operational control unit shall be located as shown and or noted on plans. All system programming of Public Address and Master Clock features shall be accomplished by a Console located in the Main Office area or over the LAN/WAN or internet by a browser based software programming software utility. The browser based programming shall be separate from the interactive Graphical User Interface (IGUI) and shall not be accepted as a substitution of the interactive Graphical User Interface (IGUI). It shall not be necessary to attend to the main equipment in the Head End for normal day-to-day operation of the system. The system shall be a 25-Volt two-way paging system providing paging zones as indicated and determined by the Owner. The system shall be of modular design utilizing plug-in circuit cards to enable quick on-site replacement or addition of components for system expansion and modification including the conversion to IP when required or deemed more suitable for installation. The system head end equipment shall be rack-mounted in the MDF where shown on the drawings with side panels and stationary platform base. Provide shelves, doors, blank panels, AC power distribution, etc. as required to support all equipment and fill empty rack space. System shall be comprised of all solid-state electronics, utilizing a microprocessor-based central processor unit, power supplies, audio interface cards, control cards, input/output cards, telephone interface cards, transformers, paging amplifiers, etc., as required for a complete system, to include capability to interface with the Owner's VoIP telephone system. The interface must comply with loop-start central office (CO) trunk standards in North America as defined by Bellcore and/or industry-standard 2500 analog station ports. System provided for this project must be capable of IP communication platform regardless of relevance to this project. It is the intent of the owner to be able to utilize IP communication to remote IDF's for future expansion. Any systems not capable or manufacturer's that have to provide a different model numbered system in the future in order to comply with IP communication capabilities are not considered convertible and shall not be acceptable for this project.

B. The system must include an interactive Graphical User Interface (IGUI) option software application that allows for the operation of the System from a Windows®-based PC. If separate and dedicated computer is required by the owner, provide networked PC, (coordinate location with Owner), keyboard, mouse, and 21" LCD Monitor. PC shall exceed manufacturer recommended specifications. This software package shall utilize an easy-to-use interactive Graphical User Interface (IGUI), quick and easy, graphically aided navigation access to all intercom functions, paging, and program distribution. The software shall also allow easy activation of class change schedules. Emergency operations shall be simplified through this software application by allowing stored audio files and alphanumeric messages for message displays to be activated from the IGUI. The IGUI shall allow common operations such as daily announcements to become automated, removing multi-step console set ups and the dial strings. The means for originating voice communication to selected locations must be separate from IGUI application and must be provided through the system Console, Telephone Handset or Microphone. The software must allow the creation of a Custom Operating Screen (s) based on the floor plans of the school facilities. Icons representing Intercom Stations, and Paging, Monitoring and Audio Program Zones shall be incorporated onto the floor plans. The Software IGUI shall provide:

1. Simple Routine Call Processing
2. Emergency Functions

3. Paging
4. Audio Program Distribution
5. Enabling and Disabling of Schedules and Bell Scheduling
6. Customizable Page Elements
7. Customizable Operating Screen
8. Element Library for Emergency Event Icons

C. The IGUI must provide an efficient and reliable method of notifying the occupants within the facility of critical situations. A variety of emergency tone signals that reside within the Intercom/Paging System shall be activated by clicking on pre-programmed buttons on the IGUI screen, initiating the transmission of tone signals to speakers, and alphanumeric messages to Message Displays/Digital Clocks. A 'lockdown' icon shall be designed as per Owner direction, with owner selecting the appropriate tone. Whole building macros for emergency or off-normal response shall be built into the internal communication system as directed by the owner. Each macro shall be capable of being activated by the console, the IGUI or any remote button locations indicated on plans or as directed by the owner. It shall be possible to activate a WAV. file message, owner selected tone and coinciding English Language Message and distribute by zone as directed by the owner, all from a single activation Icon located on the IGUI. Other single action macros shall be activated in similar fashion via the IGUI and a custom labeled Icon. English language labeling of all Icons on the IGUI shall be user changeable. Systems that require the assistance or addition of a cheat-sheet for labeling and location of specific rooms, staff or bell schedule identification are contrary to the performance requirements of the owner and shall not be acceptable.

D. The main system shall include a head-end, a networked PC with Microsoft Windows XP or Vista running the IGUI software, a monitor, data entry keyboard, Administrative Control Console, serial connections to in-house alert systems, UPS power backup, Category 6 plenum rated structured cabling system with Patch Panels and TBU-IP units in IDF's, and all associated system components: The system shall allow for the connection of multiple devices per each station port. A station port is defined as a connection point for a typical classroom i.e.: combination of: call-in device(s) and a speaker(s) and a clock (including power and synch signal).

1. Direct dialing, two-way "amplified voice" communications between all locations equipped with Administrative Control Console, IGUI and/or telephone system handset, and all locations equipped with a public address system speaker; excluding corridor speakers. Must be capable of transmitting multiple, simultaneous amplified two-way voice and paging over the IP network.

2. An Administrative Control Console for facilitating all Public Address System announcements and programming, to include but not be limited to: Emergency all-call; paging zone and number assignments; call-in priority levels with tone characteristics; Master Clock event and tone signaling; monitor and reporting on call-in line faults; and manually distribute unique tones to all zones and speakers in the system.

3. The system shall provide for remote system diagnostics and access to activity log files on the system. The system shall also provide direct connect support for the IGUI program and integrate the functionality of an Administrative Control Console or PBX system phone into the framework of a PC. Audio files that are used for daily as well as emergency announcements and music files shall be retrievable by the IGUI interface.

4. Connection to a local building digital PBX or VoIP telephone system (phone system by Owner), allowing any telephone handset that is part of the telephone system to page and conduct hands-free, open-voice communication with any speaker in the system; the Administrative Control Console; IGUI

or any other classroom telephone. The Connection to the local phone system shall not diminish or restrict any of the capabilities of local telephone system. Public Address System interfaces shall allow any programmed telephone to perform but not be limited to the following intercommunication system functions: all-call; zone call; intercom call to classroom speakers, distribute class change signals, etc. Caller ID information from Intercom must be transmitted and displayed on owner provide phone system phone displays.

5. User-programmable zone paging to all classroom and office speakers using any or all of the following: Microphone, Administrative Control Console, IGUI.

6. PBX system telephone integrated through the PBX to the internal communications head end. Public address zones shall be software programmable to include 1- and 2-digit numbers or English language labeling. Zone paging and program zones shall provide easy access to groups of zones or all-zone pages.

7. Distribution of general announcements over School loudspeakers using a microphone, Administrative Control Console, IGUI, or telephone handset, on an All-Call basis, pre-selected zone basis, or multiple-zone basis to any paging zone. Speaker assignments to any zones shall be programmable from the Administrative Control Console or the remote programming software utility via the Web or WAN/LAN.

8. Distribution of emergency paging announcements over school loudspeakers using a microphone, Administrative Control Console, GUI or telephone handset. Emergency announcements shall have the highest priority over all other system functions, including the Local Audio Systems. Emergency announcements shall automatically disconnect and override all Local Audio Systems. Provide programming source to override local audio systems. Coordinate with 27 40 00 contractor.

9. Any individual room station within the system to be designated as a fixed zone by the simple entering of keystroke at the Administrative Control Console during a page selection. Selection and monitoring of individual program sources (Microphone, AM/FM Tuner, Tape or CD) and distribution by the Administrative Control Console.

10. Programming of microphone for control and distribution of public announcements, to eliminate the need to go to the central electronics for microphone set up. Keying the microphone shall automatically mute all other audio programs at a lower priority in the system, including Local Audio Systems (emergency pages only). Microphone shall transmit to all rooms or specific speaker zones as programmed in the system software.

11. The capability of multiple open-voice intercom paths. Intercom paths shall be global. Systems which block multi-channel communication to more than one point on any card or interface in the system shall not be acceptable. Multiple amplified, open-voice intercom paths shall not be restricted over the IP network.

12. Automatic gain-control of intercom speech to assure constant speech level.

13. Automatic sounding of a warning tone over any loudspeaker selected for two-way communications to alert the classroom teacher to an incoming announcement.

14. Any system with more than one Main Administrative Control Console, shall also be provided with a minimum of two channels for intercom communications or audio program distribution. The System shall be user-programmable to allocate, upon demand, either of the two channels for intercom or audio program. Systems that only allow one channel per card or block multi-channel communication

in any way shall not be acceptable. Systems that only allow one channel over distributed IP network shall also not be acceptable.

15. The ability to monitor the school building either on or off the premises from a single telephone.

16. Audio program distribution to a minimum of eight different areas of the building selected by the Administrative Control Console and Visual Console. Inputs shall be provided for five (5) low-impedance microphones, tuner, tape player and auxiliary source. Program material shall include audio programs from standard AM/FM tuner, tape deck, CD player, or auxiliary source. Administrative Control Console shall have the ability to monitor program sources being distributed. Coordinate location of antenna(e) with architect. Locate and install for optimal performance.

17. Audio Source equipment shall have the ability to be located remotely from the main system control electronics, and shall have the ability to distribute two channels of audio simultaneously if so desired. School shall be equipped with (1) rack-mounted AM/FM tuner, (1) rack-mounted cassette tape player, (1) rack-mounted CD player.

18. RS232, USB and RJ45 connection for Input/Output Interface shall be provided. Required use of serial converters for connection to LAN/WAN shall not be acceptable. Personal Computer, LAN/WAN, Modem, and Printer for monitoring activity within System and for displaying and printing system management information shall be capable of being utilized by system. System shall perform diagnostics, or logging transactions either on or off premises via browser or LAN/WAN. Communication via modem shall require a dedicated phone line and shall be provided at no cost to the owner. Any ongoing costs incurred to support modem communication shall be absorbed by the Electrical Contractor. Reliance on methods such as Remote Desktop connection for programming and troubleshooting shall not be acceptable.

19. The ability to interface to other systems such as Access Control, CCTV, Fire alarm or activation signal supplementation shall be required. Interface shall allow for automatic activation of emergency sequence messaging (Tone, WAV., Alpha/Text Messaging) through the internal communication system.

20. Time Signal tones of an integrated Master Clock System to be distributed throughout zone(s) selected for time signaling over programmed loudspeakers on a manual or automatic basis.

21. Power amplifiers that provide a minimum power capacity of 2 watts per cone speaker location and Door Signaling device plus 15 watts of power per horn type speaker locations.

22. Cabling that is specified by the manufacturer, which provides shielding of conductors so that the Internal Communication System does not interfere with the Telephone Systems and Telephone System cabling.

23. The system must be compatible with a structured cable plant with MDF and IDF and CAT6 cabling.

24. Classroom components (including a speaker, call-in device, clock power and) may all be connected to the system via a single CAT6 cable drop for each classroom/location to either the MDF or IDF in a Networked solution.

25. Pre-announce tones will alert the listeners of incoming calls with distinct tones for each priority level. To prevent unauthorized monitoring, the tone will sound whenever an area is being monitored, and will repeat at regular intervals. Facilities shall also be provided to defeat the tone repeat function from the console if it is not desired.

26. Emergency and All Call paging and a minimum of 32 zones of group paging. The paging zones shall be independent of the time tone and audio program distribution zones and a minimum of 8 messaging zones. Systems sharing zones for both paging and tone shall not be acceptable.

27. As per NEMA SB-40, Call-in device in the classroom will be in the form of a call switch and shall include a privacy option. The system shall be capable of call-switch supervision as well as the ability to install multiple, supervised call-switches in a single room without increasing the original wiring requirements of one pair for call-in. Multiple call switch installation shall allow for each switch to be programmed to call separate console locations and have separate priorities. Systems that require additional cabling for this feature shall not be accepted. Call Switch shall interface with classroom sound field system allowing for the placement of an intercom call from the wireless panic button provided by the Sound Field System. Coordinate with Sound Field System provider to insure compatibility.

E. The system shall be capable of monitoring 32 different sections of the building, either on the premises from an Administrative Control Console, or off premises from a telephone instrument.

F. Distribution of paging announcements can be made from any Administrative Control Console, IGUI, telephone, or dedicated microphone set-up. Paging shall also be achieved by providing the capability to interface with existing premises phone system and displaying classroom caller ID information on the phone display regardless of the instrument utilized to initiate the call.

G. Emergency announcements shall have the highest priority over any other system function and seize all system loudspeakers regardless of their current mode of operation.

H. System shall support general announcements made from a conventional microphone to facilitate reading a script and the participation of multiple announcers. Keying the microphone shall automatically mute all other audio programs at a lower priority in the system and transmit the microphone audio to all buildings or specific speaker zones, as programmed into the system software.

I. System will provide Emergency and All Call Paging and a minimum of 32 zones of group paging. The paging zones shall be independent of the tone signal and audio program distribution zones.

J. Pre-announce tones will alert zones of incoming pages with distinct tones for each priority level.

K. The system must have the capability of distributing audio program sources from any authorized building telephone. Computer with interactive Graphical User Interface (IGUI) shall be provided. Systems that do not include an interactive Graphical User Interface (IGUI) shall not be accepted. Program distribution shall be accomplished on an all zone, selected zone, or individual zone basis.

L. The system shall support the automatic distribution of tone and text signals to all selected areas. Text messaging shall be displayed on digital LED display/clocks or LED displays. Messages shall be independent and or simultaneous. Messaging shall be pre-programmed or “on the fly”.

M. The system shall support a minimum of 1536 events and 24 schedules. Building zones shall be used to select which areas receive the tone. They must be totally independent from page zones and program zones and clock messaging zones and shall be capable of a minimum of 18 simultaneous schedules

N. All system programming shall be accomplished through the master console, a network computer or from a PC utilizing a standard web browser.

O. The duration of the tone, as well as frequency, burst length and output level shall be software programmable from a web browser.

P. All system tones shall be user-programmable for the following durations in seconds: 2, 3.5, 5,6,8,10,12.

Q. The system shall be capable of an open-voice intercom path used for monitoring, emergency paging, and intercom.

R. This project will require IP conversion between closets. Any manufacturer requiring proprietary data transmission shall not be acceptable. The IP Conversion units are to reside on the owner's Ethernet network.

S. Corridor speakers, and outside horns in each building shall be combined into groups of owner's preference. There must be 32 independent software paging zones that each circuit may be a part of. Each individual circuit must also have the ability to be paged independent of the software zones. Provide one high output station port per card with a minimum of 25 watts capacity.

T. All user-programmable data shall be stored in a non-volatile FLASH memory to prevent memory loss during a power failure. The system time clock shall be capable of maintaining correct time for a period of 14 days in the event of a power failure. It shall be possible to return the system programming to the original factory default setting by keying a special code from the Console. Any future software upgrades provided by the manufacturer shall be capable of being uploaded without the need to change CHIPS, Firmware or hardware.

U. The user shall have the capability to change system programming for all paging functions, bell functions, and clock functions. The Owner shall be provided with the required training, documentation, and software to accomplish these functions.

V. The system shall be connected to an (owner-provided) Ethernet network port using the TCP/IP protocol. Provide patch cord of sufficient length to connect the head end equipment to the owner provided network switch in the MDF for access to off-site remote programming and troubleshooting. Connection to the network shall be by standard RJ45 connection without the need for third party electronics or conversion. Systems that cannot provide an RJ45 connection to the network, without conversion shall not be acceptable.

W. The user-interface shall support user names and passwords. There shall be multiple levels of access allowed. Some users may have viewing privileges only while others may edit their site. All editing shall be by means of the programming software.

X. The program shall also serve as part of the documentation process. Page Zones and bell schedules shall support user-definable names and display as pick lists when editing the configuration.

Y. Diagnostic functions shall be accomplished through any PC connected to the school network and provided with the proper authorization and diagnostic software. Any off-site PC shall have access to the system for diagnostics through the use of the public internet, provided that they have been granted proper authorization to do so.

Z. Although the system is programmed through a PC interface, the system shall not have to rely upon a personal computer for day-to-day operation. All programming information shall be loaded into the system allowing independent operation of the system.

AA. Provide a -1dB balanced audio line-level output from the public address system to each local sound system and provide equipment as required for emergency pages to over-ride the local sound systems. Coordinate with the owner prior to installation during paging zone identification.

BB. The final copy of the program and the configuration of data files shall be provided to the school in electronic format.

CC. Wire supervised panic button switches (PB symbol on drawings) to PA system for contact closure input. Upon contact closure, PA system shall initiate a lockdown sequence, as specified by owner. Coordinate lockdown events with owner (tone, messaging display, etc) and provide programming to accomplish lockdown procedure which may or may not include integration to owner provided Access Control, CCTV or any other systems as required by owner. Conditions shall also be capable of being actuated by ICON(S) located on the IGUI.

DD. Unspecified Equipment and Material. Any item of equipment or material not specifically addressed on the Drawings or in this Document and required to provide a complete and functional installation shall be provided in a level of quality consistent with other specified items.

GG. LOUDSPEAKERS, BAFFLES, AND BACKBOXES

1. Speaker/Baffles: Provide backboxes to electrical subcontractor for installation.

   a. As indicated on plans (SP), provide a ceiling mounted round speaker and baffle assembly. The baffle shall be 12-7/8" in diameter and 3/8" deep. The circular design shall match the room ceiling tiles.

   b. Baffle shall be constructed of 22 gauge, cold rolled steel, coated with a baked on white powered epoxy that is resistant to scratches.

   c. Holes in the baffle shall allowing mounting to speaker backbox.

   d. Room speakers must allow hands free talk back when room is paged.

   e. Speakers must meet the following:

      1. Type: Flush mounted 8" cone
      2. Frequency Response: 50 to 18,000 Cycles
      3. Magnet: 6 oz.
      4. Axial Sensitivity 95 dB at 4 ft. with 1-watt input
      5. Speaker/Transformer/Baffle Assembly with Support Bridge and Enclosure as required or equal.
      6. 1 X 2 or 2 X 2 Lay- in style speakers matching the above transformer and speaker characteristics shall also be acceptable

2. Provide Volume attenuators where shown on the drawings (A symbol in a circle) to adjust the volume of the local PA speaker.

3. Horn Speakers: Indoor/Outdoor (Extrernal Building PA Speakers (as shown on technology drawings ES (recessed, enclosed), Internal PA Speakers for the Gymnasiums (as shown on technology drawings FS, recessed with protective enclosures)

    a. Double re-entrant type: flush mount installation.
    b. Frequency Response: 600 to 14,000 Hz.
    c. Power Handling: 15 Watts RMS, 30 Watts Peak.
    d. Variable screw taps, 25 V transformer
    e. Sound Pressure Level: 110 dB at 1 meter with 1-watt input
    f. Color: Coordinate with Architect.
    g. Atlas/Soundolier APF-15T Horn Speaker with 193-8-6 backbox (9-5/8" Sq X 6" Deep) and VP-161APF Speaker Baffle or equal.

HH. TELEPHONE INTERFACE

1. System must provide the capability to interface and connection to the Owner's telephone system (Provided by Owner). Provide all equipment and cabling necessary to connect and integrate system to the phone system. Provide a minimum of 1 connection port.
2. Each trunk shall be programmable as either incoming, or outgoing, or both.
3. For incoming trunks, system shall be able to direct calls to a user-defined attendant telephone or provide dial tone. For outgoing trunks, system shall provide access to the trunk by dialing 8, 9, or both. If digit 9 is used to access an outgoing trunk, the system shall be able to automatically dial a second 9.
4. Each trunk shall be loop start.
5. Intercom contractor must coordinate telephone interface with Owner's telephone contractor.
6. Caller ID information from classroom port shall be viewable on Owner's telephone.

J. INTERFACE WITH REMOTE SPEAKER SYSTEMS

1. The system will interface with remote audio systems located within the building. Verify and coordinate with the remote sound system contractor.

2.2 MASTER CLOCK AND SECONDARY CLOCK SYSTEM

A. The system shall provide "State of the Art" Technology for Master Clock and Secondary Clocks, so that they form an integrated system together and with the Internal Communication System. Time programming shall be accomplished by way of a microprocessor-based and user-programmable master control system and shall be accessible from anywhere on the schools WAN/LAN. The system shall be easy to learn and operate. All standard system programming shall be user-friendly to allow the system administrator the ability to easily reprogram system features. Features offered by this system shall be implemented and controlled by software programs that can be changed and expanded as customer needs evolve. The Master Clock shall use an integrated master controller capable of operating and correcting both digital and analog secondary clocks as well as controlling class change signals to all speakers. The Master Clock systems shall provide the required signals to assure synchronization of all Secondary Clocks. Provide equipment and integration as necessary to utilize the master clock system as a network time source for the school LAN.

B. Master Clock System shall provide the ability to:

1. Provide automatic distribution of user-programmable time signals controlled from an integrated, 24-schedule, 1,024-event time clock. Time signal programming for 16 of the 24 schedules shall be available from programming software allowing remote access via the LAN/WAN or internet. Eight (8) of the 24 shall be available at the Administrative Control Console. Systems that do not provide an integral master clock capable of being remotely (LAN/WAN) programmed with system programming software shall not be acceptable.

2. Provide for program override to support manual distribution of class change time signals to all areas, or select groups of speakers from the Administrative Control Console or IGUI.

3. Transmit class change tones to selected areas of the school. Duration of the tone, as well as frequency and burst length and output level shall be software-programmable from the Administrative Control Console with 500 different combinations possible. User-programmable time signals shall be available to any of 16 time zones independent from paging and program zones.

4. Incorporate a built-in calendar with the capability to program in all holidays, and provide for automatic clock correction for Daylight Saving Time and Leap Year changes.

5. The unit will further permit programming, diagnostic, and activity logging through connection to an external computer.

6. Provide a 10-year battery back-up real time clock.

7. Battery back-up shall be provided to the Public Address/Intercom/Clock System, ensuring correct timekeeping of the Master Clock System during power failures. Once power is restored, the Master Clock shall instantaneously update all clocks with the correct time.

8. The built in Master Clock shall be capable of correcting analog secondary Clocks without the need for special hardware.

9. The ability to connect through the facilities Ethernet Network to obtain time synchronization from a Time Server.

10. The system shall have the capability of providing alpha-messaging as part of the time/tone schedules. The integrated Master Clock shall provide sixteen (24) user-programmable messages which may be activated as a part of the time/tone schedules, external relay, remotely located buttons, through the front panel of the unit or the IGUI. Messages displayed in the classrooms shall not interrupt the display of time at any time.

The Digital Calendar Clock shall be equal to the Telecor Model 2484

1. The Digital Calendar Clock shall simultaneously display the current time and date. The time shall be displayed in hours, minutes and seconds. Hours and minutes shall be displayed using 4.0" digits, and seconds shall be slightly smaller for easy distinction. The date shall be displayed in plain text using a 10-character dot-matrix display showing the day of the week, followed by the month and day.

2. All secondary clocks shall be continuously synchronized with the Master. Corrections shall be done instantaneously and all clocks shall display the identical time and date. In the event of a power failure, the system shall maintain proper timekeeping during the outage. Once power is restored, all clocks shall be immediately updated with the correct time and date.

3. The Digital Calendar Clocks shall utilize AlGaAs "Super-Bright" LED displays which shall offer exceptional visibility characteristics and shall be viewable from up to 120 feet away.

4. The Digital Calendar Clocks shall also be used to display messages in the dot matrix section of the display. These messages shall be used to alert personnel of an emergency or a situation of concern.

5. Messages shall be programmed using the Administrative Control Console or a computer via the LAN/WAN or internet and programming Software. The software shall utilize a user-friendly web interface designed for programming the system. Message data shall be transmitted from the system to all Digital Calendar Clocks on the network.

6. Messages shall be activated either manually or by scheduled event allowing text to be displayed at specific times and days of the week. Messages shall be displayed using a variety of visual effects, including scrolling or flashing single lines of text, as well as alternating between different lines of text.

7. The Digital Calendar Clock shall also be used as an ancillary visual enunciator to display emergency calls placed on the Internal Communications System. When an emergency call is placed, it shall be shown in the messaging area of the display until the call is cleared from the system. The dot matrix display shall default back to the date when not displaying messages. Indication of the Emergency Call shall be programmable as to which of the (minimum) 8 messaging zones it will be displayed.

8. The Digital Calendar Clocks in the hallways shall be capable of displaying an automatic countdown of remaining minutes between bells. When the class bell time is reached the hallway clocks shall revert to displaying the standard time or any messaging present.

9. The Digital Calendar Clock shall also be used as an elapsed digital timer, providing stopwatch functionality, indicating elapsed time on the six-digit display.

    a. Elapsed timer functions shall include the ability to count upwards from zero to 24 hours, as well as counting down to zero from a specified value. The elapsed timer shall be controlled using a Timer Button Panel providing start, stop and reset functionality. When not operating as an elapsed timer, the clock shall default back to displaying the current time.

10. The clock bezel shall be anti-glare red with a smooth surface. No external screws or studs shall be visible on the bezel or clock housing.

11. The Digital Calendar Clock shall be surface mounted or on a dual assembly.

12. Provide wire guards for all clocks in the gym. Wireguards shall be constructed of 3/32" diameter welded steel wire screen with 2" openings and 3/16" reinforced hoops. All joints are to be welded for strength and durability. The guards shall be finished in a rugged epoxy powder-coat finish, suitable for both indoor and outdoor environments.

D. The Digital Secondary Clocks shall be capable of receiving both the correction signal and correction (messaging) data on a CAT 5/6 cable tied in through the manufacturer provided CAT 5 Patch Panels.

    1. Digital Secondary Clocks indicate the current time with a six digit display, the time in hours, minutes, and seconds. Hours and minutes are displayed with large 2.25" digits

    2. Units shall operate on 24 VAC as distributed from patch panels.

    3. Provide recessed enclosures to Division 16 contractor prior to installation.

PART 3—EXECUTION

3.1. EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that required utilities are available, in proper location, and ready for use.

C. Beginning of installation means installer accepts conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions. The contractor shall have equipment installed on the AC voltage supply, taking care to arrest damaging electrical transients and spikes that can cause damage to the microprocessor components of the system.

B. Install digital clocks as specified on the drawings and ewlevations. Where conflict occurs, notify the architect.

C. Install classroom and hallway loudspeakers into the suspended ceiling tiles.

C. Install and wire system in accordance with manufacturer's approved drawings and diagrams. Systems not capable of utilizing a CAT5 (or greater) cable shall not be acceptable.

D. Mount clock power supplies in IDF locations, and service via cable tray to classroom location.

E. Provide floor plan layouts for internal communication system IGUI program utilizing owner provided image files of building floor plans. Tag and label all rooms and provide full programming to maximize GUI capabilities.

3.3 INTERFACE WITH OTHERS

A. All equipment shall be installed and connected in strict accordance with the manufacturer's recommended instructions.

B. Provide interface with Owner's telephone system.

D. Interface remote sound systems. Coordinate with 27 40 00 contractor.

E. Other systems as required by owner and defined in these specifications or shown/noted on plans.

F. Coordinate with owner to provide VLAN for communications system.

4.4 FIELD QUALITY CONTROL

A. Provide field inspection and testing.

B. Perform operational test on each item of equipment and on system.

3.5 MANUFACTURER'S FIELD SERVICES

A. Observe installation of communications system.

B. Provide field technician services to make final signal cable connections to equipment.

C. Prepare and start systems.

3.6 ADJUSTING

A. Adjust controls to achieve proper operations.

B. Set status of each classroom call-in device and other stations as indicated.

C. The specified standard of equipment shall be supplied, installed, adjusted, tested, and guaranteed by a factory-authorized contractor for the products furnished. The contractor shall be responsible for verifying the completeness of the parts list and the suitability of the equipment to meet the intended purpose of the specifications and to serve the best interests of the owner.

3.7 DEMONSTRATION

A. Provide systems demonstration and instructions.

B. Employ manufacturer's field representative to demonstrate system operation to designated Owner personnel.

C. Use submitted operation and maintenance manual as reference during demonstration and training.

D. Training: Provide the Owner with a training program designed to make all control station users familiar with the operation of the voice communications system.

E. Submit field reports indicating satisfactory installation and testing of system.

3.8 WALK THROUGH

A. Conduct walking tour of project and describe function, operation, and maintenance of components. Provide volume adjustments as necessary to provide acceptable sound levels to the Owner.

END OF SECTION

# SECTION 282300
# VIDEO SURVEILLANCE

## PART 1: GENERAL

1.01 General Product Requirements

A. The software used shall be designed for enterprise level use, with an expected use period of 24/7. It shall be the manufacturer's official software.

B. The software shall incorporate open standards and published protocols and use standardized components.

C. VMS listed is based on Video Insight and is set forth as a standard of performance. Acceptable equivalents as provided by Pelco or Axis

D. The video management system provider shall be defined as the provider of the video management software, and the party responsible for rigorous self-testing of the video management software prior to the release of the software.

1.02 Quality Assurance

A. All configuration, set up, installation and integration of the software shall be done by qualified technicians who have passed a manufacturer's training program.

B. All systems shall be from the original manufacturer, not rebranded versions.

1.03 General System Description

A. The Video Management System shall support both centralized and decentralized configurations as well as hybrid options for architecture. Centralized management shall be available no matter the surveillance architecture. The system shall allow for integration with other security devices and products and be designed to allow for levering of those products to improve the user experience of the Video Management System.

B. The Video Management System must not require a central management server.

C. The VMS shall make the user experience seamless to the end user irrespective of the system architecture.

D. The Video Management System must be capable of each server being able to handle an unlimited number of cameras for recording.

E. The VMS must support Windows Server 2008 and Windows Server 2012 for the server side. Client side software must be available for Windows Vista, Windows 7, Windows 8, Mac OSX, iOS 6 and above, and Android. The operating system shall have all current and available patches.

F. The VMS shall include the following without additional license fees:

   a. Server software for recording the video
   b. Client software for Windows
   c. Client software for Mac OSX
   d. Client software for iOS6 and above
   e. Client software for Android based platforms
   f. Client software using a web based interface
   g. Standalone clients designed to provide fixed displays
   h. Video Wall functionality
   i. Access Control Integration
   j. Failover server functionality

k. A separate health monitor application

G. The VMS shall not require a separate application for administration and user based roles. Limitations for non-administrative users shall be handled via permissions.

H. The system shall support running in virtual servers for both the server application and client applications.

PART 2: PRODUCT

2.01 IP Server

A. IP Server
1. The Server shall be designed to run on a Windows platform, supporting both Desktop and Server class operating systems including Windows7, 2008r2, and 2012.
2. Server shall run as a Window's Service. This service shall run as part of the local service account. This service shall be running as long as the system is booted and has started Windows. It shall not require the user to be logged in.
3. The Server will store settings in SQL Express and shall not require a full MS-SQL license.
4. The Server shall have an option for a 32 bit binary and a true 64-bit binary. In a 64 bit OS, the server shall run as a native 64 bit application, not merely a 32 bit application.
5. The service shall connect to the camera and handle streaming to the server. It shall not require each client to connect to individual cameras.
6. This service shall allow the cameras to be placed on one network and the clients on a separate network using a different IP range.
7. The software shall support the ONVIF standard.
8. The software shall support Megapixel virtual cameras within a single camera license.
9. The server shall only require two ports for streaming video as well as handling any setting changes or commands from the client software.
10. The Server shall record the video streams from different cameras.
    a. The service shall handle transcoding of the camera streams if the cameras are MJPEG based. The video shall be re-encoded to WMV to reduce storage needs and to reduce the impact of streams to clients on the server.
    b. For MPEG-4 based cameras, the video shall be stored in the native codec of the server.
    c. For H.264 based cameras the video shall be stored in the native codec of the server.
    d. Each camera will have the option to be able to be stored in different locations (i.e. One locally, another on a NAS, a third on a different network share)
    e. Streaming from server to client shall support H.264.
    f. The server must have Pivot 3 integration.
11. The Server shall support H.264, MPEG-4, MJPEG and MXPEG based cameras.
12. The Server shall support motion detection at the camera and at the software levels.
13. The Server shall provide graphic examples of what it determines as motion to thick clients if the thick client requests it.
    a. The software shall display the motion detection as an outline around the area moving.
    b. The software shall provide a bar showing the total percentage of change. This bar shall have a slider on it to allow the user to quickly set motion detection.
14. The Server shall allow for multiple zones to be set within an image that support differing motion detection values within a cameras field of view.
    a. There shall be no limit on the total number of zones allowed, either on a per camera or per server basis.

b. Zones should allow the ability to ignore motion within an area.
c. The user shall have the ability to move the zones after the fact.
d. Motion zones should be able to be tied into a rules engine to allow the software use them as triggers for events.

15. The Server shall support the use of imported maps to show camera placement. These maps will be in .jpg, .gif, or .bmp formats as determined by the user.
    a. Hovering over a camera on a map shall cause it to be displayed in a window on the side.
    b. When the camera is displayed on the side, the option to review recently recorded video will be available to them.
    c. The user shall be able to embed layouts onto the facility map. Clicking on the layout shall change the display of the client software.
    d. Alarms from DIOs shall be able to be embedded as well.
    e. Audio sources shall also be an option.
    f. Other facility maps shall also be an option to embed. Clicking on a different embedded map shall bring up that map.
    g. Doors from certain access control systems can be imported and displayed. Hovering over the door shall display the last badge used to badge in, a live view of the camera associated with the door. The user from this pop up shall be able to see badge events and alarm events along with the associated video.
16. The Server shall not require the administrator to contact the manufacturer to replace a camera.
17. The Server shall support reporting to a diagnostic tool.
    a. The server will report the number of active cameras.
    b. The server shall report active cameras offline.
    c. The version of the server.
    d. The amount of disk space left.
    e. The recording status of the server.
18. The server shall support pre-motion and post motion recording.
19. The server shall support customizable layouts. The layouts will allow for blank spaces within the layout.
20. The server shall support an unlimited number of users.
    a. Users can be drawn from either an Active Directory server, Novell eDirectory or entered manually.
    b. There will be five different levels of user.
    c. Users can be members of a group with settings set for the group. Individual user settings can override the group settings.
    d. Permissions can be set for live viewing, access to recorded video, control of PTZ cameras, access to audio, the ability to export video, custom layouts, facility maps and rules. Permissions can be defined on a per camera basis.
    e. The server shall support the option of having the users limited to being signed in to a single location.
21. The server will include a diagnostic version with limited interface, to allow for testing of the server.
22. The server shall support an optional secondary server with failover capacity.
23. A rules engine shall be included to allow the server to handle more complex tasks.
    a. Triggers will include:
        1. Dry contacts (DIO)
        2. Motion detection of a camera stream.
        3. Scheduled events. Events can be scheduled on daily, weekly, or monthly basis. Individual events can be handled as well.

4. An Alert button for the user interaction in the monitor station.
5. Inputs sent programmatically via appropriate APIs.
6. Access control events from supported Access Control Vendors.

b. Actions will include:
1. Logging the event.
2. Opening or closing a dry contact.
3. Sending an e-mail with a custom text message tied to the trigger. Multiple texts will be allowed for different triggers.
4. Sending an e-mail with an .avi clip from a selected camera.
5. Sending an e-mail with a .jpg of a selected event from a camera.
6. Opening a live window for a user who is viewing.
7. Move a PTZ to a certain preset location.
8. Force recording.
9. Force recording with audio.
10. Instant Replay
11. Sending video to a Network Decoder
12. Switching single camera or layout views.
13. Message Instruction
14. Moving, copying or deleting of files.
15. Execute a program or batch file.
16. Send an ASCII string to a TCP port.

24. The server shall support time out functionality.
25. A universal RTSP option shall exist for adding cameras if they are not currently supported through native APIs.
26. PTZ functionality within the camera will be supported.
27. Dewarping of Panoramic shall be supported for the following manufacturers:
    a. Sentry 360
    b. Vivotek
    c. Panasonic
    d. Axis
    e. Immervision
    f. Mobotix
    g. ACTi
28. The server will only stream video to clients that the clients request.
29. If live video is paused then the server shall stop streaming video to the clients to conserve bandwidth.
30. The server shall support integration with various access control platforms, including:
    a. Imron
    b. S2
    c. Lenel
    d. RS2
    e. DSX
    f. Isonas
    g. Monitorcast
    h. Paxton
    i. Badge Pass
    j. Gallagher
    k. Continental
    l. Infinias
    m. Open Options
    n. Wren

o. AMAG

31. With Isonas and Monitorcast and Paxton, the server shall allow for importing the doors from those systems and respond to events in the VMS software along with basic door control.
32. The server shall have support for the Audio Enhancement's panic button functionality.
33. Provide Server with storage capacity for up to 30 days with additional 10% predicated on the cameras provided.

2.02 Monitor Station

A. Monitor Station
1. The monitor station will be a thick client for viewing live and recorded video, along with handling administrative tasks.
2. The software shall not require a client license to operate.
3. The thick client will support an encrypted XML file for storing settings. The file can be set up to be shared between many clients, allowing the administrator to update all clients with a single file push.
4. Clients will be able to us Active Directory to authenticate users.
5. Clients will be able to use Novell E-directory to authenticate users.
6. The Monitor Station will display the servers it's connected to along with the server's cameras in a tree view on the left hand side.
    a. The tree view will allow the user to see the status of the servers that the instance of the monitor station is aware of.
    b. The tree view will also include access to custom layouts, facility maps and action buttons.
    c. There will be an option to hide the tree on start up of the monitor station.
    d. The user shall be able search for cameras using a searchable box on the left hand tree.
7. The thick client will not be limited in the number of servers it can connect to.
8. Live view will allow views of 1, 4, 8, 9, 10, 13, 16, 25 and 36 cameras. A widescreen option for 18 and 24 cameras will also be available.
    a. Layouts will be selectable via icon or keyboard function keys.
    b. Layouts will not be limited to cameras from a single server.
    c. Users will be able to get any combinations of layouts to cycle through on the main screen.
    d. Users will be able to designate cameras within a layout to be able to cycle between multiple cameras from multiple servers.
    e. Layouts shall be able to be put into groups.
9. If motion is detected on a camera then the software, then the camera shall have a red pulse around the edge of the window.
10. Live view will allow cameras to be dragged and dropped onto the live view from the left hand tree. Cameras can be duplicated in a view.
11. Users will be able to invoke a digital zoom by drawing a box.
12. After invoking the digital zoom, the Monitor Station shall support the use of picture in picture within the zoomed image.
13. Digitally zoomed areas will be treated as a digital PTZ.
14. PTZ Presets shall be listed in a drop down menu in the camera window.
15. Users shall be able to move the PTZ movements simply by clicking on the image or by using the scroll wheel.
16. Live view will support a full screen mode that hides the UI. User shall be able to start the Monitor Station in this full screen mode with a setting.

17. Live view shall allow the user to de-warp the video from panoramic lenses and cameras.
18. Right clicking on a camera in live view will have the following behaviors:
    a. Right clicking on a camera within live view will allow the user to be able to review the recently recorded video for that camera.
    b. Right clicking on a camera within live view will also allow access to the properties dialog box for that camera.
    c. Right clicking on a camera will bring up the option to save a still image of the live view.
    d. Live audio will be able to be accessed by right clicking on a camera in the live view.
    e. Allowing access to recorded video.
19. Recorded video will be able to be accessed by right clicking the live view, expanding the camera in the tree view, or by opening the media player via the pull down menus.
20. The Media player shall support the following functionality:
    a. The ability to fast forward and rewind video at up to 16x normal playback speed. .
    b. The ability to generate clips of recorded video. The clips can be defined by either frame numbers or by the use of slider bars visible on the player.
    c. The ability to save video directly to a CD or to a local hard drive or network share.
    d. If motion detection and logging are enabled, a timeline of video will be displayed. The user will be able to zoom in on the timeline and use it to select where video will start playing from.
    e. Users will have access to a motion log which will show motion events and how long they occurred for. Clicking on the entry will start the video from the appropriate spot.
    f. The player will support digital zoom.
    g. The player will have the option to allow an object search. The user will be able to define an area and seek out changes in the image within that area.
    h. The User shall have the option of forcing export of video as the native codec of the camera or MJPEG.
    i. User will have the option to burn time-date into the video as a clip.
    j. Users will have the option of burning in the Video Insight logo on a clip.
    k. Users will have the option to create a time index file for clips.
    l. Users will be able to grab a snapshot of the recorded video.
21. Synchronized playback will allow for cameras to simply be dragged and dropped into the player. The Synchronized player shall allow for the exporting of the view of up to four cameras a single video file.
22. The thick client will include a repair utility for corrupted video.
23. The Monitor Station will be able to display logging information, such as changes to the server, lost camera signals, who exported recorded video, when did users log-on/off and other errors. This functionality will be limited to administrative users. The log will be exportable as txt or to the Windows clipboard.
24. The Monitor Station shall also provide real time status updates for server status and camera status, including the CPU usage, disk usage, bandwidth usage, licensing and number and names of users who are logged in.
25. The system will support an Alarm Log to make it easier to find DIO based events.
26. Facility maps will be available in the software for viewing.
    a. When the user hovers over a camera in the facility map it will display the camera in a window off the side of the map.

b. While a camera is displayed it will allow access to recorded video from that camera as well as the live stream.
c. Cameras will display where they are pointed.
d. Embedded layouts will change the layout of the Monitor station if they are clicked on.
e. Embedded Facility maps will cause the current map to change to the embedded map if clicked on.
f. The user will have the option of importing and placing doors from supported access control partners on the map. This shall allow them to see badge events as well as alarm events. It shall also support the ability to lock and unlock doors from the map.
g. Panic button events from the Audio Enhancement systems will be visible on the map as well.

27. The Monitor Station will support the Axis Joystick as well as standard USB joysticks.
28. The software shall support the ability to open a live window that can be moved around. This window will be able to access the view of any camera or layout the user has access to.
29. The user will be able to enable or disable the following settings:
    a. Server name in the live view.
    b. Camera Name in the live view.
    c. Audio notification on motion.
    d. Forcing aspect ratio.
    e. Use Direct Show for display.
    f. Double clicking to change the server layout.
    g. Double clicking expands the camera.
    h. Allowing multiple live windows.
    i. Block live windows from popping up.
    j. Live window always on top.
    k. The speed in which layouts cycle.
    l. Hiding left tree on start up.
    m. Launching Facility maps on start up.
30. Users with Administrator privileges will be able to configure the server and camera settings. Users will also be able to test SMTP settings and database settings.
    a. Users will be able to configure the framerate of the camera, including the option to have the server record continuously at 1 fps with the option to go to the cameras maximum framerate on motion detection.
    b. Users will be able to select various time-lapse options for the camera.
    c. Users will be able to select the camera stream type.
    d. Users will be able to select camera or server side motion detection.
31. Users will be able to access a graphic representation of what the server's motion detection settings are picking up.
32. Users will be able to configure user settings as well as layout settings from within the thick client.
33. The software shall allow users to send video or messages to other users in the form of a popup window.
34. The Monitor Station will allow users to send video to other users, allowing for remote live pop ups of video of important events.
35. The Monitor Station will support Layout touring. Selecting a layout will cycle through a list of cameras.
36. User shall be able to allow for remote support via the monitor station.

2.03 Web Client

A. Web Client
1. The Web Client will be a thin client, using either an active-x control or an MJPEG streaming method.
2. It shall support IE, Firefox, Safari, Chrome and Opera.
3. It will not be limited to Windows platforms only.
4. It will not require a license.
5. Users will not be able to change any settings within the server via the thin client.
6. Users will be able to select layouts for live viewing, or individual cameras or groups of cameras.
7. Users will be able to access recorded video.
8. Users will be able to download recorded video from the system.
9. Users will be able to use the motion log to find recorded video.
10. The Web Client shall support the use of facility maps.
11. The Web interface will support the use of custom layouts.
12. The web client will use IIS as its web server.
13. The Web client shall allow remote access for iPhone, Blackberry, Windows Mobile, and Android mobile phones without the installation of an app.

2.04 Health Monitor

A. Health Monitor
1. The Health Monitor will listen for reports given by the service as to its status.
2. If the Health Monitor detects anything abnormal, it will give a visual display through a web front end, or by sending out an e-mail to one or more users.
3. It will be able to support an unlimited number of servers.
4. It will be hosted locally or across the internet.
5. It shall have the option to be run as a service.

2.05 Video Wall

A. Video Wall
1. The video wall shall support an unlimited number of monitors.
2. The video wall shall support up to four monitors per workstation.
3. The user shall be able to select the display of the video wall via the monitor station.
4. No license shall be required for the video wall.

2.06 OS App

A. iPhone/iPad application
1. The iPhone/iPad application shall not require a license to operate.
2. The app will have access to live cameras.
3. PTZ functionality will be available in the app.
4. The app will have access to recorded video.
5. Facility map functionality will be available.
6. Users will be able to make a clip from the app.
7. Snapshots will be able to be e-mailed from the app.

2.07 Cameras
A. Advidia A-47 or equivalent as provided by Pelco or Axis

1. 3 megapixel (2048 x 1536) resolution Mini Dome
2. Onboard storage
3. IP66 Protection
4. Vandal-proof housing
5. 4 mm @F2.0 lens
6. Minimum Illumination 0.07 lux @ F1.2, AGC on 0 lux with IR

B. Advidia A-34W or equivalent as provided by Pelco or Axis
   1. 3 megapixel Wide Angle Mini Dome
   2. 2.8mm lens
   3. IR Range to 60'
   4. IP 66 protection
   5. Vandal-proof IK 10 Rated
   6. Minimum Illumination 0.05 lux

C. Advidia B-31 or equivalent as provided by Pelco or Axis
   1. 4 megapixel resolution Fixed Outdoor Camera
   2. 3.6 x optical zoom
   3. IP66 Protection
   4. Vandal-proof housing
   5. F3.3-12mm lens
   6. Day & Night

2.08 Android App

A. Android Application.
   1. The Android application shall not require a license to operate.
   2. The app will have access to live cameras.
   3. PTZ functionality will be available in the app.
   4. The app will have access to recorded video.
   5. Facility map functionality will be available.
   6. Users will be able to make a clip from the app.

PART 3: EXECUTION

3.01 System Documentation

A. The installer shall follow all documentation for system installation.

3.02 Testing

A. All equipment and software shall be tested according to manufacturer instructions.

END OF SECTION

# SECTION 283100
# FIRE ALARM VOICE EVACUATION AND MASS NOTIFICATION SYSTEM

## PART 1 – GENERAL:

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections apply to work of this section.

## PART 2 - SCOPE AND RELATED DOCUMENTS:

2.1 The work covered by and the intent of this section of the specifications includes the furnishing of all labor, equipment, materials, testing, programming and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings, as herein specified and as required by the applicable codes.

2.2 The requirements of all other applicable conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

2.3 The complete installation shall conform to the applicable sections of NFPA-71, NFPA-72A, B, C, D, Local Code Requirements and National Electrical Code (Article 760). The requirements of any local fire department and the Authority Having Jurisdiction shall also be observed in the system installation and device layout.

2.4 The work specified under this section shall be coordinated with related work specified elsewhere in these specifications.

2.5 Provide fire alarm warranty services 24 hours a day, 7 days a week.

2.6 Smoke Evacuation System.

2.7 The fire alarm and mass notification shall be voice evacuation system using one-way communications and fire fighters telephone and smoke control systems with microprocessor based operating system having the following capabilities and capacities:

2.7.1 Voice amplification shall be supervised and backed up with like amplifiers. Back up shall be one for one. Back up amplifers shall not share components and must be fully stand alone.

2.7.2 Amplifiers shall be sized as a minimum, to accommodate speakers in corridors and public spaces at 2 watts and other locations 1 watt.

2.7.3 Multiple nodes shall provide peer-to-peer voice capability in order to eliminate a single point of failure

2.7.4 Audio shall be synchronized between nodes in order to take into account common areas

2.7.5 The network, audio, and telephone risers between nodes shall be copper and support Class A loop configuration to allow communication to continue in the event of a fault

2.7.6 Speakers shall have the ability to play coded audio tones

2.7.7 The system shall provide status indicators and control switches for all of the following functions: Audible and visual notification alarm circuit zone control, speaker circuit zone control, status indicators for sprinkler system water flow and valve supervisory devices, and any additional status or control

functions as indicated on the drawings, including but not limited to: emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.

2.8 All new panels shall be equipped with a feature to disable the outputs of the EST-3 panel. Disable buttons shall be segregated into the following functions: Elevator recall and associated functions; HVAC shutdown and related functions, fire door release; and Audible/Visual outputs. Alarm Silence shall be programmed so that the strobes remain active but the voice announcements cease.

2.9 Within each building, the fire alarm annunciator panel shall be located as close as possible to the main building entrance and be easily accessible for firefighters. Provide fire alarm pull boxes as required by code and at additional locations if layout is such that additional protection of this type is warranted. Locks on pull stations shall be keyed with a Cat-45 Key for consistency with others on campus. Duct detectors installed shall be programmed as latching supervisory alarms.

2.10 All new signaling devices shall be intelligent and programmed accordingly. All new audible indicating devices shall be speakers or speaker/strobes. All audio amplification shall be accomplished using only EST-3 amplifiers. If existing fire alarm panels are used, the proper boards shall be furnished to allow for intelligent devices and amplifiers for voice announcements. Fire alarm panels must also be tied into the mass notification system (Federal System UVIC) and programed to turn off announcements and strobes and allow the mass notification system to take over any speakers.

2.11 During construction, programming the new fire alarm panel is a coordinated effort. Before the end of each day during programming, the contractor shall make sure that the updated data file is left at the Power Plant prior to leaving.

2.12 During construction, contractors shall closely coordinate with the owner whenever work could potentially trigger a false fire alarm. The owner will notify the Local Dispatch Center and let them know the details and schedule of the work.

2.13 Contractor is responsible for all required permits and inspections.

PART 3 - DESCRIPTION OF WORK:

3.1 Extent of fire alarm and detection system work is indicated by drawings and schedules.

3.2 Types of fire alarm and detection systems in this section include the following:

3.2.1 New devices, equipment, cabling, etc. shall be UL listed as a system with existing fire alarm control panel.

3.2.2 Mass Notification System shall utilize a Federal Signal Corporations UltraVoice Contoller (UVICU), and shall be located adjacent to the fire alarm control panel.

3.2.2.1 Provide a supervisory circuit and audio circuit will to fire alarm system from the UVICU.
3.2.2.2 Provide end of line resistors required for monitoring of supervisory circuit.
3.2.2.3 Make all required connections between the Fire Alarm Control Panel and Mass Notification Panel. Fire Alarm system shall be programmed to disable fire alarm strobes/speakers and allow audio from the UVICO to operate across the fire alarm system speakers when the UVICO is activated for a warning. Fire alarm system shall auto-reset after a mass notification system activation when the relay opens and returns to original status.

PART 4 - QUALITY ASSURANCE:

4.1 Manufacturers: A firm regularly engaged in manufacture of fire alarm and detection systems, of types and sizes, and electrical characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.

4.2 Installer: Qualified with at least 5 years of successful installation experience on projects with fire alarm and detection system installation work similar to that required for project.

4.3 Code Compliance: Comply with all NFPA Requirements as applicable to construction and installation of fire alarm and detection components and accessories.

4.4 UL Compliance and Labeling: Provide fire alarm and detection system components which are UL listed and labeled.

4.5 Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer. Exception as needed of: Door holders, sprinkler water flow and tamper switches. All fire alarm devices used within the system shall be listed for fire alarm service under the appropriate category by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.

4.6 The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits shall be marked in accordance with NEC Article 760.

PART 5 – GENERAL:

5.1 All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name of each component. Any catalog numbers specified under this section are intended only to identify the type, quality of design, materials, and operating features desired. Contractor shall visit the site prior to bid to determine existing system.

5.2 The listing of specific catalog numbers and equipment parameters is not intended to limit competition among other manufacturers that propose to supply equivalent equipment and services.

5.3 Equipment submissions for shop drawing review must include a minimum of the following:

5.3.1 Complete descriptive data indicating UL listing for all system components.

5.3.2 Complete sequence of operations of the system.

5.3.3 Complete system wiring diagrams for components capable of being connected to the system and interfaces to equipment supplied by others.

5.3.4 A copy of any state or local Fire Alarm System equipment approvals.

5.3.5 An AutoCAD Version 2010 or later, produced wiring diagram illustrating the basic floor plan of the building, showing all system wiring and equipment, as well as addressable device locations, with device addresses and schedule of device legends as intended to appear on the main panel and annunciator displays. Provide three disk copies of as-built drawings at close of project, to be included in operation and maintenance manuals.

PART 6 - SUBMITTALS:

6.1 Product Data: Submit manufacturer's data on fire alarm and detection systems including, but not limited to, rough-in diagrams and instructions for installation, operation and maintenance, suitable for inclusion in maintenance manuals.

6.2 Shop Drawings: Provide shop drawings showing equipment/device locations and connecting wiring of entire fire alarm and detection system. Include wiring diagrams, riser diagrams, and point to point drawings.

PART 7 - ACCEPTABLE MANUFACTURERS:

7.1 Manufacturer: Subject to compliance with requirements, provide new fire alarm and detection system devices and cabling new and existing equipment, devices and cabling hall be UL listed as a system. Fire alarm systems as manufactured by Siemens/Cerberus, Edwards, Thorn or Notifier will be acceptable.

PART 8 - FIRE ALARM AND DETECTION SYSTEMS:

8.1 General: Provide fire alarm and detection system products of types, sizes and capacities indicated, which comply with manufacturer's standard design, materials, components; construct in accordance with published product information, and as required for complete installation. Provide fire detection systems for applications indicated, and with the following sequence of operations, components and function features:

8.2 Either manual activation of a fire alarm station or activation of an automatic initiating device shall sound a non-coded alarm and provide device identification on an annunciator.

8.3 Equip and wire system so that energizing the fire alarm audible visual signaling devices also activates the following:

8.3.1 Smoke door releases

8.3.2 Fire door releases

8.4 System Operating Features:

8.4.1 The system shall automatically transmit an alarm to the local fire department.

8.4.2 Activation of any fire alarm device shall cause the associated device to indicate an alarm at the fire alarm control panel and annunciator panels, and a signal to be transmitted to the fire department.

8.4.3 Activation of any manual pull station shall cause all A/V devices to operate and release magnetic hold open devices.

8.4.4 Activation of any ceiling mounted smoke or heat detector shall cause all A/V devices to operate, release magnetic hold open devices, and transmit an alarm to the Fire Department.

8.4.5 Activation of an AHU duct smoke detector shall cause the associated air handling unit to shut down and the operations described for ceiling mounted smoke and heat detectors. Otherwise, air handling units shall continue to operate.

8.4.6 Activation of a fire protection system flow or tamper switch shall cause all A/V devices to operate and release magnetic hold open devices.

8.4.7 Provide static pressure switch in main supply air duct at all air handling units with smoke dampers in the supply air duct systems. Connect switch to shut down A.H.U. on static pressure of 2.0" water gauge (+ 1.0" field adjustable).

8.4.8 Provide all smoke damper closure and air handling unit shut-down similar to the existing system.

8.4.9 System shall operate smoke control as shown on drawings and required by code. Verify all requirements prior to installation.

8.4.10 Digital Voice Command:

8.4.10.1.1.1 The Digital Voice Command Center, located with the FACP, shall contain all equipment required for all global audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.

8.4.10.1.1.2 Up to 5 Digital Voice Command Centers shall be supported per system with the ability to limit control to one Digital Voice Command Center via a Request/Grant/Deny mechanism.

8.4.10.1.1.3 Function: The Voice Command Center equipment shall perform the following functions:

8.4.10.1.1.3.1 Operate as a supervised multi-channel emergency voice communication system.

8.4.10.1.1.3.2 Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.

8.4.10.1.1.3.3 Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.

8.4.10.1.1.3.4 Provide all-call Emergency Paging activities through activation of a single control switch.

8.4.10.1.1.3.5 As required, provide vectored paging control to specific audio zones via dedicated control switches.

8.4.10.1.1.3.6 Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC.

8.4.10.1.1.3.7 Provide a software utility capable of off-line programming for the VCC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the VCC shall not inhibit the emergency operation of other nodes on the fire alarm network.

8.4.10.1.1.3.8 The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.

8.4.10.1.1.3.9 The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

8.4.10.1.1.3.10 Mass Notification Interface: The fire alarm control panel shall interface to Mass Notification system via the AIC and be a supervised connection.

8.4.11 Mass Notification Interface: The fire alarm control panel shall interface to Mass Notification system via the AIC and be a supervised connection

PART 9 - MATERIALS AND EQUIPMENT:

9.1 Wiring System Materials: Provide basic wiring materials which comply with Division 16 Basic Materials and Methods sections, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings"; types to be selected by Engineer.

9.2 All conductors shall be solid copper, stranded copper or bunch tinned stranded copper for A.W.G. sizes 16 and 18 (stranded), a maximum of 7 strands shall be permitted. In A.W.G. sizes 16 and 18 (stranded) a maximum of 9 strands shall be permitted if strands are bunch tinned. In A.W.G. size 14 (stranded) a maximum of 19 strands shall be permitted. All conductors shall be labeled at both ends.

9.3 Junction boxes and terminal panels shall be painted red and be provided with a suitable number of terminals and of proper size for their use.

9.4 All wiring shall be installed in strict compliance with all the provisions of NEC-Article 760, Power-Limited Protective Signaling circuits. Wiring color code shall be maintained throughout the installation.

9.5 Manual Fire Alarm Stations: Provide manufacturer's standard construction, red enclosure, manual fire alarm stations to be similar to and compatible with the existing system.

9.5.1 Semi-flush mounted (finished areas).

9.5.2 Addressable

9.6 Automatic Fire Detectors: Provide manufacturer's standard construction addressable automatic fire detectors similar to and compatible with the existing system.

9.7 Automatic Smoke (Combustion Products) Detectors: Provide manufacturer's standard construction True Alarm automatic smoke detectors to be similar to and compatible with the existing system.

9.8 Automatic Alarm Initiative Switches and Extinguishing Systems: Provide manufacturer's standard construction automatic switches for the following applications:

9.8.1 Main type water flow switch.

9.8.2 Pressure or flow type switches for fixed extinguishing system.

9.9 Chimes: Provide manufacturer's standard construction electronic fire alarm chimes to be similar to and compatible with the existing system.

9.10 Combination Alarm Unit: Provide manufacturer's standard construction combination bell and light unit or combination chime and light as indicated on the drawings to meet provisions of ADA.

9.11 Annunciators: Modify all existing annunciators as required to accommodate all work of this project.

9.12 Control Panels: Modify all existing control panels and/or install new control panels as required to accommodate all work of this project.

PART 10 – POWER REQUIREMENTS:

10.1 The system shall be provided with sufficient battery capacity to operate the entire system upon loss of

normal 120 VAC power in a normal supervisory mode for a minimum of 24hrs, or a period of time as required by codes for the building occupancy. There shall be reserve battery capacity to drive all alarm appliances for five minute indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operating shall be automatic. Batteries, once discharged, shall recharge at a rate that will provide a minimum of 70% capacity in 12 hours, or sooner if required by codes. All batteries used within the system shall be of the same manufacturer, and labeled with their date when put in service.

10.2 All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

PART 11 - AUDIO VISUAL UNITS:

1. Speakers shall be UL Listed under Standard 1480 for Fire Protective Service, and speakers equipped with strobes shall be listed under UL Standard 1971 for Emergency Devices for the Hearing-Impaired

2. Speaker with strobes shall be certified to meet the requirements of FCC Part 15, Class B

3. All speakers shall be designed for a field-selectable input of either 25 or 70 VRMS; with selectable power taps from 1/8 watt to 2 watts

4. All wall-mount models shall have listed sound output of up to 89 dBA at 10 feet and a listed frequency response of 400 to 4000 Hz

5. All ceiling-mount models shall have listed sound output of up to 87 dB at 10 feet and a listed frequency response of 400 to 4000 Hz

6. Speaker shall incorporate a sealed-back construction

7. All inputs shall employ terminals that accept #12 to #18 AWG wire sizes

8. Strobe intensity, where Multi-Candela appliances are specified, shall have field-selectable settings, and shall be rated per UL Standard 1971 for:

   a. 15/30/75/110cd (wall mounting)

   b. 135/185cd (wall mounting)

9. Strobe intensity, where Multi-Candela appliances are specified, shall have field-selectable settings, and shall be rated per UL Standard 1971 for:

   a. 15/30/75/110cd (ceiling mounting)

   b. 135/185cd (ceiling mounting)

10. Selector switch for selecting the candela shall be tamper resistant

11. The strobes shall not drift out of synchronization at any time during operation

12. The strobes shall revert to a non-synchronized flash-rate, if the sync module or Power Supply should fail to operate (i.e. – contacts remain closed)

13. Wall-mount speaker and speaker-strobe appliances shall be designed for indoor-flush mounting to 4" x 2-1/8" electrical boxes without need for an extension ring or surface mounting

14. Ceiling-mount, speaker-strobe appliances shall be designed for indoor-flush mounting

15. Speaker and speaker strobe shall incorporate a speaker-mounting plate with a snap-on grille cover

16. The finish of the speakers and speakers strobes shall be white or red

17. Stair shall be separately zoned for notification.

PART 12 - INSTALLATION OF FIRE ALARM AND DETECTION SYSTEMS:

12.1 Install fire alarm and detection systems as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC.

PART 13 - INSTALLATION OF BASIC IDENTIFICATION:

13.1 Install electrical identification in accordance with Division 16 Basic Materials and Methods Section "Electrical Identification".

13.2 All conductors shall be marked at each termination and junction point. Markings shall be permanent. Markings shall be same as those which appear on "As Built Drawings".

PART 14 - INSTALLATION OF BASIC WIRING SYSTEM MATERIALS:

14.1 Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be in a completely separate conduit system from power wiring or other raceway systems. Minimum conduit size shall be 3/4" trade size.

14.2 All junction boxes shall be colored red and labeled "Fire Alarm". A consistent wiring color code shall be maintained throughout the installation. The number of wiring splices shall be minimized throughout. Excessive wire splicing shall be cause for rejection of the work, if so determined by the Engineer.

14.3 Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate tradesmen or other contractors.

14.4 The Contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of installation.

14.5 The manufacturer's authorized representative shall provide on-site supervision of installation, and shall perform the initial "power-up" of the system after he has thoroughly checked the installation.

14.6 All submittals for this project shall list names, license numbers, and telephone numbers of two installers that are employed full time by the manufacturer to install and test fire alarm systems in the installation location.

14.7 A floor plan drawing indicating fire alarm devices, their addresses, and labels shall be provided by the installing company for job site use. These drawings must be approved by the State Fire Marshal's

Office or local authority having jurisdiction, as appropriate and in accord with their requirements. A copy of this drawing shall be submitted to the Engineer for his review and project records.

PART 15 - FIELD QUALITY CONTROL:

15.1 Inspect relays and signals for malfunctioning, and where necessary, adjust units for proper operation to fulfill project requirements. Clean smoke detector chambers with gas to clear them of all foreign material.

PART 16 – TESTING:

16.1 The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the Owner's representative prior to the Fire Marshal inspection. Upon completion of a successful test, the Contractor shall certify the test results in writing to the Fire Marshal, Owner and Engineer. Provide written 72 hour advance notice of the test to all concerned parties.

16.2 All auxiliary devices the fire alarm system is connected to, including tamper switches, flow switches, etc., shall be fully tested for proper operation where interfacing with the fire alarm system.

16.3 The Contractor shall provide a minimum of eight hours of instructional time to the Owner in the operation and maintenance of all equipment and components. A receipt shall be obtained from the Owner that this has been accomplished, and a copy forwarded to the Engineer.

16.4 Contractor and manufacturer shall be required to accompany the engineer on a complete system verification after the installation has been certified. This shall include physically testing each device and reviewing descriptive device readout. This shall apply to all buildings of this project.

PART 17 - DEMONSTRATE AND INSTRUCTION:

17.1 Demonstrate and instruct Owner's representative in operation, service, and maintenance of units. Obtain receipt that this has been accomplished.

17.2 Provide a minimum of 4 hours of detailed instruction to the Owner's Representative at completion of the project.

17.3 At 4 months after completion and at 8 months after completion, provide 4 hours of detailed instructions and problem solving at the project for the Owner's Representatives.

PART 18 – WARRANTY:

18.1 The Contractor shall unconditionally guarantee (except for vandalism or misuse) the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of beneficial occupancy.

18.2 The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION

# SECTION 311000
# SITE CLEARING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, groundcovers and grass to remain.
2. Removing existing trees, shrubs, groundcovers and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and temporary erosion and sedimentation control procedures.
2. Division 1 Section "Execution" for verifying utility locations and for recording field measurements.
3. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
4. Division 32 Section "Turf and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

### 1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; 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 nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated on drawings by tree protection fence.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Record drawings, according to Division 1 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - EXECUTION

2.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

2.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

## 2.3 TREE PROTECTION

A. Erect and maintain temporary construction fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Mow lawn within and maintain fenced area free of weeds and trash throughout the duration of the project.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

## 2.4 UTILITIES

A. Contractor shall arrange for disconnecting and sealing indicated utilities that serve existing structures designated for demolition by drawings.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

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

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide alternate utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

## 2.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

## 2.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Do not stockpile topsoil within tree protection zones.
2. Stockpile surplus topsoil to allow for respreading deeper topsoil.

## 2.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

## 2.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 311000

# SECTION 312000
# EARTH MOVING

## PART 1 GENERAL

### 1.01 DESCRIPTION

A. Perform earthwork as shown and specified. The work includes:

1. Site grading and filling to indicated elevations and contours.
2. Excavating and backfilling structure footings and foundations.
3. Undercutting unsuitable materials.
4. Subgrade preparation for structure slabs, curbs, walks and paving.
5. Aggregate base for paving.
6. Topsoil distribution and finish grading.
7. Granular base under structure slabs-on-grade.

B. Related Work:

1. Section 311000: Site Clearing.
2. Section 334100: Storm Utility Drainage Piping.
3. Section 329200: Turf and Grasses.
4. Section 321313: Concrete Paving.

### 1.02 QUALITY ASSURANCE

A. Testing and inspection: Performed by a qualified independent testing laboratory, under the supervision of a registered professional engineer, specializing in geotechnical and soils engineering.

C. Contractor shall provide and pay for testing and inspection during earthwork operations. Laboratory, inspection service, and Geotechnical Engineer shall be acceptable to the Architect.

D. Owner shall provide and pay for earthwork special inspections required within the building footprint.
Special inspections for existing site soil conditions shall be as required by Section 1704 of the International Building Code (IBC).
The approved soils report and the documents prepared by the registered design professional shall be used to determine compliance.
During fill placement the special inspector shall determine that proper materials and procedures are used in accordance with the provisions of the approved soils report.

a. Verify materials below footings are adequate to achieve the design bearing capacity – periodically during construction.
b. Verify excavations are extended to proper depth and have reached proper material – periodically during construction.
c. Perform classification and testing of controlled fill materials – periodically during task listed.
d. Verify use of proper materials, densities and lift thickness during placement and compaction of controlled fill – continuous during task listed.
   1) Exception: Special inspection is not required during placement of controlled fill having a total depth of 12 inches or less. Inspection and testing under this exception is to be handled by the Contractor's testing agency.
e. Prior to placement of controlled fill, observe subgrade and verify that the site has been properly prepared – periodically during task listed.

E. Materials and methods of construction shall comply with the following standards:

1. Kentucky Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

2. American Society for Testing and Materials, (ASTM).

3. American Association of State Highway and Transportation Officials, (AASHTO).

4. National Fire Protection Association, (NFPA).

5. Report of Geotechnical Exploration by S&ME, Inc. dated June 25, 2018 and the Addendum dated July 9, 2018.

1.03 SUBMITTALS

A. Provide samples of materials proposed for use. Forward soil samples to testing laboratory for testing as directed by the Geotechnical Engineer.

B. Submit reports and certifications for testing and inspection of the following:

1. Fill and backfill materials.

2. Compaction operations.

3. Foundation excavations and footing subgrade.

1.04 PROJECT CONDITIONS

A. On behalf of the Owner, S&ME prepared the Report of Geotechnical Exploration dated June 25, 2018 and Addendum dated July 9, 2018. This report and addendum provides valuable information concerning the site and recommendations for construction. The report is provided as a reference in the Project Manual and all Contractors shall familiarize themselves thoroughly with them in order to fully understand the design intent of the Construction Documents. The Owner, Architect, Landscape Architect, Engineers and Geotechnical Engineer will not be held responsible for interpretations or conclusions

drawn by the Contractor based on data in the report. The Contractor shall ask for any ambiguities or discrepancies between the Report and the Construction Documents to be clarified prior to the deadline for final addendum, otherwise it is assumed that the Contractor fully understands the inherent site issues and no claims will be considered.

B. Known underground and surface utility lines are indicated on the drawing. Contractor is responsible for verifying location of existing utilities.

C. Protect existing trees, plants, lawns, and other features designated to remain as part of the landscaping work.

D. Protect excavations by shoring, bracing, sheeting, underpinning, or other methods, as required to prevent cave-ins or loose dirt from entering excavations. Barricade open excavations and post warning lights at work adjacent to public streets and walks.

E. Underpin adjacent structure (s), including utility service lines, which may be damaged by excavation operations.

F. Promptly repair damage to adjacent facilities caused by earthwork operations. Cost of repair at Contractor's expense.

G. Promptly notify the Architect of unexpected sub-surface conditions.

H. Protect bottoms of excavations and soil beneath and around foundation from frost and freezing.

I. Grade at excavations to prevent surface water draining into excavated areas.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. All fill material is subject to testing and inspection.

B. Fill materials outside of the building footprint: Inert subsoil material free of organic matter, rubbish, debris, and rocks greater than 6" diameter and meeting the following requirements:

1. Plasticity index of not more than 30 (lean clay) with a maximum dry density (ASTM D698) greater than 100 pcf.

2. Moisture content of compacted fill shall be maintained at plus or minus 2 percent of optimum moisture.

3. Utilize off-site borrow fill material to complete required fills of 95% compaction and above. PI of off-site borrow fill is to be less than 30. Verify suitability of off-site borrow fill material and locations with the Geotechnical Engineer.

4. Proposed fill material shall be inspected and tested prior to use in the work.

5. Suitable excavated lean clay removed to accommodate new construction may be used as fill material subject to Geotechnical Engineer's inspection and approval.

C. Fill materials within the building footprint shall be dense graded aggregate (DGA) beneath floor slab and lean concrete or flowable fill beneath foundation footings. DGA shall be compacted to 98% of standard proctor density.

D. Granular base: AASHTO M43, #2 or #57 clean uniformly graded stone or gravel as noted on plans.

E. Granular fill: AASHTO M43, #2, #57 or #9 clean uniformly graded stone or gravel as noted on plans.

F. Topsoil: Natural, friable, fertile soil characteristic of productive soil in the vicinity, reasonably free of stones, clay lumps, roots, and other foreign matter.

1. Import topsoil as required to complete the work.

2. Proposed topsoil material shall contain a minimum of 3% organic matter.
   a. Contactor shall provide testing of off-site topsoil prior to use on the project site.

G. Silt fence: Amoco 2130 or equal.

H. Other materials required for proper completion of work: As selected by Contractor and acceptable to Architect.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Establish extent of grading and excavation by area and elevation. Designate and identify datum elevation and project engineering reference points. Set required lines, levels, and elevations.

B. Do not cover or enclose work of this Section before obtaining required inspections, tests, approvals, and location recording.

### 3.02 EXISTING UTILITIES

A. Before starting grading and excavation, establish the location and extent of underground utilities in the work area by contacting utility companies. Exercise care to protect existing utilities during earthwork operations. Perform excavation work near utilities by hand and provide necessary shoring, sheeting, and supports as the work progresses.

B. Maintain, protect, relocate, or extend as required existing utility lines to remain which pass through the work area. Pay costs for this work, except as covered by the applicable utility companies.

C. Protect active utility services uncovered by excavation.

D. Remove abandoned utility service lines from areas of excavation. Cap, plug, or seal abandoned lines and identify termination points at grade level with markers.

E. Accurately locate and record abandoned and active utility lines rerouted or extended on project record documents.

3.03 SITE GRADING

A. Perform grading within contract limits, including adjacent transition areas, to new elevations, levels, profiles, and contours indicated. Provide subgrade surfaces parallel to finished surface grades. Provide uniform levels and slopes between new elevations and existing grades.

B. Grade surfaces to assure areas drain away from structures and to prevent ponding and pockets of surface drainage. Provide subgrade surfaces free from irregular surface changes and as follows:

1. Rough grading: Plus or minus 0.10 ft. subgrade tolerance. Finish required will be that ordinarily obtained from either blade-grader or scraper operations.

2. Provide subgrade surface free of exposed gravel or stone exceeding 4" in greatest dimension in paved areas or 1" in lawn and planting areas. Areas with concentrated amounts of stone of any size including smaller than 1", such as stockpile/staging areas, edges of pavement or utility trenches, shall be raked clean of stone prior to placement of topsoil.

3. Lawn and planting areas: Allow for minimum 4" average depth of topsoil at lawn areas, and 12" depth at planting areas, except as otherwise indicated on the drawings.

4. Paved areas: Shape surface of subgrade areas to line, grade, and cross-section indicated. Provide compacted subgrade suitable to receive paving base materials. Subgrade tolerance plus 0, minus 1/2".

5. Granular base: Grade subgrade surface smooth and even, free of voids to the required subgrade elevation. Provide compacted subgrade suitable to receive granular base materials. Tolerance 1/2" in 10'-0".

C. Grading at existing trees to remain:

1. Perform grading, within branch spread of existing trees to remain, by hand methods to elevations indicated.

2. Cut roots cleanly to depth 3" below proposed finish grade. Coat cut roots with tree paint.

3.04 EXCAVATING

A. All soil shall be removed below foundation footings to solid bedrock. All foundations shall bear on solid bedrock, lean concrete or flowable fill placed over solid bedrock. Floor slab shall bear on DGA placed over solid bedrock at a minimum compacted depth of 4" below bottom of slab to maximum 36" below bottom of slab. Soil shall be removed beneath floor slab to the surface of solid bedrock, but not to exceed a depth of 36" below bottom of slab. Soil greater than 36" below bottom of slab without encountering rock may

remain. Rock shall be excavated as necessary to accommodate all driveways, sidewalks/patios, site utilities and utilities under slab. No additional payment will be made for rock excavation.

B. Obtain inspection and testing of foundation excavations by Geotechnical Engineer before concrete is placed.

C. Excavate for curbs, walks, and paving to elevations and grades indicated. Allow for base material. Obtain inspection and testing of subgrades for paving.

D. Earth excavation shall include the satisfactory removal and disposal of all materials encountered, regardless of the nature of the materials, the condition of the materials at the time they are excavated, or the manner in which they were excavated. **All excavation shall be unclassified.**

E. Unauthorized excavation: Backfill and fill all over excavation to proper grades. Fill over excavation at footings with 1,500 psi concrete. Additional labor and material for unauthorized excavation and remedial work at Contractor's expense.

F. Shore, sheet, or brace excavations as required to maintain them as secure from caving. Remove shoring and bracing as backfilling progresses, when banks are safe against caving.

G. The use of explosives is not permitted.

H. Cut away rock in bottom of excavations to form level beds that follow natural strata. Form with sharp steps when steps are necessary. In utility trenches, excavate 6" below invert elevation of pipe and 24" wider than pipe diameter, minimum 36" trench width. Remove loose materials to sound base.

I. Existing sewerage: Where existing sewers pass beneath new paving, remove existing earth fill to the top of the sewer pipe or to a depth as directed by the Geotechnical Engineer. Install an approved backfill material compacted in maximum 8" layers. Extend compacted fill from top of sewer pipe to proposed paving subgrade elevation.

3.05 DRAINAGE

A. Provide necessary pumps and drainage lines and maintain excavations, including footings and pits, free from water, ice and snow during excavating and subsequent work operations.

B. Provide drainage of the working area at all times.

3.06 AGGREGATE BASE COURSES

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. Shape base course to required crown elevations and cross-slope grades.

Place base course 6 inches or less in compacted thickness in a single layer.

2. 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.

3. 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.

3.07 FILLING, BACKFILLING, AND COMPACTING

A. Obtain inspection and approval of subgrade surfaces by Geotechnical Engineer prior to filling operations. Scarify, dry, and compact soft and wet areas; remove and replace unsuitable subgrade materials with an approved compacted fill material. Take corrective measures before placing fill materials.

1. Fat Clay and Topsoil not permitted as fill or backfill material within structure limits or under paved areas.

B. Spread approved fill material uniformly in layers not greater than 8" of loose thickness over entire fill area.

1. Lift thickness requirements may be modified by Geotechnical Engineer to suit equipment and materials or other conditions when required to assure satisfactory compaction.

2. Moisture-condition fill material by aerating or watering and thoroughly mix material to obtain moisture content permitting proper compaction.

3. Place and compact each layer of fill to indicated density before placing additional fill material. Repeat filling until proposed grade, profile, or contour is attained.

4. Suspend fill operations when satisfactory results cannot be obtained because of environmental or other unsatisfactory site conditions. Do not use muddy or frozen subgrade surface. Do not place fill material on muddy or frozen subgrade surface.

5. Maintain surface conditions, which permit adequate drainage of rainwater and prevent ponding of surface water in pockets. When fill placement is interrupted by rain, remove wet surface materials or permit to dry before placing additional fill material.

D. Filling at existing trees to remain:

1. Minor fills or 6" or less: Fill with topsoil; hand grade to required finish grade elevation.

2. Moderate fills of 12" or less: Place layer of 3/4" to 1-1/2" stone or gravel on grade. Provide aggregate depth 1/2 of fill height, minimum of 3". Cover drainage fill with polypropylene filter fabric or 1" thickness straw choke. Fill remaining depth with loose topsoil; hand grade to required finish grade elevations.

E. Place backfill materials in uniform layers not greater than 8" loose thickness over entire backfill area.

1. Use hand tampers or vibrating compactors at foundation walls, retaining walls, and similar locations. Do not use large rolling equipment adjacent to foundation walls and retaining walls.

2. Do not backfill against foundation walls or retaining walls until walls for bearing surfaces have reached design strength or are properly braced, and backfilling operations approved. Provide clean backfill materials, except where granular materials are indicated. Compact in maximum 8" layers.

F. Fill all areas of settlement to proper grade before subsequent construction operations are performed.

G. Backfill building structural slabs with crushed stone per structural drawings.

H. Compaction:

1. Provide compaction control for all fill and backfill.

2. Compact top 12" of subgrade and each layer of fill or backfill material at foundations and floor slabs to 98% of maximum dry density at optimum moisture content in accordance with ASTM D698 Standard Proctor Method. Extend compaction at least 5'-0" at both sides of foundations.

2. Compact top 12" of subgrade and each layer of fill or backfill material at paved areas to 100% of maximum dry density at optimum moisture content in accordance with ASTM D698 Standard Proctor Method. Compact subgrade below 12" to 95% of maximum dry density at optimum moisture content in accordance with ASTM D698. Extend compaction at least 5'-0" at both sides of foundations and retaining walls and at least 1-0" beyond slabs-on-grade and paving.

3. Compact top 6" of subgrade and each layer of fill material at lawns and unpaved areas to 85% of maximum dry density at optimum moisture content in accordance with ASTM D698 Standard Proctor Method.

4. Water settling, puddling, and jetting of fill and backfill materials as a compaction method are not acceptable.

5. Maintain moisture content of materials, during compaction operations within required moisture range to obtain indicated compaction density.

6. Provide adequate equipment to achieve consistent and backfill materials.

## 3.08 EROSION CONTROL

A. Provide erosion control measures as indicated on plans including installation of silt fencing, installation of silt check inlet controls and sod lined channels and basins with specified materials.

1. Install silt fence in areas indicated on plans to conform with specified details. Silt fencing shall be installed prior to all grading activity.

B. Contractor shall provide continual maintenance of erosion control structures, including but not limited to:

1. Removal of silt, trash, mud, debris from ditches, channel and from silt fences and check dams.

2. Replacement of silt fence that has been damaged or destroyed.

3. Removal of erosion control structures at the end of construction or as specified.

C. Contractor shall provide sodding as required in Section 329200 as soon as disturbed area has been graded to final elevations specified.

D. Contractor shall keep all public roads free of silt, dirt, mud and debris throughout the entire project. Contractor shall remove and clean any silt, dirt, mud and debris from roadways at their expense.

E. The Storm Water Pollution Prevention Plan is found in Section 312001. Contractor shall thoroughly read and comply with all aspects of this plan. The plan includes certifications that must be signed and submitted by the contractor and appropriate sub-contractors prior to approval of the first application of payment.

F. The Contractor shall be responsible for preparing and submitting the Notice of Intent to governing agency.

3.09 FINISH GRADING

A. Prior to finish grading, make certain that areas with concentrated amounts of stone of any size including smaller than 1", such as stockpile/staging areas, edges of pavement or utility trenches, have been raked clean of stone prior to placement of topsoil. Uniformly distribute and spread stockpiled topsoil. Provide minimum 4" average depth at lawn areas, 12" at planting areas. If necessary, provide additional imported topsoil as required to complete the work. Use loose, dry topsoil. Do not use frozen or muddy topsoil. Place during dry weather. Do not grade topsoil with equipment that will over compact topsoil preventing the adequate root growth of proposed turf. Bulldozers and backhoes are not suitable for finish grading. Skid steers or tractors with box graders shall be used.

B. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of subgrades.

C. Remove stones, roots, weeds, and debris while spreading topsoil materials. Rake surface clean of stones 1" or larger in any dimension and all debris. Provide surfaces suitable for soil preparation provided under lawn and planting work.

D. Landscape Architect shall be notified a minimum of 2 days prior to placement of topsoil so the subgrade may be inspected and the placement of topsoil by the Contractor may be observed.

E. Maintenance:

1. Protect finish graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and damaged areas.

2. Where completed areas are disturbed by construction operations or adverse weather, scarify, re-shape, and compact to required density.

## 3.10 FIELD QUALITY CONTROL

A. Provide field quality control soils testing and inspection during earthwork operations.

B. Contractor shall provide adequate notice, cooperate with, provide access to the work, obtain samples, and assist testing agency and their representatives in execution of their function.

C. Fill materials: Test proposed materials to verify suitability for use, gradation of material, moisture-density relation by ASTM D698 Standard Proctor Method, design bearing value, and percent of organic materials.

D. Subgrade surfaces: Based on visual examination at the site, provide bearing tests as required to verify questionable subgrade surfaces are adequate and meet or exceed design bearing values.

1. Structure slabs and paved areas: Make at least 1 test for each 2,000 sq. ft. of questionable surface.

E. Compaction operations: Provide full-time inspection and testing during structure slabs and paved areas filling and compaction operations. Test each lift to fill to verify compaction meets specified requirements. Provide periodic inspection and testing during site area filling and compaction operations.

1. Structure slabs and paved areas: Make at least 1 test for each 5,000 sq. ft. of each 8" thick fill lift. A minimum of two tests per each lift are required.

2. Foundation wall and retaining wall backfill: Make at least 2 tests at locations and elevations directed by the Geotechnical Engineer.

F. Foundation excavations: Based on visual examination at the site, provide bearing tests as required to verify bearing surfaces are adequate and meet or exceed design bearing values.

1. Make at least 2 tests at locations directed by the Geotechnical Engineer.

G. When, during progress of work, field tests or observations indicate that installed compacted materials do not meet specified requirements, provide additional compaction until specified density is achieved, or remove and replace defective materials with new materials as directed by the Landscape Architect. Cost of additional labor, materials, and testing to attain specified density at Contractor's expense.

## 3.11 DISPOSAL OF WASTE MATERIALS

A. Stockpile, haul from site, and legally dispose of waste materials, including excess excavated materials, rock, trash, and debris.

B. Maintain disposal route clear, clean, and free of debris. Disposal in any floodplain is not allowed.

3.12 CLEANING

A. Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for site work operation.

END OF SECTION

# SECTION 312001
# STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The following documents comprise the SWPPP:

1. Specification Section 311000, 312000
2. Best Management Practices (BMP) Plan
3. Notice of Intent (NOI)
4. Notice of Termination (NOT)
5. Contractors BMP implementation schedule
6. Operation and Maintenance Plan Checklist

### 1.2 SUBMITTALS

A. Notice of Intent: An NOI is not necessary on this project since it is less than an acre of disturbance, however, all BMP must be installed and maintained as if an NOI was required.

B. Contractors BMP implementation schedule: Prior to mobilizing on the site, the Contractor shall submit a detailed schedule to the design professional outlining the sequence of major activities that includes the installation of all controls, earth disturbing activities and stabilization activities. This implementation schedule will become part of the SWPPP.

### 1.3 QUALITY ASSURANCE

A. Inspections: The Contactor shall employ a qualified erosion control inspector to inspect all storm water control measures as outlined in the KPDES Storm Water General Permit (KYR10). Qualified inspector shall be certified by the Kentucky Erosion Prevention and Sediment Control Program (KEPSC). Inspections shall be made at least once every 7 days and within 24 hours of the end of a storm event that is 0.5 inches or greater. Areas that have been temporarily or finally stabilized shall be inspected at least once every month. Revisions to the BMP plan based on the results of the inspection shall be implemented within seven (7) days of the inspection.

B. Reports: The qualified inspector conducting the inspections shall prepare a report summarizing the scope of the inspection, names and qualifications of personnel making the inspection, the date of the inspection, major observations relating to the implementation of the BMP plan, and any corrective actions taken shall be made and kept as part of the BMP plan for at least three (3) years after the date of the inspection, or until one (1) year after coverage under the General Permit (KYR10) ends. The report is to be signed by the qualified inspector. A copy of the report is to be delivered to CARMAN and the Contractor via the same transmittal and at the same time.

C. The SWPPP implementation and methods of construction shall comply with the following standards

1. KPDES General Permit No.: KYR10, General KPDES Permit for Storm Water Point Source Discharges Construction Activities.
2. EPA 832-R-92-005: Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

## 1.4 PROJECT DESCRIPTION

A. General: The proposed development and land disturbance activity is located in Woodford County at 1300 Troy Pike in Versailles, KY. A kitchen/cafeteria is being added to the existing Southside Elementary School

B. Soils: The Woodford County Soil Survey was researched to determine the soil types for the affected acreage on this project. The project site consists of the following soil types:

| Soil | Soil Type | Curve No. |
|---|---|---|
| McAfee Silt Loam 2-6% & 6-12% | C | 74 |

C. Site Conditions: The topography of the site slopes to the southeast and then curls around to the southwest in a large drainage swale where stormwater leaves the site as surface flow

D. Critical Areas:

1. Troy Pike: It is crucial for the motoring public to prevent mud and debris from entering the roadway.
2. Sediment controls must be in place prior to land disturbance activities to prevent sediment laden runoff from leaving the site and reaching the receiving water.

## 1.5 MATERIAL INVENTORY

A. The material or substances listed below are expected to be present onsite during construction. The Contractor shall amend this list as appropriate as part of the overall SWPPP.

1. Concrete
2. Detergents
3. Paints (enamel and latex)
4. Metal studs
5. Tar
6. Metal roofing
7. Fertilizers
8. Masonry Block
9. Wood
10. Petroleum products

## PART 2 - CONTROLS

### 2.1 EROSION AND SEDIMENT CONTROL MEASURES

A. The erosion and sediment control measures will be typical of a small-scale earth moving site including:

1. Construction Entrance
2. Dust and Pollutant Control
3. Fertilizer Application Control
4. Mulching-Permanent and Temporary
5. Silt Traps
6. Silt Fence Silt Control
7. Land Grading
8. Permanent Seeding/Sodding
9. Inlet Protection

### 2.2 BMP PLAN

A. The permittee shall modify the BMP plan when there is a change in design, construction, operation, or maintenance of the site which has significant effect on the potential for the discharge of pollutants to the waters of the Commonwealth and shall implement the changes within seven (7) days.

B. The permittee shall amend the BMP plan if it proves to be ineffective in controlling the discharge of pollutants to the waters of the Commonwealth and shall implement the changes within seven (7) days.

### 2.3 STABILIZATION PRACTICES

A. Temporary Stabilization: Temporary stabilization of top soil stockpiles and disturbed portions of the site shall begin within 14 days on areas where construction activities have temporarily (for 21 days or more) ceased. Temporary stabilization can be accomplished through seeding Rye (grain) applied at 120 pounds per acre and/or straw mulching at a rate of 4,000 pounds of straw per acre.

B. Permanent Stabilization: Disturbed portions of the site where construction activities permanently ceases shall be stabilized with permanent seed or sodded no later than 14 days after the last construction activity. Most areas will be sodded, however, seeded areas will receive the following. The permanent seed mix shall consist of 90% tall fescue (Festuca arundinacea) blend of minimum three (3) cultivars and 10% annual rye sown at a rate of 175-lbs/acre. Prior to seeding, ground agricultural limestone at rate specified by soil test and 220 lbs/acre of 20-26-6 fertilizer shall be applied to each acre stabilized. Seeding shall be done with a hydroseeding process as specified. Steep slopes and drainage channels shall be sodded. Follow specs for post fertilization and maintenance for watering, etc.

C. Dust Control: Apply water, polyacrylamide, or other stabilizers to bare areas if windblown dust becomes a problem. Vegetative cover is the most effective means of dust and erosion control.

D. Storm water management: The development of the site will result in increased runoff during construction while the areas are graded and denuded. The contractor shall conduct all operations responsibly to prevent off-site sedimentation. Curb and gutter, catch basins, yard drains, and trench drain and piping will provide storm water capture and underground detention chambers will provide control. Roof drains will be piped underground to the storm drain system to prevent surface splash and erosion. The structural control measures detailed on the Erosion Control Plan are proposed to minimize the impact of erosion. A water quality unit will provide permanent water quality to runoff before it leaves the site and enters the public storm sewer.

E. The contractor shall also manage the site as needed according to the following checklist:

1. Manage the site to infiltrate stormwater into the ground and keep sediment out of storm drains.
2. Minimize the amount of exposed soil on site at any one time to the extent possible.
3. Plan the project in stages to minimize the amount of area that is bare and subject to erosion.
4. Vegetate disturbed areas with permanent or temporary seeding immediately upon reaching final grade.
5. Vegetate or cover stockpiles that will not be used immediately.
6. Reduce the velocity of stormwater both onto and away from the project area.
7. Use interceptors, diversions, vegetated buffers, and check dams to slow down stormwater as it travels across and away from the project site.
8. Construct temporary diversion measures to direct flow away from exposed areas toward stable portions of the site.
9. Protect defined channels immediately with measures adequate to handle the storm flows expected.
10. Use sod, geotextile, natural fiber, riprap, or other stabilization measures to allow channels to carry water without causing erosion.
11. Maintain all BMPs to ensure their effectiveness during the life of the project.
12. Maintain fences that protect sensitive areas, silt fences, diversion structures, and other BMPs.

## 2.4 OTHER CONTROLS

A. Waste Materials: All waste materials will be collected and stored in a secure metal dumpster rented from licensed waste management company. Dumpster shall meet all local and site solid waste regulations. All trash and construction debris will be deposited in the dumpster. The dumpster will be emptied when 90% full and trash hauled to the respective approved landfill. No construction waste will be buried on site. All personnel will be instructed regarding the correct procedure for waste disposal. Notices stating these practices will be posted at the office trailer and the site superintendent will be responsible for seeing that these procedures are followed.

B. Hazardous Waste: The use of any hazardous material is not anticipated at this site. But in such an event all hazardous waste materials will be disposed of in a manner specified by local or state regulation or by manufacturer. Site personnel will be instructed in these practices, and the site superintendent will be responsible for seeing that these practices are followed.

C. Sanitary Waste: All sanitary waste will be collected from portable units at a minimum of one time per week by a licensed sanitary waste contractor as required by local regulation.

D. Offsite vehicle tracking: Stabilized construction entrances shall be provided to help reduce vehicle tracking of sediments at the primary points of entry to the site. The adjacent paved

street will be swept to remove any excess mud, dirt or rock tracked from site. Dump trucks hauling material from the site will be covered with a tarpaulin.

E. Non-Storm Water Discharges: It is expected that the following non-storm water discharges could occur from the site during the construction period

1. Water from water line sterilization/flushing. All water to be treated, neutralized, and handled per Kentucky Division of Water regulations.
2. Pavement wash waters (where no spills or leaks of toxic or hazardous materials have occurred).
3. Uncontaminated ground water (from dewatering excavation as applicable).

## 2.5 SEQUENCE OF MAJOR ACTIVITIES

A. The Contractor shall prepare his BMP implementation schedule based on the following outline of major activities.

| Construction Activity | Schedule Consideration |
|---|---|
| Construction Access-entrance to site, construction routes, equipment parking areas | This is the first land disturbing activity. As soon as construction begins, stabilize any bare areas with gravel and temporary vegetation. |
| Sediment traps and sediment fences | After construction site is accessed, principal sediment fence barriers, as applicable, should be installed, with addition of temporary traps and barriers as needed during grading operation. |
| Runoff control-diversions, perimeter dikes, water bars, outlet protection | Key practices should be installed after the installation of principal sediment traps and before land grading. Additional runoff control measures may be installed during grading as required. |
| Land clearing and grading-site preparation (topsoil strip, excavation, fill placement, grading, sediment traps, barriers, diversions, drains, surface roughening) | Implement major clearing and grading after installation of principal sediment and run off control measures, and install additional control measures as grading continues. Clear borrow and disposal areas as required, and mark tree and buffers for preservation. Clearing will be kept to a minimum. |
| Surface stabilization-temporary and permanent seeding, mulching, sodding, riprap | Temporary or permanent stabilizing measure should be applied immediately to any disturbed areas where work has been either completed or delayed 21 days. Land disturbance will be scheduled to limit exposure of bare soils to erosive elements to the extent possible. |
| Building construction-buildings, utilities, storm piping, curb and gutter, paving | During construction, install any erosion and sediment control measures that are needed per the attached specific sediment control plan and ac- |

| | |
|---|---|
| | cording to local regulatory agency, i.e., additional inlet control, etc. Install gravel areas for building material lay down and for vehicular traffic. |
| Landscaping and final stabilization-backfilling, topsoil replacement, trees, shrubs, permanent seeding, sodding, riprap | Last construction phase. Vegetation and mulch will be applied to applicable areas immediately after final grading is completed. Stabilize all open areas, including, borrow and fill areas, remove and stabilize temporary control measures as prescribed on the accompanying erosion control plan sheets. |

B. Timing of controls/measures: As indicated on the Sequence of Major Activities, silt fences and construction entrances will be constructed prior to clearing or grading on other portions of the site. Areas where construction activity ceases for more than 21 days will be stabilized with temporary seed and mulch within 14 days of the last disturbance. Once construction activity ceases permanently in an area, that area will be stabilized with permanent seed and mulch or sod as specified. After the entire site is stabilized, the accumulated sediment will be removed from the trap or basin and the berms removed as applicable.

## 2.6 SPILL PREVENTION

A. Good Housekeeping: The following are material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.

1. An effort will be made to store only enough product to do the job.
2. All materials stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
3. Portable restrooms are to be located so that any spill will not enter into the stormwater runoff.
4. Products will be kept in their original containers with original manufacturers label.
5. Substances will not be mixed with one another unless recommended by manufacturer.
6. Whenever possible, all of a product will be used up before disposing of the container.
7. Manufacturers' recommendations for proper use and disposal will be followed.
8. The site superintendent will inspect daily to ensure proper use and disposal of materials onsite.
9. Petroleum products if stored on-site are to be contained within a double wall steel tank. Tank is to be inside of a bermed area lined with 6 mil plastic. Containment area is to be capable of withholding the entire contents of the tank in the event of a catastrophic spill.

B. Hazardous Products: Hazardous materials are not expected to be brought to the site, if they are required then the guidelines below should be followed.

1. Product will be kept in original containers unless they are not resealable.
2. Original labels and material safety data sheets will be retained for product information.
3. If surplus product must be disposed of, manufacturer's, local government, and state recommended methods for proper disposal shall be followed.

C. Petroleum Products: All onsite vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chances of leakage. Petroleum products will be stored in tightly sealed containers, which are clearly labeled. Portable equipment fuel tanks will be

located as far away from surface water bodies as possible. All oils drained from equipment will be captured in pans or other suitable equipment and placed in drums for removal from site for disposal at an approved off-site location.

D. Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

E. Paints: All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system, but will be properly disposed of according to manufacturers' instructions or State and local regulations.

F. Concrete trucks will be required to wash out or discharge surplus concrete or drum wash water into a wash out pit that would be constructed by the Contractor. The wash out pit shall be designated in an area that does not receive significant runoff and does not drain into a storm network. Upon the completion of the project, this area would be cleared of the concrete and the site restored.

G. Any asphalt substances used onsite will be applied according to LFUCG standards.

H. Spill Control Practices: In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup.

1. Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the locations of the information and cleanup supplies.
2. Materials and equipment necessary for spill cleanup will be kept in the material storage are onsite. Equipment and materials will include but not limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically designed for this purpose.
3. All spills will be cleaned up immediately after discovery.
4. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
5. Spills of toxic or hazardous material will be reported to the appropriate State or local government agency, regardless of size.
6. The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill is there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.
7. The site superintendent responsible for the day-to-day site operations will be the spill prevention and cleanup coordinator. He will designate at least three other site personnel who will receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area in the office trailer onsite.

I. Spill Notification: In the event of a spill, make the appropriate notification(s) consistent with the following procedures.

1. Any spill of gasoline greater than 25 gallons in a 24-hour period or spill of diesel fuel greater than 75 gallons in a 24-hour period must be reported to the Kentucky Environmental Response Team at (800) 928-2380.

2. Any spill of oil that 1) violates water quality standards, 2) produces a "sheen" on a surface water, or 3) causes a sludge or emulsion must be reported to the Kentucky Environmental Response Team at (800) 928-2380.
3. Any spill of oil or hazardous substance to waters of the state must be reported immediately by the telephone to the List State agency and phone number.
4. Any release of a hazardous substance that may be a threat to human heath or the environment must be reported to the List State agency and phone number immediately upon discovery.

## PART 3 - CERTIFICATION

### 3.1 CONTRACTORS AND SUBCONTRACTORS

A. As part of the BMP implementation schedule, the Contractor shall clearly state the Contractor or Subcontractor that will implement each control measure identified on the BMP plan.

B. All Contractors and Subcontractors identified in the BMP plan must sign a copy of the certification statement below before conducting any professional service at the site.

1. General Contractor

"I certify under penalty of law that I understand the terms and conditions of the general National Pollution Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification."

_____ _____
Company Name, Address and Phone Name

_____ _____
Title

_____ _____
Site Address

_____

2. Earthwork Subcontractor

"I certify under penalty of law that I understand the terms and conditions of the general National Pollution Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification."

_____ _____
Company Name, Address and Phone Name

_____ _____
Title

_____ _____
Site Address

_____

3. Storm Sewer Subcontractor

"I certify under penalty of law that I understand the terms and conditions of the general National Pollution Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification."

_____ _____
Company Name, Address and Phone Name

_____ _____
Title

_____ _____
Site Address

_____

4. Site Utility Subcontractor

"I certify under penalty of law that I understand the terms and conditions of the general National Pollution Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification."

_____ _____
Company Name, Address and Phone Name

_____ _____
Title

_____ _____
Site Address

END OF SECTION 312001

# SECTION 313116
# TERMITE CONTROL

## 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. This Section includes the following:

1. Soil treatment with termiticide.

### 1.3 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

### 1.4 SUBMITTALS

A. Product Data: For termiticide system.

1. Include the EPA-Registered Label for termiticide products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products through one source.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" to schedule application of termiticide products.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Termiticides:

a. Aventis Environmental Science USA LP; Termidor.

b. BASF Corporation, Agricultural Products; Termidor.

c. Bayer Environmental Science; Premise 75.

d. FMC Corporation; Agricultural Products Group; Prevail.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

## 3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

## 3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

# SECTION 321313
# CONCRETE PAVING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Walkways.
2. Driveways.

B. Related Sections include the following:

1. Section 312000 "Earth Moving" for subgrade preparation, grading, and subbase course.
2. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.

### 1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

### 1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

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

C. Field quality-control test reports.

### 1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

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

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

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

## 1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

## 2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet (30.5 m) or less.

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

## 2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

C. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

D. Tie Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

E. Hook Bolts: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

## 2.4 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150, Type I, gray.

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

1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

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

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide 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.

## 2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

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.

1. Products:

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edeco; BurkeFilm.

c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, ChemRex Inc.; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation; Finishing Aid.
p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Products:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. Burke by Edoko; Aqua Resin Cure.
c. ChemMasters; Safe-Cure Clear.
d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
f. Euclid Chemical Company (The); Kurez DR VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; Aqua Kure-Clear.
i. L&M Construction Chemicals, Inc.; L&M Cure R.
j. Meadows, W. R., Inc.; 1100 Clear.
k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
l. Symons Corporation; Resi-Chem Clear.
m. Tamms Industries Inc.; Horncure WB 30.
n. Unitex; Hydro Cure 309.
o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

## 2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4500 psi.
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
2. Air Content: 6 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.
3. Air Content: 6 percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

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

1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

## 2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

## 2.8 RELATED MATERIALS

A. Joint Fillers: ASTM D1752 premolded resilient non-extruding, non-staining closed cell foam polyethylene.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) require correction according to requirements in Division 2 Section "Earthwork."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

## 3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

## 3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement 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. 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.

## 3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings 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 pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Butt Joints: Use bonding agent 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 (38 mm) into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet (15.25 m), unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) 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. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. 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 to match jointing of existing adjacent concrete pavement:

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 (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

E. Edging: Tool edges of pavement and joints in concrete adjacent to existing concrete to match existing. If no adjacent concrete to match, tool edges of pavement and joints in concrete after initial floating with an edging tool to a 1/4-inch (6-mm) radius.

## 3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and 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.

F. Do not add water to fresh concrete after testing.

G. 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.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

J. Screed pavement surfaces with a straightedge and strike off.

K. 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.

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

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) 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 mix designs.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. 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. Medium Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 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 (1 kg/sq. m 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:

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

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

## 3.9 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch (6 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm).
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).

7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

## 3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: 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 1 composite sample for each 5000 sq. ft. (465 sq. m) or fraction thereof of each concrete mix 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/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. 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 mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 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 (3.4 MPa).

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. 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.

F. 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.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

# SECTION 321373
# 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. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.

B. Related Sections include the following:

1. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

### 1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

## 1.6 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.
2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

### 2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.3 COLD-APPLIED JOINT SEALANTS

A. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Use T.

a. Available Products:

1) Pecora Corporation; Urexpan NR-300; or equal

## 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.

1. 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. 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 sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

D. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

F. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

## 3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

## 3.5 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 with repaired areas are indistinguishable from the original work.

END OF SECTION 321373

# SECTION 329200
# TURF AND GRASSES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Hydroseeding for temporary stabilization.

2. Erosion control blankets.

3. Sodding for all permanent lawns.

B. Related Sections include the following:
1. Section 312000 "Earth Moving" for excavation, filling and backfilling, and rough grading.

### 1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

### 1.4 SUBMITTALS

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

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for sod, identifying source, including name and telephone number of supplier.

C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

D. Qualification Data: For landscape Installer.

E. Material Test Reports: For existing surface soil and imported topsoil.

F. Planting Schedule: Indicating anticipated planting dates for each type of planting.

G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape contractor with a minimum of three (3) years experience with successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

E. Contractor shall schedule an inspection by the Landscape Architect of areas following finish grading and prior to seeding. Notifications shall be given two (2) days in advance of seeding operations.

F. Another inspection by the Landscape Architect shall be required following notification by the Contractor that seeding and mulching operations are complete.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

## 1.7 SCHEDULING

A. Planting Restrictions: Sod during the following period. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Fall Planting: October 1 – November 15
2. Spring Planting: March 1 – May 15

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

2. Sodded Lawns: 30 days from date of Substantial Completion.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches for a minimum of three (3) weeks after seeding/sodding or throughout the maintenance period, whichever is greater.

1. Water daily with a fine spray and schedule watering based on weather conditions to prevent drying, wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. A typical Kentucky summer evapotranspiration rate for lawn of 0.16 inches/day means that 1.12 inches of precipitation per week, whether it be irrigation or rainfall, is needed to maintain lawn growth. Complete reliance on rainfall, even for large sites, is unacceptable, if less than one inch of rain occurs per week. Water established lawns at a minimum rate of 1.12 inches per week, including rainfall. Severely hot and dry weather will require more than the minimum rate of watering in order to maintain the moisture depth to 4 inches.
3. Contractor shall provide the water. Temporary meter(s) shall be used to purchase water from the utility company or it shall be hauled to the site at Contractor's expense.

C. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow grass 2.5 to 3 inches high.

D. Lawn Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to lawn area.

## PART 2 - PRODUCTS

### 2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species, as follows:

C. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Proportioned by weight as follows:

a. 100 percent annual rye.

### 2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
1. 90% turf type tall fescue (Festuca arundinacea) and 10% bluegrass.

### 2.3 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of one percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth. Provide 6" minimum depth in lawn areas.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs or marshes.

### 2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.
2. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## 2.5 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

## 2.6 PLANTING ACCESSORIES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.7 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.8 MULCHES

A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.9 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in an accelerated photodegradable polypropylene mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long. The basis of design shall be DS75 by North American Green (www.nagreen.com).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

   1. Protect adjacent and adjoining areas from hydroseeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

## 3.3 LAWN PREPARATION

A. Limit lawn subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1 inch (25 mm) in any dimension and large quantities of smaller rock, including remnants of gravel stockpiles or excess pavement DGA, as well as sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply fertilizer directly to subgrade before loosening.
2. Spread topsoil, apply fertilizer on surface, and thoroughly blend planting soil mix.

    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil mix to a depth of 6 inches minimum but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

    a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of planting soil mix.
    b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least of 6 inches (150 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches (100 mm) of soil. Till soil to a homogeneous mixture of fine texture.

    a. Apply fertilizer directly to surface soil before loosening.

3. Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, trash, and other extraneous matter. Also remove large quantities of smaller rock, specifically remnants of gravel stockpiles.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. No clods greater than ½" in diameter shall remain. Finish grading shall be performed with appropriate equipment such as box grader, not with a bobcat or backhoe. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

## 3.4 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 2000-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.

## 3.5 EROSION CONTROL

A. Install erosion control blankets on slopes for temporary stabilization when sod cannot be installed due to climatic conditions. Install per manufacturer's recommendations using staples to secure on slopes.

## 3.6 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

## 3.7 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).

B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

C. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

## 3.8 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION 329200

# SECTION 329300
# PLANTS

## PART 1 GENERAL

### 1.01 DESCRIPTION

A. Provide trees, shrubs ornamental grasses, ground covers and perennials as shown and specified. The work includes:

1. Soil preparation.
2. Trees and shrubs.
3. Planting mixes.
4. Mulch and planting accessories.
5. Maintenance.

B. Related Work:

1. Section 075216: SBS Modified Bituminous Membrane Roofing in BP#3
2. Section 312000: Earth Moving.
3. Section 329200: Turf and Grasses

### 1.02 QUALITY ASSURANCE

A. Plant names indicated, comply with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed conform generally with names accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.

B. Comply with sizing and grading standards of the latest edition of "American Standard for Nursery Stock". A plant shall be dimensioned as it stands in its natural position.

C. All plants shall be nursery grown under climatic conditions similar to those in the locality of the project for a minimum of 2 years.

D. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost, and providing that the larger plants will not be cut back to size indicated. Provide plants indicated by two measurements so that only a maximum of 25% are of the minimum size indicated and 75% are of the maximum size indicated.

E. Provide "specimen" plants with a special height, shape, or character of growth. Tag specimen trees or shrubs at the source of supply. The Landscape Architect will inspect specimen selections at the source of supply for suitability and adaptability to selected location. When specimen plants cannot be purchased locally, provide sufficient photographs of the proposed specimen plants for approval.

F. Plants may be inspected and approved at the place of growth, for compliance with specification requirements for quality, size, and variety.

1. Such approval shall not impair the right of inspection and rejection upon delivery at the site or during the progress of the work.

G. Provide and pay for material testing. Testing agency shall be acceptable to the Landscape Architect. Provide the following data:

1. Test representative material samples proposed for use.

2. Topsoil:

a. pH factor.

b. Mechanical analysis.

c. Percentage of organic content.

d. Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

3. Peat Moss:

a. Loss of weight by ignition.

b. Moisture absorption capacity.

H. Installer qualifications: A firm qualified as a landscape installer with a minimum of five (5) years experience of work of this type whose work has resulted in successful establishment of exterior plants.

1. Be available to respond to inquiries from the Landscape Architect.

1.03 SUBMITTALS

A. Submit the following material samples:

1. Mulch.

2. Planting accessories.

B. Submit the following materials certification:

1. Topsoil source and pH value.

2. Peat moss.

3. Plant fertilizer.

4. Superphosphate.

2. Dolomite.

3. Perlite.

4. Vermiculite.

5. Bonemeal.

C. Submit material test reports.

D. Upon plant material acceptance, submit written maintenance instructions recommending procedures for maintenance of plant materials.

E. Provide plant material record drawings:

1. Legibly mark drawings to record actual construction.

2. Indicate horizontal and vertical locations, referenced to permanent surface improvements.

3. Identify field changes of dimension and detail and changes made by Change Order.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer materials in original, unopened, and undamaged containers showing weight, analysis, and name of manufacturer. Store in manner to prevent wetting and deterioration.

B. Take all precautions customary in good trade practice in preparing plants for moving. Workmanship that fails to meet the highest standards will be rejected. Spray deciduous plants in foliage with an approved "Anti-Desiccant" immediately after digging to prevent dehydration. Dig, pack, transport, and handle plants with care to ensure protection against injury. Inspection certificates required by law shall accompany each shipment invoice or order to stock and on arrival, the certificate shall be filed with the Landscape Architect. Protect all plants from drying out. If plants cannot be planted immediately upon delivery, properly protect them with soil, wet peat moss, or in a manner acceptable to the Landscape Architect. Water heeled-in plantings daily. No plant shall be bound with rope or wire in a manner that could damage or break the branches.

C. Cover plants transported on open vehicles with a protective covering to prevent wind burn.

D. Provide dry, loose topsoil for planting bed mixes. Frozen or muddy topsoil is not acceptable.

1.05 PROJECT CONDITIONS

A. Work notification: Notify Landscape Architect at least 7 working days prior to installation of plant material.

B. Protect existing utilities, paving, and other facilities from damage caused by landscaping operations.

C. A complete list of plants, including a schedule of sizes, quantities, and other requirements is shown on the drawings. In the event that quantity discrepancies or material omissions occur in the plant materials list, the planting plans shall govern.

1.06 WARRANTY

A. Warrant plant material to remain alive and be in healthy, vigorous condition for a period of 1 year after completion and acceptance of entire project.

1. Inspection of plants will be made by the Landscape Architect at completion of planting.

B. Replace, in accordance with the drawings and specifications, all plants that are dead or, as determined by the Landscape Architect, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes due to the Contractor's negligence. The cost of such replacement(s) is at Contractor's expense. Warrant all replacement plants for 1 year after installation.

C. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.

D. Remove and immediately replace all plants, as determined by the Landscape Architect, to be unsatisfactory during the initial planting installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plants: Provide plants typical of their species or variety; with normal, densely developed branches and vigorous, fibrous root systems. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sun scald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation. All plants shall have a fully developed form without voids and open spaces. Plants held in storage will be rejected if they show signs of growth during storage.

1. Dig balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standard for Nursery Stock". Cracked or mushroomed balls are not acceptable.

2. Container-grown stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.

a. No plants shall be loose in the container.

b. Container stock shall not be pot bound.

3. Provide tree species that mature at heights over 25 feet with a single main trunk. Trees that have the main trunk forming a "Y" shape are not acceptable.

4. Plants planted in rows shall be matched in form.

5. Plants larger than those specified in the plant list may be used when acceptable to the Landscape Architect.

a. If the use of larger plants is acceptable, increase the spread of roots or root ball in proportion to the size of the plant.

6. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the plant list.

7. No pruning wounds shall be present with a diameter of more than 1" and such wounds must show vigorous bark on all edges.

8. Evergreen trees shall be branched to the ground.

9. Shrubs and small plants shall meet the requirements for spread and height indicated in the plant list.

a. The measurements for height shall be taken from the ground level to the height of the top of the plant and not the longest branch.

b. Single stemmed or thin plants will not be accepted.

c. Side branches shall be generous, well twigged, and the plant as a whole well-bushed to the ground.

d. Plants shall be in a moist, vigorous condition, free from dead wood, bruises, or other root or branch injuries.

## 2.02 ACCESSORIES

A. Standard Topsoil for Planting Beds: Fertile, friable, natural topsoil of loamy character, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay, lumps, coarse sands, stones, plants, roots, sticks, and other foreign materials, with acidity range of between pH 6.0 and 6.8 and a minimum organic matter content of 5%.

1. Topsoil that has been stripped and stockpiled on site shall be the primary topsoil to be utilized on this project. Provide additional topsoil from off-site if necessary. Based on soil borings preformed by Geotechnical Engineer, on-site topsoil will need to be supplemented with off-site sources in order to obtain the required topsoil depth.

2. Provide topsoil free of substances harmful to the plants that will be grown in the soil.

C. Peat Moss: Brown to black in color, weed and seed free granulated raw peat or baled peat, containing not more than 9% mineral on a dry basis.

1. Provide ASTM D2607 sphagnum peat moss with a pH below 6.0 for ericaceous plants.

D. Standard Plant Fertilizer: Commercial type approved by the Landscape Architect, containing 5% nitrogen, 10% phosphoric acid, and 5% potash by weight. 1/4 of nitrogen in the form of nitrates, 1/4 in form of ammonia salt, and 1/2 in form of organic nitrogen.

E. Anti-Desiccant: Protective film emulsion providing a protective film over plant surfaces; permeable to permit transpiration. Mixed and applied in accordance with manufacturer's instructions.

F. Mulch:

1. Organic: 6 month old well rotted shredded native hardwood bark mulch not larger than 4" in length and 1/2" in width, free of wood chips and sawdust.

G. Water: Free of substances harmful to plant growth. Hoses or other methods of transportation furnished by Contractor.

H. Stakes for Staking: Hardwood, 2" x 2" x 8'-0" long.

I. Stakes for Guying: Hardwood, 2" x 2" x 36" long.

J. Guying/Staking/Wire/Strap: Flat woven polypropylene material, ¾ " wide, 900 lb. Break strength lock stitch with rounded weave.

K. Tree Wrap: Standard waterproofed tree wrapping paper, 2-1/2" wide, made of 2 layers of crepe craft paper weighing not less than 30 lbs. per ream, cemented together with asphalt.

L. Twine: Two-ply jute material.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine proposed planting areas and conditions of installation. Do not start planting work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Time of planting:

1. Evergreen material: Plant evergreen materials between September 1 and November 1 or in spring before new growth begins. If project requirements require planting at other times, plants shall be sprayed with anti-desiccant prior to planting operations.

2. Deciduous material: Plant deciduous materials in a dormant condition. If deciduous trees are planted in-leaf, they shall be sprayed with an anti-desiccant prior to planting operation.

3. Planting times other than those indicated shall be acceptable to the Landscape Architect.

B. Planting shall be performed only by experienced workmen familiar with planting procedures under the supervision of a qualified supervisor.

C. Locate plants as indicated or as approved in the field after staking by the Contractor. If obstructions are encountered that are not shown on the drawings, do not proceed with planting operations until alternate plant locations have been selected.

D. Excavate circular plant pits with sloped sides, except for plants specifically indicated to be planted in beds. Provide pits at least twice the diameter of the root system for trees and shrubs. Depth of pit shall accommodate the root system. Provide undisturbed subgrade to hold root ball at nursery grade as shown on the drawings. Remove excavated materials from the site.

E. Provide pre-mixed planting mixture for use around the balls and roots of the plants consisting of planting topsoil and 1/2 lb. plant fertilizer Type "A" for each cu. yd. of mixture.

F. Provide pre-mixed ground cover bed planting mixture consisting of 3 parts planting topsoil to 1 part peat moss and 1/2 lb. plant fertilizer Type "A" per cu. yd. Provide beds a minimum of 8" deep. If slopes are greater than 4 to 1 increase depth to 12".

G. Provide pre-mixed planting mixture for use around the balls and roots of ericaceous plants consisting of 1 part planting topsoil to 1 part sphagnum peat moss and 1/2 lb. plant fertilizer Type "B" per cu. yd. of mixture.

3.03 INSTALLATION

A. Set plant material in the planting pit to proper grade and alignment. Set plants upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure. Set plant material so that the point at which the trunk flares out to meet the root matches finish grade. If the rootball or container contains excess soil covering a portion of the trunk, this soil shall be removed prior to setting the plant in the planting pit. No filling will be permitted around trunks or stems. Backfill the pit with planting mixture. Do not use frozen or muddy mixtures for backfilling. Form a ring of soil around the edge of each planting pit to retain water.

B. After balled and burlapped plants are set, muddle planting soil mixture around bases of balls and fill all voids.

1. Remove all burlap, ropes, and wires from the tops of balls.

C. Space ground cover plants in accordance with indicated dimensions. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants. Plant to within 12" of the trunks of trees and shrubs within planting bed and to within 6" of edge of bed.

D. Mulching:

1. Mulch tree and shrub planting pits and shrub beds with required mulching material 3" deep immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.

a. Install weed control barrier over grade prior to mulching tree and shrub planting pits and shrub beds. Secure on slopes with "T" pin anchors.

2. Mulch ground cover beds with mulch 1" to 1-1/2" deep immediately after planting.

E. Wrapping, guying, staking:

1. Inspect trees for injury to trunks, evidence of insect infestation, and improper pruning before wrapping.

2. Wrap trunks of all trees, subject to winter sunburn, spirally from bottom to top with specified tree wrap and secure in place.

   a. Overlap 1/2 the width of the tree wrap strip and cover the trunk from the ground to the height of the second branch.

   b. Secure tree wrap in place with twine wound spirally downward in opposite direction, tied around the tree in at least 3 places in addition to the top and bottom.

3. Staking/Guying:

   a. Stake/guy all trees immediately after lawn seeding or sodding operations and prior to acceptance. When high winds or other conditions, which may effect tree survival or appearance, occur, the Landscape Architect may require immediate staking/guying.

   b. Stake deciduous trees under 3" caliper. Stake evergreen trees under 8'-0" tall.

   c. Guy deciduous trees over 3" caliper. Guy evergreen trees over 8'-0" tall.

4. All work shall be acceptable to the Landscape Architect.

F. Pruning:

1. Remove or cut back broken, damaged, and unsymmetrical growth of new wood.

2. Multiple leader plants: Preserve the leader, which will best promote the symmetry of the plant. Cut branches flush with the trunk or main branch, at a point beyond a lateral shoot or bud a distance of not less than 1/2 the diameter of the supporting branch. Make cut on an angle.

3. Prune evergreens only to remove broken or damaged branches.

3.04 MAINTENANCE

A. Maintain plantings until completion and acceptance of the entire project.

B. Maintenance shall include pruning, cultivating, weeding, watering, and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease.

1. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.

2. Tighten and repair guy wires and stakes as required.

3. Correct defective work as soon as possible after deficiencies become apparent and weather and season permit.

4. Water trees, plants, and ground cover beds within the first 24 hours of initial planting, and not less than twice per week until final acceptance.

C. In addition to the initial maintenance through final completion of the entire project, the contractor shall enter into an additional three (3) year comprehensive maintenance service agreement with the University to maintain all roof garden plantings, including landscape on the roof and bridge. The maintenance shall be performed to a level consistent with upscale commercial development. All roof garden/bridge planting beds shall be mulched initially and replaced with new mulch to the original depth each spring. Shrubs, ornamental grasses, ground covers, etc. shall be fertilized annually at the appropriate time for each species. Ornamental grasses and ground covers shall be trimmed in late winter to allow winter interest, and then completely remove dead material just prior to the next growing season. Shrubs should not be pruned or trimmed unless approved by the Owner. All mulch beds shall be treated with pre-emergent herbicide annually and weeded by hand on a weekly basis during the growing season. Any other litter or debris shall be removed from the landscape during the weekly weeding services. While all roof/bridge garden plant materials are to be warranted for three years, any plants that do not survive during the extended maintenance period, shall be removed from the landscape and disposed of in an appropriate off-site location. Replacements of dead materials shall be made at the next appropriate planting season and no limitations shall be placed on repeated replacement during the 3 year period.

3.05 ACCEPTANCE

A. Inspection to determine acceptance of planted areas will be made by the Landscape Architect, upon Contractor's request. Provide notification at least 10 working days before requested inspection date.

1. Planted areas will be accepted provided all requirements, including maintenance, have been complied with and plant materials are alive and in a healthy, vigorous condition.

B. Upon acceptance, the Owner will assume plant maintenance for all landscape, except the roof/bridge garden plants that are to be maintained by the Contractor for a three (3) year period identified above.

3.06 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soils, debris, and equipment. Repair damage resulting from planting operations.

END OF SECTION 329300

# SECTION 334100
# STORM UTILITY DRAINAGE PIPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Special fittings for expansion and deflection.
2. Piping.
3. Precast concrete drainage structures.
4. Cast iron downspout adaptors.

### 1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

### 1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: Pipe joints shall be at least silttight, unless otherwise indicated.

### 1.5 SUBMITTALS

A. Shop Drawings: For the following:

1. Stormwater Headwall. Include plans, elevations, sections, details, and grates.
2. Downspout Adaptors: Include plans, elevations and sections.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle headwall according to manufacturer's written rigging instructions.

## 1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Landscape Architect no fewer than two (2) days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

## 2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. PVC Cellular-Core Piping:

1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

## 2.3 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

## 2.4 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

## 2.5 HEADWALLS

A. Standard Precast Concrete Headwall:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Frame & Grates: Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

## 2.6 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

a. Josam Company.
b. MIFAB Manufacturing Inc.
c. Smith, Jay R. Mfg. Co.
d. Wade Div.; Tyler Pipe.
e. Watts Industries, Inc.
f. Watts Industries, Inc.; Enpoco, Inc. Div.
g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Medium duty.

## 2.7 DOWNSPOUT BOOTS

A. Gray iron downspout adaptors: ASTM-A-48, Class 35B gray-iron.

1. Manufacturers:J. R. Hoe and Sons, Neenah Foundry Company, or approved equal.

a. Basis of Design: 5x5 top bell, A-series by J.R. Hoe and sons.

2. Finish: Provide with one coat of primer from manufacturer and field paint color to be selected by the Architect. Building side of adaptor to be painted prior to installation.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving".

### 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 design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope as indicated.
2. Install HDPE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
3. Install reinforced – concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual".

G. Piping and conduit installed under paving or graveled areas are to be backfilled and compacted full depth with crushed stone.

### 3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join corrugated HDPE piping according to CPPA 100 and the following:

a. Use silttight couplings for Type 1, silttight joints.

2. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

## 3.4 HEADWALL INSTALLATION

A. Install headwall of type and location as indicated on the drawings.

B. Fasten grates to drains if indicated.

## 3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

## 3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.

## 3.7 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100

# SECTION 334600
# SUBDRAINAGE

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes subdrainage systems for the following:

1. Foundation Drain.

### 1.3 DEFINITIONS

A. PE: Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

C. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

### 1.4 SUBMITTALS

A. Product Data: For the following:

1. Perforated-wall pipe and fittings.
2. Geotextile filter fabrics.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 PIPING MATERIALS

A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, tube, fitting, and joining materials.

## 2.3 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 (DN 150) and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. Couplings: Manufacturer's standard, band type.

## 2.4 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

## 2.5 DRAINAGE CONDUITS

A. Single-Pipe Drainage Conduits: Prefabricated geocomposite with perforated corrugated core molded from HDPE complying with ASTM D 3350 and wrapped in geotextile filter fabric.

1. Manufacturers:

   a. Advanced Drainage Systems.

2. Filter Fabric: Nonwoven, PP geotextile.
3. Fittings: HDPE with combination NPS 4 and NPS 6 (DN 100 and DN 150) outlet connection.
4. Couplings: Corrugated HDPE band.

## 2.6 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in "Earth Moving."

## 2.7 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330-gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament.
2. Style: sock.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in "Earth Moving."

### 3.3 PIPING APPLICATIONS

A. Underground Subdrainage Piping:

1. Perforated PE pipe and fittings, couplings, and coupled joints.
2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

### 3.4 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:

1. At Grade in Earth: Cast-iron cleanouts.
2. At Grade in Paved Areas: Cast-iron cleanouts.

### 3.5 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches (150 mm) deep and 12 inches (300 mm) wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

F. Connect new foundation drain to existing foundation drain system as encountered.

G. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.

H. After satisfactory testing, cover drainage piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade.

I. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

J. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm).

K. Place initial backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

## 3.6 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches (915 mm), unless otherwise indicated.
2. Lay perforated pipe with perforations down.
3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping according to ASTM D 2321.

## 3.7 PIPE JOINT CONSTRUCTION

A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."

B. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.

## 3.8 CLEANOUT INSTALLATION

A. Cleanouts for Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches (450 by 450 by 300 mm) in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.
3. In nonvehicular-traffic areas, use NPS 4 (DN 100) cast-iron pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.

## 3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to headwalls where practical.

## 3.10 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

## 3.11 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600